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ACRONYMS

ADF	Augmented Dickey-Fuller
ARCH	autoregressive conditional heteroskedasticity
BAI	Bureau of Animal Industry
BAS	Bureau of Agricultural Statistics
BPI	Bureau of Plant Industry
CPEP	Corn Production Enhancement Program
CRDW	Cointegrating Regression DW Test
CPI	consumer price index
CSE	consumer subsidy equivalent
DA	Philippine Department of Agriculture
DF	Dickey-Fuller
DRC	domestic resource cost
ECP	Expanded Corn Program
EER	equilibrium exchange rate
EP	export promotion
EPR	effective rate of protection
FAO	Food and Agriculture Organization
FCP	feed cost per unit
FCR	feed conversion ratio
FPA	Fertilizer Pesticide Authority
FMD	Food and Mouth Disease
FNRI	Food and Nutrition Research Institute
GLS	Generalized Least Squares
GOP	Government of the Philippines
GVA	gross value added
IFPRI	International Food Policy Research Institute
IPB	Institute of Plant Breeding
IRRI	International Rice Research Institute
IRT	interregional trade

LBI	Louis Berger International
LRM	long run multipliers
MIT2	University of Southern Mindanao
NCR	National Capital Region
NEDA	National Economic Development Authority
NFA	National Food Authority
NFAC	National Food and Agriculture Council
NPC	nominal protection coefficients
NPR	nominal protection rate
NPRD	nominal protection rate—direct
NPRI	nominal protection rate—indirect
NSP	net social profitability
OER	official exchange rate
OLS	Ordinary Least Squares
OP	Open-pollinated
PAD	Policy Analysis Division
PAFMI	Philippine Association of Feed Millers
PSE	producer subsidy equivalent
RCS	Rice and Corn Survey
SER	shadow exchange rate
SUR	seemingly unrelated regression
UPLB	University of the Philippines at Los Banos
USAID	U.S. Agency for International Development
USDA	U.S. Department of Agriculture

EXECUTIVE SUMMARY

1. INTRODUCTION

This study was undertaken by the International Food Policy Research Institute (IFPRI) in cooperation with the Department of Agriculture of the Philippines (DA). The project received funding from the United States Agency for International Development (USAID), and was implemented through the Agricultural Policy Analysis Project, Phase II. The analysis was motivated by four major concerns identified by the DA and IFPRI. First, it was evident that growth in demand for corn for livestock feed is likely to be a major impetus for growth in domestic corn production. Despite relatively slow growth in production and consumption of livestock through the mid-1980's, the share of corn utilized as feed has increased significantly. In the years to come, as income growth in the Philippines recovers, it will likely be income-led demand growth for livestock, particularly poultry and pork, which will drive domestic demand for corn. Second, a number of important on-going agricultural policy debates arise from the linkages among corn, feed, and livestock industries, including pricing policies for these commodities, tariff policies, and import/export policies. Third, the domestic marketing and distribution of corn has been identified as a major constraint to the feed/livestock industry. Fourth, the data and analytical framework to permit rigorous assessment of policy options in the corn/feed/livestock subsector are in many cases inadequate.

In order to examine these issues, the report addresses a series of research topics to assess the economics of the corn/livestock sector, and integrates these analyses using an agricultural supply/demand model to derive sectoral level policy implications.

Chapter 1 provides an introduction to the report. In Chapter 2, "*Trends in the Supply and Demand for Corn and Livestock*," general trends in supply and demand for corn, feed, and livestock are assessed, together with a description of government policies in the corn/livestock sector. Chapter 3, "*The Economics of Corn Production in the Philippines*," assesses the costs of production and marketing, comparative advantage, and effects of government policies on incentives for corn production, by variety and technology levels. In Chapter 4, "*The Economics of Hog and Poultry Production*," a comparable analysis is undertaken to assess the incentives, efficiency, and performance of hog, broiler, and egg production, by region and size of operation.

In Chapter 5, "*Marketing of Corn in the Philippines: Market Integration and Dynamics of Price Formation*," the degree of market integration, patterns of price determination, and long run price transmission within Philippine corn markets are examined. Chapter 6, "*Comparative Analysis of Production and Marketing of Corn in the Philippines and Thailand*," undertakes a comparative

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This summary presents major findings and conclusions from the report, *The Philippine Corn/Livestock Sector: Performance and Policy Implications*. Results are summarized according to chapter of the main report.

study of sources of differences in production and marketing costs in Thailand and the Philippines, in order to assess the potential for policies to reduce costs in the Philippines.

Chapter 7, *"Supply Response in the Philippine Livestock Industry,"* analyzes the response of hog and chicken supply to output and input prices. Chapter 8, *"Food Demand Elasticities by Income Group by Urban and Rural Populations for the Philippines,"* undertakes an analysis of disaggregated demand parameters for food in the Philippines. Estimated parameters from these two chapters are utilized in an agricultural supply/demand model in Chapter 9, *"Policy Alternatives for the Corn Livestock Sector: A Simulation Analysis,"* to analyze alternative pricing and trade policies for the corn/livestock sector. Finally, policy implications are discussed in Chapter 10, *"Conclusion and Summary of Policy Implications."*

2. TRENDS IN THE SUPPLY AND DEMAND FOR CORN AND LIVESTOCK

Trends in supply and demand for corn and livestock are provided in the report. This summary focuses on trends in government policies.

Government Policies

Over the years, the Government of the Philippines (GOP) has pursued a set of sectoral and economy-wide policies that have directly and indirectly affected the corn-livestock subsectors. Among these are trade policies; foreign exchange rate policies; grain stabilization policies reflected in the regulations of domestic market entry and operations; inter-island shipping policies affecting the distribution of corn; and corn and livestock production programs.

Trade Policies

Like most agricultural commodities in the Philippines, international corn trade is generally regulated in two ways: imposition of import tariffs and import licensing. As of 1990, the Philippine government imposed a tariff rate of 20 percent on corn. This is lower than other feed ingredients, such as broken rice, sorghum, cassava, and sweet potato at 50 percent each, but still higher than the 10 percent tariff on soybeans, soybean meal, fishmeal, and bone meal. The proposed Executive Order 413, provides for a further increase in corn tariffs to 30 percent. In addition, beginning the end of 1990, an ad valorem levy of 9 percent was imposed on all imports. Corn trade is also regulated through import licensing administered by the Department of Agriculture (DA). Every first quarter of the year, the DA, through an interagency committee, assesses corn import needs and decides the volume and timing of corn imports.

The Philippines charges import tariffs on live animals, meat products, meat preparations, eggs and dairy. Tariffs range from 20 percent (beef, hogs, and goat's meat) to 50 percent (chickens and eggs). In addition, tariffs are imposed on feed ingredients ranging from 10 percent (fishmeal, meat and bone meal, and soybean meal) to 50 percent (sorghum, cassava, and sweet potato). Mixed feeds are taxed by 30 percent of their import values. Tariffs for feed ingredients negatively affect

the domestic production and expansion of the livestock industry, since feeds comprise a substantial portion of costs in commercial livestock production.

Grain Stabilization Policies

The GOP regulates the market entry and operations of the grains (rice, corn, sorghum, wheat) industry through the National Food Authority (NFA). The NFA regulates and administers the issuance of business licenses in the trading and distribution, processing, storage and exportation of grains. These activities are intended to support the grains stabilization program of the government. Through the NFA, the government stabilizes the supply and demand of grains through direct market intervention. Historically, rice has been the major focus of NFA's direct market interventions. The corn stabilization program has been similar to that of rice, but with a much lower resource commitment.

The NFA has a long history of attempting to stabilize corn supply and distribution by defending a procurement floor price. This was actively pursued in the 1970's and early 1980's in support of the corn self-sufficiency program. In recent years, however, NFA has taken a subdued role in corn procurement, acting only as the buyer of last resort and for as long as its budget allows it. On the average, domestic procurement of NFA has been less than three percent of total corn production. In recent years, corn purchase was constrained not only budget limitations but a policy change to limit NFA in the trading of grains, and allow a larger participation by the private sector.

Exchange Rate Policies

Over the past three decades, the GOP has pursued a development strategy centered on an industrial protection system that has negatively affected agriculture. This protection system has defended an overvalued exchange rate which has made the peso value of agricultural tradables fall, with simultaneous increases in the price of manufactured goods purchased by the agricultural sector. The deterioration in the terms of trade in agriculture due to the failure of foreign exchange policies to make short-run corrections in the peso overvaluation has also contributed to making corn-livestock products uncompetitive in international markets. Overvaluation has had negative sectoral and economy-wide effects on agricultural commodities.

Inter-Island Shipping Policies

Improvement in the efficiency of corn and livestock distribution from producing regions to consumption areas would contribute to production efficiencies in feed-grain-livestock subsectors. An efficient inter-island shipping system and port facilities can significantly reduce marketing costs. The relative unprofitability of the shipping industry due to high cost of credit financing, high tariffs on spare parts, and restrictive government route regulations, among others, has reduced the number of shipping vessels operating among the islands in the Philippines.

Until 1989, government regulation classifying corn as a basic class (lowest class rate) cargo put corn into the domestic liner's list of non-preferred cargoes. In 1989, the Presidential Task Force

on inter-island shipping reclassified corn and other agricultural products in the Class C cargo category. The same force is currently studying policy alternatives to improve the efficiency of the inter-island shipping industry.

Corn Production Programs

The first corn production program of the GOP was originally patterned after the rice production program of the 1970's. It was conceived with the following objectives: to support the expansion of the commercial livestock subsector by reducing feed input costs; to save foreign exchange by eliminating mounting imports and become corn exporter; to provide an adequate supply of food to the corn eating population; and to improve the farm incomes of corn producers.

Since its inception in the early seventies, the corn production program of the Philippines has taken several structural configurations. It started in 1969 with the launching of the National White Corn and Feedgrains Program under the National Food and Agriculture Council (NFAC). This program stressed the production of white corn for food to compliment the food self-sufficiency program of government during the period. Until 1973, this program was centered on the major corn producing/consuming regions of the Philippines. Operating under different program emphasis, it was named the Masaganang Maisan, Maisan 77, the Maisagana Program, and the Expanded Yellow Corn Production Assistance Program. All of these programs had the major objective of attaining corn productivity and self-sufficiency. The programs have had limited success.

As compared to previous programs, the current corn program, Corn Productivity Enhancement Program (CPEP), is more modest in its production target (an aggregate 5 percent increase per year) and centers its assistance on the use and distribution of two vital inputs in corn production, fertilizer and seeds. The program appears to have achieved some success in improving yields in target areas. However, the extent to which these apparent yield increases can be achieved on a cost-effective basis if the program expanded is not assured. Considerable additional analysis would be required to assess the contribution and cost-effectiveness of CPEP to these yield differentials.

3. THE ECONOMICS OF CORN PRODUCTION IN THE PHILIPPINES

Economic Incentives in Corn Production

A wide range of government policies has affected the economic incentives in the production of corn. Price and subsidy policies, import and export policies and more general macroeconomic policies, such as exchange rate and interest rates, may affect relative incentives in agriculture. Impacts of these policies on relative incentives are measured in the study by using nominal and effective protection rates. The nominal protection rate (NPR) is the ratio of the domestic price of an output to its border price expressed in local currency usually at the official exchange rate. Sector-specific and economy-wide policies influence agricultural prices. Hence three levels of nominal protection rate are analyzed here: direct nominal protection measures the impact of sector-

specific policies on levels of protection; indirect nominal protection measures the effect of foreign exchange rate distortions on protection; and total nominal protection rate is the sum of the direct and indirect effects.

The study shows that corn pricing and trade policy (particularly tariff and non-tariff barriers to trade) have provided high positive protection to corn production. During the crop year 1989/90, the direct nominal protection rates for corn were very high, 39 percent at the wholesale level and 27-41 percent at the farm level, based on the US border price of corn, and even higher relative to Thai border prices. Because of overvaluation of the peso the indirect NPR is negative, so the total nominal protection rate was lower than direct NPR, but still strongly positive.

Nominal protection rates measure only the impact of sectoral and economy-wide policy on output incentives, but not on inputs. Effective protection rates measure the net effects of government intervention on both input and output, as reflected in value added. Effective protection rates for corn are even higher, 38-77 percent, than nominal rates, confirming that government policies and market distortions on both the output and input markets artificially protect corn production, encouraging inefficient high-cost corn production. The results point out the desirability of pursuing a domestic pricing policy consistent with long run economic prices of corn, and a foreign exchange rate that equates the long term supply and demand for foreign exchange.

Comparative Advantage in Corn

Comparative advantage in the production of a given commodity system for a particular country or province is measured by comparing the social or economic opportunity costs of producing, processing, transporting, handling and marketing an incremental unit of the commodity with its border price. If the opportunity costs are less than the border price, then that country has a comparative advantage in the production of that particular crop. This study utilizes a domestic resource cost analysis to assess comparative advantage.

The domestic resource cost (DRC) of foreign exchange earned or saved from a particular production activity can be expressed as the ratio of the domestic factor costs in shadow prices per unit of output to the difference between the border price (expressed in foreign currency) of output and foreign (tradable) costs (also expressed in foreign currency). DRC measures the social opportunity cost of domestic resources employed in earning or saving a marginal unit of foreign exchange. An activity is economically competitive, or displays comparative advantage, if the opportunity cost of earning or saving an incremental unit of foreign exchange is less than the shadow exchange rate.

The domestic resource cost analysis shows that domestic corn production is efficient as a saver of foreign exchange in the domestic production of corn for import substitution. However, there is no comparative advantage in exporting corn. A major reason is the current underdevelopment in the marketing and distribution system.

Infrastructure and Support Services

The high levels of protection on corn have also contributed to inefficient corn marketing and distribution system, by reducing the incentives for provision of efficient marketing services. Lack of infrastructure facilities, particularly quality roads, bridges, ports, bulk handling and shipping facilities constrain the distribution of corn. Trading and distribution costs account for 35 percent of total corn production cost from farm to Manila's wholesale market. Freight (trucking, shipping) is a major component (35-42 percent) of total trading costs.

Given that the domestic costs of trading and marketing are quite high, improvement in the domestic distribution of corn would contribute to the productivity of the corn subsector. Increased efficiency in cargo handling services from open competition, accompanied by investments in the port facilities, including the ready supply and availability of inter-island vessels to transport corn, would reduce trading and distribution costs. In the long-run, government policy should pursue an integrated distribution system not only for corn but for other agricultural commodities as well, to minimize trading and distribution costs.

4. THE ECONOMICS OF HOG AND POULTRY PRODUCTION

The economic analysis of the non-ruminant livestock subsector brings out several policy issues which can serve as a basis for future policy dialogue. Among these are the strong linkage between corn and livestock production, trade and foreign exchange rate policies, and comparative advantage in livestock trade.

Corn-Livestock Linkage

The analysis of non-ruminant livestock production showed that feed costs contributed 65 to 87 percent of total farm production costs. In hog production, the proportion of feed costs to farm production costs was highest in the medium and large commercial farms, averaging above 80 percent. In layer farms, the proportion of feed costs to the costs of farm production ranged from 67 percent (backyard and semi-commercial) to 78 percent (large commercial). On the average, the broiler farms had the highest proportion of feed costs to total farm production costs, above 83 percent.

Costs of production in livestock non-ruminants thus show the strong linkage between the feedgrain-livestock subsectors. This linkage further implies that full efficiency cannot be realized in the domestic production of livestock non-ruminants unless efficiency in the domestic production of corn is achieved. The feedgrain-livestock subsectors should be viewed as an integrated whole.

Trade and Foreign Exchange Policies

The analysis showed that there is a large negative indirect effect on economic incentives in livestock production due to the overvaluation of the peso. Unless this negative bias is removed,

expansion and competitiveness of the feedgrain livestock subsectors will be constrained. In addition, the tariff on feedgrain and livestock products should be gradually removed and domestic pricing policies should be directed towards equalization of domestic with long-run world prices.

Economic Incentives and Comparative Advantage in Livestock Production

Analysis of economic incentives and comparative advantage for livestock also utilized nominal and effective protection rates and domestic resource cost methodology. Direct nominal protection rates for hogs were low, and with negative indirect protection due to peso overvaluation, total nominal protection was negative. Given the tariff protection on pork, it was expected that the direct nominal protection rates for hogs would be highly positive. A possible explanation for the apparent low level of direct nominal protection is a quality effect. The Philippines is endemic with foot and mouth disease (FMD), reducing the quality and value of Philippine pork in the international market. Full discounting of the price of Philippine pork to reflect quality differentials would likely result in a higher estimated level of protection.

Direct nominal protection rates for egg and chicken production were high. NPRs for egg production averaged 46 percent across producing areas. The major reason for this was the very high domestic producers price induced by high tariffs (50 percent) on eggs, which have encouraged inefficient production. Accounting for the negative indirect effects, the total nominal protection rates were still high, averaging 25 percent across producing areas.

The direct nominal protection rates for broilers were also high, averaging 54 percent across producing areas. Given the negative indirect effect of exchange rate misalignment, the total nominal protection rates due to overvaluation averaged 33 percent (Table 4.22). At the wholesale level the patterns of nominal protection rates were of similar magnitude to the producers level. Effective protection rates for eggs and broilers were even higher than nominal rates of protection.

The domestic resource cost analysis shows that there is a comparative advantage in the domestic production of hogs, egg, and broiler as import substitutes. The potential for exporting eggs and broilers appears marginal, but the analysis showed a strong comparative advantage in the export of hogs. Realization of this comparative advantage would require the elimination of FMD in the Philippines, which is a major constraint to export.

The eradication of FMD would not only be beneficial for potential hog exports but would help in maintaining a healthy population of the ruminant animals (beef and carabao) as well. It would be desirable therefore to strengthen further the current program of the Department of Agriculture in the complete eradication of the FMD. Hog-producing regions identified by the Bureau of Animal Industry as FMD-free zones should be used as an initial basis for negotiations in obtaining international certification of export worthiness in pork. Also, bilateral government agreements between the Philippines and Asian importers of pork should be pursued more vigorously.

5. MARKETING OF CORN IN THE PHILIPPINES: MARKET INTEGRATION AND DYNAMICS OF PRICE FORMATION

The general objective of this chapter is to determine the patterns of price formation for corn in the Philippines and the effect and magnitude of impact of price formation patterns on market integration. The dynamic process of price formation and market integration of corn was analyzed using the results obtained from field survey conducted by IFPRI in March 1990 to July 1990 of corn farmers, traders, shippers, livestock/poultry raisers, and corn processors from five sample provinces. Results of the survey are supplemented by results obtained from the estimation of econometric time series models.

Corn prices are discovered by the interaction of farmers and traders, and the price discovery process for corn in the Philippines is complex. In buying, corn traders contact as many as 10 or more farmers from two or more municipalities. Most of these traders have contracts with wholesalers to deliver large volumes of corn. On the other hand, farmers usually contact two or more traders of the many buying and selling corn within their municipalities. The presence of many buyers trading within a limited geographic area and the need to fulfill the volume required in their contracts with other corn buyers imply a high degree of competition for a relatively small volume of corn available at the farm.

In pricing corn, informal sources are commonly used as sources of market information. Farmers rely on traders for price information. Traders, on the other hand, use other traders as sources of information. Very few farmers and traders utilized publicly reported information. Because of concern over the possibility of price manipulation by traders, policy makers have been worried over the use of informal sources as sources of market information. The findings of the study, however, indicate that price manipulation is unlikely. According to farmers, they talk to an average of two or more traders before selling, and the "prevailing market price" is important in making their pricing decision of corn, suggesting an awareness of the level of selling price in the market. Also, to fulfill their contracts with other buyers and ensure a regular source of corn supply in the next seasons, corn buyers are likely to match the offer price of other buyers. Underpricing would erode a buyer's market share, and therefore would be unprofitable in the long run. Thus, prices within a geographic market are likely to be uniform and price deviations, if any, are also likely to minimal.

The activity of buying in low price markets and selling in high price markets (arbitrage) links separated markets and communicates information about prices prevailing in these markets. By definition, markets are integrated if price changes in one market are transmitted in another market. Results of tests of spatial integration strongly indicate that the arbitrage activities of profit seeking traders link the major regional corn markets in the Philippines. Cross long-run multipliers (LRM), a measure of market integration, are statistically significant.

However, the extent of spatial integration is imperfect. Estimates of cross LRM are less than unitary and positive, indicating that price adjustments between spatial markets to new information occur in the same direction but the magnitude of response is inelastic. Price

adjustments between regions also occur rather slowly, further indicating imperfect spatial integration. Markets situated in close proximity tend to respond to new information quicker than markets situated farther apart. High costs of transportation, inadequate transportation facilities, and poor farm-to-market roads impede the rapid flow of corn and the complete transmission of information between markets.

The results from tests of market integration and from the field survey are consistent. While available information about market conditions in several competing markets is used in the pricing of corn, structural rigidities in the market arising from poor physical farm-to-market linkages, inadequate transportation, and high costs of arbitrage exist that impair the full, complete, and rapid price adjustments between markets and their efficient integration.

The empirical findings suggest that there are benefits to developing better physical infrastructure to effectively link production points to market centers and in formulating incentive packages to encourage private investments in transportation, storage, and other necessary marketing facilities. There are also benefits to improving current public market information services to ensure the timely dissemination of accurate and reliable information. An expansion and improvement in the capability of the existing marketing system is imperative to ensure the efficient distribution, from the farmers to the feedmillers, of increments in corn production needed to meet the requirements of an anticipated expansion in the livestock/poultry sector. Marketing costs are expected to decline and farm profits are expected to rise with improvements in the corn marketing system, providing the incentives necessary to augment current levels of production to levels needed for the sustained growth in the livestock/poultry industry.

6. COMPARATIVE ANALYSIS OF PRODUCTION AND MARKETING OF CORN IN THE PHILIPPINES AND THAILAND

This chapter compares the costs of production and marketing of corn between Thailand and the Philippines. Possible sources of constraints in corn production and marketing in the Philippines, where policy interventions may lower costs, are identified.

Most of the corn produced in the Philippines and Thailand is the open-pollinated, yellow corn variety, although the use of hybrid corn is increasing more rapidly in the Philippines. Due to the high costs of fertilizers and inadequate availability of irrigation, very little hybrid corn variety is grown in Thailand. Expansion in demand of yellow corn for feeds has stimulated rapid increases in corn production in both countries.

On average, corn farms in Thailand are larger and tend to be more clustered than those in the Philippines. Because agricultural land in the Philippines is relatively scarce and land rent is high, increments in corn yield in the Philippines have come primarily from increased intensity in cultivation over the past few years. In comparison, the opening of relatively abundant new lands to corn cultivation has accounted for most of the increases in corn production in Thailand, though there has been some increase in intensity in cropping in recent years.

Production Costs

The study estimates show that the on-farm cost of producing hybrid corn and open-pollinated corn is 44 percent and 34 percent higher, respectively, in the Philippines than in Thailand. High interest costs, high levels of application of fertilizer, and larger rental expense account for the largest portion of total corn production expenses in the Philippines. A considerable portion of the differential cost of corn cultivation, however, could be eliminated by devaluation of the overvalued peso.

Marketing and Distribution Costs

The cost of marketing and distribution of corn in the Philippines is 70% higher than in Thailand. Part of this differential is due to natural agroclimatic reasons: because corn farms in the Philippines are small and geographically dispersed, and marketed volume small, per unit costs of marketing will tend to be somewhat lower than in Thailand. However, other sources of the difference in the cost of marketing could be eliminated through appropriate investments in infrastructure and market development. Although Filipino corn farmers are located closer to a local market or a buyer than Thai farmers, better rural infrastructure in Thailand enables the latter to have easier access to alternative markets. On average, Filipino farmers are located about 14 kilometers to the nearest market outlet and Thai farmers, about 40-70 kilometers, but the better Thai road system and innovations in marketing and transportation significantly reduce the unit costs of marketing. A key innovation in corn marketing and distribution in Thailand is the use of bulk handling even from small regional markets, which significantly reduces the costs of marketing. The comparative analysis of Thailand and the Philippines reinforces the findings in Chapters 3 and 5 that appropriate investments in infrastructure and marketing can reduce the costs of marketing and improve the efficiency of movement of corn from the farm level to the consumption centers.

7. SUPPLY RESPONSE IN THE PHILIPPINE LIVESTOCK INDUSTRY

In this chapter, the supply response of hogs and poultry in the Philippines is estimated at the backyard, commercial and aggregate levels. The study used annual production data, 1970 to 1989, compiled by the Policy Analysis Division (PAD) of the Philippine Department of Agriculture, Food and Agriculture Organization (FAO) of the United Nations and the United States Department of Agriculture (USDA) from basic data collected by the Bureau of Agricultural Statistics. In the estimating equations, meat production was expressed as a function of lagged production; lagged deflated prices of output, corn and soybeans; and a time trend variable representing technology.

The supply response equations were initially estimated using Ordinary Least Squares (OLS). However, to allow for correlation among the error terms of the backyard, commercial and aggregate level production, the equations for the three production levels were estimated by Generalized Least Squares (GLS) using restricted and unrestricted Seemingly Unrelated Regressions (SUR) estimators. Correction for autocorrelation was performed for all equations. The SUR estimation provided more efficient estimates.

Price elasticities were evaluated at the variable means and elasticity estimates for more recent years were obtained using the average of 1987 and 1988 values. Backyard, commercial and aggregate poultry production responded to the explanatory variables in the expected directions. There is a greater response to output than to input price changes. Commercial production is considerably more responsive to price changes relative to the backyard production. Based on the estimations using FAO and PAD production data, aggregate level elasticities at the 1987/88 means were 0.95, -0.59 and -0.30 for broiler price, corn price, and soybean price, respectively. These response levels fall between the corresponding average elasticity estimates for the commercial sector of 1.43, -0.92 and -0.34 and for the backyard sector of 0.66, -0.40 and -0.19.

A negative response of commercial level hog production to output prices was consistently observed in estimations using any of the three data sets. This prevented a comparison of the relative responsiveness of the backyard and commercial hog sectors. However, the three data sets provided reasonably close price elasticity estimates for total hog supply. Based on averages from the estimations, the long-run elasticities of aggregate hog production were 1.09, -0.54 and -0.28 for pork price, corn price, and soybean price respectively.

The estimates show that supply response of livestock to output and input prices is very large, indicating that government policies which affect livestock and corn prices, such as import tariffs and trade restrictions, will have powerful effects on livestock production. The estimated livestock supply elasticities from this analysis are used in the model described in Chapter 9, together with the estimated demand parameters from Chapter 8 to analyze the relative effects of a particular government policy on these sectors.

8. FOOD DEMAND ELASTICITIES BY INCOME GROUP BY URBAN AND RURAL POPULATIONS FOR THE PHILIPPINES

This chapter presents food demand elasticity estimates for the Philippines by urban and rural populations and by income quartile for twelve food groups. Income and price elasticities are estimated using a new food demand estimation technique based on demand for characteristics. This new technique requires far less data than the usual econometric approaches and so may be implemented relatively quickly and cost-effectively. However, the resulting demand elasticity estimates depend directly on strong *a priori* assumptions made concerning food demand behavior, but assumptions which do not depend on assumptions of weak or strong separability. Rather quite the opposite assumption is made -- that the marginal rate of substitution between two foods depends directly on the levels of consumption of all other foods.

The data which are required for undertaking these estimations were provided by the Food and Nutrition Research Institute (FNRI) based on their 1978, 1982, and 1987 nationwide surveys. It is useful to state at the outset that these surveys are an invaluable data resource for food policy analysis in the Philippines. There are two alternative sources of information on food consumption. First, there are several rounds of food expenditure surveys undertaken jointly by the (now defunct) Special Studies Division of the Ministry of Agriculture and the National Food Authority from the

mid-1970s through the early 1980s. Second, the Bureau of Census has conducted income and expenditure surveys at irregular intervals since 1957. However, data from these food expenditure surveys will likely lead to gross overestimates of food and calorie income elasticities, unless "leakage" between foods that higher income households buy, but do not consume themselves (meals provided to guests and hired laborers, food "lent" to poorer relatives/friends, and waste), is carefully monitored in such surveys (Bouis and Haddad, forthcoming). By contrast, food recall techniques (including those used by the FNRI) developed by nutritionists measure foods actually consumed and so avoid this problem.

The estimated income elasticities for staple and non-staple foods are generally in accordance with *a priori* expectations. The cheapest source of calories, corn, has the lowest income elasticity. The rice income elasticity is essentially zero due to the fact that increased calorie consumption is not a priority goal of consumers at the margin. For staple foods, wheat is a relatively expensive source of calories (a "luxury" staple food) and so has a relatively high income elasticity. Meats and dairy products generally have the highest income elasticities. Income elasticities for fish are much lower.

The elasticity estimates developed in this chapter for rice, corn, wheat, pork, chicken, and eggs are used in the rice/corn/livestock model simulations in the following chapter. These eight food demand elasticity matrices may be used by policy analysts for various applications, and in particular those that are concerned with the differential impacts of government policies across income groups and urban and rural populations.

9. POLICY ALTERNATIVES FOR THE CORN LIVESTOCK SECTOR: A SIMULATION ANALYSIS

In this chapter, an agricultural supply/demand model for the Philippines is described, and then utilized to examine the impacts of alternative price and trade policies on the corn/livestock and related sectors, including rice, corn, wheat, pork, chicken, and eggs. In particular, the removal of distortions in price and trade policy, which were identified in earlier chapters as key problems for the sector, were assessed. The main part of the analysis is done by using the agricultural supply/demand model to simulate three alternative price and trade scenarios, including constant price policies maintaining existing levels of price protection; full trade liberalization; and establishment of a 20 percent uniform tariff policy across the six commodities. The simulations project production, consumption, and trade balances for the commodities to the year 2000.

The results confirm that maintaining trade protectionism to keep domestic prices above world prices, such as has been followed in the Philippine corn/livestock sector, imposes significant costs to the economy. Full trade liberalization would sharply increase the value of domestic production; raise substantially the consumption of cereals, meats, and eggs while reducing consumer expenditures on these items; and maintain or lower the net cost of imports.

Establishment of a moderate uniform tariff across the six commodities, by reducing overall levels of protection, also yields substantial economic gains compared to existing policies. The net cost of imports is cut by more than half and gross domestic value of output increases compared to the first scenario. Changes in food consumption and expenditures compared to the existing price policy scenario, however, are not large, due to continuation of moderate levels of protection. Compared to full trade liberalization, the uniform tariff policy reduces the cost of imports, but the cost is borne by domestic consumers through higher prices, lower consumption, and higher total food expenditures. The gross value of domestic production is also lower than for the trade liberalization scenario.

The analysis also showed that investment and policy reforms to reduce marketing margins can have a strong impact on corn production. By maintaining farmer incentives even with declining wholesale prices of corn, reductions in marketing margins can be a powerful spur to domestic production.

Trade liberalization produces considerable gains to the economy, but the concern may remain that liberalization also opens the economy to excessive fluctuations in world prices, which are directly transmitted to domestic prices. In general, the evidence from existing price stabilization schemes in both developing and developed countries indicates that gains from stabilization of agricultural prices are quite small. However, although the quantifiable benefits of price stabilization may be relatively modest, stabilization is a potentially important complementary policy, particularly if the government moves to liberalize trade in corn and livestock. Effective stabilization of prices would provide assurance against short term disinvestment in corn and livestock during a transitional phase. If a price stabilization policy is adopted, it is crucial that the costs of effective stabilization be minimized. In order to keep the costs of stabilization down, experience in developing countries indicates that variable taxes or levies are preferable to government buffer stock schemes.

10. CONCLUSION AND SUMMARY OF POLICY IMPLICATIONS

This report has documented the main government policies toward the corn livestock sector in the Philippines and the impacts of these policies on the competitiveness of the sector. Distortions in price and trade policy have been identified as key problems for the sector. Despite these distorted prices, corn, poultry, and pork have a comparative advantage as import substitutes and pork has a high potential to be competitive as an export commodity if sanitary and quality improvements can be made. In addition to correcting price distortions, the competitiveness of these industries would also be enhanced by improvement in structural problems in marketing and distribution. While constraints in research and extension, seed distribution, and farm level technology do exist, available evidence indicates that the most serious structural problems are in post-harvest technology, transportation and marketing, due to underinvestment and restrictive policies in these areas. Removal of these structural barriers would greatly improve the competitiveness of the corn/livestock sector.

Based on this study, an integrated set of four broad policy reforms affecting the corn-livestock sector would lead to significant economic benefits. The four areas of policy reform are trade liberalization, real exchange rate devaluation, increased public investment in and deregulation of marketing and transportation, and stabilization of corn prices.

Trade Liberalization

Trade protectionism to maintain domestic prices above world prices, such as has been followed in the corn/livestock sector, entails significant costs to the economy. Trade policies which protect some commodities or sectors at the expense of others can cause resources to shift from more efficient production activities to less efficient ones. Protective trade policies also penalize consumers through increased domestic prices. Removal of trade barriers will usually result in more efficient allocation of resources in production, and will provide net welfare gains. These effects were confirmed in the analysis of the impacts of alternative price and trade policies on the corn/livestock and related sectors, including rice, corn, wheat, pork, chicken, and eggs. The removal of distortions in price and trade policy, which have been identified as key problems for the sector, were assessed. The analysis used an agricultural supply/demand model to simulate three alternative price and trade scenarios, including constant price policies maintaining existing levels of price protection; full trade liberalization; and establishment of a 20 percent uniform tariff policy across commodities.

The results confirm that maintaining trade protectionism imposes significant costs to the economy. Full trade liberalization sharply increases the value of domestic production; substantially raises the consumption of cereals, meats, and eggs while reducing consumer expenditures on these items; and maintains or lowers the net cost of imports compared to existing policies. Full trade liberalization generates the largest economic benefits among the three policies.

Establishment of a moderate, uniform tariff across the six commodities, by reducing overall levels of protection, also yields substantial economic gains. The net cost of imports is cut by more than half and gross domestic value of output increases compared to the first scenario. Changes in food consumption and expenditures compared to the existing price policy scenario, however, are not large, due to continuation of moderate levels of protection. Compared to full trade liberalization, the uniform tariff policy reduces the cost of imports, but the cost is borne by domestic consumers through higher prices, lower consumption, and higher total food expenditures. The gross value of domestic production is also lower than for the trade liberalization scenario.

Although the net benefits of a moderate uniform tariff policy are not as high as complete trade liberalization, this policy would provide substantial benefits compared to the existing system of protection. A move toward a uniform tariff policy would preferably be seen as a step toward full trade liberalization in corn and livestock. Such a policy could provide short term protection of the sector while productivity-enhancing and cost-reducing technology development policies and public investment policies in infrastructure are instituted in conjunction with liberalization of other industries which play a critical role in the cost structure of the corn/livestock sector, such as the inter-island shipping industry. Moderate tariff levels could then be reduced as improvements in sectoral efficiency occur.

Real Exchange Rate Devaluation

The relationship between domestic and world prices of commodities has a direct impact on the competitiveness of these commodities on world markets. In addition, competitiveness is also influenced indirectly through government policies that affect the real exchange rate. In the Philippines, the indirect effects of trade and macroeconomic policies have caused overvaluation of the real exchange rate, which in turn lowers the competitiveness of agricultural commodities. As was shown in this analysis, the overvaluation of the exchange rate arising from protection of domestic industry has resulted in substantial negative protection in recent years, reducing the competitiveness of agricultural commodities with imported commodities. The report shows that the overvaluation of the peso has a strong negative impact on the competitiveness of the corn/livestock sector.

In order to maintain the competitiveness of the corn/livestock sector if full trade liberalization is adopted, the real exchange rate should be adjusted to the long term equilibrium level as prices in the corn livestock sector are adjusted toward world price levels. If the real exchange rate remains overvalued, nominal equality of domestic and world prices will leave the corn/livestock sector at a disadvantage relative to world prices.

Public Investment and Policy in Marketing and Transportation

This report has shown that Philippine corn markets are relatively competitive and well-integrated, but that structural problems persist. Structural rigidities in the market arise from poor physical farm-to-market linkages, inadequate transportation, and high costs of arbitrage that impair complete and rapid price adjustments between markets and efficient integration of markets.

The findings of the study suggest that there are benefits to developing better physical infrastructure to effectively link production points to market centers and in formulating incentive packages to encourage private investments in transportation, storage, and other necessary marketing facilities. The analysis also showed that investment and policy reforms to reduce marketing margins can have a strong positive impact on corn production and can significantly reduce corn imports. By maintaining farmer incentives even with declining wholesale prices of corn, reductions in marketing margins can be a powerful spur to domestic production. There are also benefits to improving current public market information services to ensure the timely dissemination of accurate and reliable information.

Increased efficiency in cargo handling services from open competition, accompanied by investments in the port facilities, including the ready supply and availability of inter-island vessels to transport corn, can sharply reduce trading and distribution costs. Deregulation in ports and shipping, already underway, should be vigorously pursued. The results indicate that investment and policy reforms to reduce marketing margins can have a strong impact on corn production.

Another area where public investment could have a major payoff is in the control or eradication of foot and mouth disease. The eradication of FMD is not only beneficial for potential

hog exports but in maintaining healthy population of the ruminant animals (beef and carabao) as well. It would be desirable therefore to strengthen further the current program of the Department of Agriculture for the eradication of the FMD. Hog-producing regions identified by the Bureau of Animal Industry as FMD-free zones should be used as an initial basis for negotiations in obtaining international certification of export worthiness in pork. Bilateral government agreements between the Philippines and Asian importers of pork should be pursued more vigorously.

Price Stabilization

While trade liberalization produces considerable gains to the economy, the concern remains that liberalization also opens the economy to excessive fluctuations in world prices, which are then directly transmitted to domestic prices. The quantifiable benefits of price stabilization may not be as high as the other policy areas described above, but stabilization is a potentially important complementary policy, particularly if the government moves to liberalize trade in corn and livestock. Effective stabilization of prices would provide assurance against short term disinvestment in corn and livestock during a transitional phase toward liberalization.

The evidence from existing price stabilization schemes in both developing and developed countries indicates that gains from stabilization of agricultural prices are quite small. The main impacts are distributional, with shifts in benefits from producers to consumers, or vice versa, depending on the design of the stabilization schemes employed, probability distributions of prices, and other factors. Nevertheless, the government may prefer to stabilize prices if a movement toward trade liberalization is contemplated, in order to maintain confidence in the stability of prices during the period of transition toward trade liberalization. If a price stabilization policy is adopted, it is crucial that the costs of effective stabilization be minimized. In order to keep the costs of stabilization down, experience in developing countries indicates that variable taxes or levies are preferable to government buffer stock schemes.

Analysis of existing stabilization schemes also shows that attempts to stabilize prices using governmental agencies to manage buffer stock schemes have been extremely costly, in terms of both the government's budget and the efficient operation of the economy. Recent studies of the operations of the National Food Authority have essentially agreed with these general findings, arguing that the operations of NFA have reduced the profitability of private sector marketing activities to the extent that investments in milling, storage, handling, and transport are discouraged, contributing to inefficiency and high costs in marketing. The experiences of most countries indicate that, for the stabilization of the price of traded goods, variable levy policies represent effective and less costly alternatives to marketing agencies. Design and implementation of an appropriate variable levy system for corn and livestock should be considered in an integrated fashion with trade liberalization policies.

1. INTRODUCTION

The International Food Policy Research Institute (IFPRI) undertook this study of the corn and feed/livestock sector in the Philippines in cooperation with the Department of Agriculture of the Philippines (DA). The study, funded by USAID and implemented through the Agricultural Policy Analysis Project, Phase II, was begun in April 1990.

The study is motivated by four major concerns identified by the DA and IFPRI. First, it is evident that growth in demand for corn for livestock feed is likely to be a major impetus for growth in domestic corn production. Despite relatively slow growth in production and consumption of livestock through the mid-1980's, the relative share of corn utilized as feed has increased significantly. In the years to come, as income growth in the Philippines recovers, it will likely be income-led demand growth for livestock, particularly poultry and pork, which will drive domestic demand for corn. Second, a number of important on-going agricultural policy debates arise from the linkages among corn, feed, and livestock industries, including pricing policies for these commodities, tariff policies, and import/export policies. Third, the domestic marketing and distribution of corn has been identified as a major constraint to the feed/livestock industry. Fourth, the discussions indicated that the data and analytical framework to permit rigorous assessment of policy options in the corn/feed/livestock subsector are in many cases inadequate. The study can therefore fill a substantial gap by developing the data base and analytical framework to address policy options in an increasingly important component of the agricultural sector.

The broad objectives of the study were three-fold: (1) to provide analysis which is directly relevant to consideration of policy issues by the DA and other concerned government agencies; (2) to provide, through research collaboration with the DA, a vehicle for training DA staff in analysis; and (3) to develop and provide a framework for policy analysis which can be used by the DA on a continuing basis to analyze policy in the feed/livestock subsector.

In Chapter 2, *Trends in the Supply and Demand for Corn and Livestock*, general trends in supply and demand for corn, feed, and livestock are assessed, together with a description of government policies in the corn/livestock sector. Chapter 3, *The Economics of Corn Production in the Philippines*, assesses the costs of production, yields, comparative advantage, and effects of government policies on incentives for corn production, by variety and technology levels. In Chapter 4, *The Economics of Hog and Poultry Production*, a comparable analysis is undertaken to assess the incentives, efficiency, and performance of hog, broiler, and egg production, by region and size of operation.

In Chapter 5, *Marketing of Corn in the Philippines: Market Integration and Dynamics of Price Formation*, the degree of market integration, patterns of price determination, and long run price transmission within Philippine corn markets area examined. Chapter 6, *Comparative Analysis of Production and Marketing of Corn in the Philippines and Thailand*, undertakes a comparative study of sources of differences in production and marketing costs in Thailand and the Philippines, in order to assess the potential for policies to reduce costs in the Philippines.

Chapter 7, *Supply Response in the Philippine Livestock Industry*, analyzes the response of hog and chicken supply to output and input prices. Chapter 8, *Food Demand Elasticities by Income Group by Urban and Rural Populations for the Philippines*, undertakes an analysis of disaggregated demand parameters for food in the Philippines. Estimated parameters from these two chapters are utilized in an agricultural supply/demand model in Chapter 9, *Policy Alternatives for the Corn Livestock Sector: A Simulation Analysis*, to analyze alternative pricing and trade policies for the corn/livestock sector. Finally, policy implications are discussed in Chapter 10, *Conclusion and Summary of Policy Implications*.

2. TRENDS IN THE SUPPLY AND DEMAND FOR CORN AND LIVESTOCK

Leonardo A. Gonzales, Betina V. Dimaranan, and Preceles H. Manzo

2.1 Introduction

Corn has become increasingly important as a major Philippine feed/food crop in the 1990's. Several reasons account for the relative economic importance of corn. Around 12 million Filipinos depend on white corn as the major source of their energy intakes; a third of total Filipino farmers depend on corn as the major source of their livelihood; and corn contributes 7 percent in real terms to gross value added in agriculture, with a growth rate of 3.7 percent per year over the past 2 decades (Table 2.1).

2.2 Supply Trends

2.2.1 Corn

Historically, corn ranks second to rice in terms of harvested area. However, starting in 1985, the harvested area to corn (29 percent of total cropped area) outpaced that of rice (27.4 percent) and coconut (27.5 percent). Since then, corn area has continued to increase, reaching a record high of 3.8 million hectares in 1990, while the harvested areas for rice and coconut have stagnated at around 3.4 million hectares each. Over the past 20 years, total harvested area for all crops grew at only 1.12 percent per year. The average annual growth of corn harvested area was 1.93 percent, in contrast to rice (-0.30 percent), coconut (2.25 percent), sugarcane (-3.88 percent), and rootcrops (2.01 percent). During the past decade corn area continued to grow, while other major crops stagnated in terms of growth rate (Table 2.2) and absolute harvested hectarage (Figures 2.1a and 2.1b).

The expansion in corn area came completely from yellow corn area, which grew at an annual rate of 9.5 percent from 1980 to 1989 (Table 2.3). Although the majority of total corn area is still planted to white corn, the relative share of yellow corn harvested area has increased from 10 percent in 1974 to 27 percent in 1989. Likewise, the relative contribution of yellow corn to total corn production increased from 8 percent to 36 percent during the same period.

Total corn production reached 4.5 million mt in 1989. During the 1974-89 period, it grew by a rate of 3.9 percent per year. This rate increased to 4.5 percent during 1980-89, due to the high annual growth (16.4 percent) of yellow corn production. The major source of growth in total corn production was from corn yields, particularly the yield improvements in yellow corn. The annual yield growth rate of yellow corn was 6.9 percent in 1980-89, in contrast to around 1 percent for white corn. Overall, however, the Philippine national average yield of 1.2 metric ton per hectare is still relatively low by Asian standards.

Geographical Distribution of Production. Trends in the quarterly distribution of corn area, production, and yield by major geographical groupings show that Mindanao dominated the production and hectarage harvested to corn in the Philippines (Figure 2.2). From 1970 to 1990, Mindanao accounted for 60 percent of national corn production and more than one-half of area harvested. Luzon has around 20 percent of both production and hectarage while the remainder was in the Visayas (Table 2.4). The Mindanao region also had the highest yield, 4.8 percent more than the national average of 0.83 mt/ha in 1970, increasing to 13.4 percent higher than the national yield average in 1990 (Table 2.4).

Seasonal Supply of Corn. Corn supply is seasonal and follows the general patterns of agroclimatic distribution across the different regions in the Philippines.[1] The major domestic supply of corn comes from Mindanao and generally reaches its peak during the harvest months of July to September and becomes very tight from February to June (Table 2.5).

The seasonality of domestic corn supply induces fluctuations in market prices. Fluctuating inversely with domestic corn supplies, domestic corn prices gradually rise during the lean months (first and second quarter) then drop abruptly during the harvest quarters (July to November). The seasonal variability of both domestic production and prices are reflected in Figure 2.3, showing inverse patterns during each quarter, that is, as domestic supplies build up, domestic prices decline, then prices rise again as the quarterly stocks of corn diminish.

Imports. The Philippines is self-sufficient in white corn for food but not in yellow corn for animal feed. Yellow corn and soybean meal imports, major ingredients in domestic feed formulation, totalled 0.325 million metric tons, and 0.500 million mt, respectively, in 1990. Corn imports, which averaged 295,000 mt per year (less than 10 percent of domestic production) in 1980-85, declined to around 27 thousand metric tons per year in 1986-88 due to quantitative restrictions in corn imports (Table 2.6).

Data from Table 2.6 also indicate that the major proportion of Philippine corn imports were generally procured during the lean months (January to June). However, between 1980 and 1990 corn imports averaging 39 percent of total imports were ill-timed, arriving during the harvest season (July-September).

2.2.2 Meat

Production. Table 2.7 presents the total, commercial, and backyard pork production from 1970 to 1989. As a proportion of the total, commercial pork production rose from 15 percent in 1970 to nearly one-fourth in 1979. This growth in commercial pork production largely accounts for the 5.4 percent average growth in total pork production in the 1970s. However, a declining trend is apparent in the 1980s, with commercial pork dropping from a peak of 152,000 metric tons in 1983 to 119,000 metric tons in 1989. This reflects the effect on

[1] For a more detailed description of corn cropping patterns, please refer to the discussion in Chapter 4).

the commercial hog sector of the tight capital market in the 1980s and of the heavy livestock liquidations made early in the period due to droughts. The most recent two years showed some recovery in commercial production. Backyard pork production registered a slightly higher average growth rate of 1.9 percent as compared to the average growth of commercial production during the 1980s of 0.9 percent. Much of the growth in the backyard sector has been achieved in recent years, with backyard pork production posting an average growth of 2.9 percent from 1986 to 1989. Table 2.8 shows the trends in total, commercial and backyard pork production from 1970 to 1989.

Commercial production of poultry meat grew more rapidly than that for pork for the period 1971 to 1939. Table 2.9 presents the total, commercial and backyard production of poultry meat, and Table 2.10 shows trends by period. As a proportion of total poultry meat production, commercial production grew from one-fifth in 1970 to one-half in 1989. Commercial production grew at a rate of 5.2 percent from 1971 to 1979. After the sharp decline in meat production following the stock liquidations in 1983-84, the commercial sector recorded an average growth of 16.3 percent between 1986 and 1989. Although the growth in backyard production was slow in the 1970s, this improved in the 1980s, posting an average growth rate of 3.9 percent form 1986 to 1989.

Livestock Imports. Data on the supply/demand balances of meat and livestock products indicate that the Philippines imports very little poultry meat, pork, and eggs. Imports on pork were minimal, averaging only 3.4 thousand tons for the past 3 years, mostly in the forms of pork belly, trimmings, jowls and shoulder. The imports of beef were larger, around 7.4 thousand metric tons during the same period (Table 2.11). Briskets, trimmings and choice cuts comprised the bulk of beef imports. These are mostly imported by hotels and restaurants. The Philippines is close to 100 percent dependent on imports of milk and dairy products.

The Philippines is likewise import-dependent on breeding animals, particularly poultry and pigs and feeder cattle for fatteners. Most of the breeding animals imported are grandparent stocks. From 1987-89, the Philippines imported a total of 8,230 heads of hogs; 3.8 million day old chicks; 19.4 million hatching eggs; and from 1987/88, around 14,296 heads of cattle fatteners (Table 2.11).

2.3 Demand Trends

2.3.1 Domestic Utilization of Corn

Corn is very versatile in its uses. Aside from its traditional usage in the Philippines as food (corn grits) and animal feeds, corn can be further processed into starch crystalline sugar (dextrose), corn syrups and refined corn oil. From the corn milling industry, corn products such as dextrins can be used as pigment and paste adhesives, building materials and in cosmetics. In the Philippines, however, these alternative uses of corn are not yet fully explored.

The consumption of corn as food is localized in the regions of Cagayan Valley, the Visayas, and Mindanao. Cebu, in Central Visayas, is the largest trading center for white corn grits for food. The food consumption surveys of the Food and Nutrition Research Institute (FNRI) showed the per capita corn consumption in the Philippines exhibited a declining trend from 1978-82. Rural per capita corn consumption per year was generally higher than urban (that is, 18 kg/capita and 16 kg/capita, for 1978 and 1982, respectively for rural, while urban per capita was 7 kg/year in 1978 and 4 kg/year in 1982), although both showed declining trends (Table 2.12). The Philippine per capita mean consumption of corn and rootcrops were almost at identical levels, slightly above 13 kg/capita/year in 1978, but in 1982 rootcrops per capita consumption showed an upward trend (15 kg/capita/year), especially among the rural (20 kg/capita/year) consumers (Table 2.12). More detail on food demand patterns for corn are provided in Chapter 8.

Trends in corn supply/use are shown in Table 2.13. In 1978, the shares of corn used for food and feed as proportions of total corn production were 60 and 33 percent, respectively (Table 2.13). In 1989, the share of food corn declined to 25 percent while use of corn as feed increased to 71 percent of total consumption. The rapid increase in the consumption of corn as feed was brought forth by the expansion of the livestock industry particularly poultry and hogs. Another notable development in corn use is the increasing volume of corn utilized in the manufacturing sector. Though on the average, corn used for manufacturing was only 5 percent of total domestic supply, the volume reached 243,000 mt in 1990 (Figure 2.4).

2.3.2 Protein Consumption Trends

Data from the Food and Nutrition Research Institute indicate that fish is still the major source of protein intakes among Filipino households. The per capita consumption of fish per year (33.9 kg) was more than twice that of meat products (15.3 kg) in 1982. From 1978 to 1982, the consumption of protein rich foods in general was on an upward trend (Table 2.14). This trend was most evident among the upper income households and urban consumers.

Another feature of this consumption trend in protein-rich foods was that, although the per capita consumption of meat during the period was less than that of fish products, the total increase in meat consumption (35.4 percent) between 1978 and 1982 was almost triple that of fish products (13.4 percent). This relative substitution in consumption of fish is indicative of the scarcity of fish products.

Fish, which was historically the cheapest source of protein, has become relatively more expensive in recent years. The trends in the average wholesale price ratios of fish (bangus) and spring chicken in Metro Manila demonstrate this phenomenon. From 1980 to 1985, the wholesale price of bangus was less than that of chicken. After 1986, however, the price of bangus has tended toward equality with chicken prices, and was even higher in 1987 and 1989 (Figure 2.5). It is anticipated that as these price relatives continue to change, the substitution in the consumption of meat for fish will likewise continue to take place.

2.4 The Feedmilling Subsector

The feedmilling subsector provides the vertical and structural linkage between the feedcrop subsector and the livestock industry. There were around 210 registered manufacturers of mixed feeds in 1989, although the number of participating feed-related firms (feed ingredient manufacturers, feed importers and retailers) in the feedmilling industry totals under 2,000. The manufacturers of mixed feeds can be generally grouped into commercial and non-commercial or independent feedmillers. The commercial feedmillers are composed of four feedmillers association, controlling around 74 percent of total mixed output feed. The Philippine Association of Feed Millers (PAFMI) is the largest commercial group, with a 58 percent market share of total manufactured feeds.

Based on reported data, from 1977-90, total mixed feed production declined annually at 0.36 percent. Mixed feeds for chickens and hogs are the dominant components of the mixed feed industry, accounting for 41 percent and 47 percent, respectively, of the total mixed feeds output of 1,061 thousand metric tons in 1990 (Table 2.15). However, these data appear to be unreliable, since both commercial and total inventory production of hogs and poultry increased substantially over the 1977-90 period. It is highly likely that the degree of underreporting of feed production has increased over time, so that feed production has actually increased rapidly during this period.

The biggest demand for yellow corn comes from the National Capital Region (NCR). The major reason is that most of the feedmillers and commercial livestock farms are concentrated near the NCR, particularly Region IV (Southern Tagalog) and Region III (Central Luzon). These two regions had the highest relative shares of total mixed feed output of 59 percent and 20 percent, respectively. Central Visayas, particularly Cebu, had around 10 percent share while the total Mindanao regions had only around 8 percent.

Costales (1989) showed that in the regional distribution of commercial feedmilling capacity relative to livestock feed consumption, only the national capital regions (Metro Manila, Central Luzon, and Southern Tagalog) had capacity-consumption ratios greater than one. Although the Luzon provinces had an average of around 1.0, this was dominated by the National Capital Regions. Visayas and Mindanao had 0.22 and 0.23, feedmilling capacity-livestock feed consumption ratios, respectively (Table 2.16).

In terms of feedmilling capacity relative to corn production, the regional ratios further indicated a more skewed distribution. For the National Capital Region, the feedmilling capacity - corn production (supply) ratio was 6.50 for the same year. Luzon had 1.83; Visayas, 0.27; and the Mindanao region which produces the most corn, had the lowest feedmilling capacity - corn supply ratio of 0.05 (Table 2.16). the skewed distribution implies that there are great potentials in expanding feedmilling production activities closer to the corn-livestock producing regions.

2.5 Price Trends

2.5.1 Corn Prices

In real terms (1978=100), the prices of white and yellow corn have been nearly constant from 1980 to 1990, at around ₱1.00 per kilogram (Figure 2.6). Trends in domestic wholesale prices of yellow corn also indicated that they were generally higher than the border prices (export parity prices) of yellow corn in the world market, with reference to the price of U.S. No. 2 yellow, FOB Gulf Ports (Figure 2.7). Except in 1983, the annual ratios of the wholesale domestic prices to border prices, known as nominal protection coefficients (NPC), were greater than one, averaging 1.5 during the past two decades relative to the export parity price. However, domestic wholesale prices were lower than the import parity prices during the year 1971-73, 1978, and 1980-81. Several factors affected the levels of the NPCs. One was the fluctuation in the border prices of corn as determined by world corn trade; another was the levels of exchange rates as determined by domestic exchange rate policies; and finally, domestic prices reflecting of domestic corn supply/demand situations and pricing policies. From 1982 onwards, the net effects of all these factors led to NPCs greater than one (Table 2.17)

2.5.2 Meat Prices

The nominal and real retail prices of broilers and of pork loin are presented in Table 2.18. Although there were mild fluctuations in the real price of pork during the 1970s, it grew at a modest annual rate of 0.5 percent during the 1970s. Pork prices declined slightly in the early 1980s but in recent years have experienced an upturn, increasing at 4.0 percent per year from 1986 to 1989. Real chicken prices also started to fall in the late 1970s and into the 1980s. Although real chicken prices fell at an average rate of -1.3 percent for the entire 1980 to 1989 period, there was an upturn in chicken prices in recent years, with a 2.7 percent average annual increase from 1986 to 1989 (Table 2.19).

The price ratios between corn prices and prices of livestock products are indicators of the corn-livestock output relationship. Trends showed that ratio of yellow corn prices to the prices of chicken and duck eggs increased from 1970 to 1990. In contrast, the price ratios of corn to the prices of dressed spring chicken, pork chops and beef rump were basically constant (Figure 2.8 and Table 2.20).

2.6 Government Policies

Over the years, the Philippines has pursued a set of sectoral and economy-wide policies that directly and indirectly affected the corn-livestock subsectors. Among these are trade policies and foreign exchange rate policies; grain stabilization policies reflected in the regulations of domestic market entry and operations; inter-island shipping policies affecting the efficient distribution of corn; and corn and livestock production programs.

2.6.1 Trade Policies

International corn trade is generally regulated in two ways: imposition of import tariffs and import licensing. As of 1990, the Philippine Government imposed a tariff rate of 20 percent on corn. This is lower than other feed ingredients, such as broken rice, sorghum, cassava, and sweet potato at 50 percent each, but higher than the 3 percent tariff on soybeans, soybean meal, fishmeal, and bone meal (Table 2.21). In addition, beginning the end of 1990, an ad valorem levy of 9 percent was imposed on all imports. In addition, the government imposes quantitative restrictions on corn imports through import licensing. This power lies with the Department of Agriculture (DA). Every first quarter of the year, the DA, through an interagency committee, assesses the corn import needs and decides the volume and timing of corn imports. The Philippines also charges import tariffs on live animals, meat products, meat preparations, eggs and dairy. For breeding animals the rate is 3 percent. But for meat and eggs, the existing tariff rate is 50 percent, declining to 30 percent by 1995.

2.6.2 Grain Stabilization Policies

The Philippine Government regulates the market entry and operations of grains (rice, corn, sorghum, wheat) industry through the National Food Authority (NFA). The NFA regulates and administers the issuance of business licenses in the trading and distribution, processing, storage and exportation of grains. All of these activities are intended to support the grains stabilization program of the government. Through the NFA, the government stabilizes the supply and demand of grains through direct market intervention. Historically, rice has been the major focus of NFA's direct market interventions (through floor and ceiling prices). To a lesser extent, the corn stabilization program was similar to that of rice.

The NFA has a long history of attempting to stabilize corn supply and distribution by defending a procurement floor price. This was actively pursued in the 1970s and 1980s in support of the corn self-sufficiency program (Table 2.22). In the 1990s however, NFA has taken a subdued role in corn procurement, acting only as the buyer of last resort and for as long as its budget allows it.

A comparison of NFA corn floor price with the average farm market price of corn is shown in Table 2.23. From 1972 to 1990, the trends indicated that there were often ratios greater than one, implying that due to scarcity in supply, economic forces caused prices to be above the floor such that no defense was necessary. This was most true during the heavy corn import years of 1972, 1974, 1984 and 1989. Despite the imposition of floor prices, NFA had a very limited procurement policy (on the average domestic procurement of NFA was less than 3 percent of total corn production) due to budget limitations. Also, in more recent years, the constraint was not only budget limitations but the policy decision to limit NFA in the trading of grains, and allowing a larger participation by the private sector.

2.6.3 Foreign Exchange Rate Policies

Over the past three decades, the Philippine has pursued a development strategy centered on an industrial protection system that militated against agriculture. This protection system has defended an overvalued exchange rate which has made the peso values of agricultural tradables fall, with simultaneous increases in the price of manufactured goods purchased by the agricultural sector. The deterioration in the terms of trade in agriculture due to the failure of foreign exchange policies to make short-run corrections in the peso exchange rate has contributed to making corn-livestock products uncompetitive in the international markets. Trade studies (Bautista, 1990; Intal and Power, 1990) on the Philippines have shown that overvaluation has negative sectoral and economywide effects on agricultural commodities.

2.6.4 Inter-island Shipping Policies

Improvement in the efficiency of corn and livestock distribution from producing regions to consumption areas would contribute to production efficiencies in feed-grain-livestock subsectors (see also Chapters 3 and 4). Efficient inter-island shipping and port facilities can provide greater access of corn and livestock products across regions in the Philippines, and are essential for both domestic and international trading activities. The relative unprofitability of the shipping industry due to high cost of credit financing, high tariffs on spare parts, and restrictive government route regulations, among others, has led to a lower number of shipping vessels operating among the islands in the Philippines (Clarete, 1991).

Government regulation classifying corn as a basic class (lowest class rate) cargo before 1989 put corn into the domestic liner's list of non-preferred cargoes. After 1989, the Presidential Task Force on inter-island shipping has reclassified corn and other agricultural products in the Class C cargo category (Clarete, 1991). The same Presidential task force is currently studying policy alternatives to improve the efficiency of the inter-island shipping industry.

2.6.5 Corn Production Programs

The first corn production program of the Philippine was originally patterned after the rice production program of the 1970's. It was conceived with the following objectives: to support the expansion of the commercial livestock subsector by reducing feed input costs; to save foreign exchange by eliminating mounting imports and become corn exporter; to provide an adequate supply of food to the corn eating population; and to improve the farm incomes of corn producers.

Since its inception in the early seventies, the corn production program of the Philippines has taken several structural configurations. It started in 1969 with the launching of the "National White Corn and Feedgrains Program" under the National Food and Agriculture Council (NFAC). This program stressed the production of white corn for food to compliment the food self-sufficiency program of government during the period. Until 1973, this program was

centered on the major corn producing/consuming regions of the Philippines. Operating under different program emphasis, it has been named the "Masaganang Maisan," "Maisan 77", the "Maisagana Program " the "Expanded Yellow Corn Production Assistance Program," and more recently the "Corn Productivity Enhancement Program (CPEP)." All these programs had the major objective of attaining corn productivity and self-sufficiency. Several factors account for limited success of past corn programs, including lack of adequate technology, lack of credit, inadequate extension personnel, and high costs of marketing (Perez, 1985).

Compared to previous programs, the current corn program (CPEP) is more modest in its production target (an aggregate 5 percent increase per year in program areas) and centers its assistance on the use and distribution of two vital inputs in corn production, fertilizer and seeds. Phase I (1990) of the CPEP, indicated that of the 73,441 hectares harvested (that is, 68 percent of target area), the average yield was 3.61 mt/ha. This was higher by 15 percent over the attained yield of 3.14 mt/ha for yellow corn under the expanded corn program (ECP) in 1985 and more than double the national corn yields in 1990 (Table 2.24). Under the CPEP, there are provinces with yields higher than the program average. These are the provinces of Isabela (Cagayan Valley, Luzon) and South Cotabato (Southern Mindanao) which had high yields of 4.1 and 4.4 mt/ha, respectively (Table 2.25). However, the extent to which these apparent yield increases can be achieved on a cost-effective basis if the program is expanded is not assured. Considerable additional analysis would be required to assess the contribution and cost-effectiveness of CPEP to these yield differentials. Promising aspects of the current program include the highly viable corn package of technology, which many farmers have already adopted, for both hybrids and open-pollinated varieties, and an improvement in the ratio of farmers to technicians of 100-150:1, as compared to previous corn programs of 250:1.

Figure 2.1a Trends in Area Harvested, Corn and Major Crops, Philippines, 1971-1990

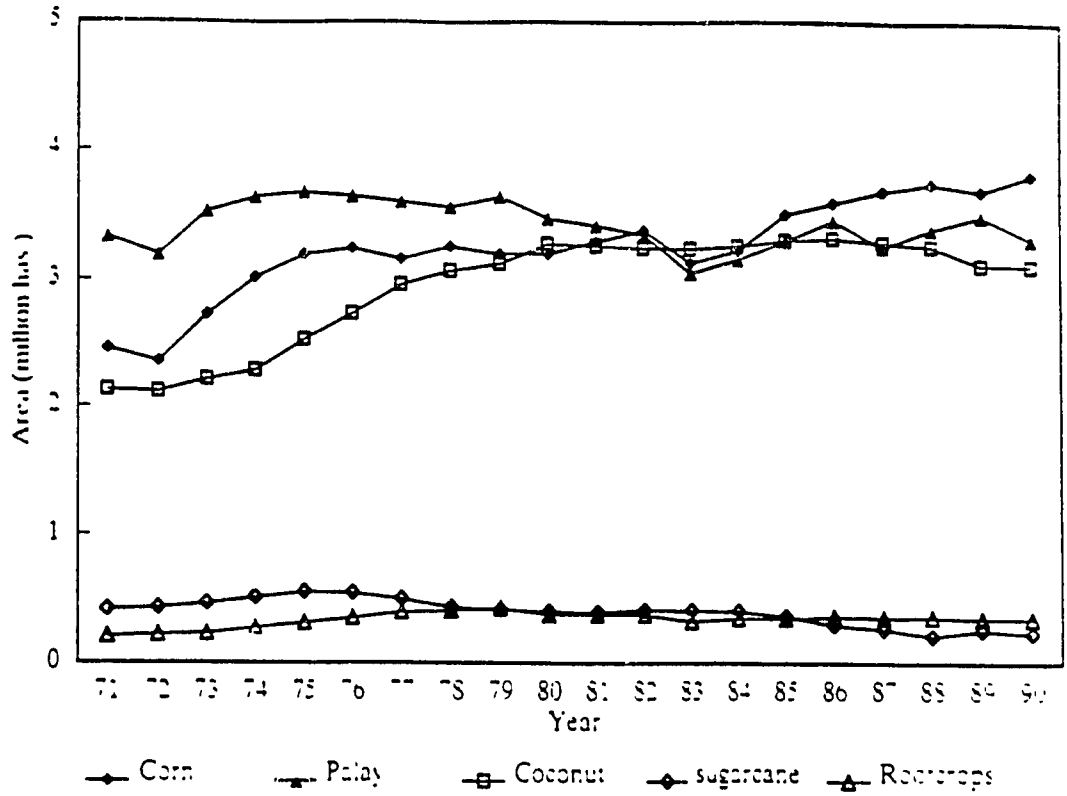


Figure 2.1b Trends in Area Harvested, Corn and Major Crops, Philippines, 1971-1990

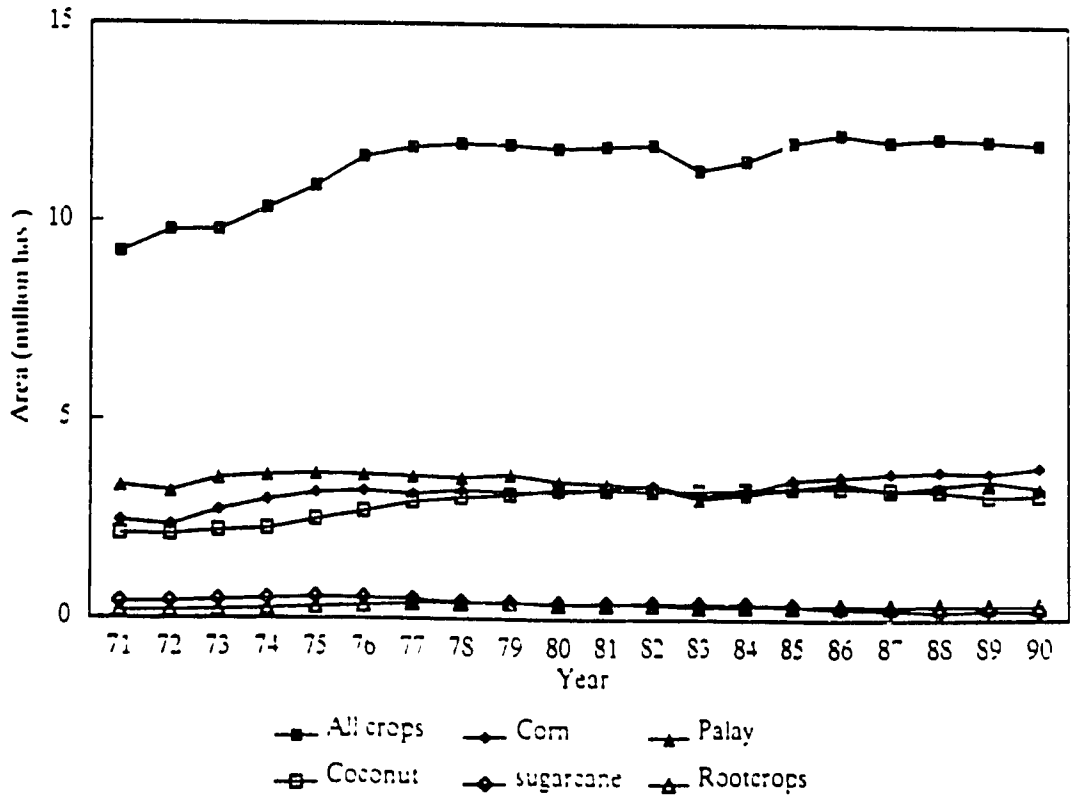


Figure 2.2 Quarterly Distribution of Domestic Corn Production, by Major Island Groups, Philippines, 1988 & 1989

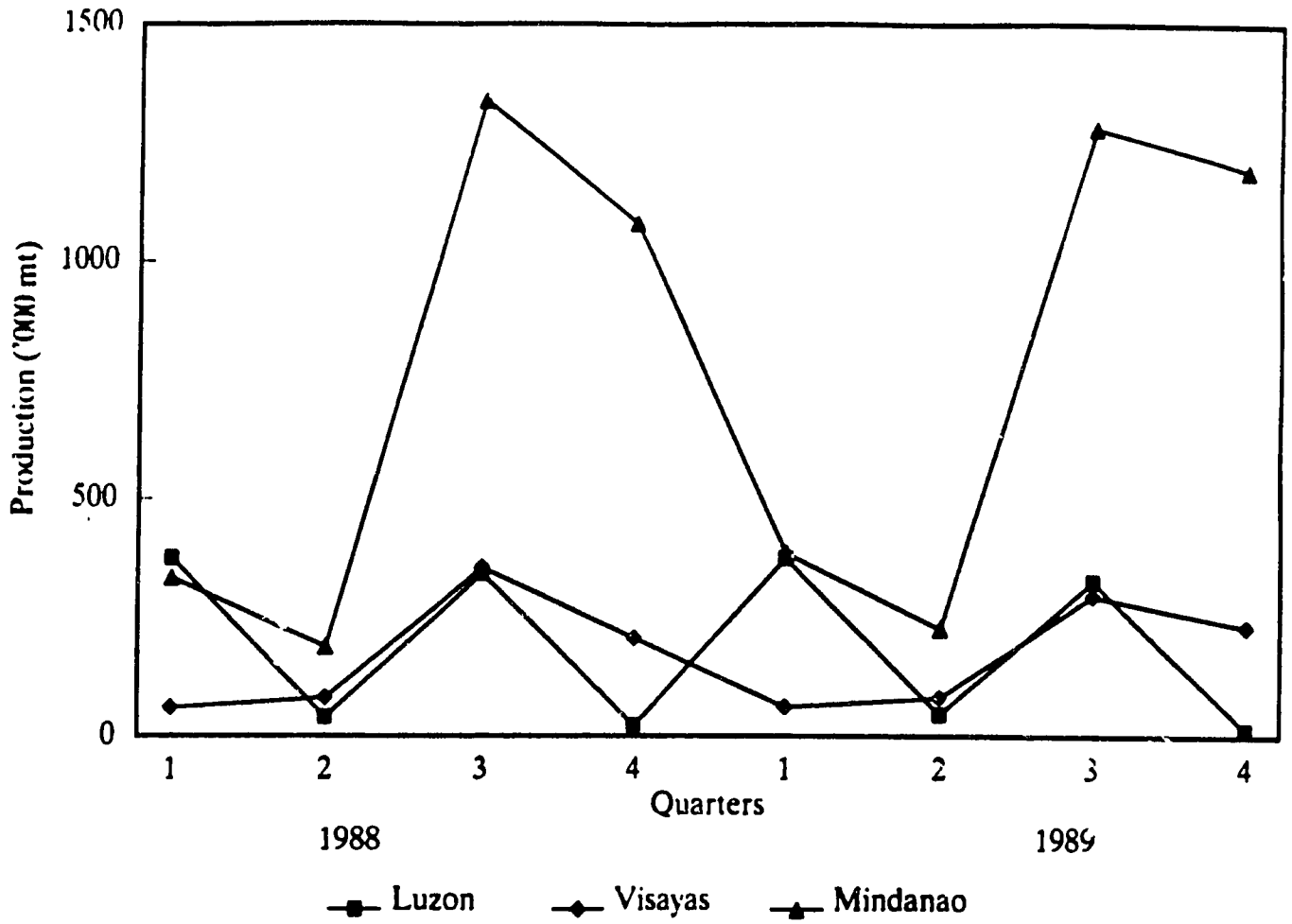


Figure 2.3 Quarterly Fluctuations in Corn Production and Real Farmgate Prices, Philippines, 1985-90

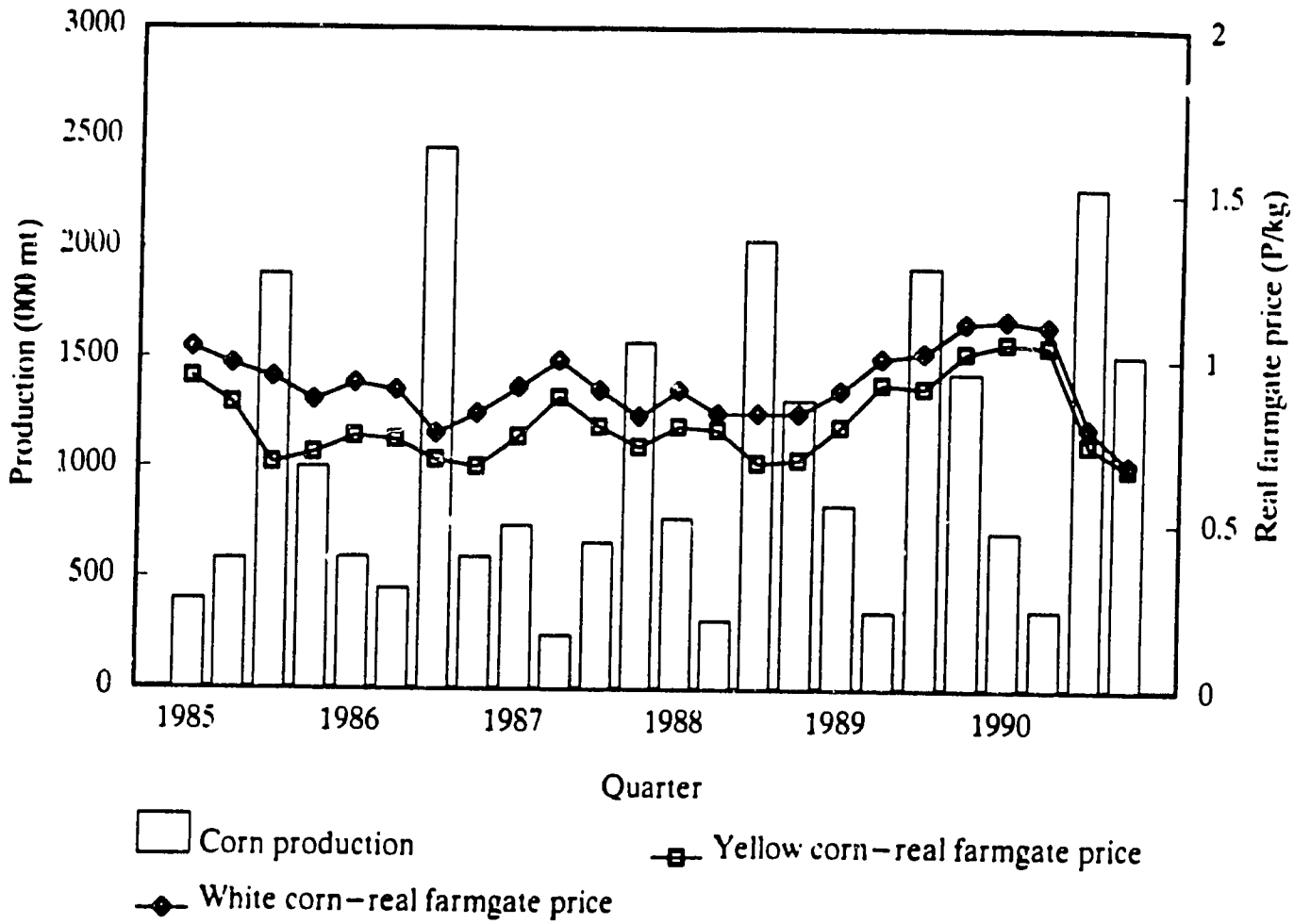


Figure 2.4 Domestic Utilization of Corn, Philippines, 1978-1990

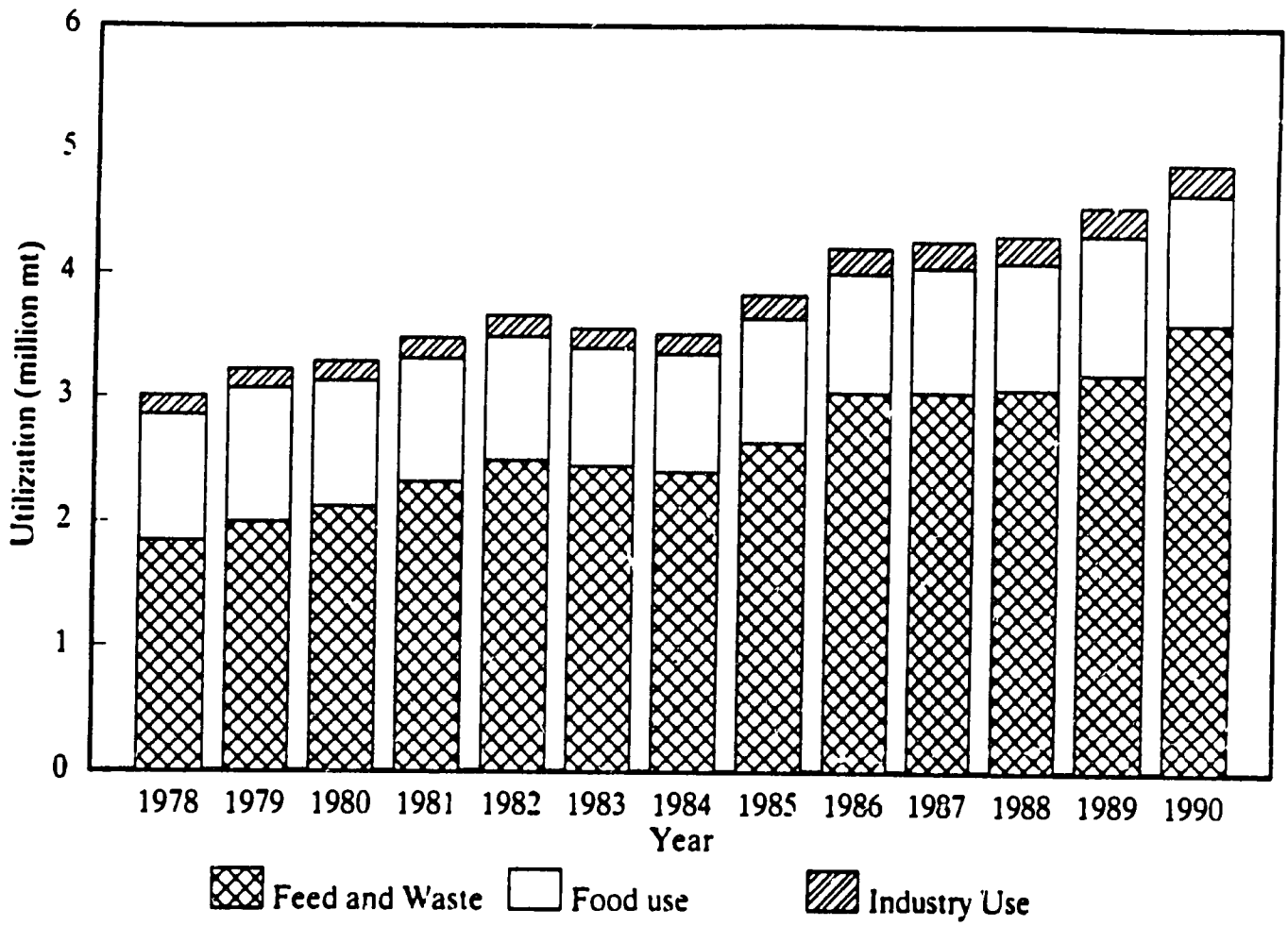
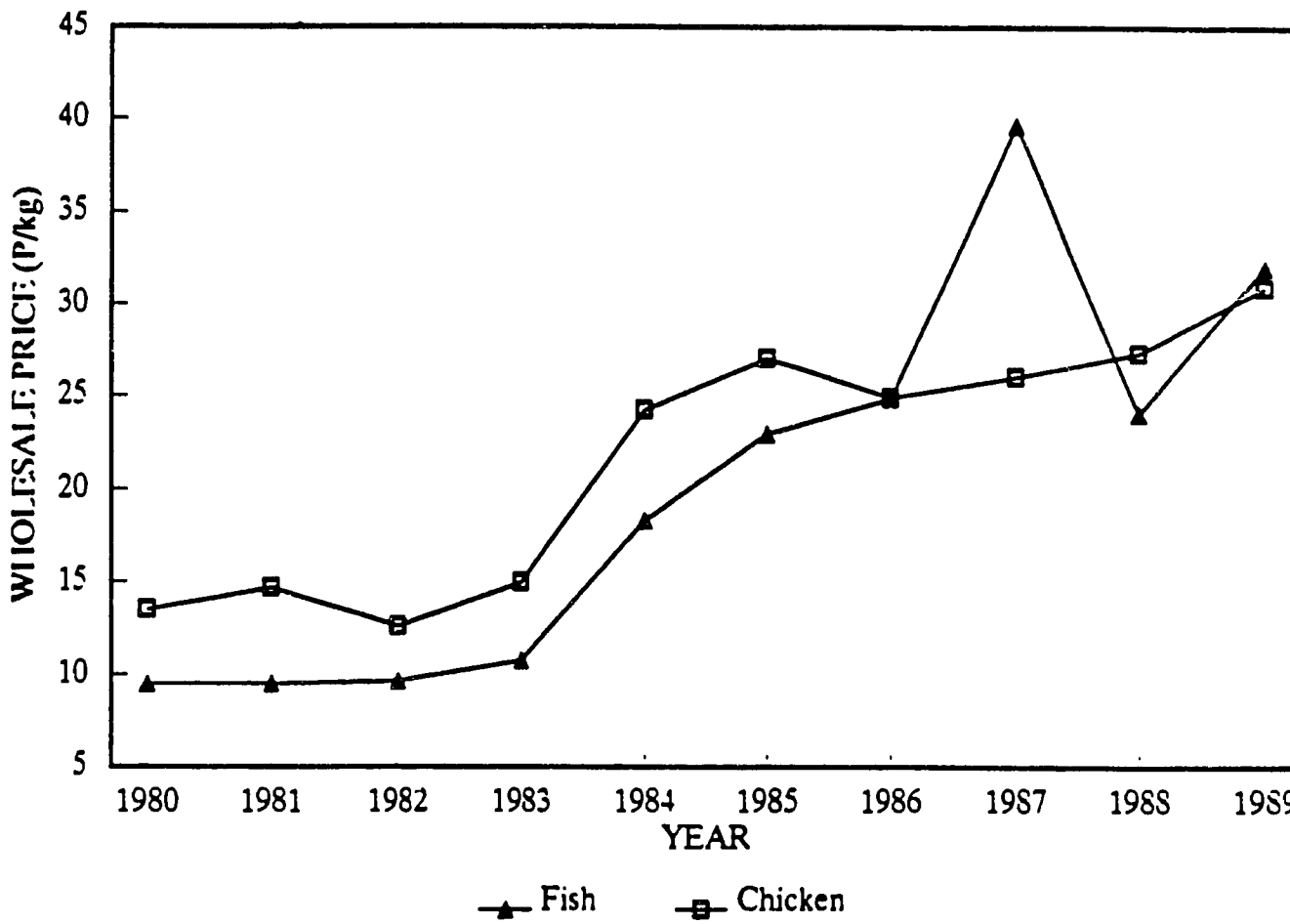
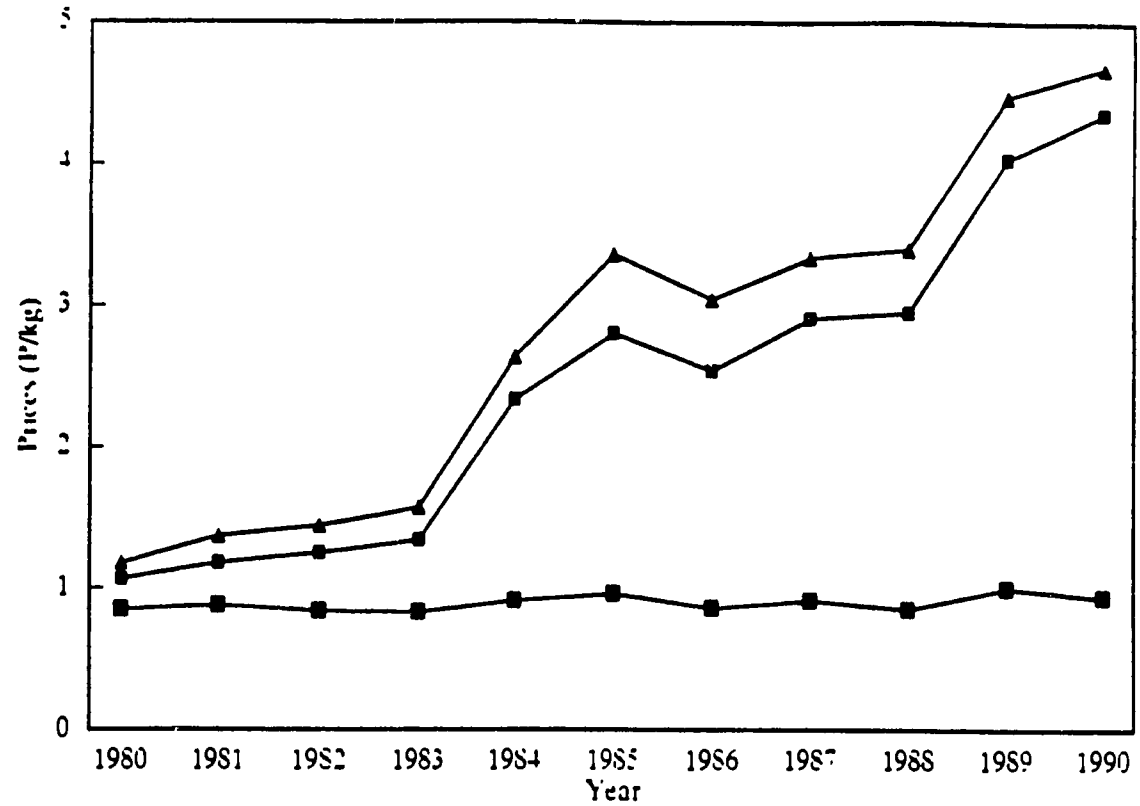


Figure 2.5 Trends in Average Wholesale Prices, Fish (bangus) and Chicken (liveweight), Metro Manila, Philippines, 1980-1990

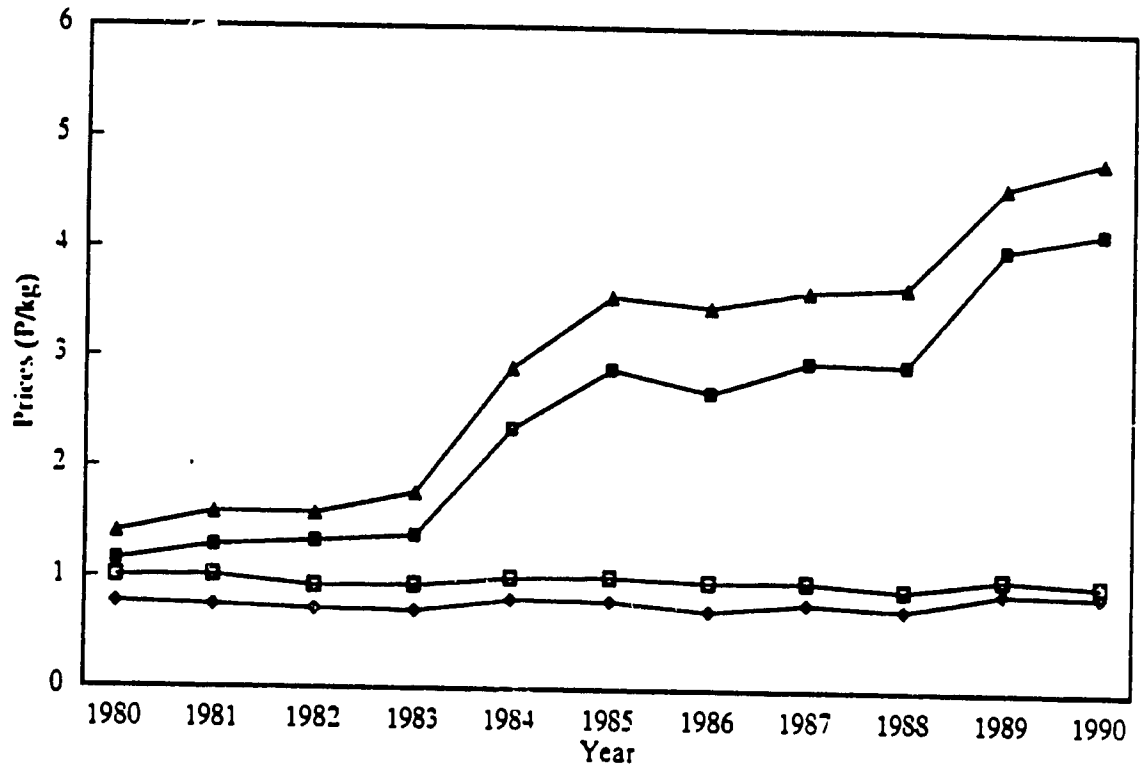


Source: BAS

Figure 2.6 Corn Prices: Nominal and Real Farm and Wholesale, Philippines, 1980-90



White Corn



Yellow Corn

Figure 2.7 Wholesale and Economic Export Parity Prices of Yellow Corn, Philippines, 1970-1990

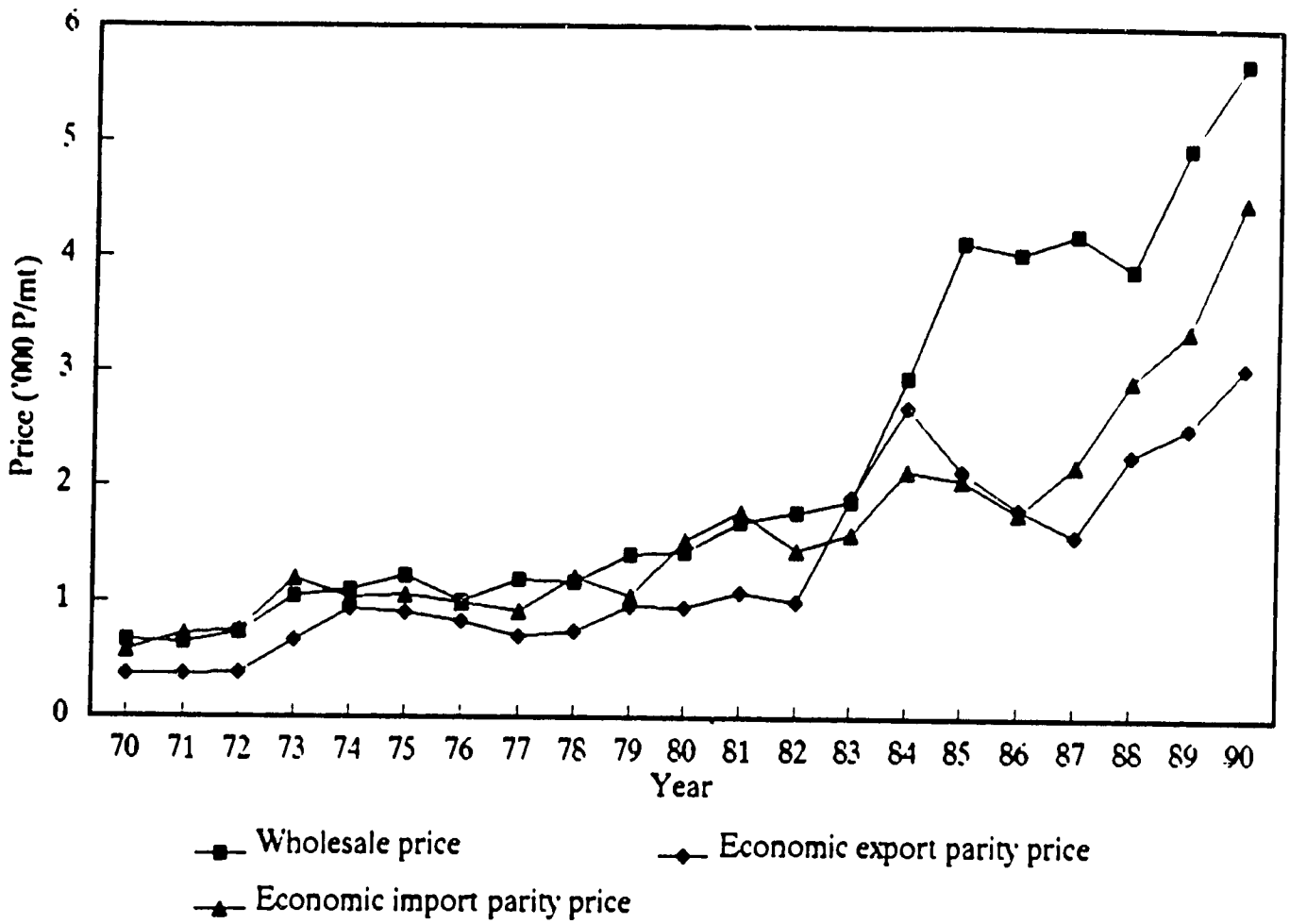


Figure 2.8 Trends in Price Ratios of Yellow Corn With Respect to Livestock Production

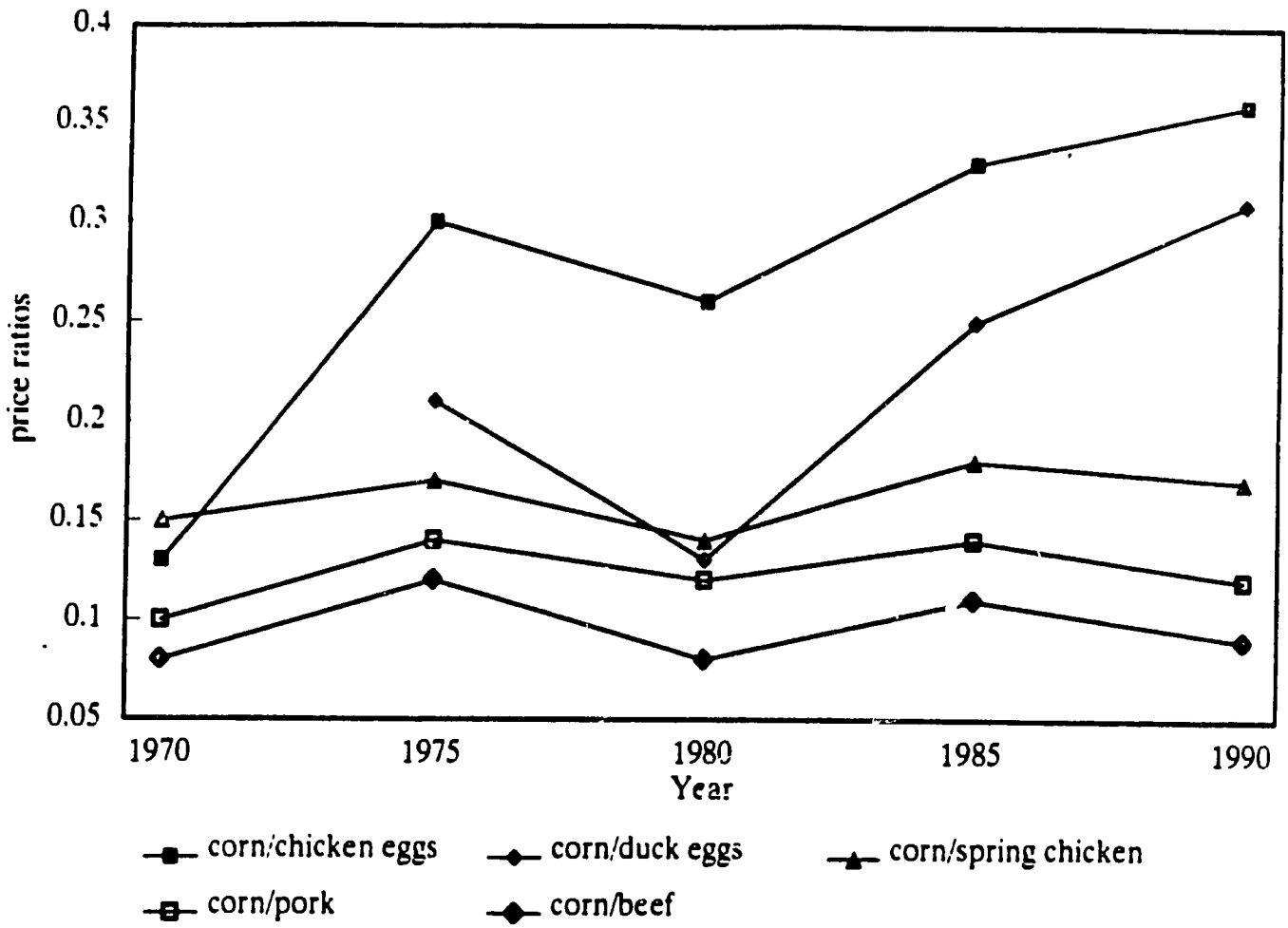


Table 2.1 **Gross value added in agriculture, fishery, and forestry, by industry group, 1972-88 (in million pesos at constant prices of 1972)**

Year	Type of Production							
	Total	Agricultural Crops			Livestock	Poultry	Fishery	Forestry
		Palay	Corn	Other Crops				
1972	16,135	2,749	1,012	5,195	1,756	724	2,689	2,010
1975	18,327	3,357	1,229	6,717	1,701	865	3,194	1,264
1980	23,662	4,169	1,447	9,310	1,841	1,633	3,876	1,386
1981	24,608	4,307	1,494	9,617	1,925	1,958	4,132	1,175
1982	25,378	4,489	1,522	9,921	2,017	2,192	4,254	983
1983	24,845	3,900	1,373	9,695	2,170	2,481	4,407	819
1984	25,409	4,201	1,470	9,893	2,162	2,589	4,329	765
1985	26,253	4,665	1,698	10,071	2,114	2,576	4,422	706
1986	27,110	4,899	1,798	10,378	2,283	2,547	4,551	654
1987	26,834	4,513	1,872	9,989	2,432	2,742	4,638	648
1988	27,771	4,788	1,924	9,834	2,647	3,055	4,834	689
Growth rates: (%)								
1972-88	3.35	3.19	3.66	3.93	2.53	9.41	3.47	-7.05
1980-88	1.81	1.75	3.94	0.77	3.96	6.42	2.28	-9.24
1985-88	1.58	-0.04	4.15	-1.10	7.38	5.85	2.86	-0.82

Source: Philippine Statistical Yearbook, 1989

Table 2.2 Trends in area harvested, corn and major crops, Philippines, 1971-90

Year	All Crops	Corn	Palay	Coconut	Sugarcane	Root Crops*
1971	9238	2454	3332	2126	420	210
1972	9792	2351	3194	2113	435	222
1973	4797	2726	3528	2706	468	232
1974	10372	3010	3632	2279	513	278
1975	10930	3193	3674	2521	553	315
1976	11664	3243	3641	2728	548	353
1977	11903	3158	3602	2957	501	400
1978	12002	3252	3561	3064	436	410
1979	11977	3201	3637	3126	417	430
1980	11884	3199	3471	3274	402	378
1981	11927	3295	3419	3264	400	379
1982	11969	3383	3351	3244	416	377
1983	11335	3132	3054	3241	411	327
1984	11568	3227	3162	3263	409	352
1985	12034	3511	3306	3310	369	355
1986	12248	3595	3464	3323	300	367
1987	12071	3683	3256	3291	269	359
1988	12159	3745	3393	3260	216	361
1989	12102	3689	3497	3110	262	351
1990	12027	3820	3319	3112	235	350
Growth Rates (%)						
1971-80	3.13	3.39	0.78	5.53	-0.68	8.47
1980-90	0.32	1.89	0.11	-0.35	-6.82	-0.54
1971-90	1.12	1.93	-0.30	2.25	-3.88	2.01

* Cassava and sweet potato only.

Source: BAS

Table 2.3 Corn (white and yellow) production, area harvested and yield, Philippines, crop year 1973/74 to 1988/89

Year	Production			Area Harvested			Yield/ha		
	White	Yellow	Total	White	Yellow	Total	White	Yellow	Total
	---------	'000 mt	----------	--------	'000 ha	---------	--------	mt	----------
1973/74	2086	171	2257	2446	281	2727	0.85	0.61	0.83
1974/75	2249	265	2514	2729	281	3010	0.82	0.94	0.84
1975/76	2460	257	2717	2828	365	3193	0.87	0.70	0.85
1976/77	2490	285	2775	2879	363	3242	0.86	0.79	0.86
1977/78	2414	382	2796	2758	400	3158	0.88	0.96	0.89
1978/79	2717	373	3090	2786	466	3252	0.98	0.80	0.95
1979/80	2717	406	3123	2761	440	3201	0.98	0.92	0.98
1980/81	2709	401	3110	2763	475	3238	0.98	0.84	0.96
1981/82	2715	575	3290	2800	560	3360	0.97	1.03	0.98
1982/83	2512	614	3126	2600	557	3157	0.97	1.10	0.99
1983/84	2511	835	3346	2624	641	3265	0.96	1.30	1.02
1984/85	2486	953	3439	2630	684	3314	0.95	1.39	1.04
1985/86	2838	1084	3922	2739	806	3545	1.04	1.34	1.11
1986/87	2912	1103	4015	2779	786	3564	1.05	1.40	1.13
1987/88	2828	1554	4382	2721	1001	3722	1.04	1.55	1.18
1988/89	2911	1610	4522	2755	1009	3764	1.06	1.60	1.20
Growth Rate (%)									
1974-89	1.56	14.22	3.97	0.05	8.46	1.46	1.55	5.75	2.48
1980-89	0.99	16.35	4.51	-0.00	9.43	1.87	1.04	6.95	2.63
1980-85	-2.14	18.66	1.86	-1.35	8.86	0.39	-0.62	9.83	1.40
1985-89	3.12	14.09	6.58	0.86	9.94	3.03	2.19	4.27	3.47

Source: Policy Analysis Division, DA, PMS. Basic data from BAS.

Table 2.4 Trends in corn production, area harvested and yield by major island groupings, Philippines, 1970-90

	Philippines	Luzon	Visayas	Mindanao
Production ('000 mt)				
1970	2013	417	396	1200
	(100.0)	(20.7)	(19.7)	(59.6)
1975	2573	561	492	1520
	(100.0)	(21.8)	(19.1)	(59.1)
1980	3050	504	550	1996
	(100.0)	(16.5)	(18.1)	(65.4)
1985	3864	679	648	2537
	(100.0)	(17.6)	(16.8)	(65.6)
1990	4853	901	700	3252
	(100.0)	(18.5)	(14.4)	(67.0)
Hectarage ('000 ha)				
1970	2427	467	622	1338
	(100.0)	(19.2)	(25.6)	(55.2)
1975	3193	680	848	1664
	(100.0)	(21.3)	(26.6)	(52.1)
1980	3199	572	911	1716
	(100.0)	(17.9)	(28.5)	(53.6)
1985	3512	656	987	1869
	(100.0)	(18.6)	(28.2)	(53.2)
1990	3820	699	1040	2081
	(100.0)	(18.3)	(27.2)	(54.5)
Yield (mt/ha)				
1970	0.83	0.76	0.69	0.87
1975	0.86	0.77	0.64	0.88
1980	0.95	0.82	0.64	1.05
1985	1.10	0.95	0.70	1.22
1990	1.27	1.22	0.70	1.44

Note: Data in parenthesis are in percent

Source: BAS

Table 2.5 **Quarterly distribution of domestic corn production, by major island groupings, Philippines, 1988-89**

Year/Region	Jan-March	April-June	July-Sept	Oct-Dec	Total
	----------	----------	'000 mt	----------	----------
1989					
Philippines	820	356	1906	1439	4522
Luzon	375	46	328	14	763
Visayas	61	82	297	231	671
Mindanao	385	228	1281	1194	3088
1988					
Philippines	771	313	2035	1310	4430
Luzon	376	41	344	22	783
Visayas	60	82	355	207	704
Mindanao	335	190	1337	1081	2943

Source: BAS

Table 2.6 Corn imports, Philippines, 1980-90

Month	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
	'000mt										
January-June	93.4	225.5	243.9	307.3	107.6	235.9	0.0	0.0	25.0	45.7	242.7
January-March	13.9	127.8	90.3	104.4	5.0	97.7	0.0	0.0	25.0	0.0	141.4
April-June	79.5	97.7	153.6	202.9	102.6	138.2	0.0	0.0	0.0	45.7	101.3
July-December	125.1	30.8	98.3	213.3	75.1	15.0	5.6	49.7	0.0	126.6	81.9
July-September	76.2	8.8	27.1	178.0	75.1	15.0	0.0	49.7	0.0	60.0	81.9
October-December	48.9	22.0	71.2	35.3	0.0	0.0	5.6	0.0	0.0	66.6	0.0
January-December	218.5	256.3	342.2	520.6	182.7	250.9	5.6	49.7	25.0	172.3	324.6

Source: Policy Analysis Division of PMS-DA, base data from NFA.

Table 2.7 Total, commercial and backyard pork production, Philippines, 1970-89

Year	Pork Production		
	Total	Commercial	Backyard
1970	432	65	367
1971	469	68	401
1972	507	71	436
1973	748	75	673
1974	476	67	409
1975	491	67	424
1976	518	53	465
1977	339	54	285
1978	468	106	362
1979	510	121	389
1980	586	117	468
1981	560	141	419
1982	554	152	401
1983	600	152	449
1984	570	115	455
1985	531	127	404
1986	537	117	420
1987	487	98	389
1988	529	121	408
1989	568	119	449

Source: BAS and Policy Analysis Division, DA

Table 2.8 Annual growth rates in pork production

Year	Total	Commercial	Backyard
Average Growth Rates			
1971-1989	3.30	5.54	3.23
1971-1979	5.44	10.69	4.67
1980-1989	1.37	0.90	1.93
1986-1989	1.95	-0.59	2.90

Source: Basic data from BAS

Table 2.9 Total, commercial, and backyard poultry meat production, Philippines, 1970-89

Year	Poultry Meat Production		
	Total	Commercial	Backyard
1970	145.08	28.09	116.99
1971	151.04	29.20	121.84
1972	135.25	26.10	109.15
1973	138.75	26.77	111.98
1974	134.96	23.42	111.54
1975	135.78	24.13	111.54
1975	135.78	24.13	111.64
1976	132.87	24.20	108.67
1977	121.20	33.82	87.39
1978	166.51	49.41	117.09
1979	157.12	36.67	120.45
1980	218.00	85.00	133.00
1981	260.00	132.00	128.00
1982	269.00	139.00	130.00
1983	284.00	142.00	142.00
1984	273.00	138.00	135.00
1985	219.00	89.00	130.00
1986	223.00	88.00	135.00
1987	215.00	84.00	131.00
1988	255.00	114.00	141.00
1989	305.00	154.00	151.00

Source: BAS and Policy Analysis Division, DA

Table 2.10 Annual growth rates in poultry meat production

Year	Total	Commercial	Backyard
Average Growth Rates			
1971-1989	4.99	14.11	1.85
1971-1979	1.66	5.20	1.18
1980-1989	7.98	22.14	2.44
1986-1989	9.11	16.28	3.90

Source: Basic data from BAS

Table 2.11 Livestock, poultry and meat imports, Philippines, 1987-90

	1987	1988	1989	1990
Meat				
Beef (mt)		5,186	9,660	4,232*
Pork (mt)		2,901	3,976	888*
Live Animals				
Cattle fatteners (heads)	2,261	12,035	-	
Hogs for breeding (heads)	1,789	2,694	3,747	
Chicks for breeding ('000 heads)	[illegible],307	1,364	1,178	
Hatching eggs ('000 pcs)	11,100	6,441	1,875	

* As of August 1990.

Sources: Bureau of Animal Industry
Livestock Development Council
National Statistics Office, NEDA

Table 2.12 Changes in mean per capita food consumption, Philippines, urban and rural, 1978-82

Food Groups	1978			1982		
	Philippines	Urban	Rural	Philippines	Urban	Rural
	kg/year					
Energy Foods						
Rice	109.5	93.1	117.9	108.0	98.0	113.0
Corn	13.9	6.6	17.9	12.0	4.0	16.0
Starchy roots and tubers	13.5	7.3	16.8	15.0	7.0	20.0
Sweet potatoes	5.1	3.3	6.2	7.0	4.0	9.0
Potatoes and products	0.7	1.1	0.4	1.0	1.0	n
Cassava and products	5.5	1.5	7.3	3.0	1.0	4.0
Others	2.2	1.5	2.9	4.0	1.0	6.0
Livestock Products						
Pork	4.4	8.0	2.2	7.0	13.0	5.0
Beef	1.1	2.2	0.4	1.0	2.0	1.0
Carabeef and others	1.1	0.4	1.8	n	n	n
Poultry	2.6	4.0	1.8	4.0	5.0	3.0
Eggs	2.9	5.1	1.8	3.0	5.0	2.0
Milk and milk products	12.0	20.1	8.0	16.0	24.0	12.0

Source: FNRI

Table 2.13 Corn supply and use estimates, Philippines, 1978-89

Year	Prod.	Begin. Stock	Imports	Supply Gross Supply	Exports	End. Stock	Net Supply Dist.	Seeds	Domestic Utilization Feeds & Wastes	Non-Food	Food Total	Per capita
												(kg)
	----------	----------	----------	----------	----------	'000 mt	----------	----------	----------	----------	----------	
1978	3073	277	106	3456	*	384	3072	64	1848	155	1005	21.95
1979	3056	384	35	3475	*	258	3217	64	1994	153	1070	21.38
1980	3050	258	250	3558	*	219	3339	64	2118	152	1005	20.80
1981	3296	219	253	3768	*	236	3532	66	2313	164	989	19.96
1982	3404	236	341	3981	*	264	3717	68	2485	170	994	19.57
1983	3134	264	528	3926	*	319	3607	63	2436	156	952	18.28
1984	3250	319	182	3751	*	182	3569	64	2393	162	950	17.81
1985	3863	182	281	4326	*	431	3895	70	2631	194	1000	18.29
1986	4091	431	0	4522	*	241	4281	72	3036	205	968	17.28
1987	4278	241	56	4575	*	230	4345	74	3039	214	1018	17.75
1988	4428	230	25	4683	*	293	4390	75	3067	221	1027	17.50
1989	4522	217	176	4915		285	4630	74	3195	231	1130	18.80

Source: Policy Analysis Division of PMS - DA. Data base from BAS

Table 2.14 Trends in per capita food consumption, Philippines, 1978-82

Food Groups/Subgroups	1978	1982	Percent Change
	---------- kg/year ----------		
Energy Foods			
Cereals and Cereal Products			
Rice and rice products	112.0	111.0	-0.9
Corn	13.9	12.4	-10.8
Other cereal products	7.7	6.6	-14.3
Starchy Roots and Tubers	13.5	15.3	13.3
Sugars and Syrups	6.9	8.0	15.9
Fats and Oils	4.7	5.1	8.5
Body-Building Foods			
Fish, Meat and Poultry			
Fish and fish products	29.9	33.9	13.4
Crustaceans and mollusks	7.3	7.3	-
Meat products	11.3	15.3	35.4
Eggs	2.9	3.3	13.8
Milk and Milk Products	15.3	16.1	5.2
Dried Beans, Nuts and Seeds	2.9	3.6	24.4
Regulating Foods			
Green Leafy and Yellow Vegetables	12.4	13.5	8.9
Vitamin C-Rich Foods	17.2	13.1	-23.8
Other Fruits and Vegetables	61.3	58.0	-5.4
Miscellaneous	7.7	11.7	51.9

Source: FNRI,NSTA, 1984

Table 2.15 Total mixed feed output, Philippines, 1977-90

Year	Poultry	Swine	Cattle	Horse	Others*	Total
	mt					
1977	536,769.00	211,884.30	4,623.00	3,594.30	7.00	756,877.60
1978	603,155.30	262,482.70	4,655.30	3,707.60	4,248.60	878,249.50
1979	608,533.30	264,146.80	7,953.20	3,324.40	5,526.10	889,483.80
1980	684,450.50	253,226.00	9,142.30	3,466.90	22,692.10	972,977.80
1981	695,563.30	321,082.00	6,025.60	3,386.40	7,103.50	1,033,160.80
1982	786,045.50	364,920.50	9,029.70	3,261.30	10,907.70	1,174,164.70
1983	765,913.30	365,264.20	4,441.20	2,971.10	6,120.00	1,144,709.80
1984	639,338.00	346,428.60	3,474.00	3,686.10	11,637.80	1,004,564.50
1985	477,537.70	319,448.90	4,052.80	3,653.00	20,898.10	825,590.50
1986	375,561.40	281,368.20	1,964.90	2,963.10	20,390.90	682,248.50
1987	394,885.60	297,519.80	520.10	2,612.80	39,841.30	735,379.60
1988	457,754.03	387,759.26	443.82	3,562.77	90,699.98	940,219.86
1989	442,779.93	436,905.16	460.27	2,770.12	79,542.19	962,457.67
1990	431,483.03	502,039.35	524.49	3,325.59	81,048.09	1,061,078.58
Growth rate (%)						
1977-90	-3.86	3.86	-23.55	-1.61	44.58	-0.36
1980-85	-5.94	3.97	-18.37	1.21	1.40	-2.66
1985-90	0.47	9.47	-58.38	-3.69	41.66	6.26

* Include feeds for rabbit, duck, pigeon, crustacean, fish, dog, monkey, buffalo and dairy goat.

Source: BAI

Table 2.16 **Regional distribution of commercial feedmilling capacity, estimated commercial livestock feed consumption, and corn production, Philippines, 1987**

Region	Rated Capacity	Poultry Feed Consumption	Hog Feed Consumption	Total Feed Consumption	Corn Production	Capacity-Feed Consumption Ratio	Capacity-Corn Production Ratio
	(mt/year)	(mt)	(mt)	(mt)	(mt)	(mt)	
I	23,712	14,127.1	238,153.7	252,280.8	95,969	0.09	0.25
II	8,424	7,636.0	168,626.2	176,262.2	438,167	0.05	0.02
III, NCR & IV	1,606,020	559,419.0	411,702.6	971,139.6	246,937	1.33	6.50
V	10,577	13,222.1	170,912.0	184,134.1	138,093	0.06	0.08
Total Luzon	1,684,733	594,404.2	989,412.5	1,583,816.7	919,166	1.04	1.83
VI	21,000	8,902.4	332,884.4	341,786.8	59,537	0.06	0.35
VII	126,672	41,431.5	202,029.1	243,460.6	286,041	0.52	0.44
VIII	5,616	1,740.0	108,377.1	110,117.1	219,455	0.05	0.02
Total Visayas	153,288	52,073.9	643,290.6	695,364.5	565,033	0.22	0.27
IX	4,680	2,907.8	131,757.5	134,665.3	241,438	0.03	0.02
X	67,200	8,629.1	139,050.8	147,679.9	355,347	0.46	0.19
XI	30,498	34,411.5	186,821.2	221,232.7	1,283,523	0.14	0.02
XII	37,440	2,887.5	107,512.0	110,399.5	1,063,444	0.34	0.03
Total Mindanao	[illegible]	48,835.9	565,141.5	613,977.4	2,943,752	0.23	0.05
Philippines	1,941 [illegible]	695,314.0	2,197,844.6	2,893,158.6	4,427,951	0.67	0.44

Sources: Animal Feed Control Division, Bureau of Animal Industry, 1988
Board of Investments, Department of Trade and Industry, 1988
BAS

From: Costales, 1989

Table 2.17 Wholesale domestic and export parity prices of yellow corn, Philippines, 1970-90

Year	Wholesale Price (₱/mt) (1)	Export Price* ($/mt) (B)	Official Exchange Rate (₱/$) (C)	Economic Export Parity Price (₱/mt) (D)	Economic Import Parity Price (E)	Ratio (A/D)	Ratio (A/E)
1970	670	58	6.43	373	582	1.80	1.15
1971	640	58	6.43	373	720	1.72	0.89
1972	730	56	6.78	380	750	1.92	0.97
1973	1046	98	6.73	660	1201	1.58	0.87
1974	1097	132	7.06	932	1035	1.18	1.06
1975	1224	120	7.49	899	1060	1.36	1.15
1976	1000	112	7.42	831	990	1.20	1.01
1977	1190	95	7.37	700	920	1.70	1.29
1978	1170	101	7.35	742	1210	1.58	0.97
1979	1408	116	7.41	860	1050	1.64	1.34
1980	1430	125	7.60	950	1520	1.50	0.94
1981	1690	131	8.20	1074	1780	1.57	0.95
1982	1780	109	9.17	999	1450	1.78	1.23
1983	1870	136	11.10	1510	1590	1.18	1.18
1984	2950	136	16.69	2269	2130	1.30	1.43
1985	4130	112	18.57	2080	2060	1.98	2.00
1986	4030	88	20.34	1790	1780	2.25	2.26
1987	4190	76	20.80	1581	2190	2.65	1.91
1988	3890	107	21.33	2281	2930	1.71	1.33
1989	4950	112	22.44	2513	3360	1.97	1.47
1990	5690	109	28.00	3052	4480	1.86	1.27

* U.S. No. 2 yellow corn, FOB Gulf ports.

Sources of data: World Bank and BAS

Table 2.18 Nominal and real retail prices of broilers and pork loin, 1970-89

Year	Broiler Retail Price (Manila)		Pork Loin Retail Price (Philippines)	
	Nominal	Real*	Nominal	Real*
	₱/kg			
1970	3.15	3.2	4.41	4.4
1971	5.00	4.1	6.18	5.1
1972	5.12	3.9	6.51	4.9
1973	6.06	3.9	7.00	4.5
1974	7.95	3.9	10.41	5.1
1975	8.52	3.9	10.95	5.0
1976	8.86	3.7	10.88	4.5
1977	10.65	4.0	12.50	4.7
1978	11.36	4.0	13.07	4.6
1979	12.33	3.7	14.95	4.5
1980	13.46	3.4	15.85	4.0
1981	15.21	3.4	17.01	3.8
1982	14.92	3.0	18.62	3.8
1983	15.72	2.9	21.30	3.9
1984	24.66	3.0	31.94	3.9
1985	28.86	2.9	39.82	4.0
1986	29.33	2.9	39.82	4.0
1987	39.90	3.8	43.42	4.2
1989	38.22	3.0	51.35	4.4

* Nominal prices deflated by Consumers Price Index (CPI), 1970=100.

Source: BAS

Table 2.19 **Growth rates of real retail prices of broilers and pork loin, 1970-89**

Year	Growth Rates of Real Retail Broiler Price	Growth Rates of Real Retail Pork Loin Price
Average Growth Rates		
1971-1989	0.42	0.28
1971-1979	2.33	0.48
1980-1989	-1.29	0.08
1986-1989	2.68	3.97

Source: Basic data from BAS

Table 2.20 Trends in the price ratios of yellow corn with respect to livestock products*

Year	Corn/ Chicken eggs**	Corn/ Duck eggs**	Corn/ Spring chicken***	Corn/ Pork***	Corn/ Beef***
1970	0.13	-	0.15	0.10	0.08
1975	0.30	0.21	0.17	0.14	0.12
1980	0.26	0.13	0.14	0.12	0.08
1985	0.33	0.25	0.18	0.14	0.11
1990	0.36	0.31	0.17	0.12	0.09

* Retail prices.
** Per dozen eggs.
*** Per kilogram meat.

Source of basic data: BAS

Table 2.21 Tariff rates for feed ingredients and mixed feeds, Philippines, 1991-95

Feed Ingredients	Year 1991	1992	1993	1994	1995
Corn grain	20	20	20	20	20
Corn bran	10	10	10	10	10
Rice (brokens)	50	50	50	50	50
Rice bran	10	10	10	10	10
Soybeans	3	3	3	3	3
Soybean meal	3	3	3	3	3
Sorghum	50	45	40	35	30
Wheat	10	10	10	10	10
Wheat bran	10	10	10	10	10
Cassava	50	45	40	35	30
Sweet potato	50	45	40	35	30
Fish meal	3	3	3	3	3
Meat and bone meal	3	3	3	3	3
MVS	3	3	3	3	3
Mixed feeds	3	3	3	3	3

Source: Tariff and Customs Code of the Philippines, 1991

Table 2.22 Government support prices for corn grain by date of effectivity, Philippines, 1970-84

Effectivity	Support Price (₱/kg)
8 January 1970	0.24
15 March 1971	0.29
17 January 1972	0.29
November 1972	0.40
February 1973	0.50
20 February 1974	0.62
15 October 1974	0.82
29 May 1976	0.90
21 September 1979	1.00
30 July 1980	1.10
29 December 1980	1.20
17 June 1981	1.30
1 September 1982	1.40
1 December 1983	1.65
26 May 1984	2.00
9 June 1984	2.30
20 October 1984	2.50
20 March 1985	2.90
1 October 1989	3.90
26 July 1990	4.00
17 September 1990	4.50

Source: BAS and NFA

Table 2.23 Floor and average farm market prices of corn, Philippines, 1972-90

Year	Floor Price	Farmgate Price	Ratio Farm to Floor
1972	0.40	0.53	1.32
1973	0.50	0.56	1.12
1974	0.62	0.91	1.47
1975	0.80	0.93	1.16
1976	0.90	0.94	1.04
1977	0.90	0.99	1.10
1978	0.90	0.97	1.08
1979	1.00	1.00	1.00
1980	1.10	1.16	1.05
1981	1.30	1.29	0.99
1982	1.30	1.34	1.03
1983	1.40	1.39	0.99
1984	2.00	2.36	1.18
1985	2.90	2.91	1.00
1986	2.90	2.70	0.93
1987	2.90	2.98	1.03
1988	2.90	2.96	1.02
1989	3.90	4.03	1.03
1990	4.50	4.19	0.93

Source: NFA and BAS

Table 2.24 Corn program yields vs. national yields, Philippines, 1972-90

Program	Period	Yield (mt/ha) White	Yield (mt/ha) Yellow	National Yield mt/ha
White corn and feedgrains	1972-1974	1.34	0.92	0.78-0.84
Masaganang Maisan	1974-1977	1.51	1.26	0.85-0.98
Maisan 77	1977-1981	2.27	2.66	0.98
MaiSagana	1982-1984	1.82	2.72	0.99
EYCPAP	1984-1985	-	3.03	1.023
ECP	1985	1.9	3.14	1.048
CPEP	1990	-	3.61	1.60

Sources: Minguez, 1986.
DA, CPEP, 1990.

Table 2.25 **Production and yields, Corn Productivity Enhancement Program, by province, Phase 1, 1990**

Province	Production	Average Yield
	---------- mt	----------
Cagayan	6,470	2.76
Isabela	115,831	4.08
Albay	5,730	2.49
Camarines Sur	7,122	2.75
Bukidnon	80,141	3.04
South Cotabato	49,835	4.35
TOTAL	265,129*	3.61

* From 68 percent of total area planted under the program or 58 percent of total target area of 126,155 hectares.

Source: CPEP, DA, October 1990

3. THE ECONOMICS OF CORN PRODUCTION IN THE PHILIPPINES

Leonardo A. Gonzales and Nicostrato D. Perez

3.1 Introduction

The major objectives of this chapter are to assess the financial and economic viability of corn as a commodity system, to analyze the impact of government policies on the corn subsector, and to evaluate the comparative advantage of corn production.

As a commodity system, corn faces a wide range of interactions among the economic, technological and institutional factors, which require an integrated analysis of the system as a whole. These interactions are reflected in the decisions of suppliers and distributors of inputs (fertilizer and seeds); farmers' adoption behavior and management practices; corn traders and processors; inter-island shippers; consumers of corn as food and feed; and corn policymakers. An understanding of this dynamic and interactive setting provides a better understanding of the tradeoffs that might exist between short-run costs and benefits for individual participants of the system and the longer run viability of the overall system. This approach is reflected in the first part of this chapter, particularly, the analysis of the financial profitability of domestic corn production and marketing from the major producing provinces to the major wholesale markets.

As a contributor to the food system, corn has a strong linkage with the livestock subsectors. Efficiency in corn production translates to a lower cost of mixed feeds which will ultimately result in lower cost of production in the livestock subsectors. As such, corn becomes a focus of possible food policy reforms which, if accompanied by appropriate investment strategies, can improve the efficiency not only of the feed grain and livestock subsectors, but the economy as well.

The efficiency of corn as a saver (through import substitution) and earner (through export) of foreign exchange hinges in part on prevailing trade and exchange rates policies. The second part of this chapter examines the relative competitiveness of corn under different trade regimes, that is, as an import substitute and as a potential export. It also examines the sectoral impacts of foreign exchange rate overvaluation on nominal protection rates and the relative comparative advantage of corn in international trade.

Carrying out the analysis of corn as a commodity system requires a highly intensive data set. To satisfy the data requirements of the project, secondary and primary data collection was undertaken during the first 7 months (January-July 1990) of the project. The primary data collection (field survey) is discussed in the succeeding section.

3.2 The Field Survey

The primary data collection for the corn livestock project started in March 1990 and ended in July 1990. The survey covered four major corn/livestock producing regions (Figure 3.1). A total of 1,127 respondents were interviewed on the production and marketing aspects of corn, poultry and hogs. The core of the survey staff was composed of seven personnel coming from the International Food Policy Research Institute (IFPRI), the International Rice Research Institute (IRRI), the University of the Philippines at Los Baños (UPLB), and the Department of Agriculture (DA). Enumerators were hired in the study areas as the need arose (Table 3.1). Other personnel from the DA also helped in the survey, particularly in identifying and visiting the study areas. The role of the Agricultural Production Technicians of DA was quite significant in the success of the survey. The recent study covered four major corn-livestock producing regions namely, Cagayan Valley, Central Visayas, Northern Mindanao, and Southern Mindanao. This study was supplemented by survey data from previous studies (Gonzales, 1984; Yorobe, 1989; and Cabanilla, 1989) to cover Regions IV and other corn/livestock-producing regions.

Table 3.2 shows the distribution of respondents by region and classification. Respondents were classified into corn farmers, corn traders/middlemen, corn traders/shippers, corn-feedmillers (corn millers, feed millers) broiler/layer producers, and swine producers. Poultry and hog producers were further classified into backyard, semi-commercial and commercial. Study areas were chosen based on their importance in corn and livestock production. Consultations were done with DA and knowledgeable private groups in the selection of the study areas, particularly at the provincial and barangay levels. Respondents were chosen randomly, except for large traders and poultry/livestock growers, where purposive sampling was used due to the limited number of potential respondents.[1] Descriptive results from the survey are presented below. These general observations provide background for the economic analysis of corn and livestock production.

3.2.1 Region II (Cagayan Valley)

Cagayan Valley accounts for roughly 10 percent of the country's total corn production. The major producing provinces are Cagayan and Isabela. However, because of the poor peace and order situation in Cagayan, the survey was limited only to Isabela, particularly the towns of San Agustin, Jones, Tumauini, Ilagan, Angadanan, and Echague. Several farmers were also interviewed in Nueva Viscaya. In these areas, planting was generally done twice a year in small to medium-sized farms. Cagayan Valley falls under the Type III climate in the Philippines, that is, the months of November to April are dry, while the rest of the year is wet. Planting depends largely on rainfall, with the first cropping in the months of April, May or June and the second cropping in September to December. Yellow hybrid corn varieties were usually planted in the survey areas. The rainfall distribution and dominant cropping patterns for Region II are

[1] For the complete listing of the interview schedules and questionnaires used, please refer to the IFPRI Progress Report of July 1990.

illustrated in Figure 3.2. Rice, corn and legumes dominate the cropping pattern for Cagayan Valley.

3.2.2 Region IV (Cebu, Central Visayas)

Cebu is the major trading center for white corn in the Philippines. Historically, it has also been a significant white corn growing region because much of the population prefers corn to rice. With changes in relative prices, rice has become cheaper compared to corn, so many consumers have shifted to rice. Also, due to the increased profitability of growing other commercial crops, the area planted to corn has diminished significantly over the years, so corn is now planted mostly in marginal areas. The majority of the white corn requirements of Cebu are obtained from Cagayan de Oro, General Santos and Negros Oriental. Because of these developments, data collection efforts concentrated on corn and feed milling and poultry and livestock growing and not on corn production.

3.2.3 Region X (Northern Mindanao)

Corn production in this area was mainly in the provinces of Bukidnon and Misamis Oriental. Extensive corn areas with medium to large farm sizes were observed in the areas of Malaybalay, Manolo Fortich, Valencia and Kadingilan. Corn is a major cash crop planted twice a year in the months of March/April and September/October. Sugarcane competes with corn in land use. Although yellow corn is the most common, many farmers were still using white varieties, especially in the remote and rolling areas.

3.2.4 Region XI (Southern Mindanao)

For the study's purposes, this region can be divided into two distinct areas: a corn consuming area comprising the province of Davao and a production area located in South Cotabato. Corn production in the Davao provinces was limited and concentrated mostly in Davao del Norte, particularly in the towns of Tagum, Campostela, Monte Vista and New Bataan. The assembly point for corn was in Tagum, from where it was transhipped to Davao warehouses and livestock growers. Poultry and hog industries were highly developed in Davao. Aside from the numerous backyard growers, several large commercial farms were in operation. Davao supplies nearly half of Mindanao with poultry products.

South Cotabato has extensive areas under corn cultivation, with a favorable agroclimatic environment for corn production. The soil is sandy loam and rainfall is evenly distributed throughout the year (Figure 3.3). Unlike in most areas of the country, this area averages three croppings per year with total production amounting to 472,000 mt in 1989, 62 percent of which was yellow. The adoption of the new technology was quite common, particularly in the use of the new varieties and mechanization.

3.3 The Sample Farmers

A total of 896 sample farmers were interviewed across six corn producing provinces. However, due to incomplete input/output coefficients for some, only 730 respondents were included in the farm level analysis (Table 3.3). Results from the survey indicate that corn farmers across the provinces had an average of 19 years of farming experience. The modal distribution of farmers (39 percent) ranged from 1 to 10 years, although a third had high farming experience of more than 21 years (Table 3.4). In terms of household size, 59 percent of sample farmers had family size between 5 to 8, and the average across the corn producing areas was around six (Table 3.5). Most of them (68 percent) thought that the quality of their farms in terms of soil type, drainage and slope was generally good for corn farming (Table 3.6).

The majority (55 percent) of farmers interviewed were owners of the land they till. Around 22 percent of total respondents were tenants; 11 percent leased their lands; and the remaining 12 percent had variable tenurial arrangements of rental/leasehold (Table 3.7). A very high percentage (88 percent) of corn farmers across regions borrowed their operating capital from informal sources (traders, landlords, relatives and friends). Only 12 percent of total corn farmers borrowed from banks and cooperatives. Lanao del Sur corn farmers were exceptions, with 39 percent borrowing from banks. The farmers who depended mostly on bank financing have relatively large farms (Table 3.8).

For formal cash loans, the amount ranged from ₱1,000 to ₱4,000 per hectare and an average interest rate of 25 percent per annum. The informal loans on the other hand, ranged from ₱1,500 to ₱3,100 per hectare, with interest per year averaging 44 percent (Table 3.9). It was also customary among corn farmers to borrow capital in kind like corn hybrid seed and fertilizer.

The average distance of corn farms to the nearest marketing outlet was around 14.1 kilometers. Lanao del Sur had the farthest distance of 43.8 kilometers, while Davao and Nueva Viscaya had the shortest distance from farm to market outlet, of 5 and 6.8 kilometers, respectively (Table 3.10).

3.4 Corn Production Technologies

For most crops, the type of cultivar is largely determined by the type of gene action and their method of pollination (Lantin, 1985). Corn falls into two basic categories: open-pollinated and hybrid. The open-pollinated (OP) varieties are products of intercrossing among selected parents followed by several generations of random mating and selection, until genetic equilibrium is reached. The development of a hybrid maize cultivar on the other hand is based on the observed superiority of the progeny, known as hybrid vigor, which is developed when two unlike parents are crossed. The more common types of hybrids presently grown in the Philippines are three-way and double crosses developed using inbred parental lines (Lantin, 1985).

A third dimension of the corn cultivar is varietal color. In terms of the domestic utilization of corn, white corn is used as a food staple (for some selected regions) and also for starch manufacturing. Yellow corn is generally used for animal feeds. For layer feeds, yellow corn provides the xantrophylls that gives a yellow color to the egg yolk of chicken.

Most open-pollinated corn genetic materials used by farmers in the Philippines have been introduced by the Department of Agriculture and the University of the Philippines at Los Baños (UPLB). In the 1960's, varietal screening and breeding for the open-pollinated corn were focused on yield and resistance to downy mildew. During the early 1970's, UPLB introduced four OPs which were downy mildew resistant, with potential yields of 4-5 tons per hectare. The other downy mildew resistant varieties were developed by the University of Southern Mindanao (MIT2) and the Bureau of Plant Industry (BPI Var 2). In 1977, yellow hybrid corn was introduced to Philippine corn farmers by the private sector. To date, the Institute of Plant Breeding (IPB) has released two cultivars of OP varieties (IPB Var 1, yellow, and IPB Var 2, white) and one hybrid (IPB Var 5) which are high yielding and downy mildew resistant. The main sources however of hybrid varieties are private corn companies. In the 1990's, Pioneer, Cargill and San Miguel Corporation have developed new generation of hybrids which are downy mildew resistant and with potential yields of 5-6 tons per hectare (Table 3.11).

For the economic analysis here, corn production was classified based on seed color (yellow and white); genetic characteristics and mode of pollination (open-pollinated and hybrid); and levels of fertilizer use. Sample farmers who were low fertilizer users applied fertilizer from 1 to less than 5 bags per hectare; medium users, 5 to less than 8; and high users, 8 bags per hectare and above. The corn production technology categories are summarized in Table 3.12. Although white corn hybrids are technologically possible, survey results did not show any corn farmer who planted white hybrids.

Table 3.13 shows the frequency distribution of sample farmers delineated by production technology. Eighty one percent of the sample were yellow corn hybrid producers, substantially higher than initially planned in the sample design. Regional and provincial statistics on white and yellow corn hectarage in 1988/89, which were the basis of the corn sampling frame, changed drastically during the 1989/90 corn cropping seasons in favor of yellow corn. This made it impossible to follow the original sampling frame by white and yellow corn farmers at the survey sites. The survey team instead utilized random selection of sample farms in the major corn producing towns/barangays regardless of varietal color.

Figure 3.4 also shows the farm sample yield distribution of the different corn production technologies. As expected, the yield of yellow hybrid, at high fertilizer use (8 bags or more per hectare) was highest at 4.92 mt/ha across survey sites. On-farm yield differences among yellow hybrid, yellow OP and white OP at medium technology (i.e., at fertilizer rates of 5 to less than 8 bags per hectare) were small; medium technology yields ranged from 3.2 to 3.6 mt/ha. Finally, at low fertilizer use, the yields of second generation hybrids and the OPs ranged from 1.344 mt/ha (white OP) to 1.7 mt/ha for F2 hybrids (Figure 3.4).

3.5 Fertilizer and Yield Estimates

The survey results in terms of corn fertilizer use and yields across technologies are compared with estimates of other studies in Table 3.14. IFPRI survey results on fertilizer use are compared with the estimates of the Bureau of Agricultural Statistics (BAS) and the Fertilizer Pesticide Authority - Louis Berger International (FPA-LBI) study of farm level survey of fertilizer use. For urea, IFPRI's average estimate (3.18 bags per hectare, at 50 kg per bag) was nearly the same as BAS estimates (3.28 bags/ha). However, for complete fertilizer, the IFPRI survey had the highest estimate of 3.85 bags per hectare.

In terms of yield, IFPRI estimated 66.82 bags as the average corn yield per hectare. This was next to the highest yield estimate of the Corn Production Enhancement Program (CPEP) of 76.47 bags per hectare. The estimates of the Rice and Corn Survey (RCS) and the FPA-LBI were relatively close to each other at 35.35 and 46.23 bags per hectare, respectively (Table 3.14). The CPEP yield estimate was relatively high, because it reflected corn farmers in the corn program areas. These are heavy users of fertilizer (around 6-8 bags per hectare), due to the fertilizer subsidy. The IFPRI survey fertilizer-yield estimates are also relatively high because of the higher proportion of hybrid farmers in the sample. But in terms of the fertilizer use - yield ratio, the IFPRI estimates appear reasonable at 1:9.5. This means that every bag of fertilizer use generated on average 475 kg of corn yield.

Although the IFPRI farm yield estimates are relatively high, they are still below the potential or experiment station yields as estimated by Lantin in 1985. Figure 3.5 demonstrates the average yield gaps across production technologies under high and low input utilization. The gap was highest at 1.77 mt/ha in hybrid corn at low input utilization. At high input use, hybrids had also the lowest gap at 1.02 metric ton per hectare. Among the OPs, white OP at low input use had a yield gap of 1.74 mt/ha, while the yellow OPs had gaps of slightly over 1.5 mt/ha at both high and low input use (Figure 3.5).

3.6 Fertilizer and Labor Use

Fertilizer and labor are the two major inputs in corn production. Although some farm mechanization is taking place in larger corn farms, corn production is still labor intensive. Fertilizer usage, however, is relatively new among corn farmers in the Philippines. It was only with the introduction of the improved open-pollinated and hybrid seed technologies that farmers began using fertilizer intensively.

Table 3.15 shows the average fertilizer and labor use in the survey. Average fertilizer application ranged from 132 kg/ha (2.64 bags) in Northern Mindanao, to 232 kg/ha (4.64 bags) in Cagayan Valley for the OPs. Fertilizer was more intensively used in hybrid corn than in open-pollinated varieties. The level of usage in hybrids ranged from of 317 kg/ha (6.34 bags) in Northern Mindanao to a high of 500 kg/ha (10 bags) in Lanao del Sur (Central Mindanao).

Labor usage per hectare ranged from 60 mandays in Southern Mindanao, to 85 mandays in Cagayan Valley. Differences in labor use were not pronounced by seed type, but reflected the variations in wages by region. Labor was more intensively employed in Cagayan Valley where wage rate was lowest (₱28.15/manday) and was less utilized in Central Mindanao where wage rate was highest at ₱47.62/manday (Table 3.15).

3.7 Profitability of Corn Production

The profitability analysis assessed the financial viability of corn production from the farm to the major wholesale markets. Detailed costs were computed based on the domestic trade flows shown in Figure 3.6. At the farm production level, detailed input/output (I/O) coefficients were estimated and aggregated by province and by specific type of production technologies. Likewise, detailed calculation of costs was done to reflect the marketing and trading costs from farm to the wholesale markets. These cost estimates were averages, reflecting in general the on-farm, and post-farm production trading and marketing activities at their prevailing market costs. Gross returns to corn production (on a per hectare basis) were estimated as the product of the yields (by production technologies) and the domestic prices (Table 3.16) on farm and at wholesale. The two wholesale markets were Cebu and Manila.

Given the input/output coefficients from farm to wholesale, the profitability of corn production by production technologies, across provinces was estimated using the generalized formulation of net profit.

$$\pi_{f_i, w_i} = R_{f_i, w_i} - C_{f_i, w_i}$$

$$R_{f_i} = Q_{ii} \cdot P_f \text{ and } R_{w_i} = Q_{ii} \cdot P_w$$

$$C_f = rA + wL + \alpha K + \beta P$$

$$C_w = C_f + \mu D + cM + vS$$

where:

π_{ii}	=	net financial profit
R_{ii}	=	gross returns
C	=	total cost
Q	=	corn output
P_f	=	price of corn on farm
P_w	=	price of corn at wholesale
A, L, K, P	=	land, labor, operating capital (material inputs) and on farm processing activities with their corresponding costs per unit r, w, α, and β

D, M, S	=	distribution (shipping), marketing, handling and storage activities with corresponding per unit costs, *u, c,* and *v*
f, w	=	farm and wholesale chains
i, t	=	region and technology

3.7.1 Cost Components

Total costs were estimated at the farm level and at wholesale (production plus trading costs). Farm production costs included land rent, hired and family labor, the cost of material inputs (seed, fertilizer, chemicals), lumped as operating capital, and costs of post harvest activities composed of hauling, drying, and inland transport to the farm marketing outlet. The total costs at wholesale included the above costs plus all costs related to marketing, distribution and trading beyond the farm. These were handling and land transport (trucking), storage, freight (shipping) and arrastre services, shrinkage and losses and all corn trading related costs up to the major wholesale markets.

For the Mindanao provinces, the *intermediate* wholesale markets were Malaybalay (Bukidnon and Lanao del Sur), Tagum (Davao), and Marbel (South Cotabato). For Cagayan Valley, the Santiago (Isabela) and Solano (Nueva Viscaya) markets were intermediate markets which are directly linked to Manila. The analysis also distinguished Cagayan de Oro, General Santos and Davao City as *medium* wholesale markets. They usually become large regional depositories of corn during harvest. From these medium markets, corn was shipped to Cebu and/or Manila -- the two *major* wholesale markets for corn in the Philippines (Figure 3.6).

The provincial marketing-distribution-trading costs from the town marketing outlets to the major wholesale markets in Manila are summarized in Table 3.17.[2] Cebu however was also considered as a separate major market channel. Traders have the option to market their corn directly to Manila or Cebu. The costs of marketing and trading across the six corn producing provinces to the Manila wholesale market ranged from ₱1,133 to ₱1,464 per metric ton of corn grain. Across provinces, freight costs (trucking and shipping) accounted for 35 to 43 percent of total trading costs. Isabela's freight costs comprised 43 percent of total trading costs, while Lanao del Sur and South Cotabato had the next highest freight cost shares of 42 and 39 percent, respectively. In terms of actual magnitude, Lanao del Sur and South Cotabato had the highest marketing-distribution costs, totaling ₱1,449 and ₱1,464 per metric ton, respectively. Bukidnon, Nueva Viscaya, Davao and Isabela had trading costs averaging ₱1,278 per metric ton (Table 3.17).

Farm production costs across production technology and regions accounted from a low of 55 percent of total cost, (South Cotabato, white OP medium, Table 3A.10, and yellow OP low technology, Table 3A.9) to a high of 75 percent (Bukidnon, yellow OP low technology,

[2] This summary is based on Appendix Tables 3A.1-3A.6.

Table 3A-9) of total costs.[3] Land rent as a proportion of farm production cost ranged from 15 percent (Bukidnon, white OP medium technology, Table 3A-10) to 25 percent (Nueva Viscaya, yellow hybrid low technology, Table 3A-8). The prevailing regional leasehold arrangements determined the rent on land and varied across regions by type of technology.[4] The average percent share of land to total farm costs across technology and producing regions was 17 percent.

Total labor costs accounted for an average of 35 percent of total farm costs. As farmers shifted to hybrid corn technology, the proportion of hired labor to total labor cost also increased. The analysis valued the opportunity cost of family labor at the prevailing market wage for the specific production activity (e.g., fertilizer application, planting, and harvesting). The relative competitiveness of the labor market in the Philippine agricultural sector justifies this valuation (Medalla, 1990).

Fertilizer and seed cost were the major expenditures for the current or material inputs, especially among the yellow hybrid production technologies. The share of material input costs to total farm production costs ranged from a low of 10 percent (Isabela, F2, yellow hybrid, Table 3A-8), to a high of 41 percent (Davao, F2 hybrid, Table 3A-8).

3.7.2 Gross Returns

Gross returns are a function of output and prices. Given yield levels, financial prices on farm and at wholesale determine the gross returns. Prices during the crop season 1989 were extremely high as compared to historical trends. Hence, the analysis used the 1990 July (on farm) and November (wholesale) prices to reflect historical levels at harvest for most regions. Farm prices generally differed by provinces depending on their distance to the intermediate or medium markets and the quality of roads in the area. Among the corn producing provinces, the survey found that Lanao del Sur farmers had the lowest farm price of ₱3.01 per kilogram in 1989. Bukidnon had a higher farm price of ₱3.45 per kilogram. The others had farm prices ranging from ₱3.38-3.78 per kilogram (Table 3.16).

For Cebu and Manila wholesale markets, the analysis used the November wholesale prices of corn in the same year. The rationale for this was to take into account the average three months turnaround time of shipping and storage from the farm production points to the major wholesale markets. The research team also observed an average ₱0.10 per kilogram price spread between Cebu and Manila wholesale markets. The Manila and Cebu wholesale prices were ₱5.20 and ₱5.10 per kilogram of corn (Table 3.16).

Gross returns of corn production from farm to wholesale, by production technology across regions, are shown in Tables 3.18-3.25. Hybrid, high technology corn production had

[3] These are summarized in Appendix Tables 3A.7-3A.10.

[4] See discussion on land rent in Appendix B.

the highest wholesale (Manila) gross revenue across production technology by province. Gross revenues ranged from ₱23,041 (Nueva Viscaya) to ₱28,127 (Lanao del Sur). Under the same corn production technology, South Cotabato and Bukidnon likewise had high gross revenue at Manila wholesale, averaging ₱25,672 per hectare. On the other hand, the white OP, low technology represented the lowest average corn gross revenue at Manila wholesale across technology. The range was from ₱5,923 to ₱8,731 per hectare (Table 3.25). This was expected because with the exception of the 0.75 mt/ha yield of yellow OP low production technology in Bukidnon (Table 3.23), on the average, across region, white OP, low technology, had also the lowest average yields.

At the farm level, since farm prices vary by production sites, the level of gross revenue on farm was determined both by the yield and farm prices. The case of Lanao del Sur, hybrid high production technology illustrated this point. It had the highest average yield (5.41 mt/ha) across production technologies, but its gross revenue on farm of ₱16,281 per hectare was lower than South Cotabato (₱17,916 per hectare). South Cotabato had a lower average yield of 4.92 mt/ha but the domestic farm price of corn was higher than Lanao del Sur by ₱0.63/kg (Table 3.18). The different levels of gross revenues on farm and at wholesale are summarized in Tables 3.18-3.25.

3.7.3 Net Profit on Farm

In the analysis, the financial profitability of corn production on farm reflected two types of net returns: those above variable farm cash costs (operating capital) and those above all farm costs. The former did not value the contribution of fixed costs (land rent and family labor) and therefore can be considered as returns to fixed factors of production. Net returns above all farm costs on the other hand, reflected all costs and can be considered as returns to management or returns to the entrepreneurial capability of the corn farmer.

Results indicated that all production technologies across producing regions had positive net farm incomes above cash costs. Net returns above cash costs ranged from a low of ₱153/ha (Bukidnon, yellow OP technology, Table 3.23) to a high of ₱10,327/ha (Isabela, white OP, medium technology, Table 3.24). On the average, South Cotabato had the highest net returns above cash costs across province and production technology. This was most notable in yellow hybrid high technology (Table 3.18), white OP, medium technology (Table 3.24) and all the yellow OP technologies (Tables 4.22-4.23). On the other hand, Bukidnon, on the average, had the lowest net returns, across province and across production technology. The major reason for low net financial profitability of corn production in Bukidnon was the relatively higher proportion of current material inputs (fertilizer, chemicals, and seed) and hired labor costs to gross returns.

The longer term financial viability of corn production can be assessed on farm by taking into account all production costs (fixed and variable costs) against gross farm revenues. Results of the analysis indicated that two corn production systems of Bukidnon (yellow hybrid, F2, Table 3.21 and yellow OP, Table 3.23) could not cover their total production costs. The net

farm loss above all costs for these production systems ranged from ₱-415 per hectare to ₱-682 per hectare.

3.7.4 Net Profit at Wholesale

The pattern of distribution of net profitabilities at wholesale (Cebu and Manila) indicated that generally, the price difference between farm and wholesale prices were enough to make trading activities profitable at wholesale. Except for F2 yellow hybrid (Table 3.21), and yellow OP low technology (Table 3.23) for Bukidnon, all the net profits at wholesale were positive for both Cebu and Manila. A major reason for the relatively higher net profit at wholesale was the price margin from farm to wholesale, ranging from 38-73 percent.

3.7.5 Breakeven Domestic Prices4

The analysis also estimated the breakeven prices at both farm and wholesale markets. Breakeven prices are indicators of the per unit cost of production. Tables 4.18-4.25 show the on-farm and wholesale breakeven prices for corn production across production systems and province. In general, the estimated breakeven prices were lower than the actual market prices received by farmers and traders in 1990. However, for the unprofitable farms (for example, F2 hybrid, Table 3.21, and yellow OP low technology, Table 3.23, of Bukidnon), the farm price of ₱3.45/kg would need to be 16 percent higher to cover all farm production costs.

The OPs in general, had lower breakeven domestic prices at both farm and wholesale, due to lower input usage. For example, white OP medium technologies for Isabela and South Cotabato covered their total farm production costs at prices ₱1.74, ₱1.80 per kilo, on farm and ₱3.02, ₱3.26 per kilo at wholesale, respectively (Table 3.24). On the average, the medium technologies (white and yellow) had the lowest breakeven prices ranging from ₱1.74 to ₱2.72 per kilo on farm and ₱3.02 to ₱4.09 at wholesale. On the other hand, for the yellow hybrid, high technology production systems to cover their total costs, minimum farmgate prices should at least range from ₱2.30 per kilo (Bukidnon) to ₱2.03 per kilo (South Cotabato) and Manila wholesale prices should range from ₱3.72 (Lanao del Sur) to ₱3.39 per kilo (Nueva Viscaya).

3.8 Economic Incentives and Comparative Advantage of Corn Production

The Philippines is a small economy in the world trade of corn and therefore is considered as a price taker in the international market. Trade policies (e.g., corn import bans and import tariffs) and exchange rate policies (defending an overvalued peso), even if directed to other sectors of the economy, can exert influence in agricultural incentives and economic performance (Bautista, 1987).

This section focuses on the impact of government policies on the relative incentives and economic performance of corn production across the different producing regions. The model,

a modified domestic resource cost (DRC) approach,[5] assesses the impact of government intervention to relative incentives and comparative competitiveness of corn production systems under two trade regimes: import substitution with interregional trade (IRT) and export promotion (EP).

The analysis of economic incentives in corn production uses both the nominal and effective protection rates as indicators. In addition, direct and indirect effects of government intervention are estimated. Assessment of comparative advantage centers on net social profitability, with domestic resource cost (DRC) and the resource cost ratio (RCR) as indicators.

The methodologies for estimating comparative advantage and direct economic incentives at the farm level for individual crops are well-established (Herdt and Lacsina, 1976; Pearson, Akrasanee, and Nelson, 1976; Gonzales, 1984; Byerlee and Longmire, 1986; Ali, 1984; Rosegrant, et al, 1987a, 1987b; Appleyard, 1987; Monke and Pearson, 1989). Likewise, methodologies for measuring the direct, indirect and total nominal protection rates for tradables are presented in Krueger, Schiff and Valdes (1988); Bautista (1987); and Durosh and Valdes (1990). The analysis here represents an extension of the literature in three ways: greater detail in commodity analysis on a regional production technology basis; a more disaggregated treatment of trade regimes; and the use of equilibrium exchange rates to calculate direct and indirect protection rates.

A limitation of the comparative advantage/economic incentive analysis is that it represents a set of fixed input/output coefficients, or a snapshot of the production and policy environment at a given point in time, without corresponding adjustments to price changes. In order to explore the implications of changes in this environment, it is necessary to assess the impacts of changes in key factors such as world prices, domestic factor costs, and crop yields. To at least partially overcome this limitation, the assessment here utilizes sensitivity analysis of these factors to examine the dynamic effects of changes in these factors on comparative advantage and economic incentives.

3.8.1 Economic Incentives

A wide range of government policies affects economic incentives in agricultural production. Price and subsidy policies, import and export policies and more general macroeconomic policies, such as exchange rate and interest rates, may affect relative incentives

[5] The modification hinges with the use of an equilibrium exchange rate (EER) instead of the traditionally estimated shadow exchange rate (SER) as the defiator of the calculated DRC to estimate comparative advantage. Past studies (Bautista, Power and Associates, 1983; Bautista, 1987 and 1990; Intal and Power, 1990; and Medalla, 1990) on trade and exchange rate policies in the Philippines, have supplemented the present analysis on the estimation of the equilibrium exchange rate.

in agriculture. Impacts of these policies on relative incentives can be measured by using the nominal and effective protection rates as indicators.[6]

3.8.2 Nominal Protection Rates (NPR)

The nominal protection rate (NPR) is the ratio of the domestic price of an output to its border price expressed in local currency usually at the official exchange rate. Commodity (sector) specific and economywide policies influence agricultural prices. Hence three levels of nominal protection rate are analyzed here: direct nominal protection (NPR_D), indirect nominal protection (NPR_I) and total nominal protection rate (NPR_T).

Formally defined by Krueger, Schiff and Valdes (KSV, 1988), the direct effects of trade and price policies on output can be measured by comparing the actual domestic prices with free trade prices that would have prevailed in the absence of intervention. Formally,

$$NPR_D = \frac{P_o^d / P_{NA}}{P_o^{d'} / P_{NA}} - 1 = P_o^d / P_o^{d'} - 1$$

where

P_o^d	=	domestic producer price of a tradable agricultural product o
$P_o^{d'}$	=	the border price translated at the nominal exchange rate E, and adjusted for transport, storage distribution and quality difference.
P_{NA}	=	a non-agricultural sector price index which consists of tradable share α and nontradable component $1-\alpha$, with their corresponding tradable (P_{NAT}) and nontradable (P_{NAH}) prices

Historically, sectoral policies on corn included quantitative restrictions (ban) on corn imports, import tariffs and price ceilings on corn grits during the 1970s.

Government policies (e.g., defending an overvalued exchange rate) can also have "indirect effect" which is caused by the deviation of the official exchange rate (OER) from the "equilibrium exchange rate" (EER) -- the latter defined as the exchange rate that would have prevailed in the absence of trade restrictions and current account imbalance (Bautista, 1987; KSV, 1988). The indirect nominal protection rate is measured by the formula,
where

[6] Although not discussed and used here, the other indicators of economic incentives are the producer subsidy equivalent (PSE) and the consumer subsidy equivalent (CSE). For a discussion on PSE and CSE, please refer to Scandizzo and Bruce (1980) and Mergos (1987).

$$NPR_I = \frac{P_o^{d'}/P_{NA}}{P_o^{d*}/P_{NA}^*} - 1 = \frac{P_o^{d'}/P_{NA}}{(E*/E)P_o^{d'}/P_{NA}} - 1$$

E^*	=	equilibrium exchange rate
P_o^{d*}	=	border price evaluated at E^*
P_{NA}^*	=	P_{NA} where the price index of the tradable part is evaluated at E^* and in the absence of trade policy, t_{NA}, affecting non-agricultural tradables.

The NPR_I which is the same for all tradables, measures the terms of trade between agriculture and non-agriculture as well as the indirect effects of exchange rate misalignment.

Finally, the total effect of trade and exchange rate policies is measured by,

$$NPR_T = \frac{P_o^d/P_{NA}}{P_o^{d*}/P_{NA}^*} - 1$$

NPR_T is the proportionate deviation of the domestic price from the border price evaluated at the equilibrium exchange rate. It is the algebraic sum of the direct and indirect effects of nominal protection.

$NPR_D + NPR_I \neq NPR_T$ because the denominator of NPR_D differs from that of NPR_I and NPR_T. To make the three measures comparable, we define another direct protection rate

$$npr_D = \frac{P_o^d/P_{NA} - P_o^{d'}/P_{NA}}{P_o^{d*}/P_{NA}^*}$$

which measures the impact $(P_o^d/P_{NA} - P_o^{d'}/P_{NA})$ of direct policies as a percent of P_o^{d*}/P_{NA}^*, the relative price which would prevail in the absence of all interventions and with $E = E^*$.

In the absence of estimates of P_{NA} and P_{NA}^*, P_{NA} and P_{NA}^* are assumed to be equal, and the formulations of NPR reduce to:

$$npr_D = \frac{P_o^d - P_o^{d'}}{P_o^{d*}}$$

$$NPR_I = \frac{E - E*}{E*}$$

$$NPR_T = \frac{P_o^d - P_o^{d*}}{P_o^{d*}}$$

These new NPRs however should be interpreted as rates of nominal protection due only to commodity specific trade policies and foreign exchange misalignment.[7] They do not reflect the terms of trade effects from the non-agricultural sectors of the economy - except via the exchange rate.

Table 3.26 presents the calculated values of direct, indirect and total nominal protection rates of corn by province. The indirect nominal protection rate of -21 percent, which is the same across producing provinces, means that the overvaluation of the peso during crop year 1989/90, has indirectly disprotected the corn farmers. The analysis showed that the direct nominal protection rates ranged from 21 percent (Lanao del Sur) to 42 percent (South Cotabato). The total nominal protection rates therefore ranged from 0 in Lanao del Sur to 21 percent in South Cotabato (Table 3.26).

At the wholesale markets however, the direct nominal protection rates were slightly higher depending on the import source. With the U.S. as an import source, the NPR_D ranged from 29-31 percent during the 1989/90 period (Table 3.27). The direct protection rates were much higher if the import source was from Thailand, ranging from 45-47 percent during the same period. The total nominal protection rates were also positive at the wholesale markets ranging from 8-10 percent (U.S. source) and 24-26 percent (Thailand source) in 1989/90. The estimates of total nominal protection rates at both the producers level and wholesale indicate that domestic corn prices were highly protected during the 1989/90 period. The results further show that the direct nominal protection rates were high, outweighing the negative indirect effects of the exchange rate overvaluation.

3.8.3 Effective Protection Rates (EPR)

The nominal protection rates measure only the impact of sectoral and economywide effects on the output and not on inputs. Effective protection rate measures the net effects of

[7] See for example the study of Bautista (1990) for rice, corn, sugar, and coconut. Also, this analysis used the equilibrium exchange rate estimation of Medalla (1990) using the Bacha-Taylor method of long run elasticities.

government intervention on both input and output as reflected in value added. This is expressed as

$$EPR = \frac{P_o^d - \sum_j a_{oj} P_j^d}{P_o^b - \sum_j a_{oj} P_j^b}$$

where,

P_o^d = domestic price of output o

P_j^d = domestic price of input j

P_o^b = border price of output o expressed in local currency

P_j^b = border price of input expressed in local currency

a_{oj} = quantity of jth input needed to produce one unit of output o

The numerator is value added, expressed in domestic or private market prices while the denominator is value added expressed in border prices at the official exchange rate. In effect, the ratio is a summary measure of the direct incentives or disincentives caused by government policies and market distortions in both the input and output markets. A positive EPR therefore implies that a particular production activity is receiving a positive incentive through protection at the existing exchange rate while a negative EPR indicates a production disincentive.

The estimated EPRs for corn confirm the high level of protection provided to corn by government policies. The average EPR's across technologies range from 38 percent to 77 percent by region (Table 3.28). Tariffs and quantitative restrictions on imports have provided a high level of support to corn production.

3.8.4 Comparative Advantage Indicators

Comparative advantage in the production of a commodity system for a particular country or province is measured by comparing the social or economic opportunity costs of producing, processing, transporting, handling and marketing an incremental unit of the commodity with its border price. If the opportunity costs are less than the border price, then that country has a comparative advantage in the production of that particular crop. In most developing countries, social or economic profitability deviates from private profitability due in part to the following reasons: distortions in the factor and output markets, externalities, and government policy interventions that tend to distort relative prices. Within the context of the

corn analysis, comparative advantage or comparative efficiency is estimated here using three indicators: net social or economic profitability, domestic resource cost, and resource cost ratio. These indicators are formally defined as follows:

$$\textit{Net Economic or Social Profitability} \quad (NSP) = P_o^b - \sum a_{oj} P_j^b - \sum a_{ok} MPP_k^y P_y^b$$

$$\textit{Domestic Resource Cost} \quad (DRC) = \frac{\sum_j a_{oj} P_j^d}{P_0^w - \sum a_{oj} P_j^w}$$

$$\textit{Resource Cost Ratio} \quad (RCR) = \frac{\sum_k a_{ok} MPP_k^y P_y^b}{P_o^b - \sum a_{oj} P_j^b}$$

where:

P_o^d = domestic price of output o

P_o^b = border price of output o expressed in local currency

P_o^w = border price of output o expressed in foreign currency

P_j^d = domestic price of input j

P_j^b = border price of input j expressed in local currency

P_j^w = border price of input j expressed in foreign currency

P_y^d = domestic price of *yth* output from alternative use of resource k

P_y^b = border price of *yth* output from alternative use of resource k expressed in local currency

P_y^w = border price of *yth* output from alternative use of resource k, expressed in foreign currency

MPP_k^y = marginal physical product of the kth resource in its alternative use, y

a_{oj} = quantity of *jth* input needed to produce one unit of output *o*

a_{ok} = quantity of kth resource needed to produce one unit of o

3.8.5 Net Social Profitability (NSP)

NSP is the difference between gross revenue and total costs expressed in economic prices. As an indicator of comparative advantage, the interpretation of NSP is straight forward. A production activity has comparative advantage if the NSP is greater than zero.

3.8.6 Domestic Resource Cost (DRC)

The domestic resource cost of a foreign exchange earned or saved from a particular production activity can be expressed as a ratio of the domestic factor costs in shadow prices per unit of output to the difference between the border price (expressed in foreign currency) of output and foreign (tradable) costs (also expressed in foreign currency). In effect, the DRC is the "own exchange rate" of a particular production activity since the numerator is expressed in local currency while the denominator is in foreign currency. DRC measures the social opportunity cost of domestic resources employed in earning or saving a marginal unit of foreign exchange. As a measure of comparative advantage, DRC can be used to determine the economic competitiveness of a production activity by comparing it with the shadow exchange rate (SER) or equilibrium exchange rate (EER) of the currency. Thus, an activity is economically competitive, or displays comparative advantage, if the opportunity cost of earning or saving an incremental unit of foreign exchange is less than the shadow exchange rate. The smaller the DRC relative to the shadow exchange rate, the greater the activity's comparative advantage.

3.8.7 The Resource Cost Ratio (RCR)

In comparing the DRC with the shadow exchange rate (SER), or the equilibrium exchange rate, (EER), we can arrive at an efficiency measure of comparative advantage. The RCR, which is the ratio of DRC and EER, is a measure of resource use efficiency because market prices used in the calculations have been adjusted net of taxes and subsidies. As a criterion for comparative advantage, the following relationships hold:

$$\text{if} \quad RCR \begin{array}{l} < \\ = \quad 1 \longrightarrow \\ > \end{array} \begin{array}{l} \textit{advantage} \\ \textit{neutral} \\ \textit{disadvantage} \end{array}$$

3.8.8 Comparative Advantage of Corn Production

This section assesses the relative comparative advantage of corn production as a saver (through import substitution) and potential earner (through export) of foreign exchange. The analysis uses the same set of input/output coefficients as the financial profitability section except that the cost components from farm to wholesale/port are valued at their economic prices and are broken down into tradable and nontradable components.[8]

Two distinct trade regimes were also postulated in the economic assessment: a trade regime of import substitution with interregional trade (IRT) and an export promotion (EP) trade regime that assesses the economic viability of corn as an export. In the IRT trade regime, corn was supplied to the major wholesale markets (Manila and Cebu) from the producing provinces to substitute for imported corn. The relevant costs covered production and distribution costs to Manila and/or Cebu. Under the IRT trade regime, the relevant domestic prices were those of Cebu/Manila wholesale domestic prices, and the border prices used were the adjusted CIF at wholesale for these markets.

The EP trade regime, on the other hand, covered the production and distribution cost up to Manila as the major port. The border (economic) price used was the projected 1995 World Bank corn FOB price of $114/mt No. 2 yellow corn, from the U.S. Gulf ports. The U.S. is the world's major producer of corn and dominates international corn trade. In 1989, the U.S. accounted for 40 percent of the global production of 470 million mt and 72 percent of total world corn exports of 78 million mt (Table 3.29). The other exporters, France, China, and Thailand account for a smaller share of production and trade and these have less impact on world prices.

The share of the Philippines in world corn production and trade is very small. In 1989, the Philippines accounted for only 1 percent of total production and 0.2 percent of world corn trade. Thailand is the major supplier of corn exports to the Southeast Asian region. However, the demand for corn feed in the region is high, especially Japan and among the newly industrialized economies because of the increasing demand for livestock products in these countries. Given this background, it is interesting therefore to assess the economic viability of the Philippines in reversing its position as corn importer to that of a potential corn exporter.

3.8.9 Corn Production as an Import Substitute

For the past decade, excluding the import ban years of 1986 and 1987, the Philippines has imported corn, averaging 262,000 mt/year, with an average annual value FOB of $36 million. These levels of imports are large in light of the serious foreign exchange constraints and foreign debt servicing problems that the economy faces. The economic question posed here is that of the efficiency of import substitution policy. Would it be more economical to import

[8] For a discussion of the detailed assumptions of the DRC methodology, please refer to Appendix B.

corn than to domestically produce it? This ex post analysis compares the relative costs of importing vs. domestic production, including the costs of interregional corn trade from the producing regions to the major wholesale markets of Manila and Cebu.

Results of the analysis are shown in Table 3.30. Except for relatively rare low technology open pollinated yellow corn and F2 hybrid production systems in Bukidnon, all estimates indicated low DRCs and RCRs for the other corn production systems across the corn producing provinces, implying that domestic production of corn is more economically efficient than corn imports. The DRCs ranged from 17 (Isabela, medium technology white OP) to 28 (yellow, hybrid F2, Davao). Across provinces, the production systems of medium technology white OP and yellow hybrid high technology, had the lowest RCRs of 0.683 and 0.693, respectively - implying their relative competitiveness over the other corn production systems as import substitute (Table 3.30).

On the average, across production systems, South Cotabato appeared the most economically efficient corn producer among the provinces. The RCRs were low for white and yellow OP, medium technologies and also for yellow hybrids, high technology corn. Overall, the results indicated that domestic production of corn in the Philippines is efficient as an import substitute even if the producing regions had to transport the commodity to Cebu or Manila -- the major users of corn. These results are consistent with other studies (Gonzales, 1984; Rosegrant, et al., 1987; Cabanilla, 1988; Winrock, 1990).

Given the cost structure of corn production and technology levels observed in the 1989/90 crop period, the relative competitiveness of corn as an import substitute can still be maintained so long as the landed cost (adjusted CIF price, Manila wholesale) of corn would range from $119 to $152/mt for yellow hybrids. This range would be substantially lower ($115-$146/mt) if the wholesale market is Cebu (Table 3.31). The OP yellow and white corn production systems are competitive as import substitutes at medium technology levels. These production systems can maintain their competitiveness as import substitutes at yields ranging from 2.0 to 2.7 mt/ha (Tables 3.32 and 3.33).

3.8.10 Potential for Corn Exports

The potential of corn as an export is affected not only by domestic policies (trade, foreign exchange rate, infrastructure and pricing policies) but also by the developments (especially world price movements) in international corn trade. Given macro policies and the local supply and demand conditions of corn, the opportunity cost of corn exports would depend on world market prices.

With current corn technology and the projected world price of corn would remain at $114/mt, the Philippines has no comparative advantage in exporting corn. The estimated RCRs were all greater than one (except for yellow OP low technology in South Cotabato), ranging from 1.026 to 2.096 (Table 3.34). For yellow hybrid high and medium production technologies, for example to attain competitiveness as export, their current yield levels would need to be

increased on the average by 12-31 percent or a range of 4-5.5 mt/ha, with no change in input costs. In the same manner, given current corn technologies and cost structures of domestic production, the border price of corn would need to increase significantly for the medium and high technology production technologies to be competitive as exports (Table 3.35).

The major reasons that could explain the relative non-competitiveness of corn as an export was the relatively high costs of production and the high shipping and distribution costs from the producing regions to Manila as a port of exit (see also Chapter 6 for a comparison with costs of production and marketing in Thailand). A possible long term strategy, however, would be to improve the marketing, bulk handling, and port facilities in the major producing regions (e.g., General Santos City) such that they become the port of exit for corn export, eliminating domestic transportation costs to Manila.

3.9 Summary and Policy Implications

The economic analysis of corn production in the Philippine points out several areas of policy concerns which can enhance the efficiency and long-run productivity of the corn subsector. Some of these concerns are: the new corn technology, corn post-production activities, infrastructure and support services, economic incentives, and comparative advantage in corn trade.

3.9.1 The New Corn Technology

Historically, white open-pollinated traditional varieties of corn, dominated corn production and hectarage in the Philippines. During the past 5 years, however, the adoption of yellow corn (improved OPs and most specifically hybrids) varieties have had significant impact in Philippine corn area and production. South Cotabato, the major corn producing province in the Philippines, typified this dramatic shift, in terms of both the area planted and production of yellow corn. Before 1980, the province concentrated in the production of white open-pollinated corn. But in 1989, 49 percent of total area planted and 63 percent of total corn production came from yellow corn (Table 3.36). This trend was similar in other corn producing regions.

The dramatic shift to yellow corn production particularly the hybrids, raises several policy concerns. These revolve around the package of corn hybrid technology itself; the component technologies that accompany it; and the relative tradeoffs between the OP varieties and hybrids in devising a corn development strategy. The corn hybrid technology in general is an input intensive production system, which is may be beyond the reach of the smaller and resource-poor farmers. Hybrid seeds and fertilizer are the major cash costs of corn production, comprising 32 percent of total farm production costs. Aside from the costs of these two inputs, their availability and timing of such availability are of vital concern among farmers. Since corn production is highly seasonal, the input distribution system should be able to account for such seasonality. In many cases, however, the timing and availability of these inputs do not meet farmers' seasonal demands. The hybrid seed in particular, is a case in point. Farmers complained about the relative scarcity and high costs (₱850-1,200/25 kg bag) of corn hybrid

seeds. It is not uncommon for some farmers to recycle their F1 hybrid seeds for the next season (F2), either because they want to save on seed costs, or because hybrid seeds were simply not available. Seed policy, particularly relative to access and pricing, should be examined. With the merger of Pioneer Seeds and San Miguel Corporation, only Cargill remains a viable competitor in the hybrid corn seed market. Are high hybrid seed prices due to duopoly profits? If so, how can policy reform make it more competitive? Or would it be better instead to enhance the access and distribution of the improved OP varieties?

The development of improved genetic materials for the open-pollinated corn varieties, such as the IPB Var 1 and 2, IES Cn 1 and 2, which are downy mildew resistant and also with high yield potentials, is recognized as a success. But government policy has not encouraged the distribution and dissemination of these cultivars for easy access and affordability among corn farmers. As envisioned, OP seed exchange is a part of Phase II of the CPEP. This should be pursued with more vigor, targeting the majority of corn farmers who are still users of OP varieties. For this reason therefore, it would be desirable for government policy to encourage the continued research on the genetic varietal improvement of the corn OP lines.

Fertilizer is a key component of the new corn technology. It is expected that inefficiencies in fertilizer occur at the early stage of adoption because farmers have not totally adjusted to the use of the input. As observed in the field, farmers in general, applied fertilizer without a firm agronomic basis. Although corn farmers generally followed the basal-split method of fertilizer application, these were done more at their own convenience rather than following a calendar of production activities. Extension assistance along these lines could improve corn productivity and help narrow the yield gap between on-farm and experiment station.

3.9.2 Corn Post-Production Activities

Corn farmers in general sold their corn output within 2-6 days after harvest. This farm marketing pattern was prevalent in most corn producing areas for several reasons: the need for immediate cash; to comply with farm credit-marketing tie-up; the lack of shelling, drying and storage facilities during harvest time, specifically with the onset of monsoon rains; and to reduce turnaround time for a second or a third cropping.

Based on field observations, the new corn technology has created a second generation problem of corn shelling and drying due to higher yields. Before, the traditional white and yellow OP corn varieties yielded only from 1-2 tons per hectare. Now, the yellow corn hybrids have significantly increased those yields. Given the very limited post-harvest shelling and drying facilities on farm, an average corn hybrid farmer, tilling from 1-2 hectares, has problems in shelling and drying an average of 3-6 metric tons of corn. The shelling and drying problem is compounded by rains during the main harvest. Since the moisture content of corn grain generally determines quality and price, it would be desirable to look into the feasibility of developing shelling and drying facilities on farm to allow farmers benefit from higher price for

quality corn. Although some corn cooperatives in South Cotabato have started to experiment with this scheme, government policy has not fully encouraged it.

Corn processing (shelling, drying, storing) is a very small cost component in the post production activities. It is also probable that profit margins are very low for these activities such that individual private entrepreneurs have no incentives to venture into them. In addition, in the current traditional domestic marketing of corn, grain quality (reflected in lower percent moisture) is not necessarily translated into higher domestic prices. This is partly due to the underdevelopment of the corn marketing system that prices are usually imposed to farmers by corn traders. But as the corn market develops and as the regions aspires for competitiveness in providing quality corn for the domestic livestock sector and perhaps the corn world market, infrastructures to improve grain quality become imperative. It would therefore be desirable for government policy to provide incentives to the private sector for the promotion of cooperative and/or business ventures in the development of infrastructures to improve corn grain quality, through standardization and grading.

3.9.3 Infrastructure and Support Services

Aside from post-harvest facilities, lack of infrastructure facilities, particularly quality roads, bridges, ports, bulk handling and shipping facilities constrain the major distribution of corn. Trading and distribution costs, account for 35 percent of total corn production cost from farm to Manila wholesale. Freight (trucking, shipping) is a major component (35-42 percent) of total trading costs. The freight and handling costs of moving corn from General Santos to Manila wholesale was ₱860/mt. This is approximately 54 percent higher than the cost insurance freight of ₱560/mt from Bangkok port to Manila at the current exchange rate (see also Chapters 5 and 6).

Given that the domestic costs of trading and marketing are quite high, improvement in the domestic distribution of corn will contribute to the productivity of the corn subsector. Increased efficiency in cargo handling services from open competition, accompanied by investments in the port facilities including the ready supply and availability of inter-island vessels to transport corn will drastically reduce trading and distribution costs. In the long-run government policy should pursue an integrated distribution system not only for corn but for other agricultural commodities as well, to minimize trading and distribution costs.

3.9.4 Economic Incentives and Comparative Advantage

A wide range of government policies (trade, foreign exchange rate, and pricing policies) has affected the economic incentives in the production of corn. The study showed that corn pricing policies (e.g., corn support prices) have positive direct (sectoral effect) effects, but the indirect effect of macropolicy (e.g., foreign exchange rate overvaluation) is negative. During the crop year 1989/90, the direct nominal protection rates (NPR_D) of corn on farm were generally positive, ranging from 21-42 percent at the farm level and 31-47 percent at the wholesale level. However, because of overvaluation of the peso, (indirect effect due to

overvaluation was NPR_I=-21 percent), the total nominal protection rate (NPR_T) were lower, ranging from 0 to 21 percent.

The sensitivity analysis also estimated the effects of the peso overvaluation on net economic incentives. Estimation of effective protection rates (EPRs), the summary measure of net incentives caused by government policies and market distortions on both the output and input markets, confirm the high level of protection provided by government policy to corn production. The above results also point out the desirability of pursuing a domestic pricing policy consistent with economic prices, and a foreign exchange rate that truly equates the supply and demand for foreign exchange.

The Philippines is efficient as a saver of foreign exchange in the domestic production of corn for import substitution. However, it has no comparative advantage in exporting corn. A major reason is the current underdevelopment in the marketing, distribution system, and on freight and cargo handling facilities for export.

Figure 3.1 Location of Corn-Livestock Study Areas

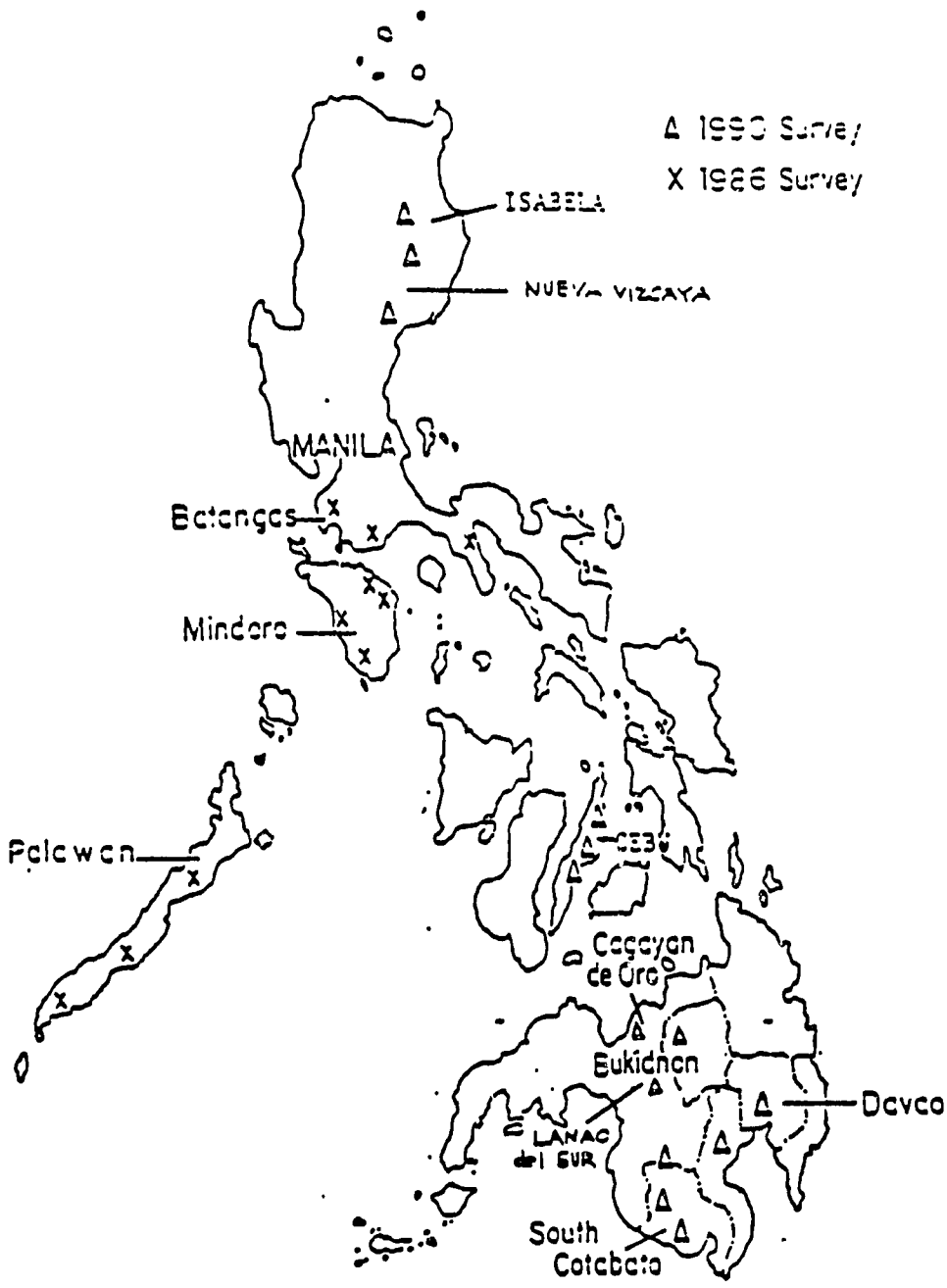


Figure 3.2 Rainfall Patterns and Dominant Cropping Patterns for Cagayan Valley (Region II)

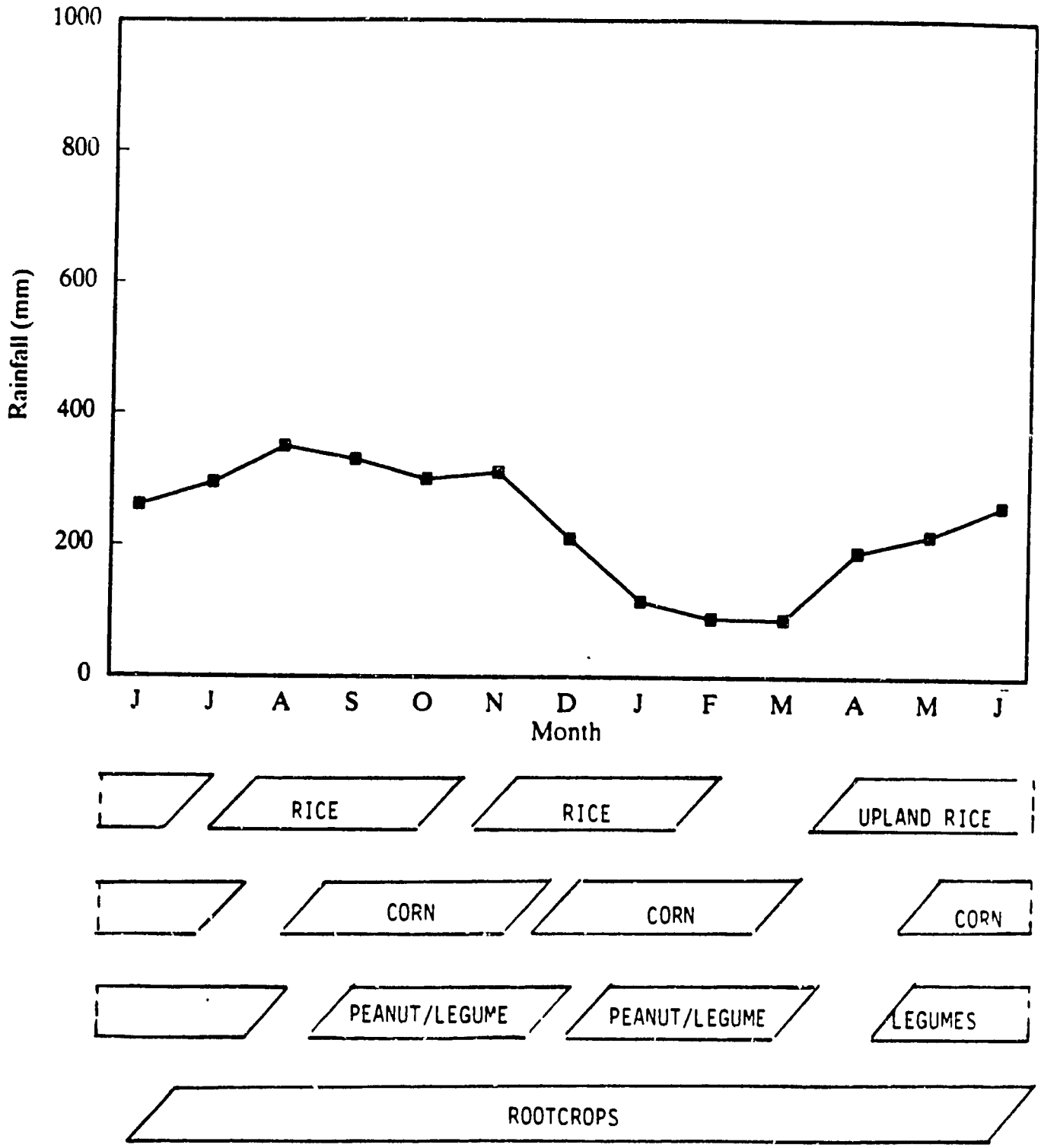


Figure 3.3 Rainfall Patterns and Dominant Cropping Patterns for Southern Mindanao (Region XI)

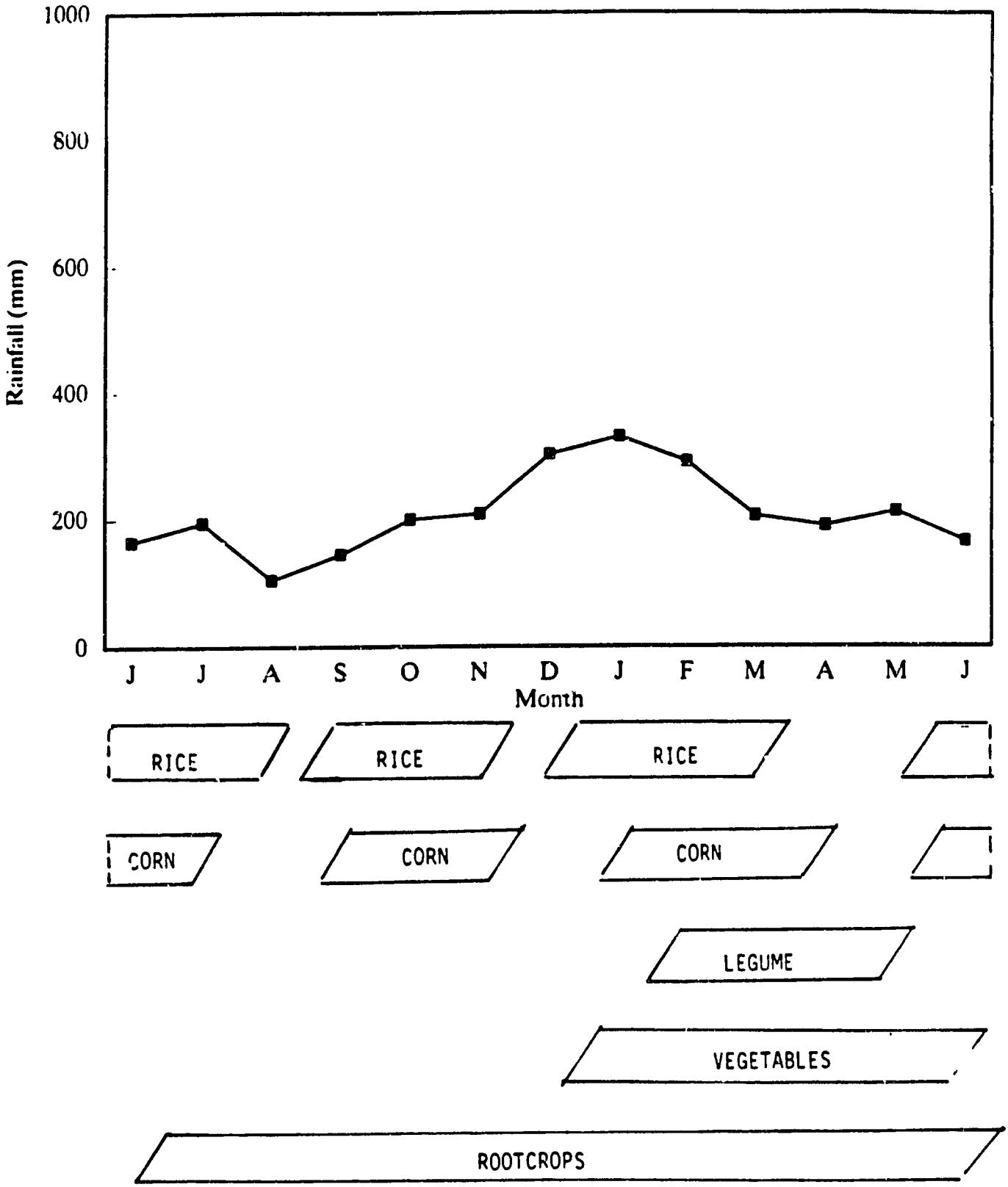
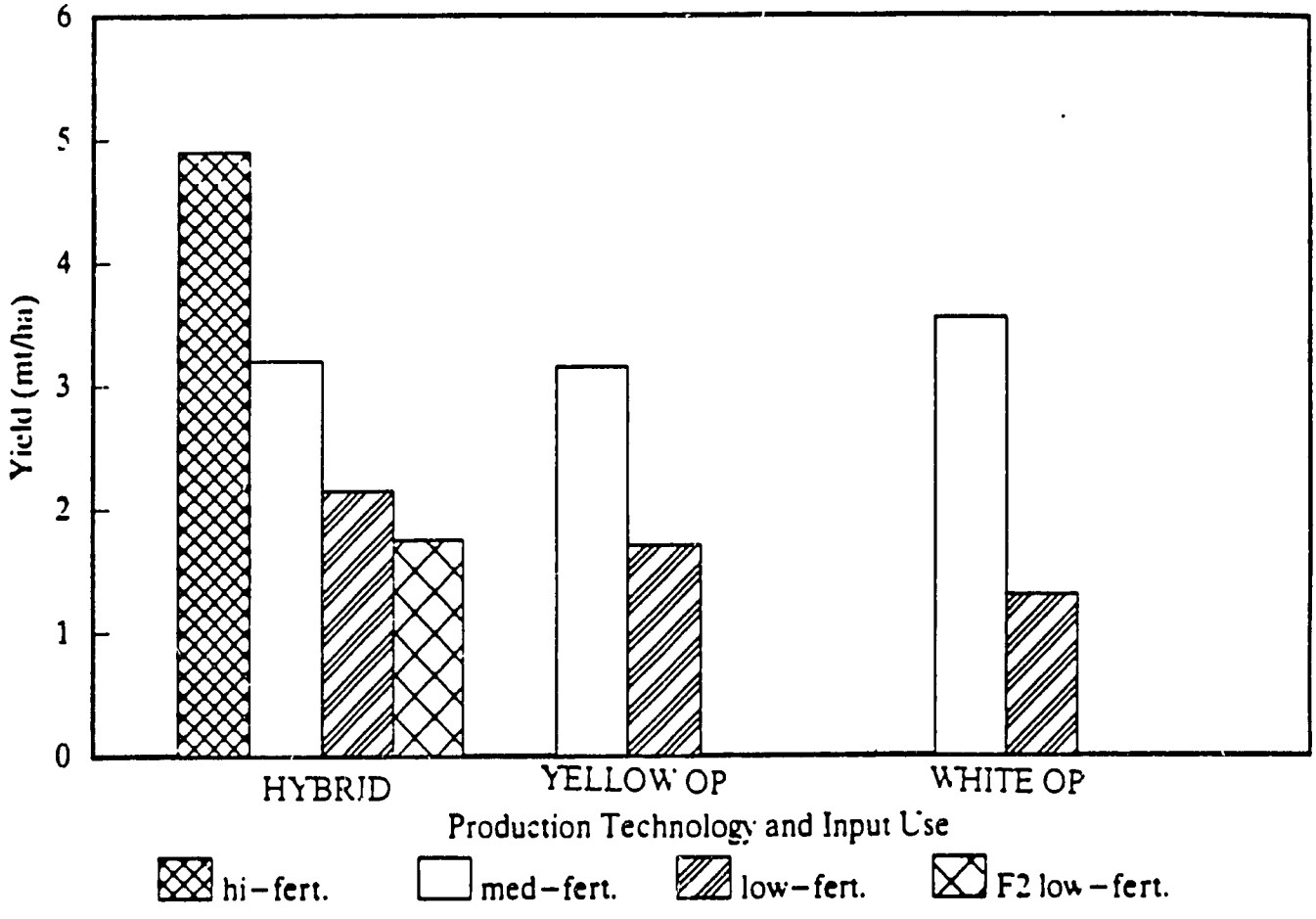
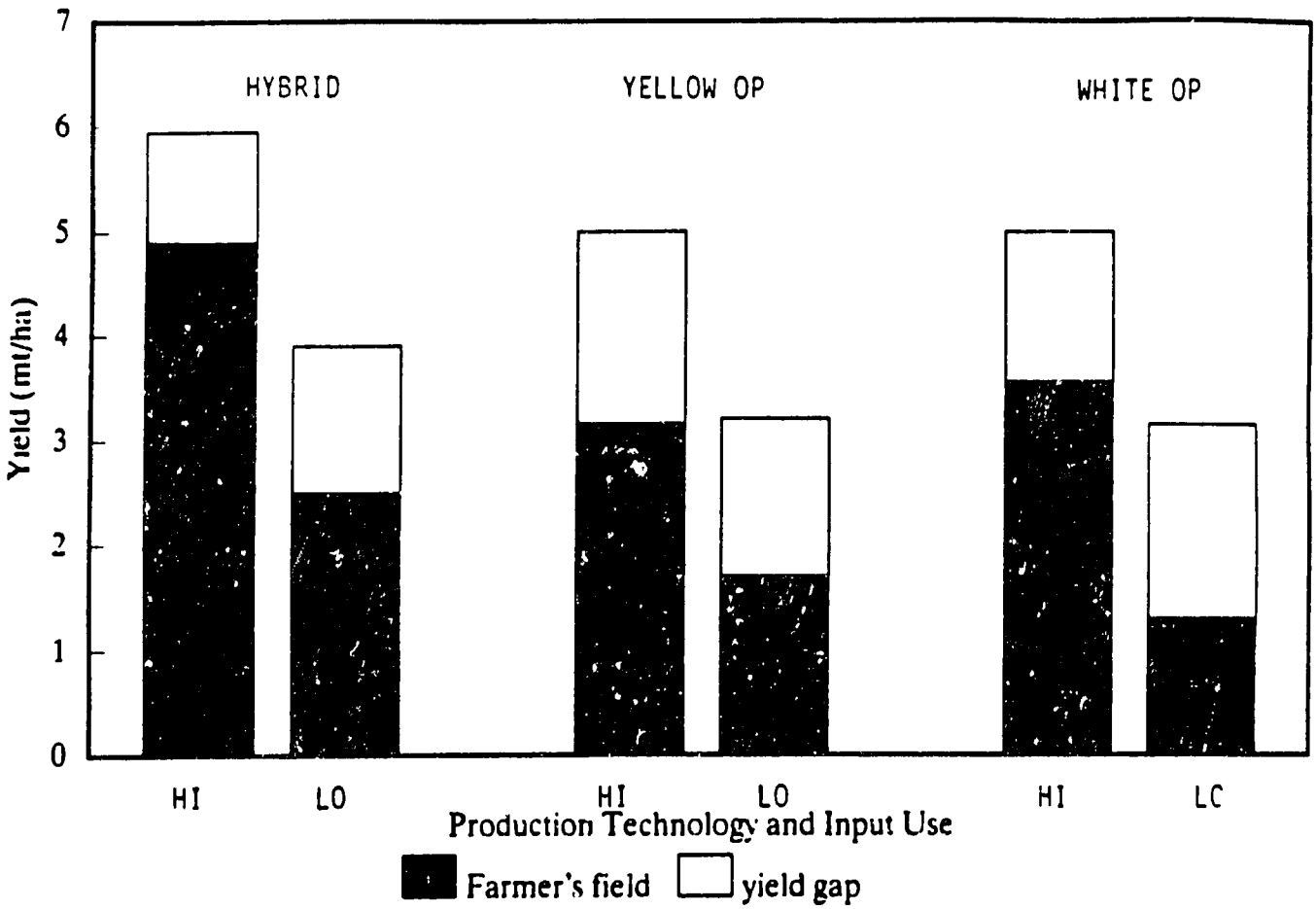


Figure 3.4 Yield Distribution of Sample Corn Farms, by Technology, Philippines, 1989/90



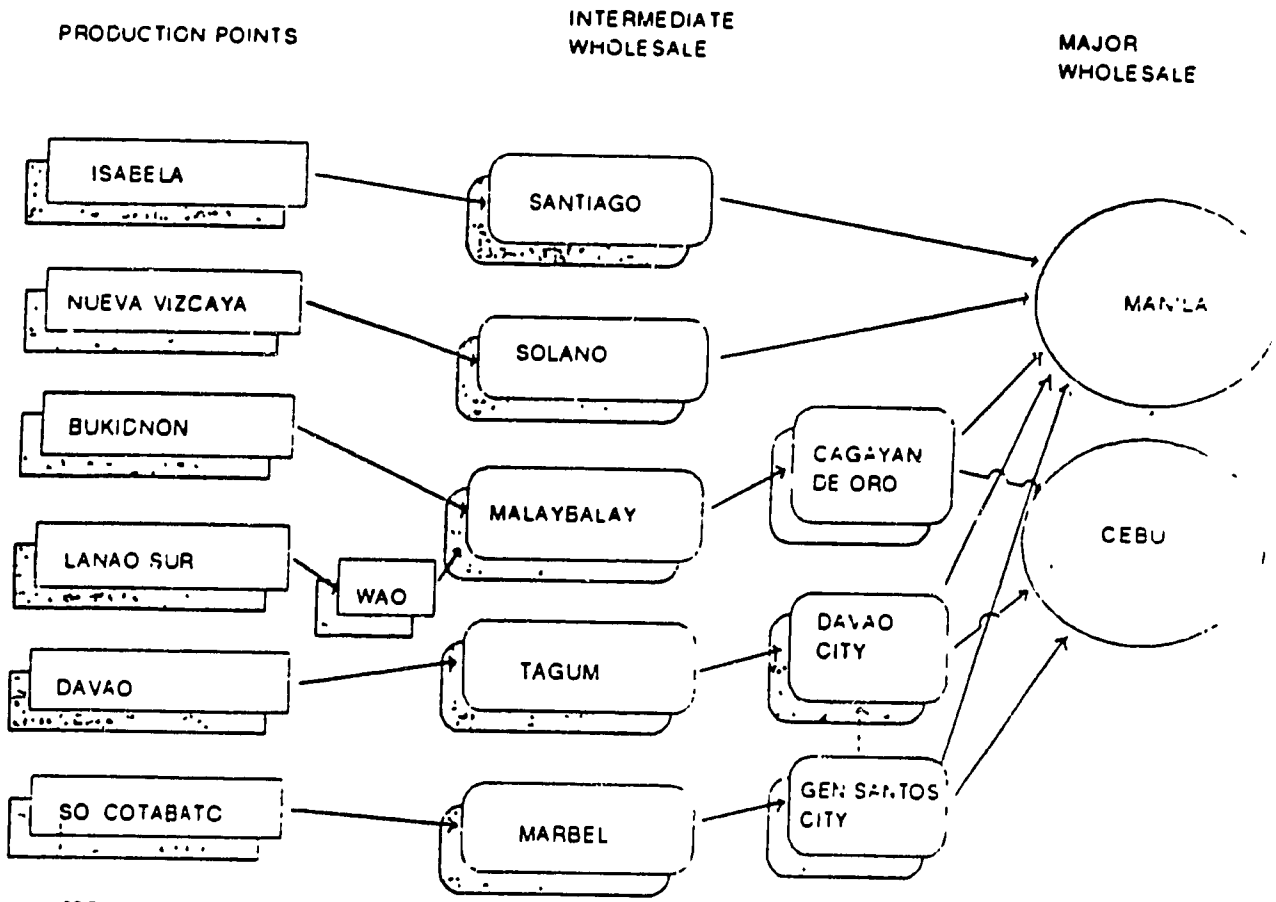
Source: IFPRI Survey

Figure 3.5 Yield Gaps: Experiment Station and On-farm Yields, by Level of Input Use



Source: IFPRI Survey and Lantin (1985)

Figure 3.6 Corn Domestic Trade Flows, Philippines 1990



Source IFPRI Survey

Table 3.1 Members of the Field Survey Team, IFPRI/DA/USAID Feedgrain Livestock Project, March 1 to July 31, 1990

A. Central Office

Leonardo A. Gonzales (IFPRI)	Team Leader
Jose Yorobe, Jr. (UPLB)	Consultant
Percy Manzo (DA)	Policy Analyst
Marilou Drilon (IFPRI)	Senior Research Assistant
Ricardo Guino (IRRI)	Senior Research Assistant
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1. Mr. Caina
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6. Ms. Adelaida Pangan**
7. Mr. Rupac
8. Mr. Sanico
9. Mr. Anthony Tagarda
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* Bukidnon-Davao City-South Cotabato
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1. Mr. Albino Gandia
2. Ms. Eva Guzman
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5. Mr. Oscar Ruma
6. Mr. Alexander Ancheta*
7. Ms. Grace Jallorina*
8. Mr. Diosdado Basug**
9. Mr. A. Domingo**

* Isabela-Nueva Viscaya
** Coordinators

Table 3.2 Distribution of sample respondents by classification, by region, IFPRI Philippines Survey, 1990

Classification	Region X*	Region XI		Region VII	Region II		Total
	Bukidnon/ Cagayan de Oro	Davao City/ Davao Norte	General Santos/ South Cotabato	Cebu City/ Mandaue City	Isabela	Nueva Viscaya	
Corn farmers	181	21	335	0	295	64	896
Trader/middlemen	32	19	43	10	24	0	128
Trader/shipper	5	1	3	0	0	0	9
Corn-feedmiller	6	5	2	12	0	0	25
Broiler/layer	21	5	8	10	0	0	44
Swine	9	5	7	4	0	0	25
Total	**254**	**56**	**398**	**36**	**319**	**64**	**1127**

* Also includes 26 corn farmers from Lanao del Sur of Region XII.

Table 3.3 Sample Distribution of Corn Farmers by Region, Philippines, 1989-90

Region		No. of Samples
Cagayan Valley (Region II)		316
Isabela	260	
Nueva Vizcaya	56	
Northern Mindanao (Region X)		137
Bukidnon	137	
Southern Mindanao (Region XI)		250
South Cotabato	234	
Davao	16	
Central Mindanao (Region XII)		27
Lanao del Sur	27	
Total		730

Source: IFPRI survey

Table 3.4 Percent distribution of corn farmers by years of experience in corn farming, Philippines, 1989-90

Provinces	1-10 years	11-20 years	21 & above	Total
	----------	%	----------	
Bukidnon	44	28	28	100.0
Davao	15	20	2	100.0
Isabela	46	25	29	100.0
Lanao del Sur	30	27	43	100.0
Nueva Viscaya	33	34	33	100.0
South Cotabato	33	37	30	100.0
All Provinces	39	30	31	100.0

Source: IFPRI survey

Table 3.5 Percent distribution of corn farmers by size of households, Philippines, 1989/90

Province	4 & below	5 to 8	9 & above	Total	Average household size
	---------- % ----------				
Bukidnon	14	17	27	17	6.3
Davao	2	3	2	2	5.9
Isabela	40	34	9	34	5.3
Lanao del Sur	3	4	4	3	6.0
Nueva Viscaya	8	6	11	7	5.8
South Cotabato	33	37	46	36	5.9
Total	100.0	100.0	100.0	100.0	5.9

Source: IFPRI survey

Table 3.6 Percent distribution of corn farmers by drainage quality of farms, Philippines, 1989/90

Total Total	No Response	Poor	Fair	Good
	----------	%	----------	
Bukidnon	1.0	1.0	5.0	11.00	17.0
Davao	0.4	-	1.0	1.0	2.0
Isabela	2.0	0.6	11.0	21.0	35.0
Lanao del Sur	-	-	1.0	2.0	3.0
Nueva Viscaya	-	-	3.0	5.0	8.0
South Cotabato	2.0	2.0	8.0	22.0	34.0
Total	5.0	4.0	29.0	62.0	100.0

Source: IFPRI survey.

Table 3.7 Percent distribution of corn farmers by tenurial status, Philippines, 1989/90

	Owner	Tenant	Leasehold	Others*	Total
	%				
Bukidnon	10.0	3.0	1.0	3.0	17.0
Davao	1.0	1.0	-	-	2.0
Isabela	19.0	7.0	4.0	4.0	34.0
Lanao del Sur	2.0	-	1.0	-	3.0
Nueva Viscaya	4.0	2.0	1.0	1.0	7.0
South Cotabato	19.0	9.0	4.0	4.0	36.0
Total	55.0	22.0	11.0	12.0	100.0

* Combinations of rental/leasehold and tenants.

Source: IFPRI survey.

Table 3.8 Percent distribution corn farmer borrowers* by sources of loans, Philippines, 1989/90

Province	Formal**	Informal***	Total
	----------	%	----------
Bukidnon	22.0	78.0	100.0
Davao	-	100.0	100.0
Isabela	5.0	95.0	100.0
Lanao del Sur	39.0	61.0	100.0
Nueva Viscaya	9.0	91.0	100.0
South Cotabato	16.0	84.0	100.0
Total (All Samples)	12.0	88.0	100.0

* Total number of borrowers was 65% of total samples
** Banks and cooperatives.
*** Landlords, traders, relatives and other nonformal financial institutions.

Source: IFPRI survey.

Table 3.9 Corn farmers, by average amount of loan by source and type, by province, Philippines

Source of Credit	Province/Region					
	Bukidnon	Davao	Isabela	Lanao del Sur	Nueva Viscaya	South Cotabato
Formal						
Cash						
Amount (₱/ha)	2529	1000	2315	4025	3148	2116
Interest (%/yr)	27		28	22	23	27
In kind						
Amount (₱/ha)	-	3103	-		2002	3092
Interest (%/yr)					50	51
Informal						
Cash						
Amount (₱/ha)	1544	-	2389	3107	2260	1776
Interest (%/yr)	44		65	22	55	33
In kind						
Amount (₱/ha)	573	-	1737	1500	1712	1695
Interest (%/yr)	35		67	36	45	57

Source: IFPRI survey.

Table 3.10 Corn farmers by average distance of their farms to the nearest marketing outlet, Philippines, 1989/90

Province	Average distance of farm to marketing outlet
	(kms)
Bukidnon	11.9
Davao	5.0
Isabela	7.6
Lanao del Sur	43.8
Nueva Viscaya	6.8
South Cotabato	9.5
All Provinces (Average)	14.1

Source: IFPRI survey.

Table 3.11 Important corn varieties released by UPLB and other institutions in the Philippines, 1960-90

Year	Variety Name	Origin/ Breeding Inst.	Type	Color	Yield (t/ha)	Other Traits
1960's	UPCA Var 1	UPLB	OPV	Y	4-5	susceptible to downy mildew
	UPCA Var 2	UPLB	OPV	W	4-5	susceptible to downy mildew
	UPCA Var 3	UPLB	OPV	Y	4-5	susceptible to downy mildew
	UPCA Var 4	UPLB	OPV	W	4-5	susceptible to downy mildew
1970's	Phil. DMR 1	UPLB	OPV	Y	4-5	resistant to downy mildew
	Phil. DMR 2	UPLB	OPV	W	4-5	resistant to downy mildew
	Phil. DMR Comp 1	UPLB	OPV	Y	4-5	resistant to downy mildew
	Phil. DMR Comp 2	UPLB	OPV	W	4-5	resistant to downy mildew
	MIT 2	USM	OPV	W	4	resistant to downy mildew
	BPI Var 2	BPI	OPV	Y	4-5	resistant to downy mildew
1980's to 90's	IPB Var 1	UPLB	OPV	Y	4-5	resistant to downy mildew
	IPB Var 2	UPLB	OPV	W	4-5	resistant to downy mildew
	IPB Var 5	UPLB	Hybrid	Y	4-5	resistant to downy mildew, early maturing
	USMARC Varieties	USM	OPV	Y&W	4-5	resistant to downy mildew
	VISCA Varieties	VISCA	OPV	Y&W	4-5	resistant to downy mildew
	IES Cn Vars.	BPI	OPV	Y&W	4-5	resistant to downy mildew
	Pioneer hybrids		Hybrid	Y&W	5-6	mostly resistant to downy mildew
	Cargill hybrids		Hybrid	Y	5-6	mostly resistant to downy mildew
	SMC hybrids		Hybrid	Y&W	5-6	mostly resistant to downy mildew

Source: Logronio, M. of IPB (Personal communication, 1991).

Table 3.12 Corn production technologies delineated by seed type and level of fertilizer use, Philippines, 1989/90

Technology	Seed Type	Fertilizer Use (bags/ha)
I. Hybrid (F_1)		
Low technology	Yellow, F_1 hybrid	< 5
Medium technology	Yellow, F_1 hybrid	5 and ≤ 8
High technology	Yellow, F_1 hybrid	8 and above
II. Hybrid (F_2)	Yellow, Second generation (F_2) hybrid	No delineation
III. Open-Pollinated (OP)		
Yellow		
Low technology	Yellow, red, traditional OP varieties	< 5
Medium technology	Yellow, improved OP varieties	5 and ≤ 8
High technology	Yellow, improved OP varieties	8 and above
White		
Low technology	White, traditional OP varieties	<5
Medium technology	White, improved OP varieties	5 and ≤ 8
High technology	White, improved OP varieties	8 and above

Source: IFPRI survey.

Table 3.13 Frequency distribution of corn farmers, delineated by corn production technology, by province, Philippines, 1989/90

Technology	Bukidnon	Davao	Isabela	Lanao del Sur	Nueva Viscaya	South Cotabato	Total
I. Open-pollinated							
Yellow							
Low technology	1		7			6	14
Medium technology			9			2	11
White							
Low technology	55	9	3			25	92
Medium technology	6		1			8	15
II. Hybrid (Yellow)							
F_1							
Low technology	32	1	79		10	42	164
Medium technology	24	3	105	4	29	116	281
High technology	17		55	23	17	31	143
III. Hybrid (Yellow)							
F_2	2	3	1			4	10
T O T A L	137	16	260	27	56	234	730

Source: IFPRI survey.

Table 3.14 **Comparison of different estimates on corn yields, fertilizer use, by corn producing provinces, Philippines, 1989/90**

	Bukidnon	Davao	Isabela	Lanao del Sur	Nueva Viscaya	South Cotabato	All Provinces
	50 kg bag/ha						
Fertilizer Use							
1) Urea							
BAS[1]	3.60	-	3.00	3.50	-	3.00	3.28
FPA-LBI[2]	1.72	0.80	2.28	2.08	-	3.00	1.98
IFPRI	2.95	2.28	3.04	3.68	4.12	3.01	3.18
2) Complete (Mixed)							
BAS	2.40	-	1.80	1.30	-	2.50	2.00
FPA-LBI	0.85	0.20	3.20	0.40	-	1.00	1.13
IFPRI	3.70	2.68	3.23	6.47	3.83	3.18	3.85
Yield							
RCS[3]	35.60	18.60	38.00	38.60	-	46.00	35.35
FPA-LBI	36.83	17.44	63.70	62.74	-	50.44	46.23
IFPRI	66.14	35.48	62.08	98.78	74.14	64.32	66.82
CPEP[4]	60.80	-	81.60	-	-	87.00	76.47

1 BAS = Bureau of Agricultural Statistics.

2 FPA-LBI = Fertilizer Pesticide Authority - Louis Berger International Study on Farm Level Survey on Fertilizer Use.

3 RCS = Rice and Corn Survey.

4 CPEP = Corn Production Enhancement Program Phase I.

Table 3.15. Average actual levels of fertilizer, labor, yields, and prices, corn farms, by variety, by region, Philippines, 1989/90

Region/Technology	Fertilizer application (bags/ha)	Labor application (md/ha)	Yield (mt/ha)	Prices: Fertilizer (₱/kg)	Prices: Labor (₱/md)	Prices: Corn (₱/kg)
Cagayan Valley (Isabela, Nueva Viscaya)				4.65	28.15	4.07
OP	4.64	85	2.288			
Hybrid	6.82	75	3.259			
Northern Mindanao (Bukidnon)				4.65	30.19	3.95
OP	2.64	67	1.436			
Hybrid	6.34	81.	3.282			
Southern Mindanao (South Cotabato, Davao)				4.65	40.77	4.16
OP	3.82	60	2.037			
Hybrid	6.60	69	3.331			
Central Mindanao (Lanao del Sur)				5.27	47.62	3.60
Hybrid	10.00	63	5.091			

Source: IFPRI survey.

Table 3.16 Corn prices used in the financial analysis, Philippines, 1990

Region/Province	Farm[a]	Davao[a]	General Santos[a]	Cagayan de Oro[a]	Cebu[b]	Manila[b]
	₱/kg					
Bukidnon	3.45			4.00	5.10	5.20
Davao	3.78	4.15			5.10	5.20
Isabela	3.38					5.20
Lanao del Sur	3.01			4.00	5.10	5.20
Nueva Viscaya	3.42					5.20
South Cotabato	3.64		3.90		5.10	5.20

[a] July price.

[b] November price.

Source: IFPRI survey.

Table 3.17 Summary of marketing-distribution-trading costs of corn from farm market outlet via intermediate and medium wholesale markets to Manila wholesale market, Philippines, 1989/90[a]

Components of Trading Costs	Province/Region					
	Bukidnon	Davao	Isabela	Lanao del Sur	Nueva Viscaya	South Cotabato
	₱/mt					
Freight	493	479	545	613	402	579
%	(36)	(36)	(43)	(42)	(35)	(39)
Handling	281	265	201	279	201	281
%	(21)	(20)	(16)	(19)	(18)	(19)
Warehousing	257	262	259	250	260	260
%	(19)	(20)	(20)	(17)	(23)	(18)
Interest and others	332	335	269	307	271	344
%	(24)	(24)	(21)	(21)	(24)	(23)
Total cost	1364	1341	1274	1449	1133	1464
%	(100)	(100)	(100)	(100)	(100)	(100)

[a] Details of cost components are in Appendix Tables A-1 to A-6.

Table 3.18 Financial profitability of yellow corn production, hybrid, high technology, by province, Philippines, 1989/90

	Corn Producing Provinces					
	Bukidnon	Davao	Isabela	Lanao del Sur	Nueva Viscaya	South Cotabato
Gross Revenue (₱/ha)						
Farm	17084	-	16150	16281	15154	17916
Wholesale						
Cebu	25255	-	-	27586	-	25102
Manila	25750	-	24846	28127	23041	25595
Total Cost (₱/ha)						
Farm	11396	-	10596	12286	9986	10000
Wholesale						
Cebu	17043	-	-	18942	-	16344
Manila	18148	-	16685	20123	15010	17206
Net Returns (₱/ha)						
Farm						
Above cash costs	7646	-	8607	6257	7674	10235
Above all costs	5689	-	5554	3996	5168	7916
Wholesale						
Cebu	6792	-	-	8644	-	8758
Manila	7602	-	8161	8003	8031	8388
Breakeven Price (₱/kg)						
Farm	2.30	-	2.22	2.27	2.25	2.03
Wholesale						
Cebu	3.44	-	-	3.50	-	3.32
Manila	3.66	-	3.49	3.72	3.39	3.50
Basic Data						
Yield (mt/ha)	4.952	-	4.778	5.409	4.431	4.922
Price (₱/kg)						
Farm	3.45	-	3.38	3.01	3.42	3.64
Wholesale						
Cebu	5.10	-	-	5.10	-	5.10
Manila	5.20	-	5.20	5.20	5.20	5.20

Source: IFPRI survey.

Table 3.19 Financial profitability of yellow corn production, hybrid, medium technology, by province, Philippines, 1989/90.

	Corn Producing Provinces					
	Bukidnon	Davao	Isabela	Lanao del Sur	Nueva Viscaya	South Cotabato
Gross Revenue (₱/ha)						
Farm	12637	11854	10934	9445	11563	12092
Wholesale						
Cebu	18681	15994	-	16004	-	16945
Manila	19048	16307	16822	16318	17581	17274
Total Cost (₱/ha)						
Farm	8755	7305	8199	8668	8193	7790
Wholesale						
Cebu	12933	10956	-	12530	-	12072
Manila	13750	11510	12322	13215	12026	12654
Net Returns (₱/ha)						
Farm						
Above cash costs	5726	5971	5535	2294	5598	6217
Above all costs	3882	4549	2735	777	3370	4302
Wholesale						
Cebu	5748	5038	-	3474	-	4871
Manila	5292	4797	4500	3102	5555	4621
Breakeven Price (₱/kg)						
Farm	2.39	2.33	2.53	2.76	2.42	2.34
Wholesale						
Cebu	3.53	3.49	-	3.99	-	3.63
Manila	3.75	3.67	3.81	4.21	3.56	3.81
Basic Data						
Yield (mt/ha)	3.663	3.136	3.235	3.138	3.381	3.322
Price (₱/kg)						
Farm	3.45	3.78	3.38	3.01	3.42	3.64
Wholesale						
Cebu	5.10	5.10	-	5.10	-	5.10
Manila	5.20	5.20	5.20	5.20	5.20	5.20

Source: IFPRI survey.

Table 3.20 Financial profitability of yellow corn production, hybrid, low technology, by province, Philippines, 1989/90

	Corn Producing Provinces					
	Bukidnon	Davao	Isabela	Lanao del Sur	Nueva Viscaya	South Cotabato
Gross Revenue (₱/ha)						
Farm	7131	7258	6983	-	8294	8223
Wholesale						
Cebu	10542	9792	-	-	-	11521
Manila	10748	9984	10743	-	12610	11747
Total Cost (₱/ha)						
Farm	6488	5415	6072	-	6643	6079
Wholesale						
Cebu	8846	7650	-	-	-	8991
Manila	9307	7989	8705	-	9393	9386
Net Returns (₱/ha)						
Farm						
Above cash costs	1884	2829	2856	-	3464	3739
Above all costs	643	1843	911	-	1650	2144
Wholesale						
Cebu	1696	2142	-	-	-	2530
Manila	1442	1995	2038	-	3219	2360
Breakeven Price (₱/kg)						
Farm	3.14	2.82	2.94	-	2.74	2.69
Wholesale						
Cebu	4.28	3.98	-	-	-	3.98
Manila	4.50	4.16	4.21	-	3.87	4.16
Basic Data						
Yield (mt/ha)	2.067	1.920	2.066	-	2.425	2.259
Price (₱/kg)						
Farm	3.45	3.78	3.38	-	3.42	3.64
Wholesale						
Cebu	5.10	5.10	-	-	-	5.10
Manila	5.20	5.20	5.20	-	5.20	5.20

Source: IFPRI survey

Table 3.21 Financial profitability of yellow corn production, second generation hybrid (F_2), by province, Philippines, 1989/90

	Corn Producing Provinces					
	Bukidnon	Davao	Isabela	Lanao del Sur	Nueva Viscaya	South Cotabato
Gross Revenue (₱/ha)						
Farm	4485	4275	5493	-	-	8736
Wholesale						
Cebu	6630	5768	-	-	-	12240
Manila	6760	5881	8450	-	-	12480
Total Cost (₱/ha)						
Farm	5167	3599	3474	-	-	5465
Wholesale						
Cebu	6649	4916	-	-	-	8558
Manila	6939	5115	5545	-	-	8979
Net Returns (₱/ha)						
Farm						
Above cash costs	1562	1929	3817	-	-	4873
Above all costs	-682	676	2019	-	-	3271
Wholesale						
Cebu	-19	853	-	-	-	3682
Manila	-179	766	2905	-	-	3501
Breakeven Price (₱/kg)						
Farm	3.97	3.18	2.14	-	-	2.28
Wholesale						
Cebu	5.11	4.35	-	-	-	3.57
Manila	5.34	4.52	3.41	-	-	3.74
Basic Data						
Yield (mt/ha)	1.300	1.131	1.625	-	-	2.40
Price (₱/kg)						
Farm	3.45	3.78	3.38	-	-	3.64
Wholesasle						
Cebu	5.75	5.10	-	-	-	5.10
Manila	5.20	5.20	5.20	-	-	5.20

Source: IFPRI survey

Table 3.22 Financial profitability of yellow corn production, open-pollinated, medium technology, by province, Philippines, 1989/90

	Corn Producing Provinces					
	Bukidnon	Davao	Isabela	Lanao del Sur	Nueva Viscaya	South Cotabato
Gross Revenue (₱/ha)						
Farm	-	-	10454	-	-	11997
Whoesale						
Cebu			-	-	-	16810
Manila	-	-	16084	-	-	17139
Total Cost (₱/kg)						
Farm	-	-	8021	-	-	6575
Wholesale						
Cebu	-	-	-	-	-	10823
Manila	-	-	11963	-	-	11401
Net Returns (₱/ha)						
Farm						
Above cash costs	-	-	5411	-	-	7183
Above all costs	-	-	2433	-	-	5422
Wholesale						
Cebu	-	-	-	-	-	5986
Manila	-	-	4121	-	-	5738
Breakeven Price (₱/kg)						
Farm	-	-	2.59	-	-	1.99
Wholesale						
Cebu	-	-	-	-	-	3.28
Manila	-	-	3.87	-	-	3.46
Basic Data						
Yield (mt/ha)	-	-	3.093	-	-	3.296
Price (₱/kg)						
Farm		-	3.42	-	-	3.64
Wholesale						
Cebu	-	-	-	-	-	5.10
Manila	-	-	5.20	-	-	5.20

Source: IFPRI survey.

Table 3.23 Financial profitability of yellow corn production, open-pollinated, low technology, by province, Philippines, 1989/90

	Corn Producing Provinces					
	Bukidnon	Davao	Isabela	Lanao del Sur	Nueva Viscaya	South Cotabato
Gross Revenue (₱/ha)						
Farm	2588	-	5678	-	-	10126
Wholesale						
Cebu	3825	-	-	-	-	14148
Manila	3900	-	8736	-	-	14466
Total Cost (₱/ha)						
Farm	3003	-	4433	-	-	5044
Wholesale						
Cebu	3858	-	-	-	-	8629
Manila	4025	-	6574	-	-	9117
Net Returns (₱/ha)						
Farm						
Above cash costs	153	-	2959	-	-	7112
Above all costs	-415	-	1245	-	-	5083
Wholesale						
Cebu	-33	-	-	-	-	5559
Manila	-125	-	2162	-	-	5350
Breakeven Price (₱/kg)						
Farm	4.00	-	2.64	-	-	1.81
Wholesale						
Cebu	5.14	-	-	-	-	3.10
Manila	5.37	-	3.91	-	-	3.28
Basic Data						
Yield (mt/ha)	0.750	-	1.680	-	-	2.782
Price (₱/kg)						
Farm	3.45	-	3.42	-	-	3.64
Wholesale						
Cebu	5.10	-	-	-	-	5.10
Manila	5.20	-	5.20	-	-	5.20

Source: IFPRI survey

Table 3.24 **Financial profitability of white corn production, open-pollinated, medium technology, by province, Philippines, 1989/90**

	Corn Producing Provinces					
	Bukidnon	Davao	Isabela	Lanao del Sur	Nueva Viscaya	South Cotabato
Gross Revenue (₱/ha)						
Farm	11561	-	13250	-	-	13945
Wholesale						
Cebu	17090	-	-	-	-	19538
Manila	17425	-	20384	-	-	19921
Total Cost (₱/ha)						
Farm	9128	-	6832	-	-	6886
Wholesale						
Cebu	12941	-	-	-	-	11823
Manila	13689	-	11827	-	-	12495
Net Returns (₱/ha)						
Farm						
Above cash costs	4689	-	10327	-	-	9350
Above all costs	2441	-	6418	-	-	7059
Wholesale						
Cebu	4149	-	-	-	-	7715
Manila	3736	-	8557	-	-	7427
Breakeven Price (₱/kg)						
Farm	2.72	-	1.74	-	-	1.80
Wholesale						
Cebu	3.86	-	-	-	-	3.09
Manila	4.09	-	3.02	-	-	3.26
Basic Data						
Yield (mt/ha)	3.351	-	3.920	-	-	3.831
Price (₱/kg)						
Farm	3.45	-	3.38	-	-	3.64
Wholesale						
Cebu	5.10	-	-	-	-	5.10
Manila	5.20	-	5.20	-	-	5.20

Source: IFPRI survey.

Table 3.25 Financial profitability of white corn production, open-pollinated, low technology, by province, Philippines, 1989/90

	Corn Producing Provinces					
	Bukidnon	Davao	Isabela	Lanao del Sur	Nueva Viscaya	South Cotabato
Gross Revenue (₱/ha)						
Farm	3995	4305	5029	-	-	6112
Wholesale						
Cebu	5906	5809	-	-	-	8563
Manila	6022	5923	7738	-	-	8731
Total Cost (₱/ha)						
Farm	3822	4157	4148	-	-	4341
Wholesale						
Cebu	5143	5483	-	-	-	6505
Manila	5401	5684	6044	-	-	6799
Net Returns (₱/ha)						
Farm						
Above cash costs	1730	1366	2859	-	-	3724
Above all costs	-173	-149	-882	-	-	1771
Wholesale						
Cebu	763	326	-	-	-	2058
Manila	620	239	1694	-	-	1932
Breakeven Price (₱/kg)						
Farm	3.30	3.65	2.79	-	-	2.59
Wholesale						
Cebu	4.44	4.81	-	-	-	3.87
Manila	4.66	4.99	4.06	-	-	4.05
Basic Data						
Yield (mt/ha)	1.158	1.139	1.488	-	-	1.679
Price (₱/kg)						
Farm	3.45	3.78	3.42	-	-	3.64
Wholesale						
Cebu	5.10	5.10	-	-	-	5.10
Manila	5.20	5.20	5.20	-	-	5.20

Source: IFPRI survey

Table 3.26 Direct, indirect, and total nominal protection rates of corn imports, by producing provinces, 1989/90

Province	Nominal Protection Rates		
	Direct	Indirect	Total
	----------	percent	----------
Bukidnon	32	-21	11
Davao	41	-21	20
Isabela	27	-21	6
Lanao del Sur	21	-21	0
Nueva Viscaya	23	-21	4
South Cotabato	42	-21	21
All Provinces	31	-21	10

Source: Producers' prices and border prices on farm adjusted for domestic marketing and distribution costs were from the IFPRI survey. The calculation also used an official exchange rate of ₱22.50:$1, and adjusted for 27 percent exchange rate overvaluation, to approximate the equilibrium exchange rate.

Table 3.27 Direct, indirect, and total nominal protection rates of corn imports at Manila wholesale by source of imports, 1987-90

Year	Direct		Indirect	Total	
	U.S.	Thailand		U.S.	Thailand
	----------	----------	percent	----------	----------
1987	43	70	-21	13	34
1988	16	33	-21	-8	5
1989	37	60	-21	8	24
1990	39	59	-21	10	26

The corn wholesale prices used were CIF adjusted for domestic transport and distribution costs. The peso official exchange rates to the dollar were 20.53, 21.02, 21.78, 22.50 for 1987 to 1990. Total NPR is the sum of direct and indirect NPR plus an interaction effect between direct and indirect NPR.

Table 3.28 Effective protection rates of corn production, by type of production technology, by province, Philippines, 1989/90

Production Technology	Bukidnon	Davao	Isabela	Lanao del Sur	Nueva Viscaya	South Cotabato
	percent					
Yellow hybrid						
High technology	54	-	48	36	42	72
Medium technology	52	70	50	40	41	73
Low technology	55	75	48	-	42	76
Yellow, open-pollinated						
Medium technology	-	-	48	-	-	64
Low technology	65	-	43	-	-	63
Yellow, hybrid (F2)	67	93	38	-	-	70
White, open-pollinated						
Medium technology	51	-	39	-	-	64
Low technology	49	71	49	-	-	65
Average (All Production Systems)	56	77	45	38	42	68

Table 3.29 World corn production and trade, 1989

Country	Total (mil. mt)	Share of World (%)	Exports -- (mil. mt) ---	Imports	Share of World Export (Import) Trade (%)
United States	191	40.6	56.5	-	72.4
China	76	16	4.4	-	5.6
Brazil	27	5.7	-	-	0.3
France	12.9	2.7	7.7	-	9.8
Romania	11.8	2.5	-	-	-
USSR	17.0	3.6	-	18.9	(24.2)
Mexico	9.9	2.1	-	3.6	(4.6)
Japan	-	-	-	15.8	(20.2)
Indonesia	6.3	1.3	0.26	-	0.3
Thailand	4.5	1.0	1.2	-	1.5
Philippines	4.5	1.0	-	0.17	(0.2)
Africa	36.0	7.7	-	4.4	(5.6)
Other	73.1	15.5	7.9	35.1	-
World Total	**470**	**100.0**	**78.0**	**78.0**	

Source: FAO Production Yearbook
FAO, Trade Yearbook
BAS

Table 3.30 Domestic resource costs (DRCs)[1] and resource cost ratios (RCRs),[2] corn production systems, by province, import substitution with interregional trade, Philippines, 1989/90

Production Technology	Bukidnon		Davao		Isabela		Lanao del Sur		N. Viscaya		S. Cotabato		Ave. (Phils.)	
	DRC	RCR	DRC	RCR	DRC	RCR	DRC	RCR	DRC	RCR	DRC	RCR	DRC	RCR
Yellow hybrid														
High technology	20	.710			20	.694	21	.729	19	.654	19	.676	20	.693
Medium technology	21	.745	20	.695	22	.783	25	.863	20	.699	22	.755	22	.757
Low technology	27	.938	23	.813	25	.883			22	.782	24	.847	24	.853
Yellow, open pollinated														
Medium technology					23	.811					19	.674	21	.742
Low technology	35	1.235			23	.809					18	.636	25	.893
Yellow hybrid (F2)	36	1.253	28	.987	20	.688					21	.751	26	.920
White, Open-pollinated														
Medium technology	24	.845			17	.580					18	.625	20	.683
Low technology	28	.991	31	1.067	25	.867					24	.828	27	.938

[1] DRC = domestic resource cost, expressed as ₱/$.

[2] RCR = ratio of DRC with the shadow (equilibrium) exchange rate, a measure of comparative advantage.

Table 3.31 **Breakeven yields and breakeven border prices in corn production, by region and trade regime, Philippines, 1989/90.**

Technology/Region	Trade Regime*	Actual Yield	Breakeven Yield	Actual Border Price	Breakeven Border Price
		--- mt/ha ---		----- $/mt -----	
Yellow hybrid, low technology					
South Cotabato	IRT-Manila	2.259	1.908	159.81	142.01
Isabela	IRT-Manila	2.066	1.830	159.81	146.14
Bukidnon	IRT-Manila	2.067	1.937	159.81	152.38
Nueva Vircaya	IRT-Manila	2.425	1.931	159.81	134.44
Davao	IRT-Manila	1.920	1.565	159.81	137.89
Yellow hybrid, medium technology					
South Cotabato	IRT-Manila	3.322	2.473	159.81	130.56
Isabela	IRT-Manila	3.235	2.544	159.81	134.25
Bukidnon	IRT-Manila	3.663	2.658	159.81	127.50
Nueva Viscaya	IRT-Manila	3.381	2.404	159.81	123.80
Davao	IRT-Manila	3.136	2.141	159.81	122.18
Lanao del Sur	IRT-Manila	3.138	2.718	159.81	144.50
Yellow hybrid, high technology					
South Cotabato	IRT-Manila	4.922	3.218	159.81	120.16
Isabela	IRT-Manila	4.778	3.308	159.81	122.95
Bukidnon	IRT-Manila	4.952	3.471	159.81	124.59
Nueva Viscaya	IRT-Manila	4.431	2.966	159.81	118.62
Lanao del Sur	IRT-Manila	5.409	3.861	159.81	127.07
Yellow hybrid, low technology					
South Cotabato	IRT-Cebu	2.259	1.838	159.81	137.51
Bukidnon	IRT-Cebu	2.067	1.841	159.81	146.20
Davao	IRT-Cebu	1.920	1.513	159.81	133.57
Yellow hybrid, medium technology					
South Cotabato	IRT-Cebu	3.322	2.369	159.81	125.52
Bukidnon	IRT-Cebu	3.663	2.514	159.81	120.77
Davao	IRT-Cebu	3.136	2.053	159.81	117.12
Lanao del Sur	IRT-Cebu	3.138	2.569	159.81	137.86
Yellow hybrid, high technology					
South Cotabato	IRT-Cebu	4.922	3.082	159.81	115.12
Bukidnon	IRT-Cebu	4.952	3.284	159.81	117.87
Lanao del Sur	IRT-Cebu	5.409	3.649	159.81	120.42

* IRT=import substitution with interregional trade. Manila and Cebu are the major wholesale markets.

Table 3.32 Breakeven yields and breakeven border prices in corn production, by region and trade regime, Philippines, 1989/90

Technology/Region	Trade Regime*	Actual Yield	Breakeven Yield	Actual Border Price	Breakeven Border Price
		--- mt/ha ---		----- $/mt -----	
Yellow OP, low technology					
South Cotabato	IRT-Manila	2.782	1.599	159.81	111.12
Isabela	IRT-Manila	1.680	1.355	159.81	135.20
Bukidnon	IRT-Manila	0.750	0.917	159.81	186.06
Yellow OP, medium technology					
South Cotabato	IRT-Manila	3.296	2.068	159.81	117.13
Isabela	IRT-Manila	3.093	2.493	159.81	136.56
Yellow OP, low technology					
South Cotabato	IRT-Cebu	2.782	1.533	159.81	106.14
Bukidnon	IRT-Cebu	0.750	0.869	159.81	179.55
Yellow OP, medium technology					
South Cotabato	IRT-Cebu	3.296	1.980	159.81	112.09
Yellow hybrid, (F2)					
South Cotabato	IRT-Manila	2.400	1.747	159.81	128.67
Isabela	IRT-Manila	1.625	1.036	159.81	116.43
Bukidnon	IRT-Manila	1.300	1.604	159.81	187.31
Davao	IRT-Manila	1.131	1.117	159.81	158.39
Yellow hybrid (F2)					
South Cotabato	IRT-Cebu	2.400	1.675	159.81	123.69
Bukidnon	IRT-Cebu	1.300	1.518	159.81	180.72
Davao	IRT-Cebu	1.131	1.073	159.81	153.46

* IRT=import substitution with interregional trade. Manila and Cebu are the major wholesale markets.

Table 3.33 Breakeven yields and breakeven border prices in corn production, by region and trade regime, Philippines, 1989/90

Technology/Region	Trade Regime*	Actual Yield	Breakeven Yield	Actual Border Price	Breakeven Border Price
		--- mt/ha ---		----- $/mt -----	
White OP, low technology					
South Cotabato	IRT-Manila	1.679	1.352	159.81	137.54
Isabela	IRT-Manila	1.488	1.290	159.81	143.91
Bukidnon	IRT-Manila	1.158	1.147	159.81	158.66
Davao	IRT-Manila	1.139	1.218	159.81	168.07
White OP, medium technology					
South Cotabato	IRT-Manila	3.831	2.189	159.81	110.73
Isabela	IRT-Manila	3.920	2.066	159.81	103.15
Bukidnon	IRT-Manila	3.351	2.779	159.81	139.72
White OP, low technology					
South Cotabato	IRT-Cebu	1.679	1.297	159.81	132.63
Bukidnon	IRT-Cebu	1.158	1.086	159.81	152.08
Davao	IRT-Cebu	1.139	1.170	159.81	163.13
White OP, medium technology					
South Cotabato	IRT-Cebu	3.831	2.097	159.81	105.69
Bukidnon	IRT-Cebu	3.351	2.629	159.81	133.00

* IRT=import substitution with interregional trade. Manila and Cebu are the major wholesale markets.

Table 3.34 Domestic resource costs (DRCs) and resource cost ratios (RCRs) yellow corn production for export, by production technology, by province, Philippines, 1989/90

Province	Yellow Hybrid			Yellow OP		F2
	High	Medium	Low	Medium	Low	
Bukidnon						
DRC	33	33	43		60	62
RCR	1.140	1.170	1.519		2.096	2.168
Davao						
DRC		32	38			49
RCR		1.106	1.334			1.715
Isabela						
DRC	32	37	41	37	36	29
RCR	1.120	1.282	1.451	1.292	1.256	1.026
Lanao del Sur						
DRC	34	42				
RCR	1.175	1.460				
Nueva Viscaya						
DRC	30	32	37			
RCR	1.063	1.133	1.289			
South Cotabato						
DRC	31	35	40	30	28	34
RCR	1.080	1.224	1.397	1.037	0.967	1.186

Table 3.35 Breakeven yields and breakeven border prices in corn production, by region and trade regime, Philippines, 1989/90

Technology/Region	Trade Regime*	Actual Yield Price	Breakeven Yield	Actual Border	Breakeven Border Price
		--- mt/ha ---		----- $/mt -----	
Yellow hybrid, low technology					
South Cotabato	EP	2.259	3.180	114.00	142.00
Isabela	EP	2.066	2.964	114.00	146.00
Bukidnon	EP	2.067	3.169	114.00	152.00
Nueva Viscaya	EP	2.425	3.054	114.00	134.00
Davao	EP	1.920	2.550	114.00	138.00
Yellow hybrid, medium technology					
South Cotabato	EP	3.322	4.123	114.00	131.00
Isabela	EP	3.235	3.899	114.00	134.00
Bukidnon	EP	3.663	4.350	114.00	128.00
Nueva Viscaya	EP	3.381	3.801	114.00	124.00
Davao	EP	3.136	3.489	114.00	122.00
Lanao del Sur	EP	3.138	4.534	114.00	145.00
Yellow hybrid, high technology					
South Cotabato	EP	4.922	5.363	114.00	120.00
Isabela	EP	4.778	5.356	114.00	123.00
Bukidnon	EP	4.952	5.681	114.00	125.00
Nueva Viscaya	EP	4.431	4.690	114.00	119.00
Lanao del Sur	EP	5.409	6.440	114.00	127.00
Yellow OP, low technology					
South Cotabato	EP	2.782	2.665	114.00	111.00
Isabela	EP	1.680	2.162	114.00	135.00
Bukidnon	EP	0.750	1.501	114.00	186.00
Yellow OP, medium technology					
South Cotabato	EP	3.296	3.446	114.00	117.00
Isabela	EP	3.093	4.037	114.00	137.00
Yellow hybrid (F2)					
South Cotabato	EP	2.400	2.912	114.00	129.00
Isabela	EP	1.625	1.678	114.00	116.00
Bukidnon	EP	1.300	2.624	114.00	187.00
Davao	EP	1.130	1.821	114.00	158.00

* EP=export promotion.

Table 3.36 Trends in the production of white and yellow corn, South Cotabato, 1979-89

Year	Area Planted (in hectares)			Production (in tons)		
	Yellow	White	Total	Yellow	White	Total
1979		151,450	151,450		372,861	372,861
1980		134,079	134,079		337,080	337,080
1981	5,907	172,871	178,878	26,740	460,568	489,309
1982	17,183	168,818	186,001	85,958	426,235	511,293
1983	29,965	139,514	169,479	103,844	321,777	427,621
1984	31,642	130,492	162,134	169,479	308,082	440,879
1985	23,441	162,451	185,892	102,808	448,480	634,352
1986	19,148	139,601	158,749	86,074	389,602	415,676
1987	30,545	131,612	162,157	134,493	361,989	496,482
1988	37,497	117,991	155,488	179,610	294,499	474,109
1989	63,212	64,731	127,943	297,367	174,791	472,158

Source: Provincial Agricultural Office, Department of Agriculture, South Cotabato, 1990.

APPENDIX 3A: MARKETING, DISTRIBUTION, AND PRODUCTION COST TABLES

Table 3A.1 Marketing cost distribution of corn from Town Marketing Center to different marketing points, Bukidnon, 1989/90

Marketing Points	Cost Items	Total Cost	Freight	Handling	Warehsg	Interest & Others
		----------	----------	₱/mt	----------	
Town marketing center to Malaybalay (50 km)	Trucking	71.50	71.50			
	Load/Unload	17.00		17.00		
Malaybalay to CDO City (93 km)	Scaling	8.50		8.50		
	Rebagging/Sewing	8.50		8.50		
	Loading	8.50		8.50		
	Trucking	132.99	132.99			
	Unloading & Pouring out	8.50		8.50		
	Sacks (DEP)	30.00		30.00		
	Bank Inter. (7 days)	15.95				15.95
	Canvasser's Com.	40.00				40.00
Cagayan de Oro City	Storage (3 mos)					
	Rental	80.00			80.00	
	Labor	58.30			58.30	
	Fumigation	20.00			20.00	
	Sack Sep.	20.00			20.00	
	Ins/Surety Bond (%)	39.50			39.50	
	Shrinkage (1%)	39.50			39.50	
	Bank Inter. (3 mo)	207.38				207.38
To Cagayan de Oro City (sub-total)		**806.12**	**204.49**	**81.00**	**257.30**	**263.33**
To Cebu	Rebagging, Palletizing Loading	30.00		30.00		
	CDO Trucking to Port	14.30	14.30			
	Arrastre (CDO/Cebu)	50.00		50.00		
	Freight	90.00	90.00			
	Cebu Trucking	14.30	14.30			
	Shrinkage	19.75		19.75		
	Sacks	100.00		100.00		
	Bank Inter. (7 days)	15.95				15.95
To Cebu (sub-total)		**1140.42**	**323.09**	**280.75**	**257.30**	**279.28**
To Manila	Rebagging, Palletizing Loading	30.00		30.00		
	CDO Trucking to Port	14.30	14.30			
	Arrastre (CDO/MLA)	50.00		50.00		
	Freight	260.00	260.00			
	MLA Trucking	14.30	14.30			
	Shrinkage	19.75		19.75		
	Sacks	100.00		100.00		
	Bank Inter. (30 days)	69.13				69.13
Town Center to Manila		1363.59	493.09	280.75	257.30	332.45

Source of Data: IFPRI survey and C.D.O. Chamber of Industry Foundation, Inc., 1990

Table 3A.2 Marketing cost distribution of corn from Town Marketing Center to different marketing points, Davao, 1989/90

Marketing Points	Cost Items	Total Cost	Freight	Handling	Warehsg	Mat & Ga
		----------	----------	₱/mt	----------	----------
Town marketing center to Davao City (35 km)	Trucking	50.05	50.05			
	Load/Unload	17.00		17.00		
Davao City	Scaling	8.50		8.50		
	Rebagging/Sewing	8.50		8.50		
	Sacks (DEP)	30.00		30.00		
	Canvasser's Com.	40.00			40.00	
	Storage (3 mos)					
	Rental	80.00			80.00	
	Labor	58.30			58.30	
	Fumigation	20.00			20.00	
	Sack Dep.	20.00			20.00	
	Ins/Surety Bond (%)	42.10			42.10	
	Shrinkage (1%)	42.10			42.10	
	Bank Inter. (3 mo.)	221.03			221.03	
To Davao City (sub-total)		**637.58**	**50.05**	**64.00**	**262.50**	**261.03**
To Cebu	Rebagging, Palletizing Loading	30.00		30.00		
	Davao Trucking to Port	14.30	14.30			
	Arrastre (DVO/Cebu)	50.00		50.00		
	Freight	280.00	280.00			
	Cebu Trucking	14.30	14.30			
	Shrinkage	21.05		21.05		
	Sacks	100.00		100.00		
	Bank Inter. (7 days)	17.00			17.00	
To Cebu (sub-total)		**1164.23**	**358.65**	**265.05**	**262.50**	**278.03**
To Manila	Rebagging, Palletizing Loading	30.00		30.00		
	Davao Trucking to Port	14.30	14.30			
	Arrastre (DVA/MLA)	50.00		50.00		
	Freight	400.00	400.00			
	MLA Trucking	14.30	14.30			
	Shrinkage	21.05		21.05		
	Sacks	100.00		100.00		
	Bank Inter. (30 days)	73.68			73.68	
Town Center to Manila		1340.90	478.65	265.05	262.50	334.70

Source: IFPRI survey

Table 3A.3 Marketing and distribution cost of corn, Town Marketing Center, Isabela to Manila, 1989/90

Marketing Points	Cost Items	Total Cost	Freight	Handling	Warehsg	Interest & Ins
		----------	----------	P/mt	----------	----------
Town Marketing Center to Santiago (50 km)	Trucking	71.50	71.50			
	Load/unload	17.00		17.00		
Santiago	Scaling	8.50		8.50		
	Rebagging/sewing	8.50		8.50		
	Sacks (dep)	30.00		30.00		
	Canvasser's Com.	40.00			40.00	
	Storage (3 mos)					
	Rental	80.00			80.00	
	Labor	58.30			58.30	
	Fumigation	20.00			20.00	
	Sack Dep.	20.00			20.00	
	Ins/Surety Bond (%)	40.50			40.50	
	Shrinkage (1%)	40.50			40.50	
	Bank Inter. (3 mos)	212.63			212.63	
Town Center to Santiago		647.43	71.50	64.00	259.30	252.63
Santiago to Manila (331 km)	Trucking	473.33	473.33			
	Load/unload	17.00		17.00		
	Shrinkage	20.25		20.25		
	Sacks	100.00		100.00		
	Bank Inter. (7 days)	16.36			16.36	
Town Center to Manila		1274.36	544.83	201.25	259.30	268.98

Source: IFPRI survey

Table 3A.4 Marketing cost distribution of corn from Town Marketing Center to different marketing points, Lanao del Sur, 1989/90

Marketing Points	Cost Items	Total Cost	Freight	Handling	Warehsg	Interest & Others
		₱/mt				
Town marketing center to WAO (20 km)	Trucking	28.60	28.60			
	Load/Unload	17.00		17.00		
WAO to CDO City (207 km)	Scaling	8.50		8.50		
	Rebagging/Sewing	8.50		8.50		
	Loading	8.50		8.50		
	Trucking	296.01	296.01			
	Unloading & Pouring out	8.50		8.50		
	Sacks (DEP)	30.00		30.00		
	Bank Inter. (7 days)	14.54				14.54
	Canvasser's Com.	40.00				40.00
Cagayan de Oro City	Storage (3 mos)					
	Rental	80.00			80.00	
	Labor	58.30			58.30	
	Fumigation	20.00			20.00	
	Sack Dep.	20.00			20.00	
	Ins/Surety Bond (%)	36.00			36.00	
	Shrinkage (1%)	36.00			36.00	
	Bank Inter. (3 mo.)	189.00				189.00
To Cagayan de Oro City (sub-total)		**899.45**	**324.61**	**81.00**	**250.30**	**243.54**
To Cebu	Rebagging, Palletizing Loading	30.00		30.00		
	CDO Trucking to Port	14.30	14.30			
	Arrastre (CDO/Cebu)	50.00		50.00		
	Freight	90.00	90.00			
	Cebu Trucking	14.30	14.30			
	Shrinkage (0.5%)	18.00		18.00		
	Sacks	100.00		100.00		
	Bank Inter. (7 days)	14.54				14.54
To Cebu (sub-total)		**1230.59**	**443.21**	**279.00**	**250.30**	**258.08**
To Manila	Rebagging, Palletizing Loading	30.00		30.00		
	CDO Trucking to Port	14.30	14.30			
	Arrastre (CDO/MLA)	50.00		50.00		
	Freight	260.00	260.00			
	MLA Trucking	14.30	14.30			
	Shrinkage	18.00		18.00		
	Sacks	100.00		100.00		
	Bank Inter. (30 days)	63.00				63.00
To Manila (sub-total)		**1449.05**	**613.21**	**279.00**	**250.30**	**306.54**

Source: IFPRI Survey and CDO Chamber of Commerce and Industry Foundation, Inc., 1990.

Table 3A.5 Marketing and distribution cost of corn, Town Marketing Center, Nueva Viscaya to Manila, 1989/90

Marketing Points	Cost Items	Total Cost	Freight	Handling	Warehsg	Interest & Others
		₱/mt				
Town Marketing Center to Solano (20 km)	Trucking	28.60	28.60			
	Load/unload	17.00		17.00		
Solano	Scaling	8.50		8.50		
	Rebagging/sewing	8.50		8.50		
	Sacks (Dep)	30.00		30.00		
	Canvasser's Com.	40.00				40.00
	Storage (3 mos)					
	Rental	80.00			80.00	
	Labor	58.30			58.30	
	Fumigation	20.00			20.00	
	Sack dep.	20.00			20.00	
	Ins/Surety bond (%)	40.80			40.80	
	Shrinkage (1%)	40.80			40.80	
	Bank Inter. (3 mos)	214.20				214.20
Town Center to Solano		606.70	28.60	64.00	259.90	254.20
Solano to Manila (261km)	Trucking	373.23	373.23			
	Load/unload	17.00		17.00		
	Shrinkage	20.40		20.40		
	Sacks	100.00		100.00		
	Bank Inter. (7 days)	16.48				16.48
Town Marketing Center to Manila		1133.81	401.83	201.40	259.90	270.68

Source: IFPRI survey

Table 3A.6 Marketing and distribution of corn from Town Marketing Center to different marketing points, South Cotabato, 1989/90

Marketing Points	Cost Items	Total Cost	Freight	Handling	Warehsg	Interest & Others
		----------	----------	₱/mt	----------	
Town marketing center to Marbel (35 km)	Trucking	50.05	50.05	49.14		
	Load/Unload	17.00		17.00		
Marbel to Gen. Santos City (70 km)	Scaling	8.50		8.50		
	Rebagging/Sewing	8.50		8.50		
	Loading	8.50		8.50		
	Trucking	100.10	100.10			
	Unloading & Pouring out	8.50		8.50		
	Sacks (DEP)	30.00		30.00		
	Bank Inter. (7 days)	16.56				16.56
	Canvasser's Com.	40.00				40.00
Gen. Santos City	Storage (3 mos)					
	Pental	80.00			80.00	
	Labor	58.30			58.30	
	Fumigation	20.00			20.00	
	Sack Dep.	20.00			20.00	
	Ins/Surety Bond (%)	41.00			41.00	
	Shrinkage (1%)	41.00			41.00	
	Bank Inter. (3 mo.)	215.25				215.25
To Gen. Santos City (sub-total)		**763.26**	**150.15**	**81.00**	**260.30**	**271.81**
To Cebu	Rebagging, Palletizing Loading	30.00		30.00		
	GSC Trucking to Port	14.30	14.30			
	Arrstre (GSC/Cebu)	50.00		50.00		
	Freight	280.00	280.00			
	Cebu Trucking	14.30	14.30			
	Shrinkage	20.50		20.50		
	Sacks	100.00		100.00		
	Bank Inter. (7 days)	16.56				16.56
To Cebu (sub-total)		**1288.92**	**458.92**	**281.50**	**260.30**	**288.37**
To Manila	Rebagging, Palletizing Loading	30.00		30.00		
	GSC Trucking to Port	14.30	14.30			
	Arrastre (GSC/MLA)	50.00		50.00		
	Freight	400.00	400.00			
	MLA Trucking	14.30	14.30			
	Shrinkage	20.50		20.50		
	Sacks	100.00		100.00		
	Bank Inter. (30 days)	71.75				71.75
To Manila (sub-total)		**1464.11**	**578.75**	**281.50**	**260.30**	**343.56**

Source: IFPRI Survey

Table 3A.7 Percent distribution of per hectare costs of corn production, farm to Manila wholesale, by production technology, by province, Philippines, 1989/90

Technology/Input Costs	Bukidnon	Davao	Isabela	Lanao del Sur	Nueva Viscaya	South Cotabato
	%					
Yellow Hybrid, High Technology						
Costs						
Current	21.0	-	21.0	21.0	22.0	20.0
Labor	19.0	-	21.0	19.0	12.0	17.0
Land	11.0	-	11.0	11.0	16.0	12.0
Interest/Capital	8.0	-	6.0	8.0	8.0	6.0
Processing	4.0	-	4.0	4.0	9.0	3.0
Production	63.0	-	64.0	61.0	67.0	58.0
Trading/Marketing	37.0	-	36.0	39.0	33.0	42.0
TOTAL COST	100.0 (₱18148.00)	-	100.00 (₱16685.00)	100.00 (₱20123.00)	100.00 (₱15010.00)	100.00 (₱17206.00)
Cost/Unit (₱/kg)	3.66		3.49	3.72	3.39	3.50
Yellow Hybrid, Medium Technology						
Costs						
Current	19.0	23.0	21.0	22.0	20.0	20.0
Labor	26.0	18.0	24.0	19.0	14.0	19.0
Land	11.0	12.0	11.0	11.0	17.0	12.0
Interest/Capital	4.0	6.0	6.0	8.0	8.0	7.0
Processing	4.0	6.0	4.0	6.0	9.0	3.0
Production	64.0	63.0	67.0	66.0	68.0	62.0
Trading/Marketing	36.0	37.0	33.0	34.0	32.0	38.0
TOTAL COST	100.0 (₱13750.00)	100.0 (₱11510.0)	100.0 (₱12322.00)	100.0 (₱13215.00)	100.0 (₱12026.00)	100.0 (₱16654.00)
Cost/Unit (₱/kg)	3.75	3.67	3.81	4.21	3.56	3.81

Source: IFPRI survey

Table 3A.8 Percent distribution of per hectare costs of corn production, farm to Manila wholesale, by production technology, by province, Philippines, 1989/90

Technology/Input Costs	Bukidnon	Davao	Isabela	Lanao del Sur	Nueva Viscaya	South Cotabato
	%					
Yellow Hybrd, Low Technology						
Costs						
Current	19.0	28.0	21.0		20.0	21.0
Labor	29.0	19.0	27.0		14.0	20.0
Land	11.0	12.0	11.0		18.0	13.0
Interest/Capital	8.0	5.0	7.0		11.0	10.0
Processing	3.0	4.0	3.0		8.0	3.0
Production	70.0	68.0	70.0		71.0	65.0
Trading/Marketing	30.0	32.0	30.0		29.0	35.0
TOTAL COST	100.0 (₱9307.00)	100.0 (₱7989.00)	100.0 (₱8705.00)		100.0 (₱9393.00)	100.0 (₱9386.00)
Cost/Unit (₱/kg)	4.50	4.16	4.21		3.87	4.16
Yellow Hybrid, F_2						
Costs						
Current	23.0	29.0	7.00			15.0
Labor	35.0	21.0	35.0			22.0
Land	11.0	14.0	15.0			14.0
Interest/Capital	3.0	3.0	1.0			6.0
Processing	3.0	4.0	4.0			3.0
Production	74.0	70.0	63.0			61.0
Trading/Marketing	26.0	30.0	37.0			39.0
TOTAL COST	100.0 (₱6939.00)	100.0 (₱5115.00)	100.0 (₱5545.00)			100.0 (₱8979.00)
Cost/Unit (₱/kg)	5.34	4.52	3.41			3.74

Source: IFPRI survey.

Table 3A.9 Percent distribution of per hectare costs of corn production, farm to Manila wholesale, by production, farm to Manila wholesale, by production technology, by province, Philippines, 1989/90

Technology/Input Costs	Bukidnon	Davao	Isabela	Lanao del Sur	Nueva Viscaya	South Cotabato
	%					
Yellow, Open-Pollinated, Medium Technology						
Costs						
Current			17.0			12.0
Labor			32.0			23.0
Land			11.0			14.0
Interest/Capital			4.0			6.0
Processing			4.0			3.0
Production			67.0			58.0
Trading/Marketing			33.0			42.0
TOTAL COST			100.0 (₱11963.00)			100.0 (₱11401.00)
Cost/Unit (₱/kg)			3.87			3.46
Yellow, Open-Pollinated, Low Technology						
Costs						
Current	21.0		14.0			10.0
Labor	32.0		34.0			22.0
Land	14.0		13.0			15.0
Interest/Capital	4.0		3.0			4.0
Processing	3.0		4.0			4.0
Production	75.0		67.0			55.0
Trading/Marketing	25.0		33.0			45.0
TOTAL COST	100.0 (₱4025.00)		100.0 (₱6574.00)			100.0 (₱9117.00)
Cost/Unit (₱/kg)	5.37		3.91			3.28

Source: IFPRI survey.

Table 3A.10 Percent distribution of per hectare costs of corn production, farm to Manila wholesale, by production technology, by province, Philippines, 1989/90

Technology/Input Costs	Bukidnon	Davao	Isabela	Lanao del Sur	Nueva Viscaya	South Cotabato
	%					
White, Open-Pollinated, Medium Technology						
Costs						
Current	14.0		9.0			12.0
Labor	36.0		25.0			20.0
Land	10.0		14.0			14.0
Interest	2.0		5.0			5.0
Processing	4.0		5.0			4.0
Production	67.0		58.0			55.0
Trading/Marketing	33.0		42.0			45.0
TOTAL COST	100.0 (₱13689.0)		100.0 (₱11827.0)			100.0 (₱12495.00)
Cost/Unit (₱/kg)	4.09		3.02			3.99
White, Open-Pollinated, Low Technology						
Costs						
Current	11.0	16.0	15.0			11.0
Labor	40.0	35.0	28.0			29.0
Land	13.0	12.0	13.0			15.0
Interest	4.0	5.0	9.0			6.0
Processing	3.0	4.0	3.0			3.0
Production	71.0	73.0	69.0			64.0
Trading/Marketing	29.0	27.0	31.0			36.0
TOTAL COST	100.0 (₱5401.00)	100.0 (₱5684.00)	100.0 (₱6044.00)			100.0 (₱6799.00)
Cost/Unit (₱/kg)	4.66	4.99	4.06			4.05

Source: IFPRI survey.

APPENDIX 3B: DATA SOURCES AND ASSUMPTIONS IN THE ECONOMIC ANALYSIS

General Assumptions

Primary and secondary data on farm and at wholesale were used in the economic analysis of corn. They can be grouped categorically as follows.

a) technical input/output coefficients at the farm and regional levels, delineated into production technologies by corn varieties (OPs, hybrids) and by color (white, yellow);

b) domestic prices of inputs and output (corn) at the different production-marketing points; and

c) border prices (import-export) of inputs and output including costs of freight, insurance, internal costs of marketing, processing, transport/shipping of corn to the relevant market points by trade regimes.

Using the domestic trade flows of corn as a commodity system, two trade regimes were assumed: import substitution with interregional trade (IRT), and export promotion (EP). The IRT trade regime assumed Manila and Cebu as the major wholesale markets and therefore the relevant border price of corn was the CIF price adjusted for internal transport and distribution from port to domestic wholesale (Table 3B.1). Under the EP trade regime, the relevant port of exist used was Manila.[1]

Tradable and Nontradable Costs

A crucial aspect of the domestic resource cost (DRC) approach lies in the estimation of implicit tax or subsidy and the allocation of economic costs into their tradable (foreign) and nontradable (domestic) components. Based on existing secondary information and from the survey, the implicit tariffs and economic allocation of land, labor, interest, seed, transport and processing services are shown in Table 3B.2. For trucking, the financial and economic costs are shown in Table 3B.3. Shelling, drying and transport services have foreign economic cost ranging from 44-54 percent of total economic costs.

[1] An *ex ante* analysis however was also done separately for EP using the major ports of the corn producing provinces as major ports of exit.

Fertilizer and Chemicals

Fertilizer and chemical inputs are highly tradable. Their foreign costs ranged above 65 percent of total economic costs. During the 1989/90 crop period, fertilizer was subsidized (negative ITs), ranging from 1 percent to 24 percent of domestic farm price depending on the type of fertilizer used and the distance of the corn producing province to the major fertilizer markets. Chemical input costs on corn production were not subsidized but were implicitly taxed by around 20 percent across provinces (Table 3B.4). Details of the distribution costs of chemicals by province are shown in Table 3b.5. For fertilizer, the detailed financial and economic costs by type of fertilizer by provincial destinations are shown in Tables 3B.6-3B.12.

Land Rent

In principle, the social value of land should be equal to its highest alternative productive use. Bananas, pineapples, orchards (guava and mango), sugar and upland rice were prevalent alternative crops in the corn producing areas covered by the survey. However, detailed economic analyses on these crop enterprises were missing to provide a comparison with corn production.

Another method was used for estimating the opportunity cost of land. Land rent was assumed to be roughly equal to the opportunity cost of land. To reflect land quality and variability by type of production systems, rental payments of leaseholds were regressed with yields derived from their lands with regional dummies represented by South Cotabato (for Mindanao) and Isabela and Nueva Viscaya (for Luzon). The regression result was represented by:

$$\textit{Land rent} = 496.6 + 325.1\ \textit{Yield (mt/ha)}$$

$$- 172.1\ \textit{(if Isabela)} + 426.1\ \textit{(if Nueva Viscaya)}$$

From this equation, land rent was derived by production technology and producing provinces. Land rent distribution is shown in Table 3B.13. Land rent ranged from ₱568/ha (yellow OP, low technology in Bukidnon) to ₱2363/ha (yellow hybrid, high technology corn, Nueva Viscaya). On the average, however, land rent was 17 percent of total farm costs.

Interest Rate

The interest rate is the payment for the use of capital. Generally, the rate would vary depending on the supply and demand of loanable funds (capital) in a given economy. As in the estimation of the shadow prices for land and other production factors, the shadow price of capital is the opportunity cost of money, i.e., the marginal productivity of additional investment in the best alternative uses (Squire and van der Tak, 1988).

The estimation of the opportunity cost of capital was made based on prevailing interest rates in the Philippine capital market. The social rates should be adjusted with the rate of inflation so

that the real value of the transactions of the lenders and users of money will not deteriorate overtime.

This adjustment to inflation was done using the formula suggested by the policy analysis matrix model (Monke and Pearson, 1989).

$$i^R = \frac{1 + i^0}{1 + f} - 1 \qquad (26)$$

where,

i^R	=	real rate of interest
i^0	=	observed interest rate
f	=	inflation rate

At low interest rates and inflation, the real rate of interest can be calculated by just the simple difference of the observed interest rate and the inflation rate, (i^0-f). For the period 1989/90, the observed interest rates in the Philippines varied from money market and deposit rates of 14 percent to a lending rate of 24 percent (IMF, 1991). The average lending rate of 21.69 percent was used for it reflected a long term view of the potential marginal rate for incremental investment in the Philippines.

Inflation on the other hand, was calculated as the yearly changes in consumer prices and for the Philippines. During the 1989/90 period, it was around 11.0 percent (IMF, 1990). Thus, using the Monke and Pearson formula, the real interest rate was calculated to be around 10 percent.

For the financial analysis, the interest rate used was 37.2 percent per year. This was the average rate paid by the corn farmers during the period. It was applied for three months during the corn production cycle.

The Equilibrium Exchange Rate

In measuring the domestic value of a tradable resource, two rates of exchange can be used. One is the official exchange rate (OER) and the other, the shadow exchange rate (SER). Some developing countries adopt an official exchange rate which may be misaligned and therefore may not reflect the true domestic value of the tradable good. For this reason, some economists employ the use of the shadow exchange rate.

In principle, the SER is the exchange rate that would clear the supply and demand for foreign exchange in the absence of any controls or trade restrictions. The methodology of approximating this rate of exchange has been postulated by the earlier works of Balassa (1973), Squire and van der Tak (1988), and Gittinger (1982).

Recently, however, there has been a growing agreement among economists that misalignment, or maintaining the real exchange rate at a level different from the long-run

equilibrium could significantly affect the growth of the agricultural sector and economic performance of developing countries (Valdez, 1990; Bautista and Valdez, 1989; and Edwards, 1988). Two concepts need to be defined at this point: real exchange rate (RER) and real equilibrium exchange rate (REER).

Economic literature defines real exchange rate as the ratio of the relative prices between tradable and nontradable or home goods.

$$e = \frac{EP*}{P_H}$$

where,

e	=	real exchange rate
E	=	nominal exchange rate in peso per US dollar
$P*$	=	index of foreign prices in US dollars at tradable goods, and
P_H	=	index of home goods prices.

$P*$ can be calculated as the average of the wholesale price indices of the major trading partners (U.S. and Japan) of the Philippines, adjusted for changes in their currencies bilateral exchange rate. P_H on the other hand, can be the average price indices of housing and labor. In effect RER measures the real terms of trade between traded and nontraded goods.

Equilibrium real exchange rate (REER) can be defined as the long-run rate of exchange which reflects a country's competitiveness in international trade. Valdes argues that there is no single REER but rather a path of equilibrium rates (Valdes, 1990). REER is affected by what Edwards calls the domestic and external real exchange rate "fundamentals" (Edwards, 1988). The domestic fundamentals of REER which are affected by domestic policies include trade policies, exchange and capital control and government expenditures. The external REER fundamentals are foreign (border) prices, global and real interest rates, and international transfers.

There are two basic approaches in estimating the real equilibrium exchange rate. One is the elasticity approach and the other, an estimation of exchange rate equation, known as the omega function.

Several studies (Bautista and Power, 1983; Bautista, 1987, 1990; Intal and Power, 1990; Medalla, 1990) in the Philippines have estimated the exchange rate misalignment using both the elasticity and the omega approaches. For this study, the estimates of the peso overvaluation made by Medalla (1990) was utilized.

Table 3B.1 Financial and economic cost of corn imports, Philippines, 1989/90

Cost Item	Financial Cost	Economic Cost	Domestic	Allocation Foreign
Procurement				
FOB	114.00			
Freight	28.00			
Cost and Freight	142.00			
Exchange rate (₱/$)	22.50			
Equivalent in peso	3195.00	3195.00		3195.00
Import tax (20%)	639.00			
Opening commission (1/332% of C&$)	1.00	1.00	1.00	
Documentary stamp (₱0.30/₱200 of C	4.79	4.79	4.79	
Marine insurance (0.425% of C&F)	13.58	13.58	13.58	
Cable/postage	0.16	0.16	0.16	
Spillage allowance (2%)	63.90	63.90	63.90	
Interest cost (21%, 3 mos.)	167.74	167.74	167.74	
Sub-Total	4223.93	3278.43	83.43	3195.00
Landing Charges				
Wharfage	31.85	31.85	31.85	
Stevedoring	31.79	31.79	31.79	
Arrastre	44.30	44.30	44.30	
Checking charges	6.76	6.76	6.76	
Weighing	2.00	2.00	2.00	
Total Cost Ex-Pier	4340.63	3395.13	200.13	3195.00
Handling and Distribution				
Trucking to warehouse (50 km)	71.50	61.33	28.43	32.88
Handling (truck to file)	11.60	11.60	11.60	
Margin	127.68	127.68	127.68	
Total Cost Ex-Warehouse (₱/mt)	4551.41	3595.74	367.84	3227.88
Allocation of Economic Cost		100.00	10.20	89.80
Implicit tariff (%)	26.60			
Import Parity Price ($/mt)	159.81			

Source: IFPRI survey

Table 3B.2 **Percent allocation of economic costs and implicit tariffs, selected inputs, corn production, Philippines, 1989/90**

Inputs	Implicit Tariff (IT)	Economic Cost Allocation Domestic	Foreign
	----------	%	----------
Land	-	100.00	-
Labor	-	100.00	-
Interest	-	63.00	37.00
Seed	12.90	63.00	37.00
Tractor service	10.41	50.50	49.50
Sheller service	13.19	56.00	44.00
Drying services	30.00	35.00	65.00
Transport and distribution services	16.59	46.00	54.00

Source: IFPRI survey.

Table 3B.3 Financial and economic cost of trucking operation, Philippines, 1989/90

Cost Item	Financial Cost	Economic Cost	Allocation Domestic	Allocation Foreign
Breakeven Freight Rate (₱/mt/km)	1.43			
Income from Hauling (1)	1373385			
Variable Expenses				
Fuel (2)	184654	153878	-	153878
Oil (3)	4224	3520	-	3520
Wages (4)	57600	57600	57600	-
Food (5)	14400	14400	14400	-
Sub-total	260878	229398	72000	157398
Fixed Expenses				
Repair and maintenance (6)	300000	230769	-	230769
Tires (7)	168000	129231	-	129231
Depreciation (8)	170000	114094	-	114094
Interest on capital (9)	127500	127500	127500	-
Overhead cost (10)	24000	24000	24000	-
Sub-Total	789500	625594	151500	474094
Cost of Operation	1050378	854992	223500	631492
Operator's Margin (35% of op. cost)*	323007	323007	323007	
Total Cost	1373385	1177999	546507	631492
Allocation of Economic Cost (%)		100.00	46.39	53.61
Implicit Tariff (%)	16.59			

* Excluding interest cost.
(1) 500 cavans/trip, 400 km/trip, 8 trips/mo, 12 months a year.
(2) At consumption rate of 1 li/2.3 km, at ₱5.53/li, 20% tariff rate (Tax Code, 1988).
(3) At 32 liters every 2 months, at ₱22/li, 20% tariff rate.
(4) Driver at ₱450/trip; helper at ₱150/trip.
(5) Food for driver and helper at ₱150/trip.
(6) ₱25,000/month, at 30% tariff rate.
(7) Tires at ₱7,000 each with 5 months life, tariff rate of 30%.
(8) With purchase price of ₱850,000 economic life of 5 years, 20% tariff.
(9) At interest rate of 20% payable in two years (payment is per annum).
(10) Estimated to be ₱2,000/mo per truck.

Source of basic data: IFPRI survey

Table 3B.4 Percent allocation of economic costs and implicit tariffs of chemicals and fertilizer by grade, by province, corn production, Philippines, 1989/90

Inputs	Bukidnon	Davao	Isabela	Lanao del Sur	Nueva Viscaya	South Cotabato
	Percent					
Chemicals						
Implicit tariff	19.5	19.5	19.3	19.4	19.5	19.5
Cost allocation						
Foreign	66	66	65	66	66	66
Domestic	34	34	35	34	34	34
Fertilizer						
Urea (46-0-0)						
Implicit tariff	-3	-9	-12	-1	-8	-4
Cost allocation						
Foreign	68	68	66	67	67	68
Domestic	32	32	34	33	33	32
Ammosul (21-0-0)						
Implicit tariff	-5	-36	-27	-9	-25	-12
Cost allocation						
Foreign	66	66	65	65	65	66
Domestic	34	34	35	35	35	34
Ammophos (16-20-0)						
Implicit tariff	-10	-18	-23	-10	-18	-17
Cost allocation						
Foreign	69	69	68	68	68	69
Domestic	31	31	32	32	32	31
Complete (14-14-14)						
Implicit tariff	-12	-20	-24	-12	-20	-19
Cost allocation						
Foreign	69	69	68	68	68	69
Domestic	31	31	32	32	32	31
Potash (0-0-60)						
Implicit tariff	-18	-14	-16	-21	-14	-15
Cost allocation						
Foreign	67	68	66	66	66	67
Domestic	33	32	34	34	34	33

Source: IFPRI survey

Table 3B.5 Financial and economic cost of chemicals by provincial destinations, Philippines, 1989/90

Cost Item	Financial Cost	Economic Cost	Allocation Domestic	Allocation Foreign
C&F ($/mt)	230.00			
OER	22.50			
Peso equivalent	5175.00	5175.00		5175.00
Tax rate (30%)	1552.50			
Interest (21%, 90 days)	271.69	271.69	271.69	
Insurance (1%)	51.75	51.75	51.75	
Financing				
L/C opening (1/4 of 1%)	12.94	12.94	12.94	
Bank commission	12.94	12.94	12.94	
Doc. stamps (₱0.30/₱200)	7.76	7.76	7.76	
Landing Charges				
Wharfage	23.50	23.50	23.50	
Brokerage	10.00	10.00	10.00	
Survey/checking	10.00	10.00	10.00	
Ex-Pier Cost	7128.08	5575.58	400.58	5175.00
Transshipment				
Transport (within 50 km)	71.50	61.33	28.43	32.88
Handling (in and out)	36.00	36.00	36.00	
Warehousing				
Storage (60 days)	40.00	40.00	40.00	
Interest (21%, 60 days)	249.48	249.48	249.48	
Contingencies (1% of C&F)*	51.75	51.75		51.75
Margin (15%)	1021.40	1021.40	1021.40	
Ex-Warehouse Cost (₱/mt)	8598.21	7035.53	1775.89	5259.63
Provincial Movement				
Isabela				
To Santiago (331 km)				
Trucking	473.33	405.98	188.21	217.64
Load/unload	20.00	20.00	20.00	
Santiago				
Storage				
Rental (2 mos.)	50.00	50.00	50.00	
Labor	38.87	38.87	38.87	
Insurance/surety bond (1%)	42.99	42.99	42.99	
Bank interest (21%, 2 mos.)	300.94	300.94	300.94	
Margin (35%, 2 mos.)**	538.03	538.03	538.03	
Domestic retail price (₱/mt)	10062.36	8432.34	2954.93	5477.27
IT and allocation (%)	19.33		35.04	64.96

Table 38.5 Chemicals (cont'd.)

Cost Item	Financial Cost	Economic Cost	Allocation Domestic	Allocation Foreign
Nueva Viscaya				
To Solano (261 kms)				
Trucking	373.23	320.12	148.41	171.62
Loand/unload	20.00	20.00	20.00	
Solano				
Storage				
Rental (2 mos.)	50.00	50.00	50.00	
Labor	38.87	38.87	38.87	
Insurance/Surety bond (1%)	42.99	42.99	42.99	
Bank interest (21%, 2 mos.)	300.94	300.94	300.94	
Margin (35%, 2 mos.)**	532.19	532.19	532.19	
Domestic Retail Price (₱/mt)	9956.43	8340.64	2909.28	5431.24
IT and Allocation (%)	19.37		34.88	65.12
Bukidnon				
To Malaybalay (93 kms)				
Load/unload	20.00	20.00	20.00	
Trucking	132.99	114.07	52.88	61.15
Storage				
Rental (2 mos.)	50.00	50.00	50.00	
Labor	38.87	38.87	38.87	
Insurance/surety bond (1%)	42.99	42.99	42.99	
Bank interest (21%, 2 mos.)	300.94	300.94	300.94	
Margin (35%, 2 mos.)**	518.18	518.18	518.18	
Domestic Retail Price (₱/mt)	9702.17	8120.57	2799.74	5320.78
IT and Allocation (%)	19.48		34.48	65.52
Lanao del Sur				
To Wao (207 kms)				
Load/unload	20.00	20.00	20.00	
Trucking	296.01	253.89	117.70	136.11
Storage				
Rental (2 mos.)	50.00	50.00	50.00	
Labor	38.87	38.87	38.87	
Insurance/surety bond (1%)	42.99	42.99	42.99	
Bank interest (21%, 2 mos.)	300.94	300.94	300.94	
Margin (35%, 2 mos.)**	527.69	527.69	527.69	

Table 38.5 Chemicals (cont'd.)

Cost Item	Financial Cost	Economic Cost	Allocation Domestic	Allocation Foreign
Domestic Retail Price (₱/mt)	9874.70	8269.91	2874.07	5395.74
IT and Allocation (%)	19.41		34.75	65.25
South Cotabato				
To Marbel (70 kms)				
Load/unload	20.00	20.00	20.00	
Trucking	100.10	85.86	39.80	46.03
Storage				
Rental (2 mos.)	50.00	50.00	50.00	
Labor	38.87	38.87	38.87	
Insurance/surety bond (1%)	42.99	42.99	42.99	
Bank interest (21%, 2 mos.)	300.94	300.94	300.94	
Margin (35%, 2 mos.)**	516.26	516.26	516.26	
Domestic Retail Price (₱/mt)	9667.36	8090.44	2784.75	5305.65
IT and Allocation (%)	19.49		34.42	65.58
Davao				
To Davao City area (within 50 kms)				
Load/unload	20.00	20.00	20.00	
Trucking	71.50	61.33	28.43	32.88
Storage				
Rental (2 mos.)	50.00	50.00	50.00	
Labor	38.87	38.87	38.87	
Insurance/surety bond (1%)	42.99	42.99	42.99	
Bank interest (21%, 2 mos.)	300.94	300.94	300.94	
Margin (35%, 2 mos.)**	514.59	514.59	514.59	
Domestic Retail Price (₱/mt)	9637.09	8064.25	2771.71	5292.50
IT and Allocation (%)	19.50		34.37	65.63

Table 3B.6 Financial and economic cost of urea, by provincial destinations, Philippines, 1989/90

Cost Item	Financial Cost	Economic Cost	Allocation	
			Domestic	Foreign
C&F ($/mt)	138.25			
OER	22.50			
Peso equivalent	3110.63	3110.63		3110.63
Interest (21%, 90 days)	163.31	163.31	163.31	
Insurance (1%)	31.11	31.11	31.11	
Financing				
L/C opening (1/4 of 1%)	7.78	7.78	7.78	
Bank commission	7.78	7.78	7.78	
Document stamps (₱0.30/₱200)	4.67	4.67	4.67	
Landing Charges				
Wharfage	23.50	23.50	23.50	
Brokerage	10.00	10.00	10.00	
Survey/checking	10.00	10.00	10.00	
Ex-Pier Cost	3368.76	3368.76	258.13	3110.63
Transshipment				
Transport (within 50 kms)	71.50	61.33	28.43	32.88
Handling (in and out)	36.00	36.00	36.00	
Warehousing				
Storage (60 days)	40.00	40.00	40.00	
Inerest (21%, 60 days)	117.91	117.91	117.91	
Contingencies (1% of C&F)*	31.11	31.11		31.11
Margin (15%)	488.97	488.97	488.97	
Ex-Warehouse Cost (₱/mt)	4154.24	4144.07	969.44	3174.61
Provincial Movement:				
Isabela				
To Santiago (331 kms)				
Trucking	473.33	405.98	188.21	217.64
Load/unload	20.00	20.00	20.00	
Santiago				
Storage				
Rental (2 mos.)	50.00	50.00	50.00	
Labor	38.87	38.87	38.87	
Insurance/surety bond (1%)	20.77	20.77	20.77	
Bank interest (21%, 2 mos.)	145.40	145.40	145.40	
Margin (35%, 2 mos.)**	277.50	277.50	277.50	
Domestic Retail Price (₱/mt)	4498.79	5102.59	1710.19	3392.25
IT and Allocation (%)	-11.83		33.52	66.48

Table 38.6 Urea (cont'd.)

Cost Item	Financial Cost	Economic Cost	Allocation Domestic	Allocation Foreign
Nueva Viscaya				
To Solano (261 km)				
Trucking	373.23	320.12	148.41	171.62
Loand/unload	20.00	20.00	20.00	
Solano				
Storage				
Rental (2 mos.)	50.00	50.00	50.00	
Labor	38.87	38.87	38.87	
Insurance/surety bond (1%)	20.77	20.77	20.77	
Bank interest (21%, 2 mos.)	145.40	145.40	145.40	
Margin (35%, 2 mos.)**	271.66	271.66	271.66	
Domestic Retail Price (₱/mt)	4606.55	5010.89	1664.55	3346.23
IT and Allocation (%)	-8.07		33.22	66.78
Bukidnon				
To Malaybalay (93 kms)				
Load/unload	20.00	20.00	20.00	
Trucking	132.99	114.07	52.88	61.15
Storage				
Rental (2 mos.)	50.00	50.00	50.00	
Labor	38.87	38.87	38.87	
Insurance/surety bond (1%)	20.77	20.77	20.77	
Bank interest (21%, 2 mos.)	145.40	145.40	145.40	
Margin (35%, 2 mos.)**	257.65	257.65	257.65	
Domestic Retail Price (₱/mt)	4671.20	4790.82	1555.01	3235.76
IT and Allocation (%)	-2.50		32.46	67.54
Lanao del Sur				
To Wao (207 kms)				
Load/unload	20.00	20.00	20.00	
Trucking	296.01	253.89	117.70	136.11
Storage				
Rental (2 mos.)	50.00	50.00	50.00	
Labor	38.87	38.87	38.87	
Insurance/surety bond (1%)	20.77	20.77	20.77	
Bank interest (21%, 2 mos.)	145.40	145.40	145.40	
Margin (35%, 2 mos.)**	267.16	267.16	267.16	

Table 38.6 Urea (cont'd.)

Cost Item	Financial Cost	Economic Cost	Allocation Domestic	Allocation Foreign
Domestic Retail Price (₱/mt)	4871.67	4940.16	1629.34	3310.72
IT and Allocation (%)	-1.39		32.98	67.02
South Cotabato				
To Marbel (70 kms)				
Load/unload	20.00	20.00	20.00	
Trucking	100.10	85.86	39.80	46.83
Storage				
Rental (2 mos.)	50.00	50.00	50.00	
Labor	38.87	38.87	38.87	
Insurance/surety bond (1%)	20.77	20.77	20.77	
Bank interest (21%, 2 mos.)	145.40	145.40	145.40	
Margin (35%, 2 mos.)**	255.73	255.73	255.73	
Domestic Retail Price (₱/mt)	4585.19	4760.69	1540.01	3220.64
IT and Allocation (%)	-3.69		32.35	67.65
Davao				
To Davao City area (within 50 kms)				
Load/unload	20.00	20.00	20.00	
Trucking	71.50	61.33	28.43	32.88
Storage				
Rental (2 mos.)	50.00	50.00	50.00	
Labor	38.87	38.87	38.87	
Insurance/surety bond (1%)	20.77	20.77	20.77	
Bank interest (21%, 2 mos.)	145.40	145.40	145.40	
Margin (35%, 2 mos.)**	254.06	254.06	254.06	
Domestic Retail Price (₱/mt)	4312.00	4734.50	1526.97	3207.49
IT and Allocation (%)	-8.92		32.25	67.75

Table 3B.7 Financial and economic cost of ammonium sulfate, by provincial destinations, Philippines, 1989/90

Cost Item	Financial Cost	Economic Cost	Allocation	
			Domestic	Foreign
C&F ($/mt)	103.05			
OER	22.50			
Peso equivalent	2318.63	2318.63		2318.63
Interest (21%, 90 days)	121.73	121.73	121.73	
Insurance (1%)	23.19	23.19	23.19	
Financing				
L/C opening (1/4 of 1%)	5.80	5.80	5.80	
Bank commission	5.80	5.80	5.80	
Documentary stamps (₱0.30/₱200)	3.48	3.48	3.48	
Landing Charges				
Wharfage	23.50	23.50	23.50	
Brokerage	10.00	10.00	10.00	
Survey/checking	10.00	10.00	10.00	
Ex-Pier Cost	2522.11	2522.11	203.49	2318.63
Transhipment				
Transport (within 50 kms)	71.50	61.33	28.43	32.88
Handling (ini and out)	36.00	36.00	36.00	
Warehousing				
Storage (60 days)	40.00	40.00	40.00	
Interest (21%, 60 days)	88.27	88.27	88.27	
Margin (15%)	371.57	371.57	371.57	
Contingencies (1% of C&F)*	23.19	23.19		23.19
Ex-Warehouse Cost (₱/mt)	3152.64	3142.46	767.76	2374.69
Provincial Movement:				
Isabela				
To Santiago (331 kms)				
Trucking	473.33	405.98	188.21	217.64
Load/unload	20.00	20.00	20.00	
Santiago				
Storage				
Rental (2 mos.)	50.00	50.00	50.00	
Labor	38.87	38.87	38.87	
Insurance/surety bond (1%)	15.76	15.76	15.76	
Bank interest (21%, 2 mos.)	110.34	110.34	110.34	
Margin (35%, 2 mos.)**	218.78	218.78	218.78	
Domestic Retail Price (₱/mt)	2916.67	4002.20	1409.72	2592.33
IT and Allocation (%)	-27.12		35.22	64.78

Table 38.7 Ammonium sulfate (cont'd.)

Cost Item	Financial Cost	Economic Cost	Allocation Domestic	Allocation Foreign
Nueva Viscaya				
To Solano (261 kms)				
Trucking	373.23	320.12	148.41	171.62
Loand/unload	20.00	20.00	20.00	
Solano				
Storage				
Rental (2 mos.)	50.00	50.00	50.00	
Labor	38.87	38.87	38.87	
Insurance/surety bond (1%)	15.76	15.76	15.76	
Bank interest (21%, 2 mos.)	110.34	110.34	110.34	
Margin (35%, 2 mos.)**	212.95	212.95	212.95	
Domestic Retail Price (₱/mt)	2916.67	3910.50	1364.08	2546.31
IT and Allocation (%)	-25.41		34.88	65.12
Bukidnon				
To Malaybalay (93 kms)				
Load/unload	20.00	20.00	20.00	
Trucking	132.99	114.07	52.88	61.15
Storage				
Rental (2 mos.)	50.00	50.00	50.00	
Labor	38.87	38.87	38.87	
Insurance/surety bond (1%)	15.76	15.76	15.76	
Bank interest (21%, 2 mos.)	110.34	110.34	110.34	
Margin (35%, 2 mos.)**	198.93	198.93	198.93	
Domestic Retail Price (₱/mt)	3500.00	3690.43	1254.54	2435.34
IT and Allocation (%)	-5.16		33.99	66.01
Lanao del Sur				
To Wao (207 kms)				
Loand/unload	20.00	20.00	20.00	
Trucking	296.01	253.89	117.70	136.11
Storage				
Rental (2 mos.)	50.00	50.00	50.00	
Labor	38.87	38.87	38.87	
Insurance/surety bond (1%)	15.76	15.76	15.76	
Bank interest (21%, 2 mos.)	110.34	110.34	110.34	
Margin (35%, 2 mos.)**	208.44	208.44	208.44	

Table 38.7 Ammonium sulfate (cont'd.)

Cost Item	Financial Cost	Economic Cost	Allocation Domestic	Allocation Foreign
Domestic Retail Price (₱/mt)	3500.00	3839.77	1328.87	2510.80
IT and Allocation (%)	-8.85		34.61	65.39
South Cotabato				
To Marbel (70 kms)				
Loand/unload	20.00	20.00	20.00	
Trucking	100.10	85.86	39.80	46.83
Storage				
Rental (2 mos.)	50.00	50.00	50.00	
Labor	38.87	38.87	38.87	
Insurance/surety bond (1%)	15.76	15.76	15.76	
Bank interest (21%, 2 mos.)	110.34	110.34	110.34	
Margin (35%, 2 mos.)**	197.01	197.01	197.01	
Domestic Retail Price (₱/mt)	3212.96	3660.30	1239.54	2420.72
IT and Allocation (%)	-12.22		33.86	66.14
Davao				
To Davao City area (within 50 kms)				
Loand/unload	20.00	20.00	20.00	
Trucking	71.50	61.33	28.43	32.88
Storage				
Rental (2 mos.)	50.00	50.00	50.00	
Labor	38.87	38.87	38.87	
Insurance/surety bond (1%)	15.76	15.76	15.76	
Bank interest (21%, 2 mos.)	110.34	110.34	110.34	
Margin (35%, 2 mos.)**	195.34	195.34	195.34	
Domestic Retail Price (₱/mt)	2320.00	3634.11	1226.50	2407.57
IT and Allocation (%)	-36.16		33.75	66.25

Table 3B.8 Financial and economic cost of ammonium phosphate, by provincial destinations, Philippines, 1989/90

Cost Item	Financial Cost	Economic Cost	Allocation	
			Domestic	Foreign
C&F ($/mt)	173.96			
OER	22.50			
Peso equivalent	3914.10	3914.10		3914.10
Interest (21%, 90 days)	205.49	205.49	205.49	
Insurance (1%)	39.14	39.14	39.14	
Financing				
L/C opening (1/4 of 1%)	9.79	9.79	9.79	
Bank commission	9.79	9.79	9.79	
Documentary stamps (₱0.30/₱200)	5.87	5.87	5.87	
Landing charges				
Wharfage	23.50	23.50	23.50	
Brokerage	10.00	10.00	10.00	
Survey/checking	10.00	10.00	10.00	
Ex-Pier Cost	4227.67	4227.67	313.57	3914.10
Transshipment				
Transport (within 50 kms)	71.50	61.33	28.43	32.88
Handling (in and out)	36.00	36.00	36.00	
Warehousing				
Storage (60 days)	40.00	40.00	40.00	
Interest (21%, 60 days)	147.97	147.97	147.97	
Margin (15%)	608.08	608.08	608.08	
Contingencies (1% of C&F)*	39.14	39.14		39.14
Ex-Warehouse Cost (₱/mt)	5170.36	5160.19	1174.05	3986.12
Provincial Movement:				
Isabela				
To Santiago (331 kms)				
Trucking	473.33	405.98	188.21	217.64
Load/unload	20.00	20.00	20.00	
Santiago				
Storage				
Rental (2 mos.)	50.00	50.00	50.00	
Labor	38.87	38.87	38.87	
Insurance/surety bond (1%)	25.85	25.85	25.85	
Bank interest (21%, 2 mos.)	180.96	180.96	180.96	
Margin (35%, 2 mos.)**	337.07	337.07	337.07	
Domestic Retail Price (₱/mt)	4804.60	6218.92	2015.02	4203.76
IT and Allocation (%)	-22.74		32.40	67.60

Table 38.8 Ammonium phosphate (cont'd.)

Cost Item	Financial Cost	Economic Cost	Allocation Domestic	Allocation Foreign
Nueva Viscaya				
To Solano (261 kms)				
Trucking	373.23	320.12	148.41	171.62
Load/unload	20.00	20.00	20.00	
Solano				
Storage				
Rental (2 mos.)	50.00	50.00	50.00	
Labor	38.87	38.87	38.87	
Insurance/surety bond (1%)	25.85	25.85	25.85	
Bank interest (21%, 2 mos.)	180.96	180.96	180.96	
Margin (35%, 2 mos.)**	331.23	331.23	331.23	
Domestic Retail Price (₱/mt)	5007.41	6127.22	1969.38	4157.74
IT and Allocation (%)	-18.28		32.14	67.86
Bukidnon				
To Malaybalay (93 kms)				
Load/unload	20.00	20.00	20.00	
Trucking	132.99	114.07	52.88	61.15
Storage				
Rental (2 mos.)	50.00	50.00	50.00	
Labor	38.87	38.87	38.87	
Insurance/surety bond (1%)	25.85	25.85	25.85	
Bank interest (21%, 2 mos.)	180.96	180.96	180.96	
Margin (35%, 2 mos.)**	317.22	317.22	317.22	
Domestic Retail Price (₱/mt)	5323.05	5907.16	1859.83	4047.27
IT and Allocation (%)	-9.89		31.48	68.52
Lanao del Sur				
To Wao (207 kms)				
Load/unloas	20.00	20.00	20.00	
Trucking	296.01	253.89	117.70	136.11
Storage				
Rental (2 mos.)	50.00	50.00	50.00	
Labor	38.87	38.87	38.87	
Insurance/surety bond (1%)	25.85	25.85	25.85	
Bank interest (21%, 2 mos.)	180.96	180.96	180.96	
Margin (35%, 2 mos.)**	326.73	326.73	326.73	

Table 38.8 Ammonium phosphate (cont'd.)

Cost Item	Financial Cost	Economic Cost	Allocation Domestic	Allocation Foreign
Domestic Retail Price (₱/mt)	543[illegible].78	6056.49	1934.17	4122.23
IT and Allocation (%)	-10.22		31.94	68.06
South Cotabato				
To Marbel (70 kms)				
Load/unload	20.00	20.00	20.00	
Trucking	100.10	85.86	39.80	46.03
Storage				
Rental (2 mos.)	50.00	50.00	50.00	
Labor	38.87	38.87	38.87	
Insurance/surety bond (1%)	25.85	25.85	25.85	
Bank interest (21%, 2 mos.)	180.96	180.96	180.96	
Margin (35%, 2 mos.)**	315.30	315.30	315.30	
Domestic Retail Price (₱/mt)	4859.61	5877.03	1844.84	4032.15
IT and Allocation (%)	-17.31		31.39	68.61
Davao				
To Davao City area (within 50 kms)				
Load/unload	20.00	20.00	20.00	
Trucking	71.50	61.33	28.43	32.88
Storage				
Rental (2 mos.)	50.00	50.00	50.00	
Labor	38.87	38.87	38.87	
Insurance/surety bond (1%)	25.85	25.85	25.85	
Bank interest (21%, 2 mos.)	180.96	180.96	180.96	
Margin (35%, 2 mos.)**	313.63	313.63	313.63	
Domestic Retail Price (₱/mt)	4775.00	5850.83	1831.80	4018.99
IT and Allocation (%)	-18.39		31.31	68.69

Table 3B.9 Financial and economic cost of mixed fertilizers, by provincial destinations, Philippines, 1989/90

Cost Item	Financial Cost	Economic Cost	Allocation	
			Domestic	Foreign
C&F ($/mt)	177.24			
OER	22.50			
Peso equivalent	3987.90	3987.90		3987.90
Interest (21%, 90 days)	209.36	209.36	209.36	
Insurance (1%)	39.88	39.88	39.88	
Financing				
L/C opening (1/4 of 1%)	9.97	9.97	9.97	
Bank commission	9.97	9.97	9.97	
Documentary stamps (₱0.30/₱200)	5.98	5.98	5.98	
Landing charges				
Wharfage	23.50	23.50	23.50	
Brokerage	10.00	10.00	10.00	
Survey/checking	10.00	10.00	10.00	
Ex-Pier Cost	4306.57	4306.57	318.67	3987.90
Transshipment				
Transport (within 50 kms)	71.50	61.33	28.43	32.88
Handling (in and out)	36.00	36.00	36.00	
Warehousing				
Storage (60 days)	40.00	40.00	40.00	
Interest (21%, 60 days)	150.73	150.73	150.73	
Contingencies (1% of C&F)*	39.88	39.88		39.88
Margin (15%)	619.02	619.02	619.02	
Ex-Warehouse Cost (₱/mt)	5263.69	5263.52	1192.84	4060.66
Provincial Movement:				
Isabela				
To Santiago (331 kms)				
Trucking	473.33	405.98	188.21	217.64
Loand/unload	20.00	20.00	20.00	
Santiago				
Storage				
Rental (2 mos.)	50.00	50.00	50.00	
Labor	38.87	38.87	38.87	
Ins/surety bond (1%)	26.32	26.32	26.32	
Bank interest (21%, 2 mos.)	184.23	184.23	184.23	
Margin (35%, 2 mos.)**	342.55	342.55	342.55	
Domestic Retail Price (₱/mt)	4806.62	6321.46	2043.02	4278.30
IT and Allocation (%)	-23.96		32.32	67.68

Table 38.9 Mixed fertilizers (cont'd.)

Cost Item	Financial Cost	Economic Cost	Allocation Domestic	Allocation Foreign
Nueva Viscaya				
To Solano (261 kms)				
Trucking	373.23	320.12	148.41	171.62
Load/unload	20.00	20.00	20.00	
Solano				
Storage				
Rental (2 mos.)	50.00	50.00	50.00	
Labor	38.87	38.87	38.87	
Ins/surety bond (1%)	26.32	26.32	26.32	
Bank interest (21%, 2 mos.)	184.23	184.23	184.23	
Margin (35%, 2 mos.)**	336.71	336.71	336.71	
Domestic Retail Price (₱/mt)	5007.41	6229.76	1997.37	4232.27
IT and Allocation (%)	-19.62		32.06	67.94
Bukidnon				
To Malaybalay (93 kms)				
Load/unload	20.00	20.00	20.00	
Trucking	132.99	114.07	52.88	61.15
Storage				
Rental (2 mos.)	50.00	50.00	50.00	
Labor	38.87	38.87	38.87	
Ins/surety bond (1%)	26.32	26.32	26.32	
Bank interest (21%, 2 mos.)	184.23	184.23	184.23	
Margin (35%, 2 mos.)**	322.69	322.69	322.69	
Domestic Retail Price (₱/mt)	5280.66	6009.69	1887.83	4121.81
IT and Allocation (%)	-12.13		31.41	68.59
Lanao del Sur				
To Wao (207 kms)				
Load/unload	20.0	020.00	20.00	
Trucking	296.01	253.89	117.70	136.11
Storage				
Rental (2 mos.)	50.00	50.00	50.00	
Labor	38.87	38.87	38.87	
Ins/surety bond (1%)	26.32	26.32	26.32	
Bank interest (21%, 2 mos.)	184.23	184.23	184.23	
Margin (35%, 2 mos.)**	322.20	322.20	322.20	

Table 38.9 Mixed fertilizers (cont'd.)

Cost Item	Financial Cost	Economic Cost	Allocation Domestic	Allocation Foreign
Domestic Retail Price (₱/mt)	5437.78	6159.02	1962.16	4196.77
IT and Allocation (%)	-11.71		31.86	68.14
South Cotabato				
To Marbel (70 kms)				
Load/unload	20.00	20.00	20.00	
Trucking	100.10	85.86	39.80	46.03
Storage				
Rental (2 mos.)	50.00	50.00	50.00	
Labor	38.87	38.87	38.87	
Ins/surety bond (1%)	26.32	26.32	26.32	
Bank interest (21%, 2 mos.)	184.23	184.23	184.23	
Margin (35%, 2 mos.)**	320.77	320.77	320.77	
Domestic Retail Price (₱/mt)	4859.61	5979.56	1872.84	4106.68
IT and Allocation (%)	-18.73		31.32	68.68
Davao				
To Davao City area (within 50 kms)				
Load/unload	20.00	20.00	20.00	
Trucking	71.50	61.33	28.43	32.88
Storage				
Rental (2 mos.)	50.00	50.00	50.00	
Labor	38.87	38.87	38.87	
Ins/surety bond (1%)	26.32	26.32	26.32	
Bank interest (21%, 2 mos.)	184.23	184.23	184.23	
Margin (35%, 2 mos.)**	319.11	319.11	319.11	
Domestic Retail Price (₱/mt)	4775.00	5953.36	1859.79	4093.53
IT and Allocation (%)	-19.79		31.24	68.76

Table 3B.10 Financial and economic cost of potash, by provincial destinations, Philippines, 1989/90

Cost Item	Financial Cost	Economic Cost	Allocation	
			Domestic	Foreign
C&F ($/mt)	123.22			
OER	22.50			
Peso equivalent	2772.45	2772.45		2772.45
Interest (21%, 90 days)	145.55	145.55	145.55	
Insurance (1%)	27.72	27.72	27.72	
Financing				
L/C opening (1/4 of 1%)	6.93	6.93	6.93	
Bank commission	6.93	6.93	6.93	
Documentary stamps (₱0.30/₱200)	4.16	4.16	4.16	
Landing charges				
Wharfage	23.50	23.50	23.50	
Brokerage	10.00	10.00	10.00	
Survey/checking	10.00	10.00	10.00	
Ex-Pier Cost	3007.25	3007.25	234.80	2772.45
Transshipment				
Transport (within 50 kms)	71.50	61.33	28.43	32.88
Handling (in and out)	36.00	36.00	36.00	
Warehousing				
Storage (60 days)	40.00	40.00	40.00	
Interest (21%, 60 days)	105.25	105.25	105.25	
Contingencies (1% of C&F)*	27.72	27.72		27.72
Margin (15%)	438.84	438.84	438.84	
Ex-Warehouse Cost (₱/mt)	3726.57	3716.39	883.32	2833.05
Provincial Movement:				
Isabela				
To Santiago (331 kms)				
Trucking	473.33	405.98	188.21	217.64
Load/unload	20.00	20.00	20.00	
Santiago				
Storage				
Rental (2 mos.)	50.00	50.00	50.00	
Labor	38.87	38.87	38.87	
Insurance/surety bond (1%)	18.63	18.63	18.63	
Bank interest (21%, 2 mos.)	130.43	130.43	130.43	
Margin (35%, 2 mos.)**	252.43	252.43	252.43	
Domestic Retail Price (₱/mt)	3900.00	4632.73	1581.90	3050.70
IT and Allocation (%)	-15.82		34.15	65.85

Table 38.10 Potash (cont'd.)

Cost Item	Financial Cost	Economic Cost	Allocation Domestic	Allocation Foreign
Nueva Viscaya				
To Solano (261 kms)				
Trucking	373.23	320.12	148.41	171.62
Load/unload	20.0	20.00	20.00	
Solano				
Storage				
Rental (2 mos.)	50.00	50.00	50.00	
Labor	38.87	38.87	38.87	
Insurance/surety bond (1%)	18.63	18.63	18.63	
Bank interest (21%, 2 mos.)	130.43	130.43	130.43	
Margin (35%, 2 mos.)**	246.59	246.59	246.59	
Domestic Retail Price (₱/mt)	3900.00	4541.04	1536.25	3004.67
IT and Allocation (%)	-14.12		33.83	66.17
Bukidnon				
To Malaybalay (93kms)				
Load/unload	20.00	20.00	20.00	
Trucking	132.99	114.07	52.88	61.15
Storage				
Rental (2 mos.)	50.00	50.00	50.00	
Labor	38.87	38.87	38.87	
Insurance/surety bond (1%)	18.63	18.63	18.63	
Bank interest (21%, 2 mos.)	130.43	130.43	130.43	
Margin (35%, 2 mos.)**	232.58	232.58	232.58	
Domestic Retail Price (₱/mt)	3525.00	4320.97	1426.71	2894.20
IT and Allocation (%)	-18.42		33.02	66.98
Lanao del Sur				
To Wao (207 kms)				
Load/unload	20.00	20.00	20.00	
Trucking	296.01	253.89	117.70	136.11
Storage				
Rental (2 mos.)	50.00	50.00	50.00	
Labor	38.87	38.87	38.87	
Insurance/surety bond (1%)	18.63	18.63	18.63	
Bank interest (21%, 2 mos.)	130.43	130.43	130.43	
Margin (35%, 2 mos.)**	242.09	242.09	242.09	

Table 38.10 Potash (cont'd.)

Cost Item	Financial Cost	Economic Cost	Allocation Domestic	Allocation Foreign
Domestic Retail Price (₱/mt)	3525.00	4470.30	1501.05	2969.16
IT and Allocation (%)	-21.15		33.58	66.42
South Cotabato				
To Marbel (70 kms)				
Load/unload	20.00	20.00	20.00	
Trucking	100.10	85.86	39.80	46.03
Storage				
Rental (2 mos.)	50.00	50.00	50.00	
Labor	38.87	38.87	38.87	
Insurance/surety bond (1%)	18.63	18.63	18.63	
Bank interest (21%, 2 mos.)	130.43	130.43	130.43	
Margin (35%, 2 mos.)**	230.66	230.66	230.66	
Domestic Retail Price (₱/mt)	3652.00	4290.84	1411.72	2879.08
IT and Allocation (%)	-14.89		32.90	67.10
Davao				
To Davao City area (within 50 kms)				
Load/unload	20.00	20.00	20.00	
Trucking	71.50	61.33	28.43	32.88
Storage				
Rental (2 mos.)	50.00	50.00	50.00	
Labor	38.87	38.87	38.87	
Insurance/surety bond (1%)	18.63	18.63	18.63	
Bank interest (21%, 2 mos.)	130.43	130.43	130.43	
Margin (35%, 2 mos.)**	228.99	228.99	228.99	
Domestic Retail Price (₱/mt)	3652.00	4264.64	1398.68	2865.93
IT and Allocation (%)	-14.37		32.80	67.20

Table 3B.11 Land rent, by corn production technology, by province, 1989/90

Production Technology	Bukidnon	Davao	Isabela	Lanao del Sur	Nueva Viscaya	South Cotabato
	₱/ha					
Yellow, hybrid						
High technology	1934	-	1878	2255	2363	2097
Medium technology	1515	1344	1376	1517	2022	1577
Low technology	996	949	996	-	1711	1231
Yellow, open-pollinated						
Medium technology	-	-	1330	-	-	1568
Low technology	568	-	871	-	-	1401
White, open-pollinated						
Medium technology	1414	-	1599	-	-	1742
Low technology	701	695	808	-	-	1042
F2, yellow hybrid	747	692	853	-	-	1277

Source: IFPRI survey.

4. THE ECONOMICS OF HOG AND POULTRY PRODUCTION

Leonardo A. Gonzales and Nicostrato D. Perez[1]

4.1 Introduction

The Philippine livestock industry contributes an average of 20 percent to the gross value added (GVA) in agriculture. This contribution comes mainly from four animal species, poultry, hogs, cattle, and carabaos, although carabaos are at present primarily raised as work animals rather than as a source of meat. Recently, goats and ducks are gaining increasing economic importance. Total gross value added for meat production in the Philippines has been growing at an average of 5 percent per year from 1980-89. The growth was highest in poultry at 6.2 percent, while the others averaged 3.9 percent during the period (Table 4.1). Domestic meat supply comes primarily from hogs and poultry, which together contribute around 80 percent of total meat supply, with hogs having the higher share of a slightly over 50 percent and poultry under 30 percent (Table 4.2).[2]

The high contributions of hog and poultry to the total growth in meat supply accentuate the importance of these non-ruminants in the feedgrain-livestock linkage. As the major users of mixed feeds, hog, and poultry production determines the derived demand for feedgrain, particularly corn, the major feed ingredient in the formulation of mixed feeds. As the economy recovers, a modest rise in real income and a consistently high population annual growth of 2.4 would sustain a rapid growth in demand for meat. There were already indications that during the recovery period (1985-90) the growth of total livestock consumption accelerated to 7 percent per year, contributed mostly by hogs and poultry (Table 4.3). However, factors that can constrain the further expansion of the subsector are not only the limited domestic supply of feeds but government policies that directly and indirectly affect the efficiency of livestock production. This chapter analyzes the factors that affect the financial profitability of hogs and poultry at the farm and wholesale levels. It further assesses the impact of government policies on economic incentives and comparative advantage.

4.2 The Sample Farmers

The data for this analysis came from secondary and primary data generated during the feedgrain-livestock survey of 1990.[3] The original sample frame planned a higher proportion of backyard producers, based on the data provided by the Bureau of Agricultural Statistics (BAS), where livestock inventory was 84 percent and 71 percent backyard, for hogs and

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[1] With the help from Jose Yorobe, Jr. during the earlier phase of the study.

[2] Please refer to Chapter 2 for a more detailed discussion of supply/demand trends on livestock.

[3] Please refer to Chapter 3 for the general description and coverage of the field survey.

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chickens, respectively (Table 4.4). Unfortunately, very few backyard livestock farms were found in the regions covered, so a higher proportion of commercial farms were included in the sample.

A total of 57 livestock farms (20 for hogs, 25 layers, and 12 for broilers) provided the input/output coefficients for the livestock economic analysis. The majority (72 percent) of the respondents were commercial farms and only 28 percent were of the backyard types. For broilers, all respondents were commercial farms. A distribution of the livestock sample farms are shown in Table 4.5. They were classified by commercial, semi-commercial and backyard, depending on the levels of livestock inventory, investment and management practices. There were large variabilities in the pattern of management practices and levels of investment in the livestock production systems across provinces. No standard classification system can fully differentiate the production systems in the industry.

To capture economies of scale, the analysis further classified commercial production into small, medium, and large scale. For hogs, the classification was based on the number of sows and population inventory. The basis of classification for layer was the number of heads of active laying population (backyard with less than 150 laying hens through large commercial with 10,000 layers and above). Finally, all the broiler sample farms were considered commercial in operation, with small farms having 10,000 heads and below; medium having greater than 10,000 but less than 25,000 heads; and large broiler farms having more than 25,000 heads (Table 4.5).

The distribution of sample farms by average population inventory are shown in Table 4.6. Backyard and semi-commercial hog farms, which operate from two to six sow heads, and had a population inventory range of 24-35 heads/farm. For the small and medium commercial hog farms, sow heads ranged from 16-92 heads/farm and their population inventory ranged from 74-828 heads/farm. The large commercial hog farms averaged 1,029 sows and a population inventory of 13,608 per farm. For layers, the average laying hens per farm ranged from 129-324 for backyard and semi-commercial, and 722-49,373 layers for the commercial farms. Finally, the average number of commercial broilers per farm ranged from 5,200-13[illegible],500 (Table 4.6).

Across production systems, the hog farms had the highest level of average investment per farm ranging from ₱9,875 (backyard) to ₱7,945,069 (Table 4.7). These included not only the basic investments in buildings and equipments but breeding animals especially for the highly commercial farms. For the layer farms, the average investment per farm ranged from ₱7,000 to ₱1.9 million, while the broiler farms had the lowest levels ranging from ₱25,000 to ₱328,000 per farm. On a per animal head basis, the hog farms had the highest, averaging ₱845 across type of operation; layers had ₱62/head, and broiler farms, ₱3.5/head. Among the commercial farms, the peso investment per head was lower for the larger farms than for the smaller farms, indicating some economies of scale on the level of investment per farm (Table 4.7).

Most of the farms visited by the survey team were old established farms which on the average, showed relatively lower depreciation values. This tended to understate the depreciation costs and hence the actual marginal costs of new investment in hogs and poultry. To reflect true marginal costs of livestock investment depreciation costs were adjusted on the average by a range of 50-100 percent of actual depreciation cost, depending on the type of operation.

A contrasting pattern of feed management practices was observed among livestock producers. For hogs, the semi-commercial to the large commercial farms generally mixed their own feeds. In contrast, the majority of layer farms up to medium commercial level bought ready mixed commercial feeds. This same pattern was true for broilers. It was only at large commercial levels that layer and broiler farms were observed mixing their own feeds (Table 4.8).

Livestock producers generally borrowed some of their working capital requirements from formal sources. The interest rates were mostly at commercial rates ranging from 18-25 percent per annum. Only the backyard and small livestock operators were observed to have borrowed from non-bank sources, mostly from close relatives where terms were very flexible and interest rates generally low. The average loans borrowed by large commercial livestock producers were highest among hog farms (₱5.98 million); followed by layer farms (₱1.4 million); and broilers (₱0.3 million) (Table 4.9).

4.3 Feed Use Efficiency

Feeds are a major cost component in livestock production. For this reason, it is worthwhile to examine the efficiency of feed use among the sample farms. There were two types of feed efficiency indicators used in the analysis. One is the feed conversion ratio (FCR) and the other the proportion of feed cost per unit of production (FCP). The FCR is the ratio of total feed usage to the total volume of production while the FCP is the ratio of total costs of feeds to total production.

Feed management practices across livestock farms (hogs, layers, broilers) varied by level of commercialization, and therefore comparing the FCR and FCP across different types of livestock farms would be inaccurate. For one, hog farms in general, mixed their own feeds and therefore the FCRs are not necessarily comparable with the FCRs of the broiler farms which usually depend on mixed commercial feeds. In terms of the total costs of feeds, it is also expected that the broiler farms would incur higher feed costs compared to the hog farms, because mixed commercial feeds were generally priced higher. A better method then is therefore to compare FCRs and FCPs within farms by type of production scale against standards in the industry. This was done individually for the different livestock farms.

4.3.1 Hog Farms

The feed efficiency of hog production by province and by type of operation is shown in Table 4.10. Feed conversion ratios differed by type of commercialization across producing provinces. The FCRs for large commercial hog farms were generally lower ranging from 3.09 (Bukidnon) to 3.97 (Cebu), as compared to backyard hog production. The FCRs for backyard farms and semi-commercial farms ranged from 3.57 (Davao) to 4.19 (Cagayan de Oro), while the small and medium commercial hog farms had an average FCR of 3.79 (Table 4.10). The average FCRs across provinces by type of operation, shown in Table 4.11, indicate the relative advantage of large hog commercial production (FCR=3.59) over the backyard production system (FCR=4.11).

Prices of feeds also varied across provinces because of the fluctuations in the pricing of commercial mixed feeds and feed ingredients. Surprisingly, the average price per kilo of feeds was lowest in small commercial farms (Table 4.11). These prices were in turn reflected in the FCPs (shown in the table as feed cost per kg meat) and the proportion of total feed cost to total value of hog production. The results showed that the per unit cost of feed as a percentage of per unit price of hogs on farm, was lowest in semi-commercial and large commercial farm at less than 63 percent and highest in backyard farms at 81 percent (Table 4.11).

4.3.2 Layer Farms

The layer farms were analyzed within an 18-month production period. This included the cycle of purchasing day-old chicks (for some, they start with growers and pullets) to the culling stage after the fourteenth to the eighteenth month. Aside from the feed conversion ratio as an indicator of feed efficiency, laying rate (in percent) could also be used as a short term gauge of layer performance. However, data do not show a direct correlation between laying rate and FCR. Low laying rates occurred in all types or farms. In Cagayan de Oro and Bukidnon, for example, medium commercial farms had lower laying rates than their backyard (Cagayan de Oro) and semi-commercial (Davao) counterparts (Table 4.12). In fact over the range of samples examined, the semi-commercial farms had the highest average laying rate of 80 percent. This was much higher than the mean laying rate of 72 percent in the tropics (Say, 1987). In contrast, large and small commercial egg farms had laying rates from 72-74 percent, while the backyard and medium commercial farms were in the range of 68-69 percent (Table 4.13).

In terms of feed conversion ratios, all types of farms had similar conversion ratios, which were generally slightly less efficient than the ideal of 1.64 (PCARRD, 1989). However, by location, the semi-commercial and backyard egg farms of General Santos City (South Cotabato) had the most efficient (lowest) FCR of 1.68 and 1.72, respectively. It was also from this province where feed cost as a percentage of total production value had the lowest average of 59.2 percent (Table 4.12). The main advantage of large commercial egg farms was a lower feed cost per unit, because they mixed their own feeds, which were generally translated into lower percentage of feed costs to production value (Table 4.13).

4.3.3 Broiler Farms

Most broiler producers started with day old chicks and sold their birds after 40-55 days. Among the sample farmers, the live weights of the marketed fouls ranged from 0.88 kg to 1.50 kg/bird, depending on market placements/orders of wholesalers and integrators. For farms catering to the higher priced spring barbecue chicken market, for example the Cagayan de Oro farms, the birds were grown to less than a kilo.

The patterns of feed use efficiency among the sample broiler farms are summarized in Table 4.14. Over a production cycle of around 52 weeks, the medium commercial Cagayan de Oro broiler farm had the lowest FCR of 1.68, which was highly efficient compared to the Philippine industry standard of 1.75-2.5. Since most commercial broiler producers bought commercial mixed feeds, the cost per unit was similar across farm-types, and variations were only observed across provinces. Feed cost as a proportion to total value was relatively low in broiler production compared to the layer and hog farms. The data also pointed out that on the average, the larger broiler farms had slightly more efficient FCRs of 2.03 as compared to medium and small commercial farms with FCRs of 2.10 and 2.11, respectively (Table 4.14).

4.4 Net Profitability of Livestock Production

The profitability of livestock farms were analyzed at two levels, farm and wholesale. The commodity trade flows for hogs, eggs, and broilers are shown in Figures 4.1-4.2. From the producing regions, hogs were generally transported live to Manila as the major wholesale market (Figure 4.1). The Mindanao region supplies at least 40 percent of the Manila live hogs market.

On the other hand, broiler and egg products seldom leave the Visayan and Mindanao regions for the Manila wholesale market. Cebu is emerging as the Central market for eggs and broiler products in the Visayas and Mindanao regions. However, interregional trade in livestock products between Cebu and the Mindanao/Visayan provinces is not yet fully established. One constraint was the very high fluctuation in the demand/supply balances of these products. In addition, infrastructural support services (ports, inter-island shipping vessels, etc.) are still relatively underdeveloped, making the costs of interregional freight and handling extremely high.

4.4.1 Profitability of Hog Production

Feed and labor were the major cost components in hog production. Across provinces and production systems, feed costs were highest in medium and large commercial hog farms, averaging around 87 percent of total farm production costs. Labor costs, on the other hand, were highest in backyard and semi-commercial farms, averaging 22 percent of total farm production cost (Table 4A.1).

Compared to corn, the percentage share of hog trading and distribution costs to total costs was small, averaging 9 percent of total costs. The estimated trading and distribution costs

for live hogs from Mindanao to Manila were ₱1,254/mt for Davao; ₱1,067/mt for Cebu; ₱1,541/mt for Bukidnon; ₱1,219/mt for General Santos City; and ₱1,049/mt for Cagayan de Oro City and ₱403/mt for Laguna (Table 4.15).

Given a price range on farm of ₱25-30/kg for live hogs, and a wholesale price of ₱43.50/kilo of carcass weight, the net financial profitability of hogs by type of operation are shown in Table 4.16. The results indicate that backyard hog farms (with the exception of that in Cagayan de Oro) had negative net profits on farm ranging from ₱-2,955 to ₱-23,320/farm and ₱-5,468 to ₱-31,525/farm at wholesale. The loss at wholesale averaged ₱13/kg of carcass weight. This implied that backyard hog operations in the Mindanao/Cebu area were not financially viable in supplying the Manila hogs market (Table 4.15).

To a certain extent, this was also the case for semi-commercial and small commercial hog farms of Davao. At the farm levels, the semi-commercial and small commercial hog operation had positive net profit ranging from ₱0.9/kg to ₱3.1/kg of live hogs, but at the wholesale levels, the range of net loss was ₱2.3 to ₱5.5/kilo. Only the small commercial farm of Bukidnon had a positive net farm income of ₱55,722 (Table 4.16).

The medium and large commercial hog farms, on the other hand, demonstrated high net financial profits. On a per farm or per kilogram basis, the large commercial hog farms of Bukidnon demonstrated the highest absolute profit at wholesale of ₱8.8 million pesos or a net profit of ₱10.0 per kilogram. The results clearly pointed out that the medium and large commercial hog farms were more financially viable than the smaller type of hog production (Table 4.16).

4.4.2 Profitability of Egg Production

The patterns of cost distribution in egg production were similar to those of the hog enterprises, with feeds and labor costs, comprising the major cost components. On the average, backyard and semi-commercial layer farms spent 67 percent and 18 percent of total farm costs for feed and labor costs, respectively. For small and medium commercial egg farms, feed costs as a percentage of farm production costs averaged 73 percent, while in large commercial farms it was highest at 78 percent (Table 4A.2).

As shown in Figure 4.2, eggs and broilers are usually sold at the major wholesale market of the producing region. Egg production appeared financially viable for all types of operation. Among backyard and semi-commercial farms, net financial profits on farm ranged from ₱4,112 to ₱26,634/farm, and ₱6,000 to ₱36,700/farm at wholesale. For the commercial layer farms, net profits were relatively higher, ranging form ₱54,884 to ₱4.8 million and ₱68,774 to 5.9 million per farm, on farm and at wholesale, respectively. The analysis further indicated that the larger commercial farms had higher net profit per unit of operation, implying economies of scale (Table 4.17).

4.4.3 Profitability of Broiler Production

Among the livestock enterprises analyzed, commercial broiler production had the highest proportion of feed costs to total farm production costs. For the small commercial farms, feed costs accounted for an average of 86 percent of total costs; for medium and commercial farms, 85 percent; and for large commercial broiler farms, 78 percent (Table 4A.3). The lower proportion of feed costs to total costs among large commercial farms can be attributed the large commercial broiler farms mixing their own feeds. In contrast, small and medium size commercial broiler farms used ready-mixed feeds, which are more expensive.

Broiler production was profitable both on farm and at wholesale. On farm, net financial profitability ranged from ₱1.4 to ₱9.2 per kilogram of live bird. At the wholesale, net profit per kilogram was less, ranging from ₱0.1 to ₱8.0/kilo of dressed chicken (Table 4.18). The reason for this lower profitability at wholesale was due to low price spreads between farm and wholesale prices.

4.5 Economic Incentives and Comparative Advantage of Hogs and Poultry Production

Using the same methodology discussed in Chapter 3, this section assesses the impact of government policies on relative incentives and economic performance in hog and poultry production. Two trade regimes were analyzed for this purpose: import substitution with interregional trade, and export trade promotion.

4.5.1 Nominal Protection Rates

Sectoral and macroeconomic policies in the Philippines have affected the incentive structure of domestic livestock production. Trade policies directly affecting livestock production include the tariffs imposed on live animals, meat, eggs, and meat preparations. In 1991, the existing tariff rates for live animals ranged from 30 to 40 percent. Breeding animals had tariff rates of 3 to 10 percent. On the other hand, chicken meat, eggs, and meat preparations had higher tariff rates of 50 percent in 1991 declining to 30 percent by 1995, while the tariff for pork, beef, and lamb was 30 percent (Table 4.19). In addition to these tariff rates, a tax of 7 percent on the value of imports was imposed in 1990. These taxes tend to increase the direct nominal protection rates of hogs and poultry products, eroding their long-run competitiveness in the world market.

As in the corn subsector, there are direct and indirect impacts of macro policy to the livestock subsector. Following the formulation of KSV and Bautista, the estimated direct, indirect, and total nominal protection rates are shown in Tables 4.20-4.23. The results show that overvaluation of the peso leads to negative total protection for hog production. At the producers level, direct nominal protection rates, ranged from a negative -0.5 percent (Bukidnon) to a positive 16 percent (Davao). The small average positive levels of direct nominal protection, however, is not enough to outweigh the negative indirect effects of peso overvaluation. Total nominal protection ranges from -11 percent to -25 percent (Table 4.20). Given that a 30 percent

tariff is imposed on pork, it was expected that the direct nominal protection rates for hogs should be highly positive. A possible explanation for the apparent low level of direct nominal protection is a quality effect. Philippines is endemic with foot and mouth disease, reducing the quality and value of Philippine pork in the international market. Full discounting of the price of Philippine pork to reflect quality differentials would result in a higher estimated level of protection.

Direct nominal protection rates for egg production were high, despite adjustment for overvaluation. NPRs for egg production averaged 46 percent across producing areas. The major reason for this was the very high domestic producers price partly induced by high tariffs (50 percent) on eggs and corn, which have encouraged inefficient production. On farm, the IFPRI survey found that the average domestic farm price of egg in 1989/90 was ₱18 per dozen or ₱1.50 per egg. In contrast, the average world price of egg of the same quality was $0.48 per dozen or at the official exchange rate of ₱22.5:$1, ₱0.90 an egg. Accounting for the negative indirect effects, the total nominal protection rates averaged 25 percent across producing areas (Table 4.21).

For broiler production, the direct nominal protection rates were also high, averaging 54 percent across producing areas. Also, given the negative indirect effect (NPR_I) of exchange rate misalignment of -21 percent, the total nominal protection rates due to overvaluation averaged 33 percent (Table 4.22). At the wholesale levels, the patterns of nominal protection rates were of similar magnitude to the producers level. Broilers and eggs were both highly protected.

4.5.2 Effective Protection Rates

For hogs, effective protection rates ranged from -20 percent to 17 percent across production technologies and provinces (Table 4.24). The heavy distortions in production incentives caused by government policy for broilers and layers are shown even more clearly by the effective protection rates. For egg production, effective protection rates ranged from 66 to 117 percent (Table 4.25), and the effective protection rates of broiler production ranged from 81 to 123 percent (Table 4.26). Bukidnon and Cagayan de Oro appeared to have the highest EPRs in comparison with other producing areas. The major reason was the relatively higher domestic prices of broilers in Bukidnon and Cagayan de Oro compared to other producing areas.

4.5.3 Comparative Advantage of Livestock Production

This section assesses the relative comparative advantage of livestock production under two trade assumptions: import substitution with interregional trade (IRT) and export promotion (EP). In the IRT trade regime, hogs are supplied from the producing regions to Manila as the major wholesale market. Eggs and broilers are traded within the Mindanao and Visayan regions, with Cebu as the major trading center. For the EP trade regime, the trade flow for all livestock products for export was via Manila.

The border prices used in the livestock trade analysis are shown in Table 4.27. These prices are expressed in f.o.b. values and then converted into c.i.f. at wholesale by adjusting for cost, insurance, freight from origin, and domestic distribution costs from port to the wholesale markets. A difficulty in quoting border prices of livestock products lies in the thinness and segmentation of the market itself. Pork and beef, for example, have different cuts and different levels of quality that are not fully reflected in aggregate export unit values.

4.5.4 World Production and Trade for Livestock Products

The world market for meat is thin and highly segmented. In 1989, only 6 percent, 4 percent and 2 percent of total world production were traded for poultry meat, pig meat, and fresh chicken egg, respectively (Tables 4.28-4.30). The segmentation of the world meat market is due in part to the following: sanitary and phytosanitary restrictions imposed by trading countries, commercial trade barriers, basic quality differences among meat products, diversity in production systems, animal genetics, and differences in meat processing, grading and marketing standards (World Bank, 1990).

Sanitary restrictions separate the world beef and pork markets into basically two areas: those where the foot and mouth disease (FMD) is endemic and the FMD-free areas. Uncooked meat and in many cases, cooked meat, from areas where FMD is endemic cannot be shipped to FMD-free zones. The FMD-free zone countries include Australia, New Zealand, Japan, and other East Asian countries, the United States, Canada, Denmark, Ireland, the United Kingdom, Mexico, Central America, and parts of Southern Africa. The FMD-endemic areas include parts of South America (Argentina, Brazil, Colombia, Uruguay, Venezuela), Middle Eastern countries, the USSR, parts of Eastern Europe and the Philippines (World Bank, 1990).

Poultry and pork products are also non-homogeneous and are distinguished from country of origin. In the pork market, China is the major producer, accounting for 33 percent of total global production. The United States, the USSR and Eastern European countries are also major producers of pork. The Netherlands, which had only 2.4 of world output, was the major exporter of pig meat in 1989, accounting for almost a third of all pig meat exports. Japan, Italy, France and Federal Republic of Germany on the other hand, are the major pig meat importers, together accounting for 62 percent of total pig meat imports (Table 4.28). The Philippines accounted for less than a one percent share in the global production and trade of pig meat.

China, the then-USSR, the U.S., and Japan are major producers of chicken eggs. However, the Netherlands was the major exporter of chicken eggs in 1989, with 53 percent of world exports of chicken eggs. The major importers were Federal Republic of Germany, Italy, Hongkong and Singapore. The Philippines does not import or export chicken eggs and accounted for only 0.8 percent of global production in 1989 (Table 4.29).

The United States dominates the production and export of broilers, with 27 and 23 percent of global production and exports, respectively (Table 4.30). The other exporters of broilers are France, Netherlands, Brazil, and Thailand. On the other hand, Japan, Saudi Arabia,

Federal Republic of Germany, Hongkong, and the USSR are the major importers of poultry meat sharing an aggregate 47 percent of all imports (Table 4.30). As in the pig meat and egg global markets, the Philippines has very small share in the global production and trade of poultry meat.

4.5.5 Livestock Production as Import Substitute

The Philippines is self-sufficient in poultry and egg products and is a small importer of pig meat. The analysis showed that in general, the domestic production of hogs, eggs and broilers are efficient as import substitutes, even if they are shipped from producing regions (for example, hogs are shipped from Mindanao to Manila) to the deficit regions.

In hog production, only the backyard production systems of Davao and Bukidnon were marginally inefficient as import substitutes, with RCRs ranging from 1.01-1.02. The other hog production systems were highly competitive as import substitutes, with RCRs ranging form 0.43 to 0.81. The medium to large commercial farms had the lowest RCRs, averaging 0.50 for medium commercial and 0.46 for large commercial farms (Table 4.31).

For domestic egg production, results showed that all farms were efficient as import substitutes, with RCRs ranging from 0.43 to 0.98. Under the IRT trade regime the large commercial farms tended to be more efficient (with lower RCR) than the smaller and backyard layer farms (Table 4.32).

In broiler production, the analysis showed that the small commercial broiler farms of Bukidnon and medium commercial farms of Cagayan de Oro were not efficient as import substitutes. In general, however, the other broiler farms across producing areas were highly competitive as import substitutes, with RCRs ranging from 0.65 to 0.91 (Table 4.33).

The relative competitiveness of hogs, layer and broiler production was further assessed using sensitivity analysis. Given the current levels of technology and cost structure of livestock production in the Philippines, domestic hog production (especially the commercial farms) can still sustain its competitiveness as an import substitute so long as the border price of pork chops would fall within the range of $1,265-₱1,871 (f.o.b.) per metric (Table 4.34).

For layer production, the border price could fall within the range of $610 to $863 per mt (f.o.b.) for it to sustain competitiveness as import substitute (Table 4.35). In the case of broiler, the breakeven border prices of broiler should at least be within the range of $984-$1,405/mt (f.o.b.) for medium and large commercial farms to sustain their efficiency as import substitute (Table 4.36).

4.5.6 Potentials for Livestock Export

As discussed earlier, the world market for meat is thin and highly segmented. Precisely, how the Philippines would fit in such a market would depend on domestic

supply/demand conditions, macro policy and developments in the world market itself. The analysis shows that the Philippines has a comparative advantage as exporter of pork prime cuts. The DRCs and RCRs for medium and commercial farms were low, ranging from 13.98 to 18.49 for DRCs and 0.49 to 0.65 for RCRs (Table 4.37), and comparative advantage could be maintained at considerably lower world prices (Table 4.38). The primary constraint in the international trade of pig meat for the Philippines, however, are the quality problems and resulting sanitary restrictions due to the FMD. Although not all areas of the Philippines are endemic to FMD, importing countries (Japan, Hongkong, and especially western countries) usually do not allow the movement of uncooked meat from FMD infested areas to FWD-free zones.

Except for the medium and large commercial farms in Cebu and Mindanao, the Philippines has a marginal comparative advantage to export eggs (Table 4.39). Two basic problems are faced by the Philippines in egg trade. One is the very thin international market (only 2 percent of world production) for chicken eggs. The other is the relatively long distance of the Philippines from major egg importers (Europe). The combined costs of freight, insurance and special handling will alter the relative competitiveness of Philippines as an egg exporter. A possibility, however, is a bilateral trade agreement on chicken egg with neighboring importing countries like Hongkong and Singapore. These types of agreements could be negotiated directly within the private sector, especially among the more economically efficient large commercial layer farms.

For the medium and large commercial layer farms to sustain export competitiveness, the border price of chicken egg should not be lower than $781 to $894/mt (f.o.b.) (Table 4.40). Smaller layer farms had higher breakeven border prices ranging from $858 to $1,035/mt.

The Philippines has also marginal comparative advantage in the domestic production of broilers for export under some production regimes. For the more efficient commercial broiler farms, the DRC ranged from 23 to 26 and the RCRs from 0.92 to 0.82. However, except for the commercial farms of General Santos and Cebu, the estimated RCRs were greater than one, ranging from 1.01 to 1.33, implying export comparative disadvantage (Table 4.41). For the broiler production to have comparative advantage as exports, given their current levels of production cost structure, the border prices of broiler should not fall lower than $1,294 to $1,626 (Table 4.42).

4.6 Summary and Policy Implications

The economic analysis of the non-ruminant livestock subsector brought out several policy issues, including the strong linkage between corn and livestock production, development of information system for feedgrain-livestock subsectors, trade and foreign exchange rate policies, and comparative advantage in livestock trade.

4.6.1 Corn-Livestock Linkage

The analysis of the structure of non-ruminant livestock production showed that feed costs contributed 65 to 87 percent of total farm production costs. In hog production, the proportion of feed costs to farm production costs was highest in the medium and large commercial farms, averaging above 80 percent. In layer farms, the proportion of feed costs to the costs of farm production ranged from 67 percent (backyard and semi-commercial) to 78 percent (large commercial). On the average, the broiler farms had the highest proportion of feed costs to total farm production costs, averaging above 83 percent. This structure of production shows the strong linkage between the feedgrain-livestock subsectors, indicating that costs of production of livestock non-ruminants could be substantially reduced if efficiency in the domestic production of corn was improved.

4.6.2 Data Information System for Feedgrain Livestock Sector

Considering the growing importance of the feedgrain livestock subsectors as a major source of growth, the data information system for the subsectors should be improved. Among possible areas of data improvements is better information on the actual demand for corn as feed, food and commercial uses. Data, for example, on commercial feed production are grossly understated and do not reflect how much corn is used by farms that mix their own feeds. The degree of commercialization of non-ruminants (and also ruminants) livestock production is also hard to assess. The BAS and BAI should be encouraged to study more intensively the configuration of backyard and commercial livestock production so that policy directives can help improve their efficiencies. Finally information on the efficiency and performance of livestock slaughter houses is incomplete. Data on the processing and distribution costs of livestock products, which are important to policy formulation, are not readily available.

4.6.3 Trade and Foreign Exchange Policies

Trade and exchange policies distort the economic incentives in livestock production. Direct trade policies tend to protect the industry particularly layers and broilers, while the overvaluation of the peso causes a negative indirect effect on economic incentives in livestock production. Removal of both types of distortions would improve the competitiveness of the feedgrain and livestock subsectors.

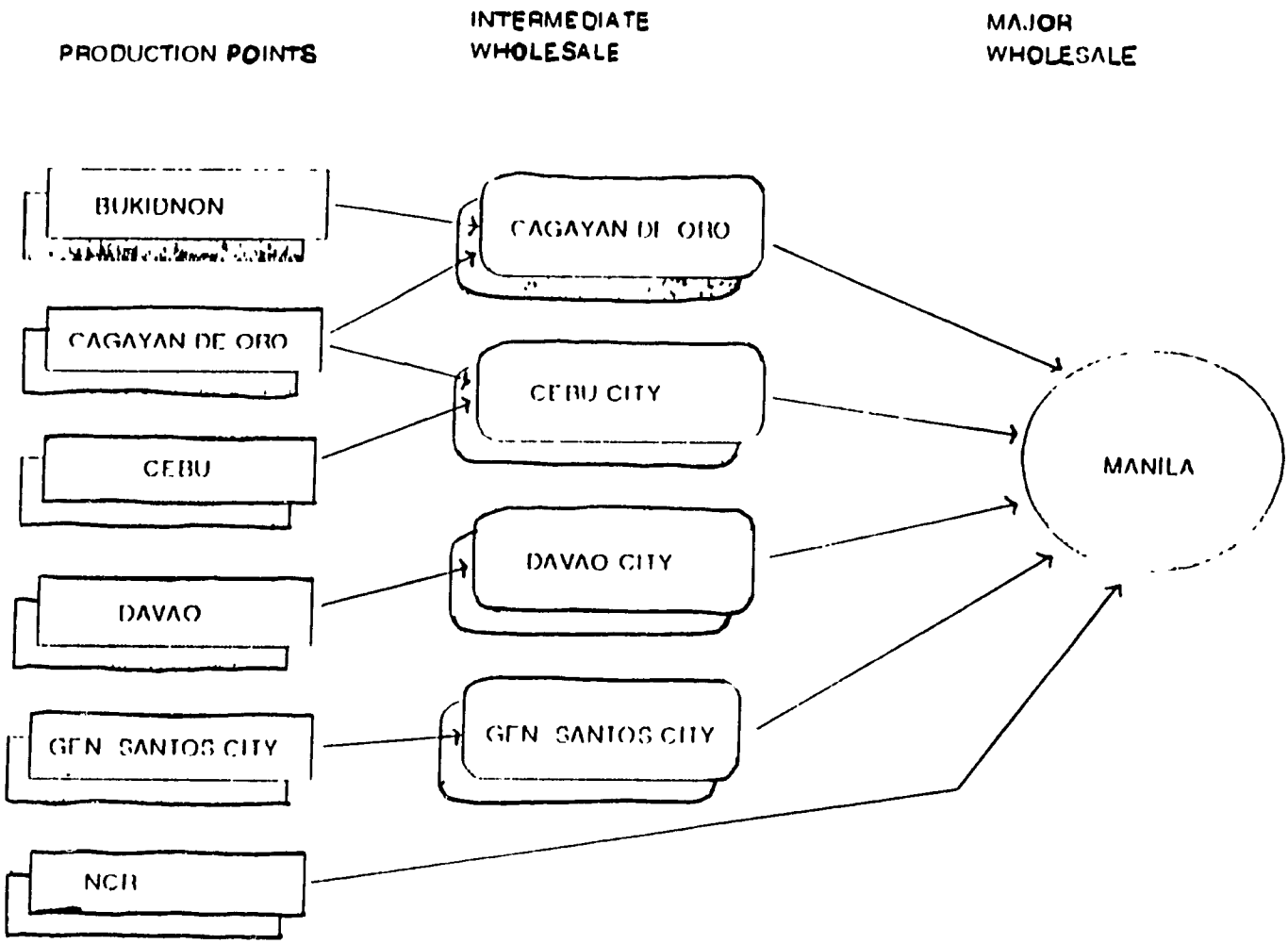
4.6.4 Comparative Advantage in Livestock Production

There is a comparative advantage in the domestic production of hogs, egg, and broiler as import substitutes. The potential for exporting eggs and broilers is marginal. Although the analysis shows a strong comparative advantage in the export of hogs, the incidence of FMD in the Philippines is a major constraint to exports. The eradication of FMD would not only be beneficial for potential hog exports but in maintaining a healthy population of the ruminant animals (beef and carabao) as well. It would be desirable therefore to strengthen further the current program of the Department of Agriculture in the complete eradication of the FMD.

Corn producing regions identified by the Bureau of Animal Industry as FMD-free zones could be used as an initial basis for negotiations in obtaining international certification of export worthiness in pork. Also, bilateral government agreements between the Philippines and Asian importers of pork (Japan, Hongkong, Singapore) should be pursued more vigorously.

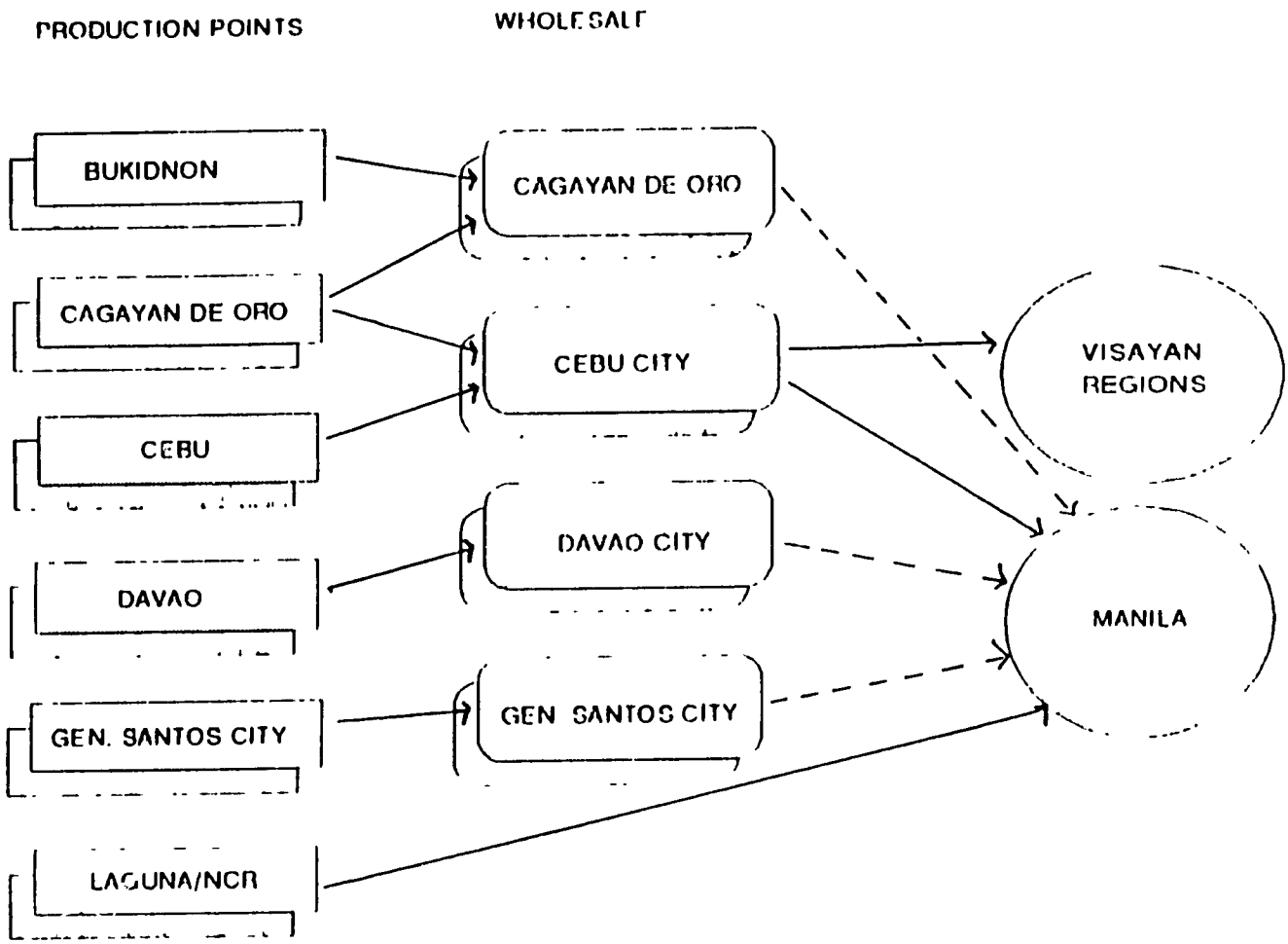
Aside from the marginal competitiveness of egg and broilers as exports, the thinness in these markets limits the potential demand for such products. It is not, however, remote that large private livestock integrators (who are not included in this study), could still tap these thin but segmented markets in specialized areas of production where they have developed efficiency.

Figure 4.1 Domestic trade flows for hog production, Philippines, 1990



Source: IFPRI Survey

Figure 4.2 Domestic trade flows for broiler and egg production, Philippines, 1990



Source IFPRI Survey

Table 4.1 **Gross value added in agriculture, fishery, and forestry, by industry group, 1972-88 (in million pesos at constant prices of 1972)**

Year	Type of Production							
		Agricultural Crops						
	Total	Palay	Corn	Other Crops	Livestock	Poultry	Fishery	Forestry
1972	16,135	2,749	1,012	5,195	1,756	724	2,689	2,010
1975	18,327	3,357	1,229	6,717	1,701	865	3,194	1,264
1980	23,662	4,169	1,447	9,310	1,841	1,633	3,876	1,386
1981	24,608	4,307	1,494	9,617	1,925	1,958	4,132	1,175
1982	25,378	4,489	1,522	9,921	2,017	2,192	4,254	983
1983	24,845	3,900	1,373	9,695	2,170	2,481	4,407	819
1984	25,409	4,201	1,470	9,893	2,162	2,589	4,329	765
1985	26,253	4,665	1,698	10,071	2,114	2,576	4,422	706
1986	27,110	4,899	1,798	10,378	2,283	2,547	4,551	654
1987	26,834	4,513	1,872	9,989	2,432	2,742	4,638	648
1988	27,771	4,788	1,924	9,834	2,647	3,055	4,834	689
Growth rates: (%)								
1972-88	3.35	3.19	3.66	3.93	2.53	9.41	3.47	-7.05
1980-88	1.81	1.75	3.94	0.77	3.96	6.42	2.28	-9.24
1985-88	1.58	-0.04	4.15	-1.10	7.38	5.85	2.86	-0.82

Source: Philippine Statistical Yearbook, 1989

Table 4.2 Meat, dairy, and egg production, Philippines, 1987-89

	1987	1988	1989
	--------	'000 mt	----------
Livestock			
Cattle	161	154	165
Carabao	99	112	121
Goat	50	53	57
Hog	768	858	962
Dairy	2.6	2.6	2.6
Poultry			
Chicken	404	455	499
Ducks	31	32	34
Chicken eggs	125	140	155
Duck eggs	26	27	29

* Up to third quarter only.

Source of data: BAS and Policy Analysis Staff

Table 4.3 Per capita national income, per capita meat consumption and population, Philippines, 1972-90

	Per Capita Income (in 1972 pesos)	Per Capita Meat Consumption (kg)				Population ('000)
		Hogs	Chickens	Beef	Total	
1972	1,190					38,928
1975	1,308					42,258
1976	1,382					43,406
1977	1,426					44,584
1978	1,455	7.91	3.89	-	11.8	45,794
1979	1,496	6.49	2.91	-	9.4	47,037
1980	1,533	9.10	3.02	1.46	13.6	48,317
1981	1,555	10.99	3.29	1.47	15.7	49,526
1982	1,537	10.20	3.31	1.41	14.9	50,783
1983	1,502	10.71	3.28	1.15	15.2	52,055
1984	1,370	10.88	3.11	1.16	15.2	53,351
1985	1,279	9.11	2.71	1.32	13.1	54,668
1986	1,284	10.34	2.79	1.44	14.6	56,004
1987	1,316	11.00	2.95	1.51	15.5	57,356
1988	1,419	12.03	2.96	1.31	16.3	58,721
1989	-	13.31	3.11	1.47	17.9	59,987
1990	-	14.4	3.33	1.51	19.2	61,480
Growth rate (%)						
1980-89	-2.22	1.16	-1.57	-0.29	0.85	2.44
1980-85	-3.74	0.07	-2.06	-4.05	-0.76	2.47
1985-90	3.36	8.01	3.20	0.25	7.15	2.38

Sources: NEDA, Philippine Statistical Yearbook and Policy Analysis Division, Department of Agriculture

Table 4.4 Livestock and poultry beginning inventory, 1970-90

Year	Carabao	Cattle	Goat	Hogs	Chicken	Ducks
	In Thousand Head					
1970	4,432	1,679	772	6,456	56,999	2,132
1971	4,556	1,795	924	7,050	56,512	2,352
1972	4,711	1,933	1,083	7,742	50,103	2,600
1973	4,937	2,099	1,248	8,627	49,965	2,906
1974	4,384	1,918	950	6,605	47,818	4,039
1975	3,278	1,827	995	6,647	46,745	4,071
1976	2,725	1,737	785	6,489	45,671	4,104
1977	2,897	1,723	1,104	5,696	45,289	4,228
1978	2,959	1,820	1,290	6,910	58,893	5,365
1979	2,803	1,833	1,374	7,445	49,321	5,338
1980	2,870	1,883	1,671	7,934	52,761	4,725
1981	2,850	1,940	1,696	7,758	57,724	4,783
1982	2,908	1,942	1,783	7,795	59,710	4,905
1983	2,946	1,938	1,859	7,980	62,255	5,419
1984	3,022	1,849	2,362	7,613	59,205	5,764
1985	2,983	1,786	2,191	7,304	52,098	5,276
1986	2,984	1,814	2,177	7,275	53,005	5,208
1987	2,868	1,747	2,016	7,114	52,930	5,139
1988	2,890	1,700	2,120	7,581	60,321	5,873
1989	2,826	1,666	2,201	7,775	65,921	6,426
1990	2,765	1,629	2,193	7,990	69,539	7,236
Farm Type:*						
Commercial (%)	1	15	-	16	29	-
Backyard (%)	99	85	-	84	71	-
Growth rate: (%)						
1970-90	-2.48	-0.38	5.55	0.58	1.12	4.73
1980-90	-0.28	-1.78	2.73	-0.29	1.37	3.31
1980-85	1.09	-1.17	6.83	-1.28	0.16	3.46
1985-90	-1.53	-2.12	0.25	2.03	6.37	6.70

* Average from 1988-90.

Source: BAS

Table 4.5 Percent distribution of livestock sample producers by scale of production, Philippines, 1990

Scale of Production	Hogs[a]	Layers[b]	Broilers[c]	Total
Backyard	7	5	-	12
Semi-Commercial	7	9	-	16
Commercial:				
Small	5	14	7	26
Medium	7	9	7	23
Large	9	7	7	23
Total	**35**	**44**	**21**	**100**

[a] Classification was based on sow heads and patterns of feed management. Backyard has less than 5 sows; semi-commercial has 5 to <10; small commercial, 10 to <20; medium commercial, 20 to <200; and large commercial has 200 sows and above.

[b] Based on the number of active laying population. Backyard layer production has 150 and below laying hens; semi-commercial ≥ 150 but < 500; small commercial, > 500 but < 1,000; medium commercial, > 1,000 but < 10,000; and large commercial, 10,000 layers and above.

[c] No backyard and semi-commercial samples. Classification based on number of broiler heads. Small commercial, 10,000 and below; medium commercial > 10,000 but < 25,000; and large commercial, 25,000 and above.

Source: IFPRI survey

Table 4.6 Distribution of livestock sample producers, by average population inventory, by scale of production, Philippines, 1990

Scale of Production	Hogs		Layers	Broilers
	Sows	Population		
	----------		heads/farm	----------
Backyard	2.0	35	129	-
Semi-Commercial	6.0	24	324	-
Commercial:				
Small	16.0	74	722	5,200
Medium	92.0	828	3,121	13,000
Large	1,029.0	13,608	49,373	131,350

Source: IFPRI survey.

Table 4.7 Distribution of livestock sample producers by average level of investment,* by scale of production, Philippines, 1990

Scale of Production	Hogs		Layers		Broilers	
	₱/farm	₱/head	₱/farm	₱/head	₱/farm	₱/head
Backyard	9,875	282	7,000	54	-	-
Semi-Commercial	12,000	500	21,400	66	-	-
Commercial						
Small	143,667	1,900	51,000	70	24,750	5
Medium	793,250	958	247,140	79	36,750	3
Large	7,945,069	584	1,922,500	39	327,750	2.5

* Basically, buildings, equipments, transport and processing facilities.

Source: IFPRI survey

Table 4.8 Percent distribution of livestock sample producers by feed management practices, by scale of operation, Philippines, 1990

Scale of Operation	Hogs		Layers		Broilers	
	Mix own feeds	Use ready comemrcial	Mix own feeds	Use ready commercial	Mix own feeds	Use ready commercial
Backyard	75	25	0	100	-	-
Semi-Commercial	100	0	0	100	-	-
Commercial:						
Small	100	0	25	75	0	100
Medium	100	0	40	60	25	75
Large	100	0	100	0	75	25

Source: IFPRI survey

Table 4.9 Distribution of livestock sample producers by average amount of loans borrowed, by scale of operation, Philippines, 1990

Scale of Operation	Hogs		Layers		Broilers	
	Average loan (₱)	Interest per annum (%)	Average loan (₱)	Interest per annum (%)	Average loan (₱)	Interest per annum (%)
Backyard	5,000[a]	25	none	-	-	-
Semi-Commercial	none	-	-	-	-	-
Commercial:						
Small	66,600	20	none	-	11,000[a]	20
Medium	350,000	25	83,000	20	20,000	18
Large	5,980,000	25	1,400,000[b]	-	300,000	20[b]

[a] From relatives and friends, all others are from banks.

[b] Authors' estimates, respondents did not specify the magnitudes of their loans.

Source: IFPRI survey

Table 4.10 Feed efficiency hog production, by province and scale of operation, Philippines, 1990

Items	DAVAO			CEBU			BUKIDNON				GEN. SANTOS CITY			CAGAYAN DE ORO CITY	LAGUNA
	Backyard	Semi-Com'l	Com'l Small	Backyard	Com'l Medium	Com'l Large	Backyard	Com'l Small	Com'l Medium	Com'l Large	Semi-Com'l	Com'l Medium	Com'l Large	Backyard	Com'l Medium
Total hogs inventory															
Beginning	3	8	17	48	288	7659	3	163	789	8770	15	1625	19873	45	26
Ending	3	44	17	96	399	9498	14	102	532	8844	17	1850	20427	26	96
Sow level															
Beginning	0	7	13	3	65	748	2	11	48	837	6	120	1318	3	26
Ending	0	6	16	3	70	878	2	17	74	734	6	148	1400	3	26
Bags of Feeds	30	100	245	400	4500	87565	65	1125	8868	78907	180	14000	135593	400	1498
Total Feed (Kg)	1500	5000	12250	20000	225000	4378250	3250	56250	443400	3945325	9000	700000	6779650	20000	74880
Production Time (wks)	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52
Total Feed Cost (P)	8310	26750	66150	120600	1350000	20315080	14625	264638	1810947	17989366	48928	3640000	35006341	94000	449280
Price of Feed Per Kg	5.54	5.35	5.40	6.03	6.00	4.64	4.50	4.70	4.08	4.56	5.44	5.20	5.16	4.70	6.00
Total production	420	1400	3270	4860	62300	1103030	850	14945	121795	1278210	2417	166880	1766450	4770	20510
value	13440	44800	104640	140940	1806700	31688092	22100	388570	3166670	33233460	72500	5006400	52993500	119250	615300
P/kg	32.00	32.00	32.00	29.00	29.00	28.73	26.00	26.00	26.00	26.00	30.00	30.00	30.00	25.00	30.00
Feed conversion (Feed/Meat)	3.57	3.57	3.75	4.12	3.61	3.97	3.82	3.76	3.64	3.09	3.72	4.19	3.84	4.19	3.65
Feed cost/kg meat (₱)	19.79	19.11	20.23	24.81	21.67	18.42	17.21	17.71	14.87	14.07	20.25	21.81	19.82	19.71	21.91
Feed Cost/Value of Production (%)	61.83	59.71	63.22	85.57	74.72	64.11	66.18	68.11	57.19	54.13	67.49	72.71	66.06	78.83	73.0

Table 4.11 Feed efficiency of hog production, Philippines, 1990

	Backyard	Semi-Commercial	Commercial Small	Commercial Medium	Commercial Large
Total hogs inventory					
Beginning	25	14	114	703	12989
Ending	35	24	74	682	13608
Sow level					
Beginning	2	6	12	61	1011
Ending	2	6	16	78	1029
Bags of feeds	224	160	832	7547	103313
Total feed (kg)	11188	8000	41583	377336	5165640
Production time (wks)	52	52	52	52	52
Total feed cost (₱)	59384	43384	198475	1812235	25261299
Price of feed per kg	5.31	5.42	4.77	4.80	4.89
Total production					
kg	2725	2163	11053	98656	1438470
value	73933	65575	293927	2752348	40828402
₱/kg	27	30	27	28	28
Feed conversion (Feed/meat)	4.11	3.70	3.76	3.83	3.59
Feed cost/kg meat (₱)	21.79	20.06	17.96	18.37	17.56
Feed cost/valu of production (%)	80.7	60.9	66.5	65.6	62.7

Table 4.12 Feed efficiency in egg production, by province and scale of operation, Philippines, 1989

	GEN SANTOS CITY		BUKIDNON				CEBU		CAGAYAN DE ORO CITY			DAVAO		LAGUNA
	Backyd	Semi-Com'l	Backyd	Semi-Com'l	Com'l Small	Com'l Medium	Com'l Medium	Com'l Large	Backyd	Com'l Small	Com'l Medium	Semi-Com'l	Com'l Medium	Com'l Large
NUMBER OF LAYERS (HEADS)														
Start	150	200	120	413	875	4591	1720	50008	206	625	2000	380	3964	10000
Finish	125	175	115	394	784	4472	1623	49373	150	600	1900	340	3878	9750
Mortality/culling rate (%)	16.67	12.50	4.17	4.55	10.46	2.60	5.67	1.27	27.18	4.00	5.00	10.53	2.16	2.50
Total eggs marketed (doz.)	2,809	3726	2409	9643	17608	107288	36180	1075235	2676	13307	30412	9125	69074	263250
Ave. egg/bird (doz.)	22.47	21.29	20.95	24.49	22.47	23.99	22.30	21.78	17.84	22.18	16.01	26.84	17.81	27
Laying rate (%)	73.88	70.00	68.87	80.51	73.88	78.88	73.31	71.60	58.66	72.92	52.62	88.24	58.56	88.77
Bags of Feeds	97	125	91	374	661	3799	1387	42357	101	491	1089	379	2602	9846
Total Feed (kgs.)	4,833	6268	4555	18724	33071	189965	69350	2117831	5059	24538	54450	18960	130097	492278
Prod'n.Time (months)	18	18	18	18	18	18	18	18	18	18	18	18	18	18
Total Feed Costs (P)	31,961	36992	29381	115117	216452	1192923	422670	11090755	25750	165819	339768	120775	770164	3052121
Price of feeds (P/kg)	6.61	5.90	6.45	6.15	6.55	6.28	6.09	5.24	5.09	6.76	6.24	6.37	5.92	6.20
Value of eggs sold (P)	50,561	67072	43362	173571	316937	1931178	615068	18278995	48173	239526	547416	164250	1243339	5001750
Price per dozen of eggs (P)	18.00	18.00	18.00	18.00	18.00	18.00	17.00	17.00	18.00	18.00	18.00	18.00	18.00	19.00
Feed Conversion Ratio (kg/doz)	1.72	1.68	1.89	1.94	1.88	1.77	1.92	1.97	1.89	1.84	1.79	2.08	1.88	1.87
Feed costs per dozen of eggs (P)	11.38	9.93	12.20	11.94	12.29	11.12	11.68	10.31	9.62	12.46	11.17	13.24	11.15	11.59
Feed Cost/Value of Production (%)	63.21	55.15	67.76	66.32	68.29	61.77	68.72	60.67	53.45	69.23	62.07	73.53	61.94	61.02

Table 4.13 Feed efficiency in egg production, Philippines, 1990

	Scale of Operation				
	Backyard	Semi-Commercial	Commercial Small	Commercial Medium	Commercial Large
NUMBER OF LAYERS (HEADS)					
Start	157	347	792	3221	42007
Finish	129	324	722	3121	41448
Mortality/culling rate (%)	17.73	6.79	8.76	3.13	1.33
Total eggs marketed (doz)	2676	7878	16174	65071	912838
Average egg/bird (doz)	28.78	24.35	22.39	20.85	22.02
Laying rate (%)	68.33	80.05	73.62	68.56	72.41
Bags of feeds	96	304	605	2381	35854
Total feed (kgs)	4820	15199	30226	119039	1792720
Production time (months)	18	18	18	18	18
Total feed costs (₱)	29763	93604	199574	730183	9483028
Price of feeds (₱/kg)	6.18	6.16	6.60	6.13	5.29
Value of eggs sold (₱)	48164	141811	291133	1160941	15623546
Price per dozen of eggs (₱)	18.00	18.00	18.00	17.84	17.12
Feed conversion ratio (kg/doz)	1.80	1.93	1.87	1.83	1.96
Feed costs per dozen of eggs (₱)	11.12	11.88	12.34	11.22	10.39
Feed costs/production value (%)	61.8	66.01	68.55	62.9	60.7

Table 4.14 Feed efficiency broiler production, by province and scale of operation, Philippines, 1990

	BUKIDNON		GEN SANTOS CITY		CAGAYAN	CEBU CITY		DAVAO	LAGUNA	PHILIPPINES		
	Small	Medium	Small	Medium	Medium	Small	Large	Large	Medium	Small	Medium	Large
Total chicks started (heads)	5,000	20,800	5,200	10,400	10,400	5,600	157,800	52,000	20,000	5,200	14,400	131,350
Mortality rate (%)	12.17	4.00	3.00	5.00	2.50	4.37	3.91	5.00	1.50	7.78	3.02	4.02
Total broilers marketed (heads)	4,392	19,968	5,044	9,880	10,140	5,355	151,625	49,400	19,700	4,796	13,966	126,069
Ave. weight per bird (kg)	1.13	1.50	1.25	1.50	0.88	1.50	1.46	1.30	1.50	1.27	1.32	1.45
Production time (weeks)	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00
Bags of feed	208	1,508	250	520	364	392	8,827	2,496	1,241	264	799	1,360
Total feed (kg)	10,380	75,400	12,500	26,000	18,175	19,600	441,350	124,800	62,050	13,215	39,960	362,213
Price of feed per kg. (₱)	6.68	6.66	6.80	7.24	7.52	7.09	6.81	6.43	6.40	6.86	6.81	6.78
Total feed cost (₱)	69,305	502,502	85,000	188,240	136,721	138,880	3,006,675	802,880	397,120	90,622	272,261	2,455,726
Total Production (kg)	4,968	29,952	6,305	14,820	8,905	8,033	221,587	64,220	29,550	6,068	18,426	182,246
Price/kg (P)	35.00	35.00	33.00	33.00	35.00	33.00	33.00	33.00	34.00	33.82	34.36	33.00
Value of Production (P)	173,878	1,048,320	208,065	489,060	311,675	265,073	7,312,382	2,119,260	1,004,700	205,224	633,086	6,014,102
Feed conversion ratio	2.09	2.52	1.98	1.75	2.04	2.44	1.99	1.94	2.10	2.18	2.17	1.99
Cost of feeds per kg broiler (₱)	13.95	16.78	13.48	12.70	15.35	17.29	13.57	12.50	13.44	14.93	14.78	13.47
Feed Cost/Value of Prod. (%)	39.86	47.93	40.85	38.49	43.87	52.39	41.12	37.88	39.53	44.16	43.01	40.83

Table 4.15 Trading and distribution costs of hogs from farm to Manila, by provincial origin, Philippines, 1989/90

Source/Cost Items	Total Cost	Freight	Handling	Interest
	₱/mt			
Davao City to Manila	**1254.40**	**514.40**	**180.00**	**560.00**
Scaling, loading	30.00		30.00	
Davao trucking to port	57.20	57.20		
Arrastre, stevedoring and wharfage (Davao to Manila)	50.00		50.00	
Freight	400.00	400.00		
Manila trucking	57.20	57.20		
Food ration	100.00		100.00	
Bank interest (30 days)	560.00			560.00
Cebu City to Manila	**1067.10**	**379.60**	**180.00**	**507.50**
Scaling and loading	30.00		30.00	
Cebu trucking to port	114.40	114.40		
Arrastre (CDO/Cebu)	50.00		50.00	
Freight	208.00	208.00		
Manila trucking	57.20	57.20		
Food ration	100.00		100.00	
Bank interest (30 days)	507.50			507.50
Bukidnon to Manila	**1541.36**	**906.36**	**180.00**	**455.00**
Malaybalay to CDO City (93 km)				
Scaling and loading	30.00		30.00	
Trucking to port	589.16	589.16		
Arrastre (CDO/Cebu)	50.00		50.00	
Freight	260.00	260.00		
Manila trucking	57.20	57.20		
Food ration	100.00		100.00	
Bank interest (30 days)	455.00			455.00
General Santos City to Manila	**1219.40**	**514.40**	**180.00**	**525.00**
Scaling and loading	30.00		30.00	
GSC trucking to port	57.20	57.20		
Arrastre (GSC/Manila)	50.00		50.00	
Freight	400.00	400.00		
Manila trucking	57.20	57.20		
Food ration	100.00		100.00	
Bank interest (30 days)	525.00			525.00
Cagayan de Oro to Manila	**1049.10**	**431.60**	**180.00**	**437.50**
Scaling and loading	30.00		30.00	
CDO trucking to port	114.40	114.40		
Arrastre (CDO/Manila)	50.00		50.00	
Freight	260.00	260.00		
Manila trucking	57.20	57.20		
Food ration	100.00		100.00	
Bank interest (30 days)	437.50			437.50
Laguna to Manila	**403**	**343.20**	**60.00**	**0**
Scaling and loading	30		30	
Trucking to Manila	343.20	343.20		
Unloading	30		30	

Source: IFPRI survey

Table 4.18 Summary of yield, prices and net financial returns in hog production, by province and type of operation, Philippines, 1989/90

Technology/Region	Trade regime	Yield		Price of Output		Net Financial Profit			
		Farm Live wt.	Wholesale Carcass wt.	Farm Live wt.	Wholesale Carcass wt.	Farmgate (NFPf)		Wholesale (NFPw)	
		-- kg/farm ---		--- ₱/kg ----		₱/farm	₱/kg	₱/farm	₱/kg
Backyard									
Davao	IRT	540	370	32.00	43.50	(2955)	(5.5)	(5468)	(14.8)
Cebu	IRT	5597	3840	29.00	43.50	(23320)	(4.2)	(31525)	(8.2)
Bukidnon	IRT	850	583	26.00	43.50	(10103)	(11.9)	(9203)	(15.8)
Cagayan de Oro City	IRT	4770	3272	25.00	43.50	9296	1.9	21469	6.5
Semi-Commercial									
Davao	IRT	1400	960	32.00	43.50	4323	3.1	(2192)	(2.3)
General Santos City	IRT	2417	1658	30.00	43.50	2518	1.0	(3811)	(2.3)
Commercial - Small									
Davao	IRT	3272	2245	32.00	43.50	2957	0.9	(12269)	(5.5)
Bukidnon	IRT	15020	10304	26.00	43.50	39807	2.6	55722	5.4
Commercial - Medium									
Cebu	IRT	62450	42841	29.00	43.50	133341	2.1	41783	0.9
Bukidnon	IRT	126445	86741	26.00	43.50	670511	5.3	804497	9.3
General Santos City	IRT	181880	1234770	30.00	43.50	1418814	7.8	942579	7.6
Laguna	IRT	20510	14070	30.00	43.50	62035	3.0	25072	1.8
Commercial - Large									
Cebu	IRT	1137980	780654	29.00	43.50	6947177	6.1	5278785	6.8
Bukidnon	IRT	1279710	877881	26.00	43.50	7436572	5.8	8792604	10.0
General Santos City	IRT	1766675	1211939	30.00	43.50	12438469	7.0	7812607	6.4

IRT = interregional trade to Manila wholesale.

Source: IFPRI survey

Table 4.17 Yields, prices and net financial profitability of egg production, by type of operation, by producing regions, Philippines, 1989/90

Technology/ Region	Trade Regime	Yield*	Price of Output		Net Financial Profit			
			Farm	Whole-sale	Farmgate (NFPf)		Wholesale (NFPw)	
		kg/farm	---- ₱/kg -----		₱/farm	₱/kg	₱/farm	₱/kg
Backyard								
Bukidnon	IS	1329	32.62	36.42	4112	3.1	6035	4.5
Gen. Santos City	IS	1550	32.60	36.50	6500	4.2	9707	6.3
Cag. de Oro City	IS	1477	32.62	36.42	5908	4.0	8701	5.9
Semi-Commercial								
Davao	IS	5036	32.62	36.51	26360	5.2	36780	7.3
Bukidnon	IS	5322	32.62	36.42	26634	5.0	34332	6.4
Gen. Santos City	IS	2056	32.62	36.51	8847	4.3	13101	6.4
Commercial - Small								
Bukidnon	IS	9717	32.62	36.42	60643	6.2	74699	7.7
Cag. de Oro City	IS	7344	32.62	36.42	54884	7.5	68774	9.4
Commercial - Medium								
Davao	IS	38120	32.62	36.51	262440	6.9	341314	8.9
Cebu	IS	19967	30.80	34.52	153282	7.7	189237	9.5
Bukidnon	IS	59210	32.62	36.42	488052	8.2	573681	9.7
Cag. de Oro City	IS	16784	32.62	36.42	140194	8.4	171937	10.2
Commercial - Large								
Laguna	IS	145281	34.43	38.05	1264399	8.7	1479601	10.18
Cebu	IS	593397	30.80	34.52	4863515	8.2	5932033	9.99

* 1 kg egg = 1.812 doz.

IS = import substitution.

Source: IFPRI survey

Table 4.18 **Yields, prices and net financial profit of commercial broiler farms, by type of operation, by province, Philippines, 1989/90**

Technology/Region	Trade regime	Yield		Price of Output		Net Financial Profit			
		Farm Live wt.	Wholesale Dressed wt.	Farm Live wt.	Wholesale Dressed wt.	Farmgate (NFPf)		Wholesale (NFPW)	
		-- kg/farm ---		---- ₱/kg -----		₱/farm	₱/kg	₱/farm	₱/kg
Commercial - Small									
Cebu	IS	8033	6185	33.00	43.85	15694	1.9	10473	1.7
Bukidnon	IS	4968	3825	35.00	45.65	8942	1.8	453	0.1
Gen. Santos City	IS	6305	4855	33.00	44.00	46884	7.4	44064	9.1
Commercial - Medium									
Bukidnon	IS	29952	23063	35.00	45.65	156483	5.2	105305	4.5
Gen. Santos City	IS	14820	11411	33.00	44.00	135741	9.2	129113	11.3
Cagayan de Oro City	IS	8905	6857	35.00	45.65	12197	1.4	942	0.1
Laguna	IS	29550	22754	34.00	40.95	146627	4.9	25126	1.1
Commercial - Large									
Davao	IS	64220	49449	33.00	44.00	195627	3.0	166907	3.4
Cebu	IS	221587	170622	33.00	43.85	1511043	6.8	1367033	8.0

IS = import substitution.

Source: IFPRI survey

Table 4.19 Tariff rates, livestock and poultry products, Philippines, 1991-95

	Year				
	1991	1992	1993	1994	1995
	percent				
Live Animals					
Poultry (chickens, ducks, turkeys, geese)	40	35	30	30	30
- Poultry for breeding	3	3	3	3	3
Hogs	30	30	30	30	30
- Hogs for breeding	3	3	3	3	3
Cattle	30	30	30	30	30
- Feeder cattle (less than 300 kg)	3	3	3	3	3
- Cattle for breeding	3	3	3	3	3
Horses	30	30	30	30	30
- Horses for breeding	10	10	10	10	10
Sheep and goats	30	30	30	30	30
- For breeding	3	3	3	3	3
Meat, Eggs, Meat Preparations					
Chicken/ducks	50	45	40	35	30
Eggs	50	45	40	35	30
Pork	30	30	30	30	30
Beef	30	30	30	30	30
Goat/lamb	30	30	30	30	30
Meat preparations	50	45	40	35	30

Source: Tariff Commission, Tariff and Customs Code of the Philippines, 1991

Table 4.20 Direct, indirect, and total nominal protection rates of hog production by producing areas, Philippines, 1989/90

Producing Areas	Nominal Protection Rates		
	Direct	Indirect	Total
	%		
Bukidnon	-.5	-21	-22
Cagayan de Oro	-4	-21	-25
Cebu	7	-21	-14
Davao	16	-21	-5
General Santos	10	-21	-11
Laguna	8	-21	-13
Average	6	-21	-15

Source: Domestic producers prices and border prices on farm adjusted for marketing, distribution and processing costs were from the IFPRI survey. The official exchange rate used was ₱22.50:$1, with an overvaluation of 27 percent.

Table 4.21 Direct, indirect, and total nominal protection rates of egg production by producing areas, Philippines, 1989/90

Producing Areas	Nominal Protection Rates		
	Direct	Indirect	Total
	%		
Bukidnon	48	-21	27
Cagayan de Oro	46	-21	25
Cebu	39	-21	18
Davao	46	-21	25
General Santos	46	-21	25
Laguna	54	-21	33
Average	46	-21	25

Source: Domestic producers prices and border prices on farm adjusted for marketing and distribution costs were from the IFPRI survey. The official exchange rate used was ₱22.50:$1, with an overvaluation of 27 percent.

Table 4.22 **Direct, indirect, and total nominal protection rates of broiler production by producing areas, Philippines, 1989/90**

Producing Areas	Nominal Protection Rates		
	Direct	Indirect	Total
	----------	%	----------
Bukidnon	61	-21	40
Cagayan de Oro	58	-21	37
Cebu	50	-21	29
Davao	50	-21	29
General Santos	50	-21	29
Laguna	55	-21	34
Average	**54**	**-21**	**33**

Source: Domestic producers prices and border prices on farm adjusted for marketing, distribution and processing costs were from the IFPRI survey. The official exchange rate used was ₱22.50:$1, with an overvaluation of 27 percent.

Table 4.23 Direct, indirect and total nominal protection rates, livestock products at Manila wholesale, Philippines, 1989/90

	Nominal Protection Rates		
	Direct	Indirect	Total
Hogs	-1.6	-21	-22.6
Eggs	52	-21	31
Broilers	44	-21	23

Table 4.24 Effective protection rates in hog production at the official exchange rate, evaluated at farmgate, by province and scale of operation, Philippines, 1989/90

Province/Scale	Trade regime	Effective Protection Rate
Backyard		
Davao	IRT	17.14
Cebu	IRT	-1.25
Bukidnon	IRT	-11.61
Cagayan de Oro City	IRT	-20.25
Semi-Commercial		
Davao	IRT	16.67
Gen. Santos City	IRT	5.71
Commercial-Small		
Davao	IRT	16.50
Bukidnon	IRT	-13.81
Commercial-Medium		
Cebu	IRT	-2.77
Bukidnon	IRT	-13.28
Gen. Santos City	IRT	5.99
Laguna	IRT	0.95
Commercial-Large		
Cebu	IRT	0.63
Bukidnon	IRT	-11.33
Gen. Santos City	IRT	5.60

Note: IRT = import substitution with interregional trade.
OER = official exchange rate.

Table 4.25 **Effective protection rates in chicken egg production at the official exchange rate, evaluated at farmgate, by province and scale of operation, Philippines, 1989/90**

Province/Scale	Trade regime	Effective Protection Rate
Backyard		
Bukidnon	IRT	99
Gen. Santos City	IRT	90
Cagayan de Oro City	IRT	79
Semi-Commercial		
Davao	IRT	98
Bukidnon	IRT	101
Gen. Santos City	IRT	83
Commercial-Small		
Bukidnon	IRT	118
Cagayan de Oro City	IRT	98
Commercial-Medium		
Davao	IRT	86
Cebu	IRT	66
Bukidnon	IRT	95
Cagayan de Oro City	IRT	90
Commercial-Large		
Cebu	IRT	68
Laguna	IRT	117

Note: IRT = import substitution with interregional trade.
OER = official exchange rate.

Table 4.26 Effective protection rates in chicken broiler production at the official exchange rate, evaluated at farmgate, by province and scale of operation, Philippines, 1989/90

Province/Scale	Trade regime	Effective Protection Rate
		%
Commercial-Small		
Cebu	IRT	91.33
Bukidnon	IRT	104.87
Gen. Santos City	IRT	79.59
Commercial-Medium		
Bukidnon	IRT	122.72
Gen. Santos City	IRT	78.08
Cagayan de Oro City	IRT	104.11
Laguna	IRT	94.11
Commercial-Large		
Davao	IRT	81.21
Cebu	IRT	91.94

Note: IRT = import substitution with interregional trade.
OER = official exchange rate.

Table 4.27 Export prices of corn and livestock products

Livestock Products	Price (FOB)
1. Fresh pig meat chilled/frozen (pork chops)	US$2,332/mt[a]
2. Fresh poultry meat, chilled/frozen	US$1,358/mt[b]
3. Fresh egg in the shell	US$861/mt[c]

[a] Four-year (1987-90) weighted unit values of pig meat exports of Netherlands, Denmark, and Canada.

[b] Four-year (1987-90) weighted unit values of chicken meat exports of the U.S., France, Netherlands, and Chile.

[c] Four-year (1987-90) weighted unit values of egg exports of Netherlands, Federal Republic of Germany and the U.S.

Sources: FAO Yearbook, various issues

USDA, ERS, Commodity Economic Division, Livestock, Dairy, Poultry Branch, 1991

World Bank, International Trade Division

Table 4.28 World pigmeat production and trade, 1989

Country	Total World	Share of World	Export	Imports	Share of World Exports (Imports)
	000mt	%	--- 000 mt ---		%
China	22,070	32.7	177		6.70
United States	7,176	10.6	80		3.03
USSR	6,750	10.0		171	(6.47)
Fed Rep. of Germany	3,300	4.9		523	(19.79)
France	1,840	2.7		293	(11.09)
Spain	1,720	2.5		67	(2.53)
Netherlands	1,632	2.4	762		28.83
Japan	1,570	2.3		487	(13.05)
Italy	1,278	1.9		487	(18.43)
Canada	1,180	1.7	228		8.63
Denmark	1,168	1.7	439		16.61
United Kingdom	947	1.4		88	(3.33)
Bel-Lux	815	1.2	291		11.01
Philippines	575	0.9		3	(0.11)
Hongkong				53	(2.01)
Others	15,583	23.1	666	613	
World Total	**67,460**	**100.0**	**2643**	**2643**	

Sources: FAO Production Yearbook
FAO Trade Yearbook
BAS

Table 4.29 World chicken egg production and trade, 1989

Country	Total	Share of World	Export	Imports	Share of World Exports (Imports)
	000mt	%	--- 000 mt ---		%
China	6,800	19.6	43		5.41
USSR	4,680	13.5		5	(0.63)
United States	3,974	11.4	36		4.48
Japan	2,408	6.9	1		0.08
Brazil	1,100	3.2			
India	1,072	3.1			
France	891	2.6		43	(5.33)
Mexico	847	2.4		10	(1.19)
Spain	773	2.2		29	(3.68)
Fed. Rep. of Germany	726	2.1		286	(35.64)
Italy	669	1.9		45	(5.68)
Netherlands	640	1.8	428		53.47
United Kingdom	612	1.8		25	(3.09)
Poland	448	1.3	9		1.15
Philippines	270	0.8			
Malaysia	190	0.5	18		2.25
Bel-Lux	157	0.5		51	(6.31)
Finland	75	0.2	18		2.28
Switzerland	44	0.1		30	(3.73)
Singapore	16	0.0		26	(3.24)
Hongkong	2	0.0		77	(9.67)
Others	8,320	24.0	247	175	
World Total	**34,714**	**100.0**	**801**	**801**	

Sources: FAO Production Yearbook
FAO Trade Yearbook

Table 4.30 World poultry meat production and trade, 1989

Country	Total	Share of World	Export	Imports	Share of World Exports (Imports)
	000mt	%	--- 000 mt ---		%
United States	10,088	26.7	482		22.65
USSR	3,250	8.6		136	(6.20)
China	2,767	7.3		48	(2.20)
Brazil	2,140	5.7	247		11.59
Japan	1,475	3.9		281	(12.79)
France	1,426	3.8	428		20.11
United Kingdom	1,102	2.9		84	(3.81)
Italy	1,080	2.9		41	(1.89)
Mexico	846	2.2		55	(2.50)
Spain	806	2.1		70	(3.17)
Canada	667	1.8		29	(1.34)
Thailand	587	1.6	111		5.20
Indonesia	447	1.2			
Netherlands	444	1.2	259		12.18
Hungary	430	1.1	178		8.37
Fed. Rep. of Germany	423	1.1		263	(11.9)
Philippines	257	0.7			0.00
Saudi Arabia	217	0.6		200	(9.11)
Hongkong	53	0.1		146	(6.6)
Others	9,312	24.6	491	988	
World Total	**37,817**	**100.0**	**2,196**	**2,196**	

Sources: FAO Production Yearbook
FAO Trade Yearbook

Table 4.31 Domestic resource cost (DRCs) and resource cost ratios (RCRs) in hog production, by province and scale of production, Philippines, 1989/90

Province/Scale	Trade regime	DRC	RCR
		P/$	
Backyard			
Davao	IRT	28.75	1.01
Cebu	IRT	23.03	0.81
Bukidnon	IRT	29.10	1.02
Cagayan de Oro City	IRT	13.69	0.48
Semi-Commercial			
Davao	IRT	19.65	0.69
Gen. Santos City	IRT	19.35	0.68
Commercial-Small			
Davao	IRT	21.42	0.75
Bukidnon	IRT	14.72	0.52
Commercial-Medium			
Cebu	IRT	16.00	0.56
Bukidnon	IRT	12.22	0.43
Gen. Santos City	IRT	12.69	0.44
Laguna	IRT	15.89	0.56
Commercial-Large			
Cebu	IRT	13.58	0.48
Bukidnon	IRT	12.68	0.44
Gen. Santos City	IRT	13.00	0.45

Note: IRT = import substitution with interregional trade.
OER = official exchange rate.
EER = equilibrium exchange rate.

Table 4.32 Domestic resource cost (DRCs) and resource cost ratios (RCRs) in chicken egg production, by province and scale of production, Philippines, 1989/90

Province/Scale	Trade regime	DRC	RCR
		₱/$	
Backyard			
Bukidnon	IRT	27.95	0.98
Gen. Santos City	IRT	24.53	0.86
Cagayan de Oro City	IRT	26.59	0.93
Semi-Commercial			
Davao	IRT	20.34	0.71
Bukidnon	IRT	23.51	0.82
Gen. Santos City	IRT	25.51	0.89
Commercial-Small			
Bukidnon	IRT	18.83	0.66
Cagayan de Oro City	IRT	15.69	0.55
Commercial-Medium			
Davao	IRT	19.18	0.67
Cebu	IRT	14.11	0.49
Bukidnon	IRT	17.64	0.62
Cagayan de Oro City	IRT	15.95	0.56
Commercial-Large			
Cebu	IRT	12.34	0.43
Laguna	IRT	19.34	0.68

Note: IRT = import substitution with interregional trade.
OER = official exchange rate.
EER = equilibrium exchange rate.

Table 4.33 Domestic resource cost (DRCs) and resource cost ratios (RCRs) in chicken broiler production, by province and scale of production, Philippines, 1989/90

Province/Scale	Trade regime	DRC	RCR
		₱/$	
Commercial-Small			
Cebu	IRT	26.07	0.91
Bukidnon	IRT	30.20	1.06
Gen. Santos City	IRT	20.21	0.71
Commercial-Medium			
Bukidnon	IRT	24.78	0.87
Gen. Santos City	IRT	18.48	0.65
Cagayan de Oro City	IRT	29.97	1.05
Laguna	IRT	23.64	0.83
Commercial-Large			
Davao	IRT	25.63	0.90
Cebu	IRT	20.88	0.73

Note: IRT = import substitution with interregional trade.
OER = official exchange rate.
EER = equilibrium exchange rate.

Table 4.34 Breakeven yields and breakeven border prices in hog production, by province and scale of production, Philippines, 1989/90

Province/Scale	Trade regime	Actual Yield	Breakeven Yield	Actual Border Price	Breakeven Adj. BP	Breakeven FOB, source
		--- mt/farm ---		------	-- $/mt	-------
Backyard						
Davao	IRT	0.162	0.162	2,564	2,576	2,344
Cebu	IRT	1.674	1.420	2,564	2,216	1,984
Bukidnon	IRT	0.254	0.258	2,564	2,599	2,367
Cagayan de Oro City	IRT	1.427	0.819	2,564	1,589	1,356
Semi-Commercial						
Davao	IRT	0.419	0.312	2,564	1,985	1,753
Gen. Santos City	IRT	0.723	0.535	2,564	1,972	1,740
Commercial-Small						
Davao	IRT	0.979	0.781	2,564	2,104	1,871
Bukidnon	IRT	4.492	2.727	2,564	1,677	1,445
Commercial-Medium						
Cebu	IRT	18.679	12.500	2,564	1,807	1,574
Bukidnon	IRT	37.819	20.141	2,564	1,509	1,276
Gen. Santos City	IRT	54.400	29.847	2,564	1,535	1,302
Laguna	IRT	6.134	4.081	2,564	1,788	1,556
Commercial-Large						
Cebu	IRT	340.365	193.465	2,564	1,576	1,343
Bukidnon	IRT	382.756	201.924	2,564	1,497	1,265
Gen. Santos City	IRT	528.405	297.777	2,564	1,569	1,336

Table 4.35 Breakeven yields and breakeven border prices in chicken egg production, by province and scale of production, Philippines, 1989/90

Province/Scale	Trade regime	Actual Yield	Breakeven Yield	Actual Border Price	Breakeven Adj. BP	Breakeven FOB, source
		--- mt/farm ---		--------- $/mt -------		
Backyard						
Bukidnon	IRT	1.329	1.315	1,020	1,018	863
Gen. Santos City	IRT	1.550	1.444	1,020	956	808
Cagayan de Oro City	IRT	1.477	1.416	1,020	981	834
Semi-Commercial						
Davao	IRT	5.036	4.418	1,020	905	758
Bukidnon	IRT	5.322	4.869	1,020	942	794
Gen. Santos City	IRT	2.056	1.936	1,020	965	818
Commercial-Small						
Bukidnon	IRT	9.717	8.376	1,020	893	746
Cagayan de Oro City	IRT	7.344	5.887	1,020	835	687
Commercial-Medium						
Davao	IRT	38.120	31.691	1,020	862	714
Cebu	IRT	19.967	14.735	1,020	775	628
Bukidnon	IRT	59.210	47.429	1,020	837	690
Cagayan de Oro City	IRT	16.784	13.089	1,020	814	667
Commercial-Large						
Cebu	IRT	593.397	426.866	1,020	758	610
Laguna	IRT	145.281	122.131	1,020	872	725

Table 4.36 **Breakeven yields and breakeven border prices in chicken broiler production, by province and scale of production, Philippines, 1989/90**

Province/Scale	Trade regime	Actual Yield	Breakeven Yield	Actual Border Price	Breakeven Adj. BP	Breakeven FOB, source
		--- mt/farm ---		--------- $/mt -------		
Commercial-Small						
Cebu	IRT	5.567	5.827	1,537	1,458	1,280
Bukidnon	IRT	3.443	3.988	1,537	1,593	1,415
Gen. Santos City	IRT	4.369	3.771	1,537	1,234	1,056
Commercial-Medium						
Bukidnon	IRT	20.757	21.076	1,537	1,422	1,243
Gen. Santos City	IRT	10.270	8.259	1,537	1,163	984
Cagayan de Oro City	IRT	6.171	7.094	1,537	1,583	1,405
Laguna	IRT	20.478	19.823	1,537	1,364	1,185
Commercial-Large						
Davao	IRT	44.504	45.631	1,537	1,432	1,253
Cebu	IRT	153.560	136.183	1,537	1,264	1,086

Table 4.37 Domestic resource cost (DRCs) and resource cost ratios (RCRs) in hog production, by province and scale of production, Philippines, 1989/90

Province/Scale	Trade regime	DRC	RCR
		₱/$	
Backyard			
Davao	EP	32.68	1.14
Cebu	EP	26.45	0.93
Bukidnon	EP	33.12	1.16
Cagayan de Oro City	EP	15.63	0.55
Semi-Commercial			
Davao	EP	22.46	0.79
Gen. Santos City	EP	22.16	0.78
Commercial-Small			
Davao	EP	24.51	0.86
Bukidnon	EP	16.86	0.59
Commercial-Medium			
Cebu	EP	18.49	0.65
Bukidnon	EP	13.98	0.49
Gen. Santos City	EP	14.51	0.51
Laguna	EP	15.89	0.56
Commercial-Large			
Cebu	EP	15.49	0.54
Bukidnon	EP	14.43	0.50
Gen. Santos City	EP	14.89	0.52

Table 4.38 Breakeven yields and breakeven border prices in hog production, by province and scale of production, Philippines, 1989/90

Province/Scale	Trade regime	Actual Yield	Breakeven Yield	Actual Border Price	Breakeven Border Price
		---- mt/farm ----		---- $/mt ----	
Backyard					
Davao	EP	0.162	0.181	2,332	2,576
Cebu	EP	1.674	1.580	2,332	2,216
Bukidnon	EP	0.254	0.288	2,332	2,599
Cagayan de Oro City	EP	1.427	0.911	2,332	1,589
Semi-Commercial					
Davao	EP	0.419	0.348	2,332	1,985
Gen. Santos City	EP	0.723	0.596	2,332	1,972
Commercial-Small					
Davao	EP	0.979	0.869	2,332	2,104
Bukidnon	EP	4.492	3.040	2,332	1,677
Commercial-Medium					
Cebu	EP	18.679	13.911	2,332	1,807
Bukidnon	EP	37.819	22.450	2,332	1,509
Gen. Santos City	EP	54.400	33.231	2,332	1,535
Laguna	EP	6.134	4.081	2,332	1,788
Commercial-Large					
Cebu	EP	340.365	215.298	2,332	1,576
Bukidnon	EP	382.756	225.077	2,332	1,497
Gen. Santos City	EP	528.405	331.537	2,332	1,569

Table 4.39 **Domestic resource cost (DRCs) and resource cost ratios (RCRs) in chicken egg production, by province and scale of production, Philippines, 1989/90**

Province/Scale	Trade regime	DRC	RCR
		₱/$	
Backyard			
Bukidnon	EP	44.45	1.56
Gen. Santos City	EP	39.68	1.39
Cagayan de Oro City	EP	37.96	1.33
Semi-Commercial			
Davao	EP	36.18	1.27
Bukidnon	EP	37.92	1.33
Gen. Santos City	EP	38.52	1.35
Commercial-Small			
Bukidnon	EP	34.58	1.21
Cagayan de Oro City	EP	27.00	0.95
Commercial-Medium			
Davao	EP	30.45	1.07
Cebu	EP	22.19	0.78
Bukidnon	EP	27.66	0.97
Cagayan de Oro City	EP	25.41	0.89
Commercial-Large			
Cebu	EP	20.16	0.71
Laguna	EP	28.56	1.00

Table 4.40 Breakeven yields and breakeven border prices in chicken egg production, by province and scale of production, Philippines, 1989/90

Province/Scale	Trade regime	Actual Yield	Breakeven Yield	Actual Border Price	Breakeven Border Price
		---- mt/farm ----		---- $/mt ----	
Backyard					
Bukidnon	EP	1.329	1.619	872	1,035
Gen. Santos City	EP	1.550	1.784	872	987
Cagayan de Oro City	EP	1.477	1.733	872	1,005
Semi-Commercial					
Davao	EP	5.036	5.474	872	937
Bukidnon	EP	5.322	5.994	872	967
Gen. Santos City	EP	2.056	2.392	872	996
Commercial-Small					
Bukidnon	EP	9.717	10.312	872	918
Cagayan de Oro City	EP	7.344	7.208	872	858
Commercial-Medium					
Davao	EP	38.120	39.190	872	894
Cebu	EP	19.967	18.030	872	798
Bukidnon	EP	59.210	58.385	872	862
Cagayan de Oro City	EP	16.784	16.024	872	838
Commercial-Large					
Cebu	EP	593.397	522.304	872	781
Laguna	EP	145.281	145.261	872	872

Table 4.41 Domestic resource cost (DRCs) and resource cost ratios (RCRs) in chicken broiler production, by province and scale of production, Philippines, 1989/90

Province/Scale	Trade regime	DRC	RCR
		₱/$	
Commercial-Small			
Cebu	EP	33.85	1.18
Bukidnon	EP	37.99	1.33
Gen. Santos City	EP	25.75	0.90
Commercial-Medium			
Bukidnon	EP	32.65	1.14
Gen. Santos City	EP	23.47	0.82
Cagayan de Oro City	EP	38.11	1.33
Laguna	EP	28.78	1.01
Commercial-Large			
Davao	EP	32.58	1.14
Cebu	EP	26.37	0.92

Table 4.42 **Breakeven yields and breakeven border prices in chicken broiler production, by province and scale of production, Philippines, 1989/90**

Province/Scale	Trade regime	Actual Yield	Breakeven Yield	Actual Border Price	Breakeven Border Price
		---- mt/farm ----		---- $/mt ----	
Commercial-Small					
Cebu	EP	5.567	6.892	1,358	1,488
Bukidnon	EP	3.443	4.740	1,358	1,626
Gen. Santos City	EP	4.369	4.499	1,358	1,275
Commercial-Medium					
Bukidnon	EP	20.757	25.049	1,358	1,454
Gen. Santos City	EP	10.270	9.853	1,358	1,203
Cagayan de Oro City	EP	6.171	8.395	1,358	1,614
Laguna	EP	20.478	22.870	1,358	1,364
Commercial-Large					
Davao	EP	44.504	54.479	1,358	1,473
Cebu	EP	153.560	161.079	1,358	1,294

Table 4A.1 Percent distribution of per farm costs of hog production, farm to wholesale, by type of operation, by producing area, Philippines, 1989/90

Type of Operation/ Input Costs	Bukidnon	Cagayan de Oro	Cebu	Davao
	----------	%	----------	
Backyard				
Costs				
Current	44	79	74.0	60
Labor	42	6.0	12	28
Land rent	1.4	0.5	0.8	1.0
Capital cost	0.9	0.9	1.0	0.8
Interest	5.2	4.8	5.0	4.0
Production	93	91	94	94
Processing/trading	7.0	9.0	6.0	6.0
Total Costs	100.0 (₱34567)	100.0 (₱10918)	100.0 (₱12913)	100.0 (₱21580)

Source: IFPRI survey

Table 4A.1 (cont'd.)

Type of Operation/ Input Costs	Davao	General Santos City
	---------- %	----------
Semi-Commercial		
Costs		
Current	69	65
Labor	14	19
Land rent	2	1
Capital cost	3	1
Interest	4	5
Production	92	92
Processing/trading	8	8
Total Costs	100.0 (₱43963)	100.0 (₱75936)

Source: IFPRI survey

Table 4A.1 (cont'd.)

Type of Operation/ Input Costs	Bukidnon	Davao
	---------- %	----------
Commercial (Small)		
Costs		
Current	72	63
Labor	6	22
Land rent	1	.6
Capital cost	4	2
Interest	5	5
Production	89	93
Processing/trading	11	7
Total Costs	100.0 (₱392489)	100.0 (₱109908)

Source: IFPRI survey

Table 4A.1 (cont'd.)

Type of Operation/ Input Costs	Bukidnon	Cebu	General Santos City	Laguna
	----------	%	----------	
Commercial (Medium)				
Costs				
Current	77	80	82	82
Labor	5	2	1	4
Land rent	0.2	0.3	0.4	1
Capital cost	1	4	1	2
Interest	5	5	5	5
Production	88	92	90	94
Processing/trading	12	8	10	6
Total Costs	100.0 (₱2968748)	100.0 (₱1821787)	100.0 (₱4484902)	100.0 (₱586967)

Source: IFPRI survey

Table 4A.1 (cont'd.)

Type of Operation/ Input Costs	Bukidnon	Cebu	General Santos City
	----------	%	----------
Commercial (Large)			
Costs			
Current	69	80	82
Labor	12	5	2
Land rent	.1	.2	.1
Capital cost	2	.9	.9
Interest	5	5	5
Production	88	91	90
Processing/trading	12	9	10
Total Costs	100 (₱29395223)	100 (₱28679676)	100 (₱44906742)

Source: IFPRI survey

Table 4A.2 Percent distribution of per farm costs of egg production, farm to wholesale, by type of operation, by producing area, Philippines, 1989/90

Type of Operation/ Input Costs	Bukidnon	Cagayan de Oro	General Santos City
	----------	%	----------
Backyard			
Costs			
Current	59	61	65
Labor	22	16	20
Land rent	2	5	1
Capital cost	6	7	2
Interest	4	5	5
Production	93	94	94
Processing/trading	7	6	6
Total Costs	100 (₱42369)	100 (₱45090)	100 (₱46886)

Source: IFPRI survey

Table 4A.2 (cont'd.)

Type of Operation/ Input Costs	Bukidnon	Davao	General Santos City
	----------	%	----------
Semi-Commercial			
Costs			
Current	62	73	57
Labor	16	9	17
Land rent	3	2	4
Capital cost	6	4	11
Interest	5	6	5
Production	92	94	94
Processing/trading	8	6	6
Total Costs	100 (₱159508)	100 (₱147090)	100 (₱61967)

Source: IFPRI survey

Table 4A.2 (cont'd.)

Type of Operation/ Input Costs	Bukidnon	Cagayan de Oro
	---------- %	----------
Commercial (Small)		
Costs		
Current	66	65
Labor	12	12
Land rent	1	2
Capital cost	6	8
Interest	6	7
Production	92	93
Processing/trading	8	7
Total Costs	100 (₱279206)	100 (₱198740)

Source: IFPRI survey

Table 4A.2 (cont'd.)

Type of Operation/ Input Costs	Bukidnon	Cagayan de Oro	Cebu	Davao
	----------	%	----------	
Commercial (Medium)				
Costs				
Current	66	62	72	67
Labor	12	15	9	15
Land rent	1	1	1	1
Capital cost	7	8	4	4
Interest	6	6	6	6
Production	91	93	92	93
Processing/trading	9	7	8	7
Total Costs	100 (₱1582819)	100 (₱439356)	100 (₱499996)	100 (₱1050516)

Source: IFPRI survey

Table 4A.2 (cont'd.)

Type of Operation/ Input Costs	Cebu	Laguna
	---------- %	----------
Commercial (Large)		
Costs		
Current	77	68
Labor	6	9
Land rent	-	1
Capital cost	3	9
Interest	6	6
Production	92	92
Processing/trading	8	8
Total Costs	100 (₱14551201)	100 (₱4048632)

- less than one percent.

Source: IFPRI survey

Table 4A.3 Percent distribution of per farm costs of broiler production, farm to wholesale, by type of operation, by producing area, Philippines, 1989/90

Type of Operation/ Input Costs	Bukidnon	Cebu	General Santos City
	----------	%	----------
Commercial (Small)			
Costs			
Current	76	82	82
Labor	11	5	7
Land rent	1	2	-
Capital cost	1	2	-
Interest	5	5	5
Production	95	96	95
Processing/trading	5	4	5
Total Costs	100 (₱174175)	100 (₱260757)	100 (₱169549)

- less than one percent.

Source: IFPRI survey

Table 4A.3 (cont'd.)

Type of Operation/ Input Costs	Bukidnon	Cagayan de Oro	General Santos City	Laguna
	----------	%	----------	
Commercial (Medium)				
Costs				
Current	82	83	79	78
Labor	4	5	19	4
Land rent	1	1	-	2
Capital cost	2	-	1	6
Interest	5	5	5	5
Production	94	96	95	95
Processing/trading	6	4	5	5
Total Costs	100 (₱947522)	100 (₱312073)	100 (₱372989)	100 (₱906630)

- less than 1%.

Source: IFPRI survey

Table 4A.3 (cont'd.)

Type of Operation/ Input Costs	Cebu	Davao
	---------- %	----------
Commercial (Large)		
Costs		
Current	82	67
Labor	6	21
Land rent	-	1
Capital cost	1	1
Interest	5	5
Production	95	96
Processing/trading	5	4
Total Costs	100 (₱6114741)	100 (₱2008866)

- less than 1%.

Source: IFPRI survey.

APPENDIX 4.B ASSUMPTIONS IN THE ECONOMIC ANALYSIS

General Assumptions

The corn-livestock survey provided the basic input/output coefficients in the economic analysis of the livestock non-ruminants. Based on livestock commodity trade flows, two trade regimes were assumed: import substitution with interregional trade (IRT) and export promotion (EP). For the IRT trade regimes for hogs, Manila was used as the wholesale market. For broilers and eggs, the wholesale markets were those in Cebu and Mindanao (wholesale markets of Cagayan de Oro, Davao, and General Santos). For the export scenario, Manila port was the major port of exit. *Ex ante* analysis, however was also made using regional ports (e.g., General Santos and Cagayan de Oro) as ports of exit under EP, but due to tentativeness of the data used, results were not included in this report.

Tradable and Non-tradable Costs

The implicit tariffs (ITs) used and the allocation of economic cost into foreign (tradable) and domestic (nontradable) components are shown in Table 4B.1.

Interest Rates

Livestock producers paid an average financial rate of 18 percent per annum on borrowed operating capital. This was applied for four months as part of operating capital cost. The economic interest used was 10 percent.

Processing Costs/Conversion Rates

Table 4B.2 provides the basic data used in the processing costs. Activities for hogs involved slaughtering of live animals to finishing carcass for prime cuts. The conversion rates used were as follows:

1) hogs: from liveweight to carcass, 70 percent and from carcass to prime cut, 56.62 percent.

2) chickens: from liveweight to dressed weight, 77 percent, plus another 10 percent loss for export processing.

3) eggs: on the average, 1 egg weighs 46 grams or one kilogram was equal to 1.81 dozen of eggs.

Domestic Prices

Domestic prices were average livestock prices received by producers in their respective regions. These included the domestic farmgate and wholesale prices. They are shown in Table 4B.3.

Table 4B.1 Percent allocation of economic costs and implicit tariffs, livestock production, Philippines, 1989/90

Inputs	Implicit Tariffs (IT)	Economic Cost Allocation Domestic	Foreign
	---------- %	----------	
Land	-	100	-
Labor	-	100	-
Interest	-	63	37
Mixed feeds	32[a]	52	48
	37b	75	25
Vet. supply/medicine	30	5	95
Transport	16.59	46	54
Blast freezing	15	35	65
Cold storage/refrigeration	20	25	75

[a] Hogs.

[b] Poultry.

Table 4B.2 Processing costs by type of activity by livestock products, 1989/90

Type of Activity	Hogs	Broiler	Eggs
	---------- ₱/mt ----------		
Slaughtering	860[a]	860[a]	-
Cutting	380[a]	-	-
Blast freezing	2000[b]	2000[b]	-
Packing/packaging	1300[b]	1300[b]	2667
Cold storage	420[b]	420[b]	420
Refrigerated transport	144[b]	144[b]	144

[a] Liveweight.

[b] Prime cut weight.

Source: BAI and IFPRI survey

Table 4B.3 Farm gate and wholesale prices of livestock products by producing regions, Philippines, 1989/90

Prices	Davao	Cebu	Bukidnon	General Santos	Cagayan de Oro	Laguna
Farm Gate						
Hogs (₱/kg livewweight)	32	29	26	30	25	30
Broilers (₱/kg liveweight)	33	33	35	33	35	34
Eggs (₱/kg)	32.62	30	32.62	32.62	32.62	34.43
Wholesale						
Hogs (₱/kg) Carcass wt., Manila)	43.50	43.50	43.50	43.50	43.50	43.50
(₱/kg of prime cut)	56.49	56.49	56.49	56.49	56.49	56.49
Broilers (₱/kg) (Dressed wt.)	44.00	43.85	45.65	44.00	45.65	48.00
Eggs (₱/kg)	36.51	34.50	36.42	36.51	36.42	38.08

5. MARKETING OF CORN IN THE PHILIPPINES: MARKET INTEGRATION AND DYNAMICS OF PRICE FORMATION[1]

Meyra S. Mendoza and Mark W. Rosegrant

5.1 Introduction

Beginning in the 1980s, the use of corn for feed has grown much more rapidly than use as food. This trend is expected to continue in the coming years. The projected increase in meat demand arising from a shift in per capita income of Filipinos is anticipated to provide the major stimulus for the growth of corn production in the Philippines. Increases in corn production will increase the volume of corn moving into the domestic market. The capability of the existing marketing system to handle the increments in corn supply to guide optimal distribution among alternative uses thus becomes a major issue. Knowledge and understanding of the market structure of corn, the dynamic process of price formation and behavior, and the factors affecting the pricing process are important in identifying possible marketing constraints that could inhibit the efficiency of prices in providing accurate and reliable market signals in the optimal distribution of corn.

Knowledge of the price relationships among markets is important in understanding the dynamics of the price discovery process among market agents, the efficiency of the market exchange process in transmitting information and in linking markets, and the implications of market efficiency to market integration and overall performance. If incomplete and/or slow transmission of information between markets are found, this could suggest imperfections and structural rigidities in the market.

The general objective of this chapter is to investigate the dynamics of the price formation process for Philippine corn, the extent to which the buying and selling activities of market agents link markets, and the impact of new information on market integration. Results of this study have important policy implications for improving the performance of the market for corn.

5.2 The Structure of the Philippine Corn Market and the Marketing of Corn

The discussion in this section is drawn from the field survey of randomly selected samples of corn farmers, traders, feedmillers, and poultry/livestock raisers conducted by the International Food Policy Research Institute (IFPRI) in selected sample provinces in major corn producing regions in the Philippines from March 1990 to July 1990.

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[1] Helpful comments from Melvyn Weeks, Consultant, International Food Policy Research Institute, Washington, D.C. are gratefully acknowledged.

The survey covered 11 sample provinces selected from 6 major corn producing regions namely, of Cagayan Valley- Region II; Southern Tagalog-Region IV; Central Visayas-Region VII; Northern Mindanao-Region X; Southern Mindanao-Region XI; and Central Mindanao-Region XII. Results presented here were obtained from the field survey conducted in the sample provinces of Bukidnon, Davao, Isabela, Nueva Viscaya and South Cotabato covering a total sample of 1,024, of which 896 are corn farmers and 128 are corn traders. The distribution of the sample respondents, by sample provinces, by region are shown in detail in Table 3.2.

5.2.1 Average Size of Corn Farms

In the Philippines, corn is grown in farms located in regions in geographically dispersed islands. Most corn farms are concentrated in the regions of Southern Tagalog, Cagayan Valley, Central Visayas, Northern Mindanao, Southern Mindanao, and Central Mindanao, where agroclimatic conditions are favorable to growing corn. Corn is grown best in upland conditions with well-drained sandy loam or clay loam soil in flat to slightly rolling topography and in areas where rainfall distribution is relatively even throughout the year.

Filipino corn farmers are predominantly small subsistence farmers. Except for Bukidnon, where corn farmers cultivated nearly six hectares, an average corn farm is over three hectares in size (Table 5.1). On average, there is no significant variation in hectarage planted to corn across sample provinces.

Because of the relatively small size of corn farms, scarcity of lands available to agriculture, and high land rent in the Philippines, increments in corn supply to sustain projected increase in demand for corn should come from either considerable increases in intensity of cultivation or shifts in land currently devoted to other crops.

5.2.2 Corn Production Cycles and Seasonality

Of the improved corn varieties grown in the Philippines, San Miguel Corporation and Pioneer varieties seem the two most popular. Other corn varieties grown include the open-pollinated varieties of IPB, Tiniguib, WOP, and UPCA 1 and 2, and the hybrid Cargill variety.

Like most agricultural crops, production of corn is highly seasonal, with seasonality patterns differing across provinces. Planting periods of corn vary across provincial samples depending on the rainfall distribution. For example, farmers in Bukidnon and South Cotabato usually plant corn in the second and third quarters. In Isabela and Nueva Viscaya, corn is planted in the second and fourth quarters and in Davao, in the first and fourth quarters.

The bulk of corn locally produced is harvested over six months. In the sample provinces of Bukidnon and South Cotabato, most of the corn is harvested during the third and fourth quarters. Corn produced in Nueva Viscaya and Isabela is from the first and third quarters harvests, and in Davao, the second and fourth quarters.

For corn consumed as food, seasonality in the production of corn is not critical. During periods of corn shortages, Filipino corn eaters have substituted rice or less expensive starchy root crops, i.e. sweet potato and cassava, in place of corn as a source of carbohydrate. For the feedmillers and large scale poultry and livestock raisers, however, where corn is a major input for operation, a regular supply of corn all year round is required. This factor coupled with the inavailability of cheaper energy substitutes for corn from domestic sources emphasize the critical role of storage in balancing intertemporal variations in the supply of and demand for corn.

5.2.3 The Corn Marketing System

The marketing of corn in the Philippines is a dynamic and complicated process of interaction among market agents actively involved in corn trading. Prices between markets guide the decision of market agents to buy and sell corn at a point in time and also determine the quantity of corn to be moved out of the farm to the wholesale level, from the wholesale level to corn millers/processors, and from corn millers/processors to urban consumption centers or other major users of corn i.e. feedmillers and livestock/poultry raisers. Traders will engage in arbitrage, the activity of buying from markets where corn price is low and selling it in high price markets, if price differentials exceed the cost of moving the products between market points. The arbitration activity by traders tends to even out supply and demand imbalances in spatially and intertemporally separated markets. The continuous transmission of information integrates and links markets.

Marketable corn surplus at the farm level. Excluding the volume of corn set aside by farmers for home consumption, seeds, and feed uses, the volume of marketable surplus of corn moving out of the farm level is generally small. Of the sample farmers reporting, two-thirds sold a total of about 60 cavans per hectare or less of corn to the market and only 19 percent sold corn exceeding 101 cavans (Table 5.1). This result suggests that cost advantages to drying, storing, and transporting corn by the farmers may not exist because the total volume of marketable surplus at the farm level is small. In addition, wet weather conditions at harvest time often make corn drying and storage difficult and very costly. The marketable surplus of corn is, however, expected to exceed current levels with increases propelled by the growth in the livestock/poultry industry arising from an increase in demand for meat due to anticipated increases in per capita income of Filipinos.

Product differentiation. At the first point of sale, from the farmer to the wholesaler, corn is sold as a homogeneous product with very little product differentiation. Differentiation of corn, if done at all, is rather arbitrary, commonly based on quality characteristics which are oftentimes unrelated to existing grades and standards set for grains. For example, in Cagayan de Oro, corn harvested during the rainy season is sold as "wet corn." Poor quality corn from South Cotabato is differentiated as "dirty corn" from better quality corn produced in other areas.

Corn is usually sold by farmers either as green, fresh, and unhusked corn or as dried, shelled corn. No standard weights of measure are used and weight standards differ by product

forms being sold. Green, fresh, and unhusked corn, is generally sold by farmers directly from the field immediately after harvest on a per ear or per sack basis, weighing about 50 to 60 kilograms. However, the volume of corn marketed in this form accounts for only a small proportion of the total volume of corn moving out of the farm. Most of the corn disposed on farm is shelled corn, commonly sold on a per kilogram or per sack basis. It is usually picked up by traders from the farmer's house or place of storage.

Corn shelling and drying. Shelling of corn is done using rented shellers and are frequently provided by traders. On-farm drying of corn is commonly done, on the cob or shelled, by solar drying. Corn on the cob are dried by tying together several ears of corn by the husk in bunches of five or more and solar dried by hanging in makeshift bamboo posts or clotheslines. Reduction of moisture content of sun-dried corn on the cob is. however, generally slower and less efficient than corn dried in shell form. The rainy season during harvest time also makes solar drying more difficult. Family labor is usually employed in corn drying, with little use of hired labor. During the rainy season when drying is a major problem, corn is oftentimes not dried and moved as "wet corn."

Corn grains flowing out of the farm are generally of poor quality. Existing methods of drying corn are rather poor and proper drying areas inadequate to ensure the production of better quality corn. Although available for rent in the area, most farmers cited the high rental cost of mechanical dryers and drying spaces as the major reason for not using them. Almost all sample farmers reported drying corn in the concrete floors of their backyards or on any available community owned cement/concrete floors, i.e. village halls, basketball courts, or sides of "high traffic" streets or public highways where foreign materials get easily mixed with the grains. In addition, corn grain damage from kernel breakage or cracking due to improper handling and from passing traffic are reportedly high during drying.

Storage. Storage allocates the available supply of seasonally produced corn, extending the marketing season from one harvest time to the next. Because of the seasonal nature of corn production, storage becomes a critical component in the successful development of the poultry/livestock industry in the Philippines. Most sample farmers reported disposing their corn as quickly as two to six days, on average, after harvest. The decision by farmers to sell corn immediately is commonly prompted by their need for cash to repay their credit and the high cost or unavailability of warehouses to store corn.

About 30 percent of the total farmer samples stored corn. The volume of corn stored on farm ranged from about two kilograms to 1,000 kilograms, averaging over 50 kilograms. Across sample provinces, farmers cited different reasons for storing corn. For instance, of the 124 sample farmers reporting in Bukidnon, over 71 percent stored two to 200 kilograms of corn for later consumption (Table 5.2). In Isabela, 46 percent of the sample farmers stored corn for the purpose of later sale and over 50 percent who are engaged in backyard poultry or hog raising set aside about one to 20 kilograms of corn for feed use. In South Cotabato, nearly 50 percent of the sample farmers stored corn two to 70 kilograms for feeds. Corn set aside for later consumption is commonly stored on the cob, while corn used for later sale and feeds is stored

in shelled form. Disposal of corn stored for later sale is typically made as the farmers' need for cash arose. Many farmers also cited "waiting for a better price" as a reason for storing corn.

The successful storage of corn depends on the low moisture content of the grains placed in storage and proper storage conditions. If dried to a level of 14 percent moisture content and kept in properly managed storage warehouses, corn may be stored for about two to three months or longer. Across sample provinces, corn was stored for two months, on average. Due to poor storage, crop losses are reportedly high. According to farmers, about five percent to 25 percent of corn is lost during storage. Farmers attributed these losses to molding of improperly dried grains, grain shrinkage, pilferage, and rat and weevil infestation.

Market outlets, opportunities, and access. Generally, sample farmers are situated close to a local market outlet, about 14 kilometers, on average. About 75 percent of the sample farmers are located within 1-11 kilometers of a market outlet or corn buyer (Table 5.3). Over 10 percent of the farmers are situated within 12 to 30 kilometers of a trader and 16 percent are located farther than 31 kilometers. According to farmers, however, access to alternative higher-priced urban markets is limited by poor farm-to-market roads, inadequate local transportation facilities, and high transportation cost.

Prior to selling corn, farmers are involved in some form of price search to determine prices prevailing in different markets. Generally, farmers face a considerable number of traders. The majority (86 percent) of the sample farmers across all provinces get in contact with about two or more traders of the 10 or more traders buying and selling of corn in the municipality (Table 5.4). Contact with the farmers is generally initiated by the traders. As shown in Table 5.5, about 86 percent of the farmers indicated that traders "come to them," with different offer prices, in search of corn to buy. Only about 12 percent of the farmers initiated contact with several prospective traders prior to making their first sale.

Most farmers sell to wholesalers, commission agents, and wholesaler-retailers offering the highest price for their corn and very few sell to traders with whom farmers have a established long standing relationship or "suki." When asked about corn millers as a market alternative, only about 26 percent of the farmers reported selling their corn directly to millers (Table 5.6). The majority do not sell to the millers because, according to the farmers, the price offered by the millers tend to be lower than that other traders are willing to pay for the same quality. Compared to other traders, millers also tend to enforce a stricter standard of grain grading with large price discounts applied to grains with low moisture content. In other cases, many millers have contract agreements with a number of farmers so that additional purchases from other farmers are not necessary.

First handlers. First handlers are traders to whom farmers first sell their corn and can be generally classified as wholesalers, wholesaler-retailers, and local assembler/commission agents. Most of these traders buy corn from many farmers, ranging from 10 or more, located in two or more municipalities. These trading areas covered by traders oftentimes overlap indicating a high degree of price competition among corn buyers.

Depending on the volume of corn handled, traders may be classified as small or large. An average corn trader handle about 250 metric tons a year. Majority (87 percent) of the corn traders indicated owning and operating their businesses independently (Table 5.7). Only about seven percent are family owned and six percent are corporate owned. Generally, corn is bought and sold by traders year round. Traders in Bukidnon and Nueva Viscaya buy and sell corn in June or July until February or April the following year. Davao traders are engaged in trading corn from April or June to the following May. For traders in Isabela, corn trading is done from March to May.

At this level, traders perform additional drying and cleaning of corn purchased from farmers as semi-wet or wet corn. This additional drying allows traders to reduce moisture content of grain thus, enabling them to store corn for longer periods than farmers usually do. It also minimizes more grain losses that could arise from molding, rotting, and infestation. Cleaning grains of foreign matters accumulated from improper on-farm drying and storage is also done by the traders.

There seems to be some price incentive at the first handlers level to sell better quality grains but these incentives are not adequate to maintain quality standards. Because municipal traders generally discount the price they offer to farmers by about ₱0.05-₱0.10 per kilogram or more for moisture content less than 14 percent and foreign matter, the returns to drying and cleaning may be as much as ₱0.05-₱0.10 per kilogram or more. Mixing poor quality grains with good quality grains is a prevalent practice among traders. About 63 percent of sample traders interviewed admitted to mixing corn (Table 5.8).

Most corn is picked up by traders directly from the field or the farmers' house. Because local transportation is often unavailable or costly, this arrangement seems preferable to farmers. Most of the corn sales are transacted in cash on the spot, regardless of whether corn is delivered by farmers or picked up by the traders. Transportation, hauling services, and packing materials are generally provided by traders. Costs associated with these services are frequently discounted by the traders from the price paid to farmers. Available data obtained from the survey is, however, inadequate to allow us to estimate the amount of this discount. Because farmers are generally well-informed about market prices and marketing costs (as will be shown in a later section), the amount of price discounts is likely to approximate actual costs.

The presence of many buyers trading within a limited geographic area and the need of traders to fulfill the volume required in their contracts with other traders imply a high degree of competition for a relatively small volume of corn available at the farm level. Traders are likely to be aware of the actions and reactions of their competitors, indicating a strong interdependence among them. The offer price of one trader is most likely matched by other buyers. In this case, farm prices may exhibit less variability as offer prices among competing traders would tend to be uniform. For example, according to local traders, the presence of itinerant traders or "viajeros" whose offer price tend to be ₱0.05-₱0.10 per kilogram higher, have forced the former to match the later's offer price. Although the corn buying activity of the "viajeros" is limited to farmers with farms located conveniently along major highways, their

presence has intensified price competition at the farm level and reduced the range of deviations among prices. According to traders, competition from the "viajeros" has resulted in a squeeze in their margins.

The rigor of price competition among traders is, however, moderated by numerous non-price factors. Competition among corn buyers does not only hinge on prices but also on services extended by traders to farmers. Traders are the most common sources of credit used by farmers. They are also the major source of farm inputs, i.e., fertilizers, seeds, and farm chemicals.

Diversification in corn trading. Because of the seasonal nature of corn production, most traders (89 percent) buy and sell corn on a part-time basis, actively trading only during the harvest months. Only 11 percent were involved in corn trading full-time (Table 5.7 previously cited). Depending on the available supply of corn, prices may vary widely from month to month. Prices would tend to be depressed during the harvest months of October-December and highly volatile during the lean months of January-March.

The monthly variability in corn prices indicate that corn trading is a high-risk business venture and income solely derived from buying and selling corn highly unstable. Thus, many sample corn traders engage in several lines of business in addition to buying and selling corn. Some traders buy and sell other agricultural crops such as rice, coffee, and peanuts, and others are involved in diverse, and often unrelated, retailing businesses, i.e. selling farm chemical and fertilizers, and general consumer goods. Others operate their own corn mills and also extend credit to farmers and non-farmers within their area of operation. Many own moderately sized transportation facilities, drying, and storage spaces which are often rented to other traders or farmers. In other instances, some traders indicated practicing their profession to augment income they derive from corn trading. These activities allow traders to mitigate possible income losses that may come from a sharp decline in corn prices.

The second handlers-corn assemblers and wholesalers. From the first handler, corn flows to other wholesalers operating at the provincial or regional level, the second handlers. Provincial or regional traders may buy corn directly from the farmers to obtain their corn supply, but most employ a number of municipal traders or assemblers as brokers or commission agents. Commission agents or brokers are generally, paid a commission or fee of ₱0.05-₱0.10 per kilogram, on average. Payments are usually made in cash upon delivery of the corn.

Municipal traders face fewer and larger provincial and regional corn buyers. They generally have contracts with 1 or 2 provincial and regional wholesalers to deliver a prespecified volume of corn which traders at the municipal consider in their buying operations at the farm.

Compared to their counterparts at the municipal level, provincial and regional corn traders tend to be better equipped and better financed. Their buying and trading operations span a wider geographical boundary oftentimes, covering several provinces across different regions

and therefore, are dependent on inter-island shipping to trade between regions. Like traders buying directly from farmers, trading boundaries of large wholesalers overlap. Thus, given that corn supply is relatively small, price competition among wholesalers would be high.

Seemingly, there are cost advantages incurred by the wholesalers in trading sizeable volumes of corn. Most provincial and regional corn traders handling large volumes of corn have their own trucking facilities, warehouses, and drying spaces. Most of these traders employ hired labor to carry out hauling/handling, drying, and other related marketing activities.

Wholesalers trading at the provincial or regional level store corn from one day to a maximum of two weeks or until adequate volume has been accumulated, prior to selling it to other wholesalers or corn processors. At this level, some corn is milled and sold in the form of grits. Milled corn is sold directly to consumers via retail centers owned or rented by many provincial or regional traders, but the proportion of the total volume sold in this form is small. The larger portion is sold to feed millers or livestock/poultry raisers who utilize milled corn as a major ingredient in their production operations.

5.3 Seasonality and Yearly Variations in the Farm-Retail Price Spreads of Corn

Typically, price spreads between points of the vertical channels of marketing are used as an indicator of market performance. Wide price bands may suggest the presence of serious market imperfections or high marketing and storage costs and that there are significant departures in prevailing market prices from competitively determined levels. To narrow the range of intertemporal variations in corn prices, corn prices have been stabilized at the farm and retail levels through price control programs, direct government purchase operations at the farm level, and regulation of imports.

In this section, margins between points of the marketing channel are estimated using secondary data of monthly farm, wholesale, and retail prices at major corn producing regions covering the 1980-1989 period. The monthly price series were obtained from the Policy Analysis Division, Department of Agriculture, Philippines. The estimated 10-year monthly averages of the farm, wholesale, and retail prices of white corn grains are graphically shown in Figure 5. 1. As would be expected, the farm-retail price bands across the major corn producing regions seem to widen starting in the third quarter of the year and tend to be widest in the last quarter, when corn supply is most abundant. A narrower farm-retail price band is observed for the first and second quarters when corn production is low. Given that monthly corn prices at the retail level are relatively stable over the 1980-1989 period, depressed corn prices at the farm level during the harvesting months would result in a large difference in farm-retail price spreads. During the lean months, the farm-retail price bands are narrower because corn prices at the farm are higher.

The widening of margins in some months and their narrowing in the other months suggest that profitable opportunities for intertemporal arbitrage exist. Positive returns from

storage may be earned by buying cheap corn during the harvest months of July to December and selling them during lean months of January to June when corn prices are high.

Interyear variations in the farm, wholesale, and retail prices for the 1980-1989 period are illustrated in Figure 5.2. It is observed that farm-retail margins have increased over the years. These large deviations in yearly margins may indicate that the costs of moving corn from the farm to consumption centers have increased during this period.

5.4 The Price Formation Process for Corn

Prices of corn are formed through the interaction of the buyers and sellers involved actively in the market. This section discusses the dynamic process of exchange between market agents in arriving at a transaction price for corn. Factors that affect the outcome of the market exchange are also discussed. Results presented here are also obtained from the March 1990 to July 1990 IFPRI.

5.4.1 Sources of Price Information and Market News

Pricing efficiency depends on the availability of accurate, reliable, and unbiased market information and the quick transmission of information between marketing points. As in other developing economies, information about prevailing corn prices and market conditions are relayed and transmitted across markets at low cost by word of mouth. Although available, publicly supported market information services are rarely used by farmers and traders as sources of information. As shown in Table 5.9, 74 percent of the sample farmers across the sample provinces used traders as their major source of information. About 14 percent of the sample farmers consulted other farmers about the prevailing market prices and for other relevant market news.

The use of print/audio media and prices posted at warehouses or buying stations of the National Food Authority (NFA) as information sources seems unpopular. Less than 5 percent of total sample farmers reporting indicated using these sources for market news. According to Dy (1988), there are several reasons why farmers do not use public market information. First, there seems to be a general distrust among farmers about the accuracy and reliability of information contained in publicly reported information sources. There is a general perception among rural farmers that public market reports are biased towards urban consumers. Second, reports are inaccessible or unavailable to most farmers, especially those located in the rural areas. And third, the delay in the release of information via the radio or printed market new bulletins has further discouraged farmers from relying on public services in their marketing decisions.

The heavy reliance of farmers on traders for price information has raised concerns among policymakers about the farmers exposure to possible exploitation by traders. Most past research of agricultural markets in the Philippines alledged that farmers exposure to price manipulation by traders is very high. This perception is pervasive and has largely influenced

agricultural commodity programs in the country. Programs on price tagging law, standardized weights and measures across agricultural commodities, grading, and collectivization of farmers to cooperatives are reflective of the government's effort to strengthen farmers bargaining position over traders.

Our results, however, suggest that evidence exists to the contrary, and although the opportunity to manipulate prices may exist in certain circumstances, it is not as large as popularly perceived. From Table 5.10, while only 37 percent of the sample farmers interviewed actively search several markets for prices prior to making a marketing decision where or whom to sell their corn, farmers' frequent involvement in corn trading and contact with several traders each season enables them to adequately read market signals and translate them into profits. As also mentioned in earlier sections, farmers often are contacted by other traders, i.e. "viajeros," with a higher offer price, so individual traders do not have strong leverage.

Traders, on the other hand, receive and transmit price information through their direct contact with other traders. In contrast to farmers, most traders search the markets for the best price. As shown in Table 5.11, two-thirds of the sample traders canvassed prices in other markets. Similarly, regular trading relationships between traders are established by mutual trust, so the possibility of price manipulation by larger traders over smaller traders may be small.

Larger traders obtain and monitor market information in major market centers and in the world market daily by telephone or radio communication. This information is then transmitted to other traders by word of mouth as forward contracts for the season are negotiated. The continuous transmission of information between market agents serves to efficiently link and integrate separated markets.

5.4.2 Factors Affecting Price Formation

According to 92 percent of the sample farmers, the prices they receive at first sale are set by the corn buyers (Table 5.12). Only seven percent of the sample corn farmers stated that corn prices are transacted through private negotiations (bargaining) and only one percent reported to specifying their selling price.

Although, this fact suggests the possible exercise of market power by the traders over the farmers, the opportunity to do so seems small. Results presented in Table 5.13 shows that farmers are knowledgeable about current market conditions. Nearly 75 percent of the sample corn farmers reported that the "prevailing market price" of corn is the most important factor in their marketing decisions. Only about 15 percent of the sample farmers indicated that their outstanding credit obligation with the traders affected their acceptance of the latter's offer price. The traditional "suki" system established by the farmers through a long, trusted trading relationship with a particular trader affected the pricing decisions of only 3 percent of the sample corn farmers reporting. As also noted above, farmers are contacted by one to four traders before selling indicating considerable competition.

Moisture content and grain purity are important determinants of corn prices. Of the sample corn farmers reporting, 67 percent ranked moisture content as the most important corn characteristic that affect corn price. Grain purity and age are ranked second and third by farmers in importance in corn pricing, respectively. Thus, while grain purity and moisture content are important determinants in corn prices, existing methods of drying, storage, and grading may be inadequate or too costly to ensure that the market demand for better quality corn grains are reflected back to the farm level. Seemingly, farmers response to price premiums for better quality grains may be very inelastic because, as farmers cited, they are able to sell even their poorest quality corn. In periods of low supply, traders on the other hand are compelled to accept poor quality corn to enable them to recover the credit they extended to farmers.

Although formal set of standards for grains exist, grading is commonly done by visual inspection or "feel" method. Rarely do traders use standard moisture meters in assessing moisture content of corn grains. Moreover, because the government set standards for grains of 14 percent moisture content and 98 percent purity are difficult to meet, traders do not strictly enforce them. Existing standards for moisture content and purity are set by traders below the government established levels. During periods of tight supply, traders tend to be lenient about grading corn and would buy from farmers "wet" corn at a discount ranging from about ₱0.05-₱0.10 per kilogram.

5.4.3 Credit Access and the Pricing Process: Does Oligopolistic Power Exist?

Traders are typically used by farmers as sources of credit to finance their production and marketing expenditures. Over half of the farmers in the sample borrowed money from traders. Generally, credit is made in advance and is in the form of cash or kind, i. e. seeds, fertilizers, and chemicals. The terms of credit, i. e., schedules for credit payment, maturity date, and amount of interest charges to be paid vary across sample farmers and across sample provinces.

The concern among policymakers about the use of traders by farmers as the major source of credit relates to the possible exposure of the later to exploitation by traders. The results, however, indicate that the opportunity to do so may be very small and, if it does exist, isolated. As shown in Table 5.15, corn moves out of storage slowly, about 10 days, on average, suggesting that farmers are not compelled to immediately sell their crops to the traders from whom they borrowed money. Across sample provinces, no significant differences in the length of storage is observed between farmers who used personal savings and those who borrow credit from traders. Inadequate warehouses and high costs of storage may, however, account for the large variation in length of storage within sample provinces.

Results also indicate that farm prices received by farmers who borrow from traders do not significantly differ from the farm prices of non-borrowers. Table 5.15 shows that average farm prices received by the farmers who borrow from traders are actually about ₱0.05/kg higher than farm prices received by non-borrowers, although this difference is not statistically significant. As indicated by the small standard deviations, corn prices at the farm level tend to

be uniform within spatial markets. These results provide further support to the contention that farm prices are competitively determined within geographic boundaries.

5.5 The Geographical Marketing Flow of Corn

Production and consumption points are linked through the arbitration activities of profit-seeking traders. Arbitrage is the activity of traders in purchasing commodities from a market with a low price and reselling in a market with a higher price. Interregional trading occurs if regional price differences exceed the cost of moving products between regions. As products flow between regions, information is continuously being transmitted, received, and interpreted. The efficiency of arbitrage in the full communication of information between markets ensures that prices between trading regions are aligned, after the cost of transportation is discounted. Non-uniform prices, after adjusting for the costs of arbitrage, could suggest the presence of serious imperfections in the market. Thus, knowledge of price relationships is important in evaluating the efficiency of arbitrage in integrating spatially separated markets and their implications on market performance.

This section describes the geographical flow of corn between regions. It provides the general framework used in modeling and testing spatial integration of regional corn markets in the Philippines.

5.5.1 Major Regional Corn Markets and Spatial Price Linkages

Corn is grown in geographically dispersed small farms located in the regions of Southern Tagalog, Cagayan Valley, Central Visayas, Northern Mindanao, Southern Mindanao, and Central Mindanao. On average, over 75 percent of the country's total corn supply is produced annually in these regions (Table 5.16). Approximately 75 percent of the country's total area harvested to corn are also concentrated in these regions (Table 5.17). Although corn prices are formed by the interaction of market agents trading in numerous local markets, it is the activity in markets in these regions that exert a considerable influence in the formation of corn price.

Among the major markets for corn, Manila and Cebu are the most important. Most of the corn produced in the Visayas and Mindanao regions are transported, via inter-island shipping, to Manila or Cebu. Most of the corn produced in Luzon are sold in Manila. Based on a variety of empirical evidence, the formation of corn prices in the local markets throughout the country is dominated by prices in Manila rather than Cebu. First, in negotiating their forward contracts with provincial or municipal corn assemblers/buyers, large wholesalers interviewed during the IFPRI survey in the Philippines have indicated that they generally set their prices based on the prevailing prices in Manila. Thus, the Manila corn price tends to lead the formation of corn prices in the local markets.

Second, Manila is the major port of loading and unloading of commodities for the inter-island trading of corn and most agricultural products in the country. In 1988, about 25 percent

of the total volume of domestically traded commodities go through Manila, and 13 percent go through Cebu, with the balance widely distributed across to Zamboanga and many smaller ports (NEDA). From Manila, commodities are also transshipped to deficit regions around the country. Changes in the market conditions in Manila, thus, would affect price variations in the other local markets.

Third, Manila is the center of commerce in the country, with particularly heavy concentration in the feed/livestock industry. Large companies, i.e. feed millers, corn processors, and poultry and hog raisers, have most of their processing plants concentrated in Manila. In 1985, over 85 percent of the total 123 feed mills in the country was located in or near Manila accounting for about 76 percent of total feed milling capacity. Of the feed mills in Luzon, 17 were in Metro Manila, 22 in Central Luzon, and 42 in Southern Tagalog. In 1987, feed mills in and around Manila accounted for over 85 percent of total feed milling capacity, (Costales as cited in Development Programs for the Livestock Sector of the Philippines). Many of these corporations also have their marketing bases centered around Manila. Manalaysay, Menegay, et al, found that buyers in the Manila area bought about 43 percent and 92 percent of the white and yellow corn grain produced in General Santos City in 1985-1986. Because the volume of their purchases is large, the buying and selling activities of corn of these large corporations, with marketing bases in Manila would significantly affect local corn prices.

Fourth, most of the country's internationally traded commodities also flows through Manila on their way to or from the international markets. In 1988, nearly 30 percent of the total volume of commodities from the foreign markets were unloaded in Manila and only five percent entered the country through the port of Cebu, (NEDA). Because of the close contact of Manila with the world market, changes in the world prices of corn would tend to be reflected first in Manila, and then, with some lags, in other markets. Manila is thus expected to lead all other markets in the formation of prices for corn.

Fifth, communications and market intelligence are also highly developed in Manila compared to other areas. The telecommunication network system in Manila is more extensive than that in other regions. Of the country's telephone communication and radio broadcasting stations, over 70 percent and 50 percent are concentrated in the National Capital Region, respectively, (NEDA). It is also in Manila where the Bureau of Agricultural Statistics (BAS), the nation's information agency for market news reporting and dissemination is located. Therefore, because of their better access to market information, corn buyers in Manila would be able to receive and transmit information more quickly than other traders in other regions.

5.6 Spatial Market Integration and the Efficiency of Arbitrage

5.6.1 Price Correlation Coefficient as a Measure of Spatial Market Integration

Calculation of the price correlation is the simplest statistical test of market integration. Price correlations involves the pairwise estimation of the correlation of cash (spot) prices of

undifferentiated goods between markets. In empirical application, high and statistically significant price correlation coefficients indicate close association between spot prices, suggesting that spatial markets are interdependent and integrated.

Estimates of price correlation coefficients between the major corn producing regions are presented here. Monthly wholesale prices of white corn grains and yellow corn grains in Manila, Cagayan Valley, Central Visayas, Southern Mindanao, Central Mindanao, and Northern Mindanao are used in the calculation of the price correlation coefficients. However, because of the numerous missing values in the monthly wholesale prices of yellow corn in Central Mindanao, this region was dropped from the analysis of yellow corn. The analysis covered the period 1980-1989. The data were obtained from the Policy Analysis Division, Department of Agriculture (DA), Philippines.

Price correlation coefficients were estimated separately for yellow corn and white corn grain. For reasons mentioned in the earlier section, the formation of corn prices is postulated to center around Manila and price changes in Manila are hypothesized to significantly affect prices in the rural markets in Cagayan Valley, Central Visayas, Northern Mindanao, Southern Mindanao, and Central Mindanao. Prices in Central Visayas (the second most important corn market in the country) were used in the absence of price quotations for white corn in Manila.

Results presented in Table 5.18 and 5.19 show the price correlations between regional markets for yellow and white corn. They are generally high, with most estimates exceeding 0.90. These suggest that prices between the urban market centers of Manila for yellow corn and Central Visayas for white corn and the rural markets are highly related and that these markets are well connected.

The use of price correlations as a measure of market integration have been seriously criticized by many studies, (Blyn; Harriss). Because of numerous inherent statistical problems in the data, i.e., time dependent price series (non-stationarity) and spurious correlations between pairs of prices arising from severe multicollinearity and serial correlation problems, inferences about market integration derived from estimates of price correlation coefficients may be incorrect. Measures of price correlations do not provide information about the dynamics, i.e., lead and lag relationships and direction of price formation between differentiated markets. They also are unable to quantify the impact of exogenous shocks on corn prices in one market on those in another market.

5.6.2 Cointegration Tests as a Better Measure of Spatial Market Integration

Recent studies on market integration have focused on alternative and better approaches to testing spatial market integration, the cointegration tests, because they correct for some of the weaknesses of price correlation. Intuitively, cointegration implies that price changes in one market are matched by price changes in another market and in the long run, price differences between trading regions equal the costs of spatial arbitrage (Engle and Granger). Cointegration thus suggests that the arbitration activities of traders are efficient in linking separated markets.

Given two price series in two regions, X^k and X^j, region k not equal to region j, the cointegration regression can be written mathematically as:

$$X_t^i = \beta X_t^j + \mu_t$$

X^k and X^j are the logarithm of the first differences of prices or price changes in region k and region j. The last term μ_t measures the magnitude of divergence between price changes X^k and X^j at each period t. From the definition of cointegration above, it then follows from equation (1) that μ_t is zero for X^k and X^j to converge to an equilibrium. The coefficient, β, is the cointegrating parameter between the contemporary pairs of prices.

The cointegrating regressions were estimated separately for wholesale prices of yellow and white corn across the major corn producing regions. For yellow corn, the cointegration tests in equation (1) were conducted with Manila as the central market and Cayagan Valley, Northern Mindanao, Southern Mindanao, and Central Mindanao as rural markets. For white corn, the tests were done with Central Visayas as the central market and the rural markets are as previously defined.

The estimation procedure uses two steps. The first stage involves estimating equation (1) for each of the pairs of the monthly wholesale price changes for yellow corn and white corn across regions using ordinary least squares. The second stage of the cointegration tests consists of a series of tests on the residuals obtained from the regression equation in (1).

To test for cointegration, 4 cointegrating regressions were estimated (Nachane, et al.). The first and quick approximation of the presence of cointegration involves the use of the cointegrating regression DW test (CRDW). The CRDW statistic is obtained from the ordinary least squares (OLS) estimation of the cointegrating regression in equation (1). A significant non-zero CRDW statistic would indicate cointegration. Other tests included the Dickey-Fuller (DF) test and the Augmented Dickey-Fuller (ADF) test. The DF test involved regressing contemporaneous residuals obtained from equation (1) against the previous month's residuals. The ADF is essentially the DF test but modified to include lagged values of 1 month and 4 months of the difference in residuals calculated from equation (1).

Table 5.20 contains the results of the cointegration tests. Results show that the null hypothesis of non-cointegration between the central markets and rural markets is rejected at conventional levels of significance for both yellow corn and white corn. Overall, these results strongly indicate that price changes in the rural markets are cointegrated with price changes in the central markets and that arbitrage is efficient in linking spatially separated markets.

5.6.3 The Dynamics of Spatial Market Integration of Corn: A Bivariate Exponential Autoregressive Conditional Heteroskedasticity (ARCH) Model

While the tests of cointegration presented in the previous section are able to verify the existence of a stable long-run relationship exists between pairs of regional prices, they are unable

to provide indications of the direction of causality between cointegrating markets nor are they able to quantify the strength of the causal relationship. In this section, the autoregressive conditional heteroskedasticity (ARCH) model of the spatial relationship between markets is developed.

The ARCH modelling procedure takes into account the fact that the assumptions of normality and constant variance in price distributions are false in agricultural commodity market. The violation of these assumptions renders standard statistical tests invalid since standard errors tend to be biased. Thus, inferences about market efficiency drawn from tests which assume normality and constant variance may be incorrect.

Diagnostic checking of the violation of the normality and homoskedasticity assumptions. Measure of kurtosis and skewness were used in testing non-normality in price distribution. If the relative kurtosis statistic exceeds 3, the price distribution is leptokurtic (non-normal), i.e., more observation on the extreme tail than normal. If the relative skewness is zero, the price distribution is symmetric, i.e., a bell-shaped distribution.

To test for non-constant variance, the Lagrange multiplier test was used. The test is conducted by regressing contemporaneous squared residuals against past realizations of the squared residuals at various lags. In this study, the lag structure used is 1 to 8. A Lagrange multiplier statistic exceeding the critical Chi-square value at conventional significance levels would indicate a heteroskedastic variance.

The bivariate exponential ARCH model. A bivariate exponential extension of the autoregressive conditional heteroskedasticity (ARCH) model developed by Engle was used in analyzing separately the spatial integration for yellow corn and white corn wholesale markets. The bivariate exponential ARCH model used is expressed mathematically as:

$$\sum_{k=1}^{2} P_{tk} + \sum_{i=1}^{2} \sum_{j=0}^{s} \beta_i P_{it-j} + \sum_{l=1}^{11} \delta_l D + \sum_{k=1}^{2} E_{tk} \qquad (2)$$

where P_{tk} is a 2 x 1 vector of the stochastic process of the monthly wholesale price changes in the rural markets k, $k=1, 2, 3, 4$ where 1 is Cagayan Valley, 2 is Northern Mindanao, 3 is Central Mindanao, and 4 is Southern Mindanao. The term P_{it-j} are the lagged endogenous variables of monthly wholesale price changes in the central markets $i=1, 2$, where 1 is Manila for yellow corn and 2 is Central Visayas for white corn, and j is the autoregressive process of order one month.

Seasonality in corn supply attributed to the biological nature of corn production is incorporated using 11 monthly binary variables, D.

The random shock E_{tk}, conditional on all past information contained in set θ_{t-1} is normally distributed with zero mean and follows an ARCH (p) process with conditional variance, h^2_{tk}:

$$(E_{tk} \mid \theta_{t-1}) = N(0, h_t^2) \tag{3}$$

$$\sum_{k=1}^{2} h_{tk}^2 = \sum_{k=1}^{2} \delta_{0k} + \sum_{k=1}^{2} \sum_{q=0}^{p} \delta_{kq} \, e_{tk-q}^2 \tag{4}$$

where h^2_{tk}, the conditional variance, is a linear function of past realizations of squared residuals, e^2_{tk-q}, in both central and rural markets and p is the order of the ARCH process. By this definition, equation (4) is able to capture the volatility clustering characteristic of series that exhibit an ARCH (q) effect. Variances are constant or homoskedastic, if $p=0$. For convergence, the non-negativity restriction of Engle on the parameters δ_{kq}, q=0,...p is not imposed. Instead, the predicted values of squared of past disturbances are restricted to be positive by using their exponential values, thus, the model is a bivariate exponential ARCH.

Equation (3) is estimated using a two-stage generalized least squares (GLS). Parameter estimates from a two-stage GLS procedure are also maximum likelihood and therefore, BLUE. The first stage involves estimating equation (3), the conditional mean equation, and obtaining the residuals. From the residuals generated from equation (3), consistent estimates of δ_{kq} were derived and on this basis, efficient estimates of equation (4) were again derived.

Granger causality test. Granger causality test is used to determine the direction of causal dependence between the central market and the rural markets. This test is applied separately for yellow corn grain and white corn grain using equation (3). The test statistic is distributed as an F statistic with (s, N-s-1) degrees of freedom. A significant F statistic in both directions of causation would indicate a feedback relationship and market leadership, if otherwise. Instantaneous causality is conducted by adding current values of price changes in market i, i not equal to j, and the test proceeds as in Granger causality testing.

The cross long-run dynamic multipliers. Long-run multipliers provides a measure of the magnitude and speed of price adjustments to new information between markets. To determine the impact of monthly wholesale price changes in the central market on the monthly wholesale price changes in the rural markets in a steady state, the long-run multipliers (LRM) were calculated as:

$$LRM_{kl} = \lim_{h \to \infty} \frac{\partial \, E[P_l \, (t+h)]}{\partial \mu_k(t)} \tag{5}$$

Of most interest are the numerical values of the cross LRM multipliers. Cross LRM quantifies the magnitude of the influence of price changes on forecasts of price changes in market i, i not equal to j, and is used here as a measure of market integration. If the cross LRM is positive and significantly different from zero, then markets can be considered as spatially integrated and if zero, markets are segmented or independent. Our definition differs from

Ravallion wherein he defined markets to be spatially integrated, if and only if, the long-run multiplier is positive and unitary.

The price series used. Available monthly wholesale prices of white and yellow corn in six geographically dispersed major regional corn trading centers in the Philippines. Regional prices are reported as average prices of the largest volume markets for corn in the region and thus, are accurate representation of market demand and supply conditions.

For yellow corn, monthly wholesale prices were collected for five major corn markets including Manila, Cagayan Valley, Northern Mindanao, Southern Mindanao, and Central Mindanao. For white corn, monthly wholesale prices in Cagayan Valley, Central Visayas, Northern Mindanao, and Southern Mindanao were used. Because monthly wholesale price quotations for white corn were not available for Manila, monthly wholesale prices in Central Visayas were used instead. Central Mindanao was again dropped from the analysis for yellow corn because of numerous missing values.

During the 1980-1989 period of this analysis, significant structural changes in the economy occurred that may cause the non-normal distribution of corn prices with non-constant variance. Among the changes was the drastic reduction in the volume of corn imported from an average of over 10 percent in 1980-1983 to less than 1 percent from 1984-1989. Changes in the volume of imports and timeliness of release influence domestic prices by affecting locally available supply. Another significant change that occurred in the Philippine corn market is the dramatic increase in the control price of corn from a low level of P1.40 per kilogram in 1980 to P4.50 per kilogram in 1989. These factors, and the general economic instability in the country in the mid-1980s could cause the postulated time-varying variance and observed ARCH effect to be significant.

The dynamics of price discovery between spatial markets and implications on market integration. Results of the tests of normality indicate that the monthly wholesale price changes of yellow corn and white corn across regions are non-normal (Table 5.21). Measures of kurtosis are less than 3.0, suggesting a thin-tailed or playtykurtic distribution. The relative skewness coefficients are mostly significantly different from 0.0, indicating asymmetric distributions.

Furthermore, estimates of the Lagrange multiplier test are greater than the critical Chi-square values at 10 percent level of significance, indicating the presence of the ARCH (Table 5.22).

Results of the Granger causality tests are presented separately in Table 5.23 for yellow corn and Table 5.24 for white corn. The first column indicates the direction of causality between pairs of price series, with the market on the left side of the arrow leading the market on the right. Results of tests of the unidirectional, feedback or instantaneous causal dependence between pairs of price series are reported in the next three columns. Estimates of the long-run multipliers and periods of adjustments are provided in the last two columns of the tables. The

period of adjustment (measured here in months) quantifies the amount of time it takes for information to be transmitted fully from one market to the other markets.

From Table 5.2, the findings provide evidence of a price leadership for the Philippine yellow corn market, with Manila as price leader. Results of the Granger causality tests are highly significant for the (unidirectional) direction of impact coming from Manila to the rural markets of Cagayan Valley, Southern Mindanao, Central Mindanao and Northern Mindanao.

No feedback relationships from the rural markets to Manila were observed, indicating that price changes in the rural markets in Cagayan Valley, Southern Mindanao, Central Mindanao, and Northern Mindanao do not have an effect on price changes in the central market of Manila. These results confirm our hypothesis that, because of its commercial importance in corn trading and relative size of volume traded, Manila is central to the local price formation for yellow corn.

Generally, results obtained from estimates of the cross long-run multiplier for the yellow corn markets suggest that wholesale price changes in the Manila market exert a positive and significant effects on wholesale price changes in the rural markets. A positive and significant cross LRM means that changes in the wholesale prices of yellow corn in Manila are transmitted to wholesale price changes in the other regions, with price adjustments between markets occurring in the same direction. These results indicate that the wholesale markets in the Cagayan Valley, Southern Mindanao, and Northern Mindanao are spatially integrated with Manila.

Estimates of the cross LRM also indicates that the price adjustments to new information between markets are incomplete. Cross LRM multipliers obtained for all equations are less than unitary. For instance, a one peso (₱1.00) increase in the wholesale price of yellow corn in Manila will increase wholesale price of yellow corn in Northern Mindanao by nearly ₱0.61.

Our results also show that price adjustments to new information between geographic markets are non-instantaneous. It takes a month to two months for wholesale prices in the rural markets to adjust to changes in wholesale prices in Manila. Since the data series used in this study are monthly prices, causality from Manila to the rural markets with a causal lag shorter than a month may show up as an instantaneous causality. On this basis, it would be reasonable to presume that an instantaneous relationship and a zero cross LRM, between markets is indicative of a short-term (less than a month) unidirectional impact of Manila on the rural markets for yellow corn.

It is also evident from Table 5.23 that the period of price adjustments are quicker between markets that are close together than between those located farther apart. For example, it takes less than a month for full information from Manila to be passed on to Cagayan Valley. In contrast, it takes about one to two months for information in Manila to be transmitted to Southern Mindanao, Northern Mindanao and Central Mindanao. This may be because of the time needed to transport corn between Manila and these markets since Manila is connected with

ports in Southern Mindanao, Northern Mindanao and Central Mindanao via inter-island shipping. For this reason, disequilibrium may be observed to persist for a longer period of time.

Results of the Granger causality testing and cross long-run multipliers for the monthly price changes of white corn are reported in Table 5.24. No causal relationship were observed between Cagayan Valley and Central Visayas markets indicating that these two trading centers are independent or segmented markets. Cagayan Valley is located in the northernmost part of the Luzon island and Central Visayas is located farther down south of the Visayas region. Thus, because of the considerable distance and high transportation cost of shipping corn between these regions, trading between Cagayan Valley and Central Visayas may be limited. Estimates of the cross long-run multiplier provide further evidence supporting this non-causal relationship. In both direction of impact, i.e., from Cagayan Valley to Central Visayas and the reverse, the cross long-run multipliers were statistically non-significant or zero.

Model validation of the bivariate exponential arch model of spatial integration. To validate the bivariate exponential ARCH (8) model used here, the rescaled data series were checked for non-normality. These results, shown in Table 5.25, indicate that the bivariate exponential ARCH (8) model is unable to model the observed skewness and kurtosis in the price series used. These findings are comparable with those found in other similar studies (Yang; Bollerslev, et al; Lastrapes; Mendoza). Similarly, the results show that estimated skewness for the rescaled monthly wholesale price changes of white corn and yellow corn are still statistically significant indicating asymmetric distribution. In many cases, measures of relative skewness are unchanged. Leptokurticity also remains a dominant factor in the non-normal distribution of the monthly wholesale price changes and was accentuated in some cases, particularly for yellow corn. These results may be due to the high volatility in wholesale prices of yellow and white corn during the 1980s period considered in the analysis. Measures of kurtosis are highly sensitive to the presence of outliers in the data series.

5.7 Conclusion and Implications of the Study

The analysis indicates a considerable degree of spatial integration of regional corn markets in the Philippines. Cross long-run multipliers obtained are positive and statistically significant, indicating that information about price changes in the central markets are transmitted to the rural markets.

Empirical results obtained from the Granger causality testing confirm the hypothesis that changes in the monthly wholesale corn prices in the central markets of Manila, for yellow corn, and Central Visayas, for white corn, lead and exert large (about twice in magnitude) and significant influences on price changes in the rural markets. These results suggest that price changes in the rural markets are more highly sensitive to exogenous market shocks transmitted from the urban markets, arising from changes in supply and demand conditions, than to local shocks. Reverse causation from the rural markets to the central markets does not hold, indicating that price changes in the rural markets do not have a significant influence on corn pricing in the urban terminal markets.

The degree of spatial integration between markets is, however, imperfect. Spatial price adjustments between the central markets and rural markets are seldom instantaneous, indicating that there may profitable arbitrage opportunities to be exploited by knowledgeable market agents. It usually takes about 1-2 months for price changes in the rural markets to adjust to exogenous shocks in the central market.

The results also show that rural corn traders do not fully and completely respond to price changes in the central markets. Estimates of cross long-run multipliers are less than unitary. These results suggest that structural market rigidities that impair the complete communication of information between markets may exist.

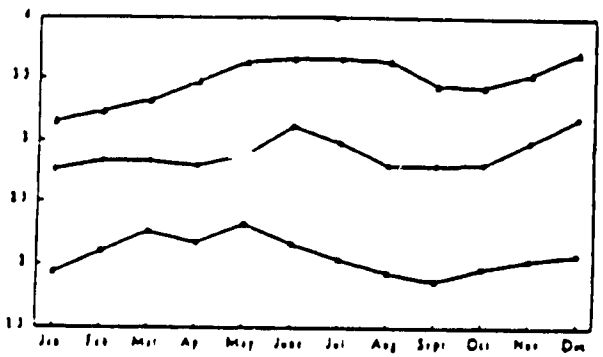
Furthermore, price adjustments between markets located farther apart tend to be slower than between markets in close proximity. High costs of transportation and the time required to ship corn between islands may contribute to the inefficiency of arbitrage in equilibrating prices between spatial markets.

The results of the bivariate exponential ARCH model are consistent with results obtained from the IFPRI field survey conducted in selected major corn producing regions in the Philippines. Results of the survey show that there are relatively many corn farmers and traders buying and selling within a geographical market area, indicating a competitive market structure. Because of the heavy reliance of traders on farm supply for corn, prices would tend to be competitively determined. One trader is likely to match the other traders' price, thereby narrowing the range of deviations between prices.

Prevailing market prices are cited as an important factor in corn pricing. However, the high costs of transportation and poor farm-to-market roads impair the rapid and complete transmission of relevant information in the efficient discovery of prices between markets. Furthermore, while moisture content and purity are important determinants in corn pricing, inadequate and high costs of drying and storing impede the demand for better quality corn to be reflected back to the producers level. There is little price differentiation between different quality grains as indicated by very small standard deviations in prices obtained.

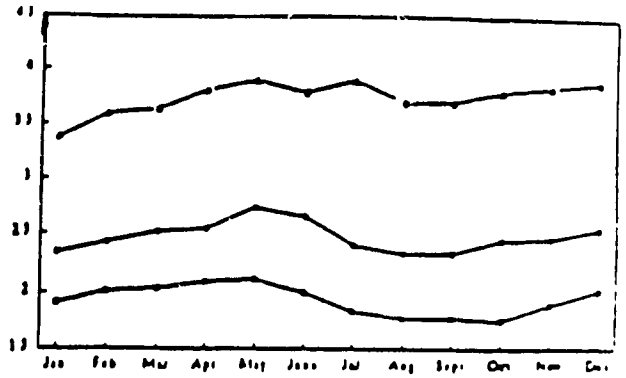
Overall, the empirical results of our study indicate that there are benefits to developing better infrastructure facilities to link production centers to market centers and in improving publicly available market information. Marketing costs could be significantly reduced if better roads and much needed marketing facilities were built. Improvements in the methods of collecting and disseminating public market information could increase the ability of market agents to better predict price behavior across spatial markets and thus, enable them to explore opportunities for profitable arbitrage. These improvements are expected to promote a more efficient price discovery process and market performance by enhancing market competition.

Figure 5.1 Seasonal variation in the monthly farm-wholesale-retail price spreads of white corn grain in selected major corn producing regions, Philippines, January 1980-December 1989



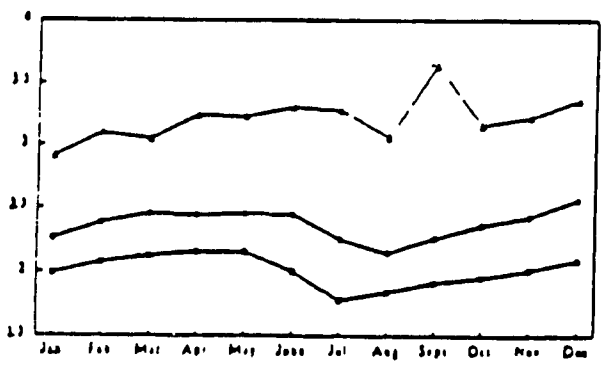
Month

Central Visayas



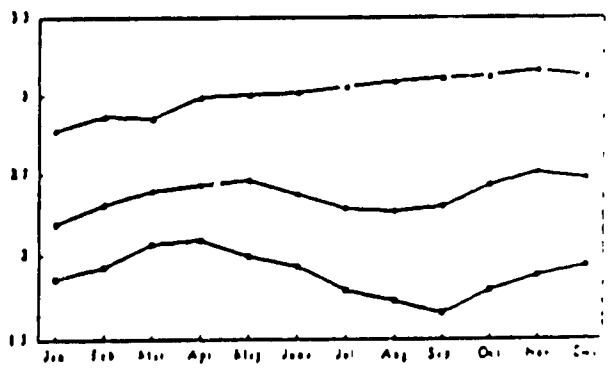
Month

Southern Mindanao



Month

Northern Mindanao



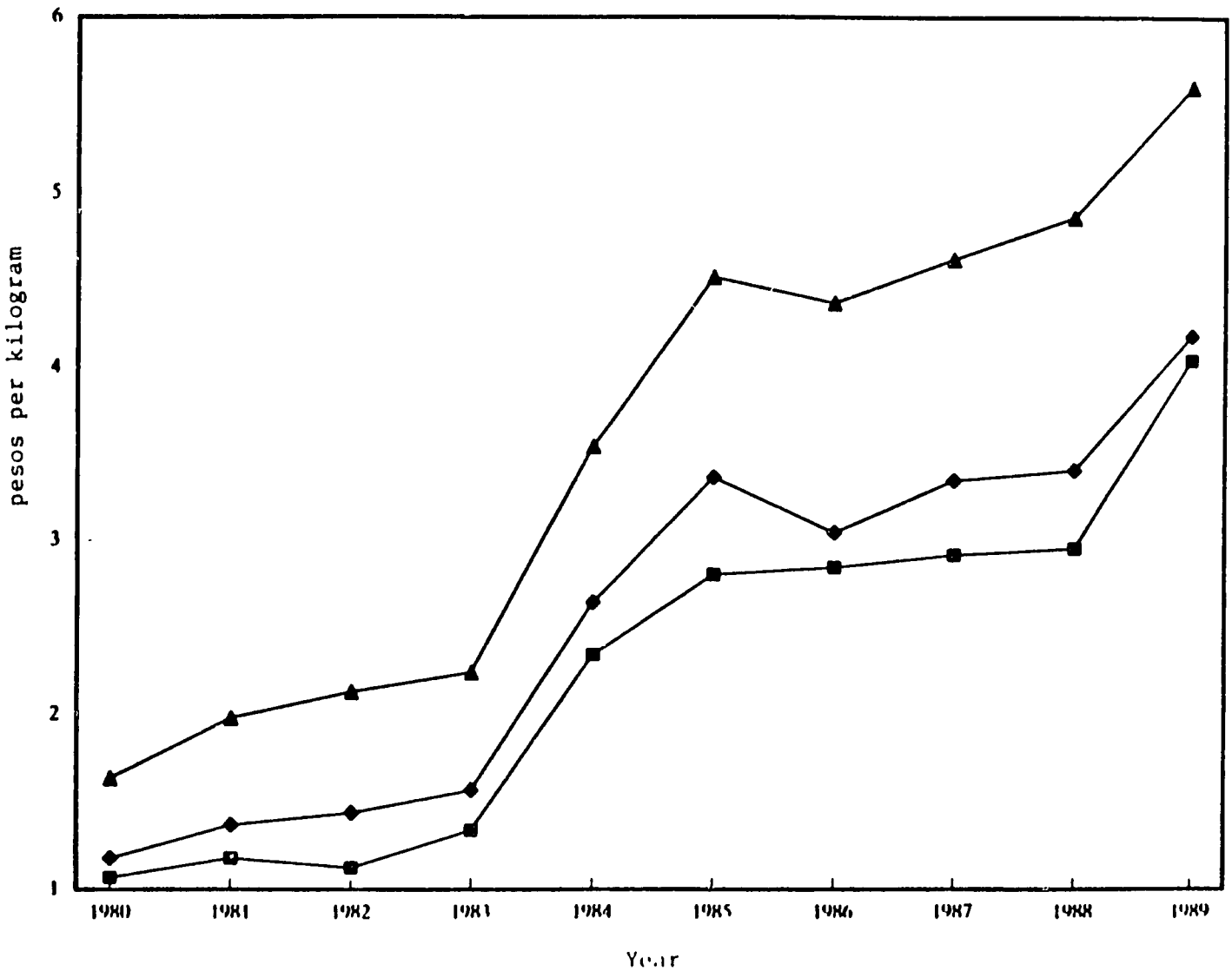
Month

Central Mindanao

Legend: Top lines represent retail prices.
Middle lines represent wholesale prices.
Bottom lines represent farm prices.

Source of basic data: PMS, Department of Agriculture, Philippines.

Figure 5.2 Yearly variation in the farm-wholesale-retail price spreads of white corn grain, Philippines, 1980-1989



Legend: Top line represents retail price.
Middle line represents wholesale price.
Bottom line represents farm price.

Source of basic data: PMS, Department of Agriculture, Philippines.

Table 5.1 General characteristics of sample corn farmers, 5 sample provinces, Philippines

Item	Sample Provinces											
	Bukidnon		Davao		Isabela		Nueva Viscaya		South Cotabato		Total	
Average farm size (has)	5.82		2.82		2.29		3.30		2.90		3.37	
No. of croppings												
1	36	(20)	2	(10)	234	(79)	22	(42)	29	(10)	323	(39)
2	144	(80)	18	(86)	46	(16)	24	(46)	210	(75)	442	(54)
3	1	[a]	1	(4)	15	(5)	6	(12)	40	(15)	63	(7)
Total	181	(100)	21	(100)	295	(100)	521	(100)	279	(100)	828	(100)
Quantity marketed (kg/ha)[b]												
≤ 60	117	(39)	24	(69)	283	(100)	42	(52)	298	(67)	764	(67)
61-100	31	(10)	-		-		39	(48)	93	(21)	163	(14)
> 101	153	(51)	11	(31)	-		-		53	(12)	217	(19)
Total	301	(100)	35	(100)	283	(100)	81	(100)	444	(100)	1144	(100)

[a] Less than one percent.

[b] Volume harvested and marketed are not averages per cropping, thus, number of farmers reporting may exceed total sample size.

Figures in parentheses are percent of sample farmers reporting to total.

Source: IFPRI survey

Table 5.2 Volume of corn stored for various purposes and length of storage, 5 sample provinces, Philippines

Purpose for storing	Sample Provinces					
	Bukidnon	Davao	Isabela	Nueva Viscaya	South Cotabato	Total
	---------- Amount Stored (kg) ----------					
For consumption[a]	2-200[c] (88)	10-20 (5)	2-3 (3)	-	2-30 (19)	(115)
For later sale[b]	5-350 (17)	-	5-1000 (49)	-	10-500 (16)	(197)
For feed use[b]	1-10 (19)	3 (1)	1-20 (55)	1-21 (7)	2-70 (32)	(114)
Length of storage (range)	1 day-5 mos.	2 days-4 mos.	4 days-7 mos.	1 day-4 mos.	1 day-5 mos.	-
Total no. reporting storage	124	6	107	7	67	275

[a] In cobs.

[b] Shelled corn.

[c] Quantity of corn stored are in ranges.

Figures in parentheses are number of farmers reporting.

Source: IFPRI survey

Table 5.3 Distance from farm to local market reported by sample farmer respondents, 5 sample provinces, Philippines

Farm to market distance (kms.)	Sample Provinces										Total	
	Bukidnon		Davao		Isabela		Nueva Viscaya		South Cotabato			
≤ 11	123	(78)	18	(100)	187	(76)	47	(87)	212	(63)	587	(73)
12-30	15	(10)	-		49	(20)	6	(13)	15	(5)	85	(11)
≥ 31	19	(12)	-		5	(4)	-		108	(32)	132	(16)
Total	157	(100)	18	(100)	241	(100)	53	(100)	335	(100	804	(100)

- = No response recorded.

Figures in parentheses are percent of sample farmers reporting to total.

Source: IFPRI survey

Table 5.4 Number of buyers contacted by farmers prior to first sale and number of buyers in the area, 5 sample provinces, Philippines

Item	Sample Provinces										Total	
	Bukidnon		Davao		Isabela		Nueva Viscaya		South Cotabato			
	Number of Farmers Reporting											
Number of buyers contacted prior to first sale												
1	18	(22)	-		8	(7)	-		19	(16)	45	(13)
2- 4	48	(59)	2	(100)	86	(80)	21	(91)	88	(76)	245	(74)
5-10	16	(19)	-		13	(13)	2	(9)	14	(8)	45	(13)
Total	82	(100)	2	(100)	107	(100)	23	(100)	116	(100)	335	(100)
Number of buyers in the area												
1	4	(6)	-		6	(7)	-		7	(7)	17	(6)
2- 4	16	(23)	-		26	(31)	2	(11)	19	(18)	63	(22)
5-10	50	(71)	2	(100)	53	(61)	17	(89)	80	(75)	202	(72)
Total	70	(100)	2	(100)	85	(100)	19	(100)	106	(100)	282	(100)

- = No response recorded.

Figures in parentheses are percent of sample farmers reporting to total.

Source: IFPRI survey

Table 5.5 Methods of contact by farmers of traders to whom to sell corn, 5 sample provinces, Philippines

How are buyers contacted by farmers?	Sample Provinces: Bukidnon		Davao		Isabela		Nueva Viscaya		South Cotabato		Total	
	Number of Farmers Reporting											
"Farmers look for buyers"	13	(8)	5	(25)	58	(23)	23	(8)	-		99	(12)
"Buyers come to farmers"	152	(92)	15	(75)	190	(77)	278	(92)	62	(100	694	(86)
Total number of farmers reporting	172	(100)	20	(100)	248	(100)	301	(100)	62	(100)	803	(100)
No. of farmers not reporting	9		1		47		34		2		93	

- = No response recorded.

Responses in column 1 are direct quotations from the survey questionnaires.

Figures in parentheses are percent of sample farmers reporting to total.

Source: IFPRI survey

Table 5.6 Corn millers as an alternative market outlet for farmers, 5 sample provinces, Philippines

Easy to sell to millers?	Sample Provinces: Bukidnon		Davao		Isabela		Nueva Viscaya		South Cotabato		Total	
	Number of Farmers Reporting											
No	73	(56)	8	(62)	224	(97)	-		127	(60)	432	(74)
Yes	57	(44)	5	(38)	8	(3)	-		85	(40)	155	(26)
Total	130	(100)	13	(100)	232	(100)	-		212	(100)	587	(100)

- = No response recorded.

Figures in parentheses are percent of sample farmers reporting to total.

Source: IFPRI survey

Table 5.7 General characteristics of sample corn traders, 4 sample provinces, Philippines

Item	Sample Provinces								Total	
	Bukidnon		Davao		Isabela		South Cotabato			
	Number of Traders Reporting									
Ownership										
Single proprietorship	5	(83)	13	(72)	20	(87)	37	(95)	75	(87)
Family business	-		-		-		-		-	
Corporation	-		5	(28)	-		-		5	(6)
Other/No Response	1	(7)	0	(-)	3	(13)	2	(5)	6	(7)
Full-time	2	(33)	3	(17)	4	(17)	-		9	(11)
Part-time	4	(67)	15	(83)	18	(78)	36	(92)	73	(89)
Other/No Response	0	(-)	0	(-)	1	(5)	3	(8)	4	(5)
Total	6	(100)	18	(100)	23	(100)	39	(100)	86	(100)

- = No response recorded.

Figures in parentheses are percent of sample traders reporting to total.

Source: IFPRI survey

Table 5.8 Number of traders who admitted to mixing different quality of corn, 4 sample provinces, Philippines

Item	Sample Provinces: Bukidnon		Davao		Isabela		South Cotabato		Total	
	Number of Traders Reporting									
Do traders mix different quality grains?										
No	7	(30)	6	(40)	13	(56)	12	(29)	38	(37)
Yes	16	(70)	9	(60)	10	(44)	19	(71)	63	(63)
Total	23	(100)	15	(100)	23	(100)	41	(100)	102	(100)

- = No response recorded.

Figures in parentheses are percent of sample traders reporting to total.

Source: IFPRI survey

Table 5.9 Source of price information used by farmers, 5 sample provinces, Philippines

Source of price information	Sample Provinces: Bukidnon		Davao		Isabela		Nueva Viscaya		South Cotabato		Total	
	Number of Farmers Reporting[a]											
Trader	98	(52)	9	(90)	252	(98)	55	(75)	215	(66)	629	(74)
Media	13	(7)	1	(10)	3	(2)	-		6	(2)	23	(3)
NFA	4	(2)	-		-		-		7	(2)	11	(*)
Other farmers	39	(21)	-		1	(*)	16	(25)	61	(19)	117	(14)
Out of town buyer	36	(18)	-		-		-		37	(11)	73	(9)
Total	190	(100)	10	(100)	256	(100)	71	(100)	326	(100)	853	(100)

Figures in parenthesis are percent of sample farmers reporting to total.

- = No response recorded.

[a] Multiple responses.

* Less than one percent.

Source: IFPRI survey

Table 5.10 Number of farmers reporting to conducting a price search among markets prior to first sale, 5 major sample provinces, Philippines

Do farmers search for "better" price prior to sale?	Sample Provinces: Bukidnon		Davao		Isabela		Nueva Viscaya		South Cotabato		Total	
	Number of Farmers Reporting											
No	77	(48)	16	(89)	188	(69)	39	(61)	201	(53)	521	(63)
Yes	84	(52)	2	(11)	85	(31)	25	(39)	112	(47	308	(37)
Total	161	(100)	18	(100)	273	(100)	64	(100)	313	(100)	829	(100)

Figures in parentheses are percent of sample farmers reporting in total.

Source: IFPRI survey

Table 5.11 Factors affecting the traders' selling price, 4 sample provinces, Philippines

Do traders search for a better offer price prior to sale?	Sample Provinces: Bukidnon		Davao		Isabela		South Cotabato		Total	
	Number of Traders Reporting									
No	9	(26)	8	(47)	11	(55)	6	(16)	34	(34)
Yes	16	(64)	9	(53)	9	(45)	31	(84)	65	(66)
Total	25	(100)	17	(100)	20	(100)	37	(100)	99	(100)

Figures in parentheses are parent of farmers reporting to total.

Source: IFPRI survey

Table 5.12 **Who sets the price, according to farmers, 5 sample provinces, Philippines**

Price Setter	Sample Provinces: Bukidnon		Davao		Isabela		Nueva Viscaya		South Cotabato		Total	
	Number of Farmers Reporting											
Buyer	152	(92)	20	(100)	217	(86)	46	(99)	288	(98)	723	(92)
Farmer	1	(1)	0		2	(1)	0		0		3	(1)
Private negotiation	13	(7)	0		32	(13)	4	(1)	7	(2)	56	(7)
Total	166	(100)	20	(100)	251	(100)	50	(100)	295	(100	782	(100)

Figures in parentheses are percent of sample farmers reporting to total.

Source: IFPRI survey

Table 5.13 **Factors considered important by farmers in corn pricing, 5 sample provinces, Philippines**

Factors considered in corn pricing	Sample Provinces: Bukidnon		Davao		Isabela		Nueva Viscaya		South Cotabato		Total	
	Number of Farmers Reporting[a]											
Prevailing market price[b]	130	(75)	8	(40)	249	(89)	64	(100)	187	(71)	638	(79)
Grain quality	16	(9)	7	(35)	13	(5)	-		27	(10)	63	(8)
Goodwill relation between farmers and traders	10	(6)	3	(15)	-		-		3	(1)	16	(2)
Outstanding credit obligation of farmers with traders	14	(8)	-		17	(6)	-		42	(17)	73	(9)
NFA price	1	(*)	-		1	(*)	-		3	(1)	5	(1)
Transportation cost	3	(2)	2	(10)	1	(*)	-		3	(1)	9	(1)
Total	174	(100)	20	(100)	281	(100)	64	(100)	265	(100)	804	(100)

Figures in parentheses are percent of sample farmers reporting to total.

[a] Multiple responses.

[b] Also includes number of farmers reporting "better price" as a factor considered pricing.

* Less than 1 percent.

Source: IFPRI survey

Table 5.14 Factors affecting the traders' selling price, 4 sample provinces, Philippines

Factors affecting selling price of trader to next buyer	Sample Provinces: Bukidnon		Davao		Isabela		South Cotabato		Total	
	Number of Traders Reporting									
Prevailing price	15	(63)	12	(86)	17	(77)	25	(68)	69	(71)
Past price	-		-		1	(5)	1	(3)	2	(2)
Quality	6	(25)	1	(7)	2	(9)	8	(22)	17	(18)
Goodwill relationship with buyer	-		1	(7)	2	(9)	2	(5)	5	(5)
Transportation cost	-		-		-		-		-	
NFA set price	1	(4)	-		-		-		1	(1)
Credit obligation with buyer	2	(8)	-		-		1	(3)	3	(3)
Total	24	(100)	14	(100)	22	(100)	37	(100)	97	(100)

- = No response recorded.

Figures in parentheses are percent of sample traders reporting to total.

Table 5.15 **Average differences in farm prices received by farmers who borrowed credit from informal sources and farmers who used personal savings to finance production expenses, 5 sample provinces, Philippines**

Sample Provinces/ Items	Sources of Funds[a] Personal Savings (1)	Traders (2)	Average Differences (1) - (2)
Bukidnon			
No. of farmers reporting	76	65	-
Storage period (in days)			
$\bar{x}$ [b]	10	11	-1
s[c]	12.51	14.70	18.98
Farm price (P/kg)			
First cropping			
$\bar{x}$	3.72	3.74	-0.02[ns]
s	0.86	0.89	1.24
Second cropping			
$\bar{x}$	4.00	4.00	0.00
s	0.76	0.74	0.00
Davao			
No. of farmers reporting	13	4	-
Storage period (in days)			
$\bar{x}$	18	10	8
s	14.18	10.65	13.71
Farm price (P/kg)			
First cropping			
$\bar{x}$	4.72	3.37	1.35***
s	0.19	1.24	1.24
Second cropping			
$\bar{x}$	4.18	4.18	0.00
s	1.32	1.32	0.00

Table 5.15 (cont'd)

Sample Provinces/ Items	Sources of Funds[a] Personal Savings (1)	Traders (2)	Average Differences (1) - (2)
Isabela			
No. of farmers reporting	17	253	-
Storage period (in days)			
$\bar{x}$	15	16	-1
s	14.10	14.32	20.91
Farm price (P/kg)			
First cropping			
$\bar{x}$	4.47	4.53	-0.05[ns]
s	0.51	0.46	0.68
Second cropping			
$\bar{x}$	4.61	4.61	0.00
s	0.38	0.38	0.00
Nueva Viscaya			
No. of farmers reporting	14	48	-
Storage period (in days)			
$\bar{x}$	6	7	-1
s	4.99	2.88	5.56
Farm price (P/kg)			
First cropping			
$\bar{x}$	3.71	4.50	-0.74[ns]
s	1.01	0.74	1.40
Second cropping			
$\bar{x}$	4.78	4.78	0.00
s	0.77	0.77	0.00
South Cotabato			
No. of farmers reporting	95	185	0
Storage period (in days)			
$\bar{x}$	6	7	-1
s	7.69	7.83	11.42

Table 5.15 (cont'd)

Sample Provinces/ Items	Sources of Funds[a] Personal Savings (1)	Traders (2)	Average Differences (1) - (2)
Farm price (P/kg) First cropping			
$\bar{x}$	3.69	3.66	0.03[ns]
s	1.27	1.17	1.79
Second cropping			
$\bar{x}$	3.88	3.88	0.00
s	1.17	1.16	0.00
ALL PROVINCES			
No. of farmers reporting	215	556	-
$\bar{x}$	10	11	-1
s	11.56	12.23	16.15
Farm price (P/kg) First cropping			
$\bar{x}$	3.93	3.98	-0.05[ns]
s	1.04	1.00	1.41
Second cropping			
$\bar{x}$	4.21	4.21	0.00
s	0.95	0.95	0.0

[a] Although some farmers reported borrowing credit from the banks, they are very few accounting for only one percent of total sample or less, and therefore, are not reported here.

[b] Mean.

[c] Standard deviation.

*** Statistically significant at one percent level. All other average differences in farm prices are not statistically significant.

Source: IFPRI survey

Table E.16 **Percentage distribution of total corn production by region, Philippines, 1980-1989**

Regions	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Philippines	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
CAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.58	0.64	0.54
Ilocos	1.34	1.26	1.59	1.92	1.95	1.80	1.58	1.49	1.53	1.48
C. Valley	6.37	8.44	7.61	7.34	9.26	9.35	9.02	9.32	9.9	9.92
C. Luzon	0.18	0.14	0.18	0.19	0.18	0.20	0.21	0.22	0.27	0.29
S. Tagalog	8.63	7.93	7.26	8.11	6.07	6.20	6.11	5.80	5.31	4.91
Bicol	3.8	2.93	3.13	3.65	3.45	3.42	3.39	2.84	3.12	2.81
Luzon	20.52	20.71	19.78	21.22	20.91	20.97	20.31	20.17	20.76	19.95
W. Visayas	1.16	1.18	1.55	1.57	0.98	1.05	1.25	1.43	1.34	1.00
C. Visayas	7.44	7.24	7.49	8.70	6.56	6.24	6.48	6.29	6.46	6.19
E. Visayas	5.65	6.62	6.55	5.90	6.65	6.06	5.20	5.06	4.96	4.80
Visayas	14.25	15.05	15.59	16.17	14.18	13.36	12.94	12.78	12.76	12.00
W. Mindanao	5.64	5.57	6.06	6.46	5.10	5.61	5.28	5.23	5.45	5.46
N. Mindanao	7.95	6.84	6.27	6.78	5.48	6.15	6.71	7.15	8.03	9.47
S. Mindanao	33.07	31.48	33.90	32.90	32.56	31.48	31.23	30.83	28.99	28.62
C. Mindanao	18.77	18.41	17.47	21.78	22.43	22.43	23.53	23.85	24.02	24.50
Mindanao	65.43	64.24	64.64	62.61	64.91	22.43	23.53	23.85	24.02	24.50

Basic source of data: PAD, Department of Agriculture, Quezon City Philippines.

Table 5.17 **Percentage distribution of total corn area harvested by region, Philippines, 1980-1989**

Regions	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Philippines	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
CAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.57	0.58	0.59
Ilocos	1.72	1.64	1.87	2.09	2.16	2.13	2.15	1.97	2.02	1.95
C. Valley	8.85	9.93	8.82	9.63	9.37	9.24	9.29	9.05	9.25	9.42
C. Luzon	0.27	0.22	0.24	0.27	0.27	0.28	0.30	0.28	0.32	0.35
S. Tagalog	7.03	7.28	8.02	8.67	7.18	6.99	6.97	6.93	6.64	6.44
Bicol	5.61	4.84	4.90	5.08	4.86	4.94	5.01	5.09	5.19	5.07
W. Visayas	2.23	1.97	2.27	2.03	2.16	2.37	2.89	3.10	3.08	2.40
C. Visayas	14.80	14.63	14.49	14.99	14.94	14.74	14.84	14.40	14.46	14.44
E. Visayas	5.85	6.19	6.11	6.21	6.12	6.07	6.10	6.24	6.01	6.16
W. Mindanao	7.87	8.14	8.20	8.64	7.79	8.21	8.23	7.98	7.99	7.30
N. Mindanao	8.92	7.12	6.79	6.30	6.38	6.72	6.81	7.40	7.70	8.50
S. Mindanao	23.07	23.07	23.75	23.62	23.17	22.55	21.27	20.92	20.78	20.96
C. Mindanao	13.79	14.96	12.47	15.67	15.75	15.75	16.15	16.09	15.99	16.43

Source of basic data: PAD, Department of Agriculture, Quezon City, Philippines.

Table 5.18 **Price correlation coefficients of wholesale prices in Central Visayas and rural market centers of white corn grain, Philippines, 1980-1989**

Regions	CVI	CV	NM	SM	CM
C.Visayas (CV)	1.00				
Rural markets:					
C.Valley (CV)	0.89	1.00			
N.Mindanao (NM)	0.95	0.89	1.00		
S.Mindanao (SM)	0.94	0.91	0.94	1.00	
N.Mindanao (NM)	0.93	0.79	0.93	0.89	1.00

Source of basic data: PAD, Department of Agriculture, Quezon City, Philippines.

All price correlations are statistically highly significant at 1 percent level.

Table 5.19 **Price correlation coefficients of wholesale prices in Manila and rural market centers of yellow corn grain, Philippines, 1980-1989**

Regions	MLA	CV	CVI	NM	SM
Manila (MLA)	1.00				
Rural markets:					
C.Valley (CV)	0.96	1.00			
C.Visayas (CVI)	0.97	0.93	1.00		
N.Mindanao (NM)	0.94	0.93	0.90	1.00	
S.Mindanao (SM)	0.87	0.86	0.84	0.81	1.00

Source of basic data: PMS, Department of Agriculture, Quezon City, Philippines.

All price correlations are statistically highly significant at 1 percent level.

Table 5.20 Co-integration tests[a] of the monthly wholesale prices changes for yellow and white corn, Philippines, January 1, 1980 - December 31, 1989

Spatial Markets	CRDW	Dickey-Fuller		Augmented Dickey-Fuller		
				p=1		p=4
		$\hat{t}_{\phi}$	$n\hat{\phi}$	$t_{\phi}^{\wedge}$	$\frac{(n-2)\hat{\phi}}{(1-\hat{b}_1)}$	$t_{\phi}^{\wedge}$
A. Yellow Corn						
Cagayan Valley	0.515	-9.82	-10.83	-9.13	-171.80	-4.95
Northern Mindanao	0.401	-9.16	-99.96	-7.16	-1454.14	-6.47
Southern Mindanao	2.62	-14.85	-155.89	-9.84	-199.03	-5.44
B. White Corn						
Cagayan Valley	2.15	-11.62	-126.36	-8.11	-653.63	-6.62
Northern Mindanao	2.23	-12.09	-131.04	-12.09	-667.23	-5.46
Southern Mindanao	1.63	-10.75	-115.83	-7.47	-632.04	-5.79
Central Mindanao	1.98	-8.85	-97.01	-8.07	-565.83	-5.40
Critical values for test statistics[b]						
1% level	0.511	-2.66	-11.90	-4.38	-22.50	-3.77
5% level	0.3860	-1.95	-7.30	-3.60	-17.90	-3.17
10% level	0.3220	-1.60	-5.30	-3.24	-15.60	-2.84

[a] Co-integration tests were conducted for yellow corn with Manila as the exogenous variable and rural markets *j*, *j* = *1, 2, 3, 4* where 1 is Cagayan Valley, 2 is Northern Mindanao, 3 is Southern Mindanao, and 4 is Central Mindanao. For white corn, cointegration tests were done with Central Visayas as the exogenous variable and rural markets *j*, *j=1, 2, 3,* and *4* as defined.

[b] From Nachane, et al, (1988), p. 1516.

Table 5.21 **Mean, coefficient of variation, and normality tests[a] of the unscaled monthly wholesale price changes of yellow and white corn by selected major regional corn areas, Philippines, January 1980-December 1989**

Type of Corn/ Region	Mean	Skewness[b]	Kurtosis[c]	C.V.[d]
A. Yellow Corn				
Cagayan Valley	0.91	-0.017	-1.41	52.29
Manila	1.09	-0.218	-1.57	40.45
Northern Mindanao	0.73	-0.113	-1.47	60.04
Southern Mindanao	0.73	0.052	-1.23	61.93
B. White Corn				
Cagayan Valley	0.69	0.539	3.88	41.78
Central Visayas	0.15	-0.187	1.49	150.74
Northern Mindanao	0.65	0.566	1.00	34.14
Southern Mindanao	0.74	-0.126	2.13	40.96
Central Mindanao	0.41	1.06	7.21	64.40

Note: Relative skewness and kurtosis statistic are all highly significant at one percent level.

[a] Normality in the distribution is tested using relative kurtosis and skewness statistics.

[b] If equal to zero, distribution is symmetric.

[c] If equal to three, distribution is normal.

[d] Coefficient of variation calculated as $(s/\bar{X})$, where s is standard deviation and $\bar{X}$ is the mean.

Table 5.22 Diagnostic tests of white noise and the presence of ARCH on residuals of the homoskedastic AR model, yellow corn,[a] Philippines, January 1980-December 1989

Diagnostic Test	Equation			Critical X^2 value at 10% level
	Cagayan Valley	Northern Mindanao	Southern Mindanao	
1. Ljung-Box Q statistic for white noise (24)[b]	25.20	30.21	16.07	33.20
2. Lagrange multiplier test for univariate ARCH				
1[c]	0.14	0.06	6.07	2.71
2	0.33	2.33	8.37	4.61
3	2.16	3.47	9.06	6.25
4	3.12	3.46	13.13	7.78
5	8.36	3.96	13.31	9.24
6	9.43	4.05	14.21	10.64
7	12.10	7.82	15.69	12.02
8	12.82	7.75	21.08	13.36
3. Lagrange multiplier test for bivariate ARCH[d]	16.04	29.21	47.53	13.36

[a] Manila as central market.

[b] Test statistic follows a X^2 distribution with 24 degrees of freedom.

[c] Test statistic follows a X^2 distribution with p as order of the ARCH process, $p=1, 2, 3, \ldots 8$.

[d] Test statistic for $\gamma_0=0$, where i=1, 2 are polynomials of order eight.

Table 5.23 Granger causality and long-run cross multiplier estimates of the spatial price relationship of monthly price changes of yellow corn between rural markets and Manila, Philippines, January 1980-December 1989

Direction of Causation	Unidirectional Causality[a]	Feed-back[b]	Instant-aneous[c]	Long-run multiplier	Adjustment period (in months)
C. Valley -> Manila	0.685 <0.409>	no	0.166 <0.684>	0.146 (0.986)	0
Manila -> C. Valley	5.445** <0.022>	-	-	0.235 (1.774)	0
S. Mindanao -> Manila	0.606 <0.438>	no	0.076 <0.784>	0.039 (0.347)	0
Manila -> S. Mindanao	5.92** <0.017>			0.232** (2.47)	1
N. Mindanao -> Manila	0.535 <0.466>	no	0.059 <0.809>	0.062 (0.51)	0
Manila -> N. Mindanao	3.38** <0.069>			0.609** (2.34)	2

** Statistically significant at five percent level. Unless otherwise indicated, all others are statistically non-significant.
Figures in parenthesis are calculated t-values. Figures in < > are levels of probability that the calculated F values exceed their critical levels.

[a] A significant F statistic would indicate that the market on the left of the arrow "Granger causes" or leads the market to its right.

[b] A significant F statistic in both directions of causation, i.e., from left to right and the reverse, would indicate a feedback relationship between markets, $i \neq j$.

[c] A significant F statistic would indicate that price adjustments between markets, $i \neq j$, are instantaneous.

Table 5.24 Granger causality and long-run cross multiplier estimates of the spatial price relationship of monthly price changes of white corn between rural markets and Central Visayas, Philippines, January 1980-December 1989

Direction of Causation	Unidirectional Causality[a]	Feed-back[b]	Instant-aneous[c]	Long-run multiplier	Adjustment period (in months)
C Valley -> C. Visayas	0.652 <0.4214>	no	1.706 <0.1947>	0.046 (0.400)	0
C. Visayas -> C. Valley	1.51 <0.2218>			0.293 (1.50)	0
S. Mindanao -> C. Visayas	4.73** <0.032>	no	6.842 <0.010>	0.606** (2.461)	2
C. Visayas -> S. Mindanao	1.986 <0.162>			0.278 (1.427)	0
C Mindanao -> C. Visayas	1.293 <0.2584>	no	2.397 <0.1250>	0.213 (1.328)	0
C. Visayas -> C. Mindanao	2.577* <0.1118>			0.423* (1.966)	
N. Mindanao -> C. Visayas	2.138 <0.147>	yes	3.999 <0.048>	0.304 (1.80)	0
C. Visayas -> N. Mindanao	2.865* <0.094>			0.278** (2.28)	1

** Statistically significant at five percent level. Unless otherwise indicated, all others are statistically non-significant.
Figures in parenthesis are calculated t-values. Figures in < > are levels of probability that the calculated F values exceed their critical levels.

[a] A significant F statistic would indicate that the market on the left of the arrow "Granger causes" or leads the market to its right.

[b] A significant F statistic in both directions of causation, i.e., from left to right and the reverse, would indicate a feedback relationship between markets, $i \neq j$.

[c] A significant F statistic would indicate that price adjustments between markets, $i \neq j$, are instantaneous.

Table 5.25 Normality and goodness-of-fit of rescaled monthly changes of wholesale prices of yellow and white corn using the bivariate exponential ARCH (8) model, Philippines, January 1980-December 1989

Regional Market	Yellow Corn		White Corn	
	Kurtosis[a]	Skewness[b]	Kurtosis[a]	Skewness[b]
Manila	4.18[c]	0.06[c]	-	-
C. Visayas	-	-	2.68[c]	1.00[c]
C. Valley	3.71	-0.97	3.88	0.539
N. Mindanao	17.97	3.69	0.998	0.566
S. Mindanao	24.36	3.15	2.134	-0.125
C. Mindanao	-	-	7.21	1.063

[a] If equal to three, distribution is normal.

[b] If equal to zero, distribution is symmetric.

[c] Results of normality and goodness-of-fit test are approximately similar across the various combinations of bivariate autoregressions.

6. COMPARATIVE ANALYSIS OF PRODUCTION AND MARKETING OF CORN IN THE PHILIPPINES AND THAILAND

Suthad Setboonsarng and Mark W. Rosegrant

6.1 Introduction

Previous chapters have shown that the production and marketing of corn in the Philippines is costly relative to world markets, with domestic prices averaging 40 percent above border prices in recent years. What are the sources of these apparently relatively high costs of production in the Philippines? An assessment of corn production and marketing in Thailand provides a useful comparison with the Philippine case, and highlights where the costs of production and marketing in the Philippines could be reduced. Thailand is a major exporter of corn, and corn is the third largest crop in terms of planted area and export revenue. In addition, before the initial import ban on corn in the Philippines in 1986, Thailand was the major exporter of corn to the Philippines. This chapter focuses on the comparison of the total cost of production and marketing between the two countries.

6.2 Corn Production in the Philippines and Thailand

Between 1973-1988, the total production of corn in the Philippines and Thailand more than doubled (Table 1). The estimated compound growth rates in production were 3.96 and 4.37 per cent per annum for the Philippines and Thailand, respectively. While corn production in the Philippines exhibited a stable growth, corn production in Thailand has been less steady. The droughts in 1977, 1982 and 1987 have dramatically reduced corn production during these periods.

However, while the overall growth rate in production was similar, the sources of growth in production of corn in recent years differ between the two countries. In the Philippines, yield increases accounted for nearly 60 percent of total production growth over this period, while in Thailand, yield growth accounted for less than one-third of production growth, with expansion of corn area accounting for over two-thirds of production growth. The pattern of growth in Thailand is due to the relatively abundant and low opportunity cost land in Thailand, so that production increases could be achieved relatively inexpensively by expansion of cultivated corn area rather than intensification of production on existing areas. In contrast, increases in corn production growth in the Philippines, where land is relatively scarce, has relied more on intensification of cropping, particularly in the 1980s.

6.2.1 Differences in Production Factors

Types of Corn. There are two major kinds of corn grown in Philippines and Thailand: white corn and yellow corn.[1] Similar to the Philippines, white corn in Thailand is mainly used for human consumption purposes, while the (harder shelled) yellow corn is usually used for animal feeds.[2] Yellow corn is a cash crop that is largely marketed. The major source of expansion of demand for corn in both countries comes from yellow corn, and most of the advancement in production technology is in yellow corn with relatively limited research for white corn.

About 92 percent of the corn produced in the Philippines in 1973 was white corn. However, after 1976 the absolute level of white corn started to decline while the output of yellow corn grew rapidly, especially beginning in the 1980s. By 1988, the output of yellow corn had increased to 1.6 million mt, or about 36 percent of total corn output. In Thailand, almost all the corn output is yellow corn. White corn is grown in limited quantity as a backyard crop.

Physical Environment. About two thirds of the total corn output in the Philippines comes from Mindanao and most of the yellow corn comes from this region. About 72 percent of the corn output in Thailand comes from the Upper Central Plain and the Northern region (Table 2). The main factor influencing this concentration of output is the specificity of climatic conditions for corn production.[3]

Production Technology. There are two major types of seeds used by the corn farmers—open pollinated (OP) and hybrid. The grain of open pollinated (OP) seed, can be used as seed for the next cropping season. Hybrid seed, which is more responsive to fertilizer, can give a 50 percent higher yield than the open pollinated seed at high input levels. However, the grain of hybrid corn when used as seed can give only 60-65 percent of its original yield. This feature requires the farmer to buy new seeds for each crop.

There is no significant difference in the seed technology available for corn production in Philippines and Thailand. Both the open pollinated and hybrid seed available for farmers in

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[1] There are also other kinds of corn, e.g., sweet corn, pop corn and various traditional corn varieties. However, they are relatively small in terms of planted area and are grown in specific location.

[2] It should be noted that the yellow corn variety grown in Thailand and Philippines is the so called, tropical flint corn. It is different from the dent corn in the USA and Latin American countries. While the dent corn has a softer grain shell, the tropical flint corn has a harder shell to protect itself from the host of insects in the tropic. The tropical flint corn has a lower yield than the dent corn. This is partly because of the advancement in the research for dent corn led by the US in the 1950s. The different in productivity made the cost of corn production relatively higher in the tropic, even with lower wage rate.

[3] Corn yield will drop considerably outside its agroclimatic niche. The corn belt in the USA is an example of this phenomena. The corn will grow outside its zone but the cost of controlling disease and insect problem will increase its production cost.

the two countries are about the same, i.e., they can give the same yield at the same level of inputs. However, the production technology chosen by the two countries are different because of the price of corn and its inputs, and the relative land and labor endowments in the two countries.

For the Philippines, about 20 percent of the total planted area of yellow corn was in hybrid corn and 80 percent is in improved OP in 1985 (Rosegrant et al, 1987, p.2.21). By 1989, the area in hybrid has increased dramatically and led to the rapid increase in average yellow corn yield (Figure 3).[4] In Thailand, about 84 percent of the planted area was in improved OP (Suwan variety) and about 16 percent was in hybrid in 1985 (Setboonsarng et al, 1988). By 1989, the hybrid corn area went up to about 20 percent and improved OP had the remaining 80 percent. Given the present price level, it is not likely that the use of hybrid seed will increase from this level. This is because high levels of fertilizer application are required in order to benefit from cultivating hybrid corn. In order to ensure the benefit from fertilizers, relatively good water control is necessary. However, there in limited irrigation area available for corn in Thailand, so expansion of hybrid corn area is constrained. If the price of corn is high enough to justify the investment in irrigation, or shifts of other irrigated crops into corn, the expansion of hybrid corn would be possible in Thailand.

6.2.2 Cost of Production

Given the similar set of technology facing farmers in the two countries, the difference in the cost of production indicates the output and input prices differences and factor endowments between the two countries. The comparison here is done by using data from the IFPRI survey of the 1989 crop for the Philippines and the Office of Agricultural Economic cost survey for the 1988/1989 cropping season in Thailand. In order to make these cost numbers comparable, the costs in the two countries were converted into US$ using the 1989 official exchange rates.[5] The comparison is made among three categories of yield levels: high, medium and low.

High Yield Level. The high yield level in the Philippines is obtained by using high and medium level of inputs on the hybrid seed and medium input for the open pollinated seed. The yields here were above 3.0 mt/ha for all locations. There is only one region in Thailand that attained this level of yield.[6] However, regions that yield above 2.7 mt/ha are also included, because these are high input areas in Thailand.

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[4] There is little change in the yield for the white corn in the Philippines.

[5] The exchange rate used is ₱22.5 per US dollar for the Philippines and B25.22 per US dollar for Thailand.

[6] This region is a special case in 1988/1989 because it is a typhoon affected area and the government has given the input (seed and fertilizer) subsidies for the corn farmer here. The cost figure used here has already adjusted for these subsidies.

The results in Table 3 show that to get the yield of 3.35 mt/ha in Thailand, the production cost (farm) is about US$81 while it costs about $108.5 to get 3.38 mt/ha using hybrids at medium technology in the Philippines (Nueva Viscaya). On the average, the yield is 15 percent higher in the Philippines for the hybrid technology while the production cost is 44 percent higher. For the medium input level on OP, yield in the Philippines is 11 percent higher while its production cost is 34 percent higher.

The major sources of difference in costs between countries come from the material, interest and land costs. The material cost is higher (2.76 times for hybrid and 1.84 times for open pollinated technology) because of the higher level of input use (especially, fertilizer) in the Philippines. The land cost is twice as high in the Philippines, again indicating relative scarcity and the higher opportunity cost of land for corn cultivation in the Philippines. The higher interest cost (4.58 times and 3.1 times) is due to the lower level of input use and the relatively better rural credit system in Thailand.

At the farm level, only the processing (shelling and drying) of corn is cheaper in the Philippines compared to Thailand, reflecting the relatively lower cost of labor in the Philippines. The most interesting difference in the cost of production is the labor cost. The two technologies in the Philippines shows that the return to labor (including family labor) for the OP is higher than for the hybrid. This is expected because the higher purchase input level means that the profit for the farmer is less. For the OP, the return to labor differs only slightly between the two countries.

Medium Yield Level. The hybrid low-technology category in the Philippines, with average yield of 2.15 mt/ha, is compared with the Thai medium yield level (average 2.39 mt/ha). About 70 per cent of the corn production in Thailand is within this yield level. The results for medium yield levels are shown in Table 4.

For this yield level, the cost of production in the Philippines is about twice as high compared with the Thai cost of production. The major sources of difference are again the interest and material costs. The lower land cost in Thailand again suggests the lower opportunity cost of using land for corn cultivation. The return to labor in the Philippines is slightly lower. However, the return is only marginally different compared to the high yield level production in Thailand.

Low Yield Level. For the low yield level, the hybrid—F2 (which averages a yield of 1.61 mt/ha) and the OP low technology (with an average yield of 1.74 t/ha)—are compared to the Thai low yield regions (which has an average yield of 1.86 t/ha). At this level, the interest and material cost are still very different. However, the return to labor is only slightly different (Table 5). It is interesting to note that as the yield level increases, the return to labor goes down. At the same time, the interest and material cost increase substantially with yield. This is true for both countries.

In summary, the average yield of yellow corn in Philippines in higher than that in Thailand. However, the cost of production in the Philippines is higher by a greater margin. At the high and low yield levels, the cost of production per mt in the Philippines is about 30 percent higher than in Thailand. Aside from the difference in factor costs, especially land, higher input use in the Philippines is required to attain the same level of yield achieved in Thailand. This difference in the marginal productivity of input reflects the difference in the physical environment of the corn production areas between the two countries.

The protection on the import of corn in the Philippines has raised the domestic price and enabled the production of corn at a high cost level. However it should also be noted that the overvaluation of the Philippine exchange rate by about 27 percent can also account for virtually all of the difference in the farm level production costs. A devaluation of the peso to the equilibrium level would nearly equalize farm level production costs on a US$/mt basis.

6.3 Corn Marketing in the Philippines and Thailand

Marketing of corn is determined by both the type of corn produced and the volume of corn traded. Different marketing channels and infrastructures are devised to support the flow of corn to the final consumer market. A comparison of marketing costs is first made, and then the differences in marketing channels and infrastructure which contribute to the differential costs of marketing are described.

6.3.1 Marketing Cost

The cost of marketing and transportation is one of the major costs of corn, because of the bulkiness of corn relative to its value. The ability to minimize this cost determines the comparative advantage of a particular location.

The cost of marketing from the farm to the user in the Philippines was about US$60 per ton (see Tables 6.3-6.5). The major cost is in bringing the output from the farm to the local market city (about US$36 per ton or about 60 percent of the marketing cost). The cost from the regional market to the market center is another US$24.

The cost of moving corn to the local market center in Thailand is about US$12 per ton, or about one-third that of the Philippines. This is largely because of the low cost of transportation, which will be discussed below. It costs about US$100 for a 12-15 mt truck load from most of the corn production areas to Bangkok. This is made possible because of the competition among the trucking companies. The large volume of corn stimulates this competition. The total marketing cost of corn in Thailand is about US$35. The costs of marketing of corn in the Philippines are therefore about 70 percent higher than the marketing cost in Thailand.

The difference in the marketing cost can be explained in terms of the characteristics of the corn marketing channels, infrastructure, and government policy.

6.3.2 Corn Marketing Channels

Many economic agents are responsible for making arrangements to move corn through different level of marketing, from the farmer to the local middlemen, to the city or intermediate markets and to the final consumer. There is a service charge for these agents: the more complex the marketing channel the higher the charge, and more importantly, the smaller the volume, the higher the transaction costs per unit.

Philippines. Most of the farmer sold their corn to the local middlemen or trader two to six days after the harvest because corn is usually harvested during the wet season. Drying, hauling, husking and shelling were mostly performed by these barangay/town corn middlemen or trader. Some farmers dry and shell their own corn. Family labor is typically used in conducting post-harvest functions, i.e., drying and storage.

For the major production region in Mindanao, the corn will be sent to the intermediate wholesale market in Malaybalay, Tagum and Marbel. In Cagayan Valley, the Santiago and Solano markets were the intermediate wholesale markets which are linked directly to Manila. These intermediate markets are directly linked with the wholesale market in Manila and Cebu, the two main consumption areas. On average, farm to market distance is about 14 kilometers (see also Chapter 5 for more detail on corn marketing in the Philippines).

Thailand. About 60 percent of the corn output in Thailand comes from the Upper Central Plain and Lower Northern regions. Corn output from these regions are mostly transported either to the export silo in Tha Rua district, Ayuthya, adjacent to the Bangkok Metropolitan area, or to the animal feed companies located around Bangkok. The corn produced in the North and Northeast regions are generally utilized by animal feed factories in these regions.

In the past, farmers sold their corn on the cob shortly after the harvest.[7] Drying and shelling were done by the local middlemen. The dried grains were then put in gunny sacks and loaded on the 10-wheeler trucks to be delivered to the exporter or animal feed plants in the Bangkok area. At present, most of the farmer dry their own corn and hire corn shelling machines to shell their corn at the farm. The middlemen who lend money to the corn farmers usually rent the corn shelling machine. After shelling and weighing the corn, the balance of the proceeds will be given to the farmer.

The corn from the farmer are loaded on a pickup truck or other larger size trucks and delivered to the local middlemen. The distance from the major production areas, e.g., the Petchaboon province, to the local middlemen is about 40-70 km., farther than that in the Philippines. Corn is usually handled in bulk, rather than bagged. The transportation cost is

[7] Corn is harvested during the wet season similar to that in Philippines.

about 100 baht/mt (about 150 baht per trip and the average load of a pickup truck is about 1.5 tons).

Similar to Filipino corn traders, Thai traders are well equipped. The local buyer usually has a large weighing machine which weighs the whole truck before and after unloading the corn to get the corn weight. Some of these local middlemen take positions on the price of corn, and will carry some stock at the beginning of the cropping period. They usually have their own 10-wheeler truck which can load up to 15 metric tons per trip. This corn will be delivered directly to the silo of the animal feed company or exporters.

The distance between the major production center of Petchaboon in the lower north and upper central plain and major export point at Tha Rua district in Ayuthaya is about 300 km. The cost per trip is about 3000 baht, or about 200 baht/mt. Because bulk loading is utilized, the cost of loading and unloading is very small. In comparison, as was shown in Chapter 5, the Philippines has a longer marketing channel because there are many buying points beginning from widely dispersed small farmers. Most of the drying, cleaning, and storing of corn are done at the traders level and very little are done on farm.

The volume of corn per transaction is another constraint. Since a large portion of the transaction costs are fixed, the smaller the volume, the larger the transaction cost per unit of corn. The total amount of yellow corn produced in the Philippines is more scattered across relatively small farms in many areas. The production of corn in Thailand is more concentrated on relatively large farms in specific locations. The volume per transaction in Thailand is thus relatively larger and the transaction cost per unit is smaller.

Infrastructure. Because of the diffuse nature of corn production and marketing and the relatively poor infrastructure in the Philippines it often takes two to three months for the corn to get from the farm to the final consumer. In Thailand, the average time for the corn from the farm to be utilized by the final consumer is less than one month. It often takes only one day for the corn from the farm to reach the exporter silo or the animal feed company anywhere in the country.

Accessibility is also an important factor determining the size of corn area. This is because corn is bulky; its price is the lowest among crops. Therefore, if the cultivated area is not easily accessible, the transportation cost of corn will make the cost of corn too high to be grown in that location.

The accessibility of the production area depends both on the marketing and transportation systems. The question of economy of scale is particularly important for the corn market. In the Philippines, while the main production area is in the South (Mindanao), the main market is in Metropolitan Manila. Shipping is the most important means to transport corn and the shipping cost can reduce significantly with the size of the shipment. However, monopolies in ports and government regulations of the shipping industry have tended to increase the costs of inter-island shipping. Since the significant expansion of yellow corn from Mindanao took

place only in the 1980s, the transportation infrastructure for corn is still in its early stage of development.

In comparison, the good road system is one of the main strengths of the Thai agricultural sector. The accessibility and relatively cheap transportation cost is one of the main factors that stimulated the expansion of maize and cassava cultivation in Thailand during the past three decades.

Market Orientation and Government Policy. Differences in government policy affect the market orientation within commodity markets in the two countries. In the Philippines, the increase in the demand for yellow corn during the past two decades has greatly stimulated its production. The domestic consumption of yellow corn increased from about 600,000 mt in 1980 to 1.6 million mt in 1988. About 40 percent of the total domestic demand for yellow corn in 1983 came from imports. But with stricter control on imports, this was reduced to about 20 percent in 1985 and to virtually nothing in 1988 (Table 6).[8] Over this period, nominal rates of protection for corn at the wholesale level increased from around 10 percent in the mid-1980s to over 50 percent in the late 1980s.

Th high degree of protection raised the domestic price of yellow corn well above the world price, stimulating domestic production, but also facilitating the adoption of higher cost production technology. More seriously, import restrictions also protected the marketing and distribution sector, reducing the incentives for efficiency in marketing and contributing to the high costs.

For Thailand, corn is an exportable. The effort to regulate the export of corn to Japan and Taiwan during 1960s to 1981 negatively affected the domestic price of corn (Siamwalla and Setboonsarng, 1987, p. 96). Since 1981 there has been free trade on corn, with the objective of optimizing revenue for the country. This policy stimulates competition in both production and marketing, leading to greater efficiency.

6.4 Conclusion

This exploration of the costs of yellow corn in the Philippines and Thailand shows that the cost of production in the Philippines is higher than that in Thailand because of both production and marketing costs. The production cost is higher in most areas in the Philippines because of the higher land rent (due to alternative uses for land) and the high costs of input use induced by government policy and relative factor endowments. The results indicate that some of the higher cost areas would probably not be competitive at world prices. However, while the farm level costs of production are higher in the Philippines at the official exchange rate, an adjustment of the exchange rate to equilibrium levels would nearly eliminate the differences in these costs in most cases.

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[8] It is assumed that all the white corn are used for direction consumption and all the import are yellow corn.

A more important factor explaining differences in total costs of corn are the higher costs of marketing in the Philippines. The relatively small size and dispersed nature of the corn market is partly instrumental in making the cost of corn marketing high for the Philippines. If the volume of corn trade increases, the cost of transportation per unit could be cheaper. More importantly, the poor quality of transportation infrastructure, government regulation of transport and shipping, and government price protection, which reduces incentives for efficiency, have contributed to high costs of marketing. In comparison, the high quality road network in Thailand makes it easy for the corn to access the market, and the high concentration of output in a few provinces makes it economical to set up infrastructural facilities, such as silos, to facilitate the flow of corn from the production regions to the market. Government policy for free trade encourages competition and development of efficiency in marketing and production.

Table 6.1 Corn production in Thailand and Philippines

Year	Thailand			Philippines								
				Total			White			Yellow		
	Output 000mt	Area 000ha	Yield kg/ha	Output 000mt	Area 000ha	Yield kg/ha	Output 000mt	Area 000ha	Yield kg/ha	Output 000mt	Area 000ha	Yield kg/ha
1973	2339	1148	2.04	2257	2747	0.82	2086	2466	0.85	171	281	0.61
1974	2500	1240	2.02	2514	3010	0.84	2249	2729	0.82	265	281	0.94
1975	2863	1312	2.18	2717	3193	0.85	2460	2828	0.87	257	365	0.70
1976	2675	1285	2.08	2775	3242	0.86	2490	2879	0.86	285	363	0.79
1977	1677	1205	1.39	2796	3158	0.89	2414	2758	0.88	382	400	0.96
1978	2791	1386	2.01	3090	3252	0.95	2717	2786	0.98	373	466	0.80
1979	2863	1525	1.88	3123	3201	0.98	2717	2761	0.98	406	440	0.92
1980	2998	1434	2.09	3110	3238	0.96	2709	2763	0.98	401	475	0.84
1981	3448	1567	2.20	3290	3360	0.98	2715	2800	0.97	575	560	1.03
1982	3002	1679	1.79	3126	3157	0.99	2512	2600	0.97	614	557	1.10
1983	3552	1684	2.11	3346	3265	1.02	2511	2624	0.96	835	641	1.30
1984	4226	1817	2.33	3439	3314	1.04	2486	2630	0.95	953	684	1.39
1985	4934	1980	2.49	3922	3545	1.11	2838	2739	1.04	1084	806	1.34
1986	4309	1951	2.21	4015	3565	1.13	2912	2779	1.05	1103	786	1.40
1987	2781	1751	1.59	4382	3722	1.18	2828	2721	1.04	1554	1001	1.55
1988	4675	1835	2.55	4521	3764	1.20	2911	2755	1.06	1610	1009	1.60

Output, area, and yield index of corn in Thailand and Philippines (1973=1).

Year	Thailand			Philippines								
				Total			White			Yellow		
	Output	Area	Yield	Output	Area	Yield	Output	Area	Yield	Output	Area	Yield
1973	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1974	1.07	1.08	0.99	1.11	1.10	1.02	1.08	1.11	0.97	1.55	1.00	1.55
1975	1.22	1.14	1.07	1.20	1.16	1.04	1.18	1.15	1.03	1.50	1.30	1.16
1976	1.14	1.12	1.02	1.23	1.18	1.04	1.19	1.17	1.02	1.67	1.29	1.29
1977	0.72	1.05	0.68	1.24	1.15	1.08	1.16	1.12	1.03	2.23	1.42	1.57
1978	1.19	1.21	0.99	1.37	1.18	1.16	1.30	1.13	1.15	2.18	1.66	1.32
1979	1.22	1.33	0.92	1.38	1.17	1.19	1.30	1.12	1.16	2.37	1.57	1.52
1980	1.28	1.25	1.03	1.38	1.18	1.17	1.30	1.12	1.16	2.35	1.69	1.39
1981	1.47	1.37	1.08	1.46	1.22	1.19	1.30	1.14	1.15	3.36	1.99	1.69
1982	1.28	1.46	0.88	1.39	1.15	1.21	1.20	1.05	1.14	3.59	1.98	1.81
1983	1.52	1.47	1.04	1.48	1.19	1.25	1.20	1.06	1.13	4.88	2.28	2.14
1984	1.81	1.58	1.14	1.52	1.21	1.26	1.19	1.07	1.12	5.57	2.43	2.29
1985	2.11	1.73	1.22	1.74	1.29	1.35	1.36	1.11	1.22	6.34	2.87	2.21
1986	1.84	1.70	1.08	1.78	1.30	1.37	1.40	1.13	1.24	6.45	2.80	2.31
1987	1.19	1.53	0.78	1.94	1.35	1.43	1.36	1.10	1.23	9.09	3.56	2.55
1988	2.00	1.60	1.25	2.00	1.37	1.46	1.40	1.12	1.25	9.42	3.59	2.62

Sources: Agricultural Statistics of Thailand, various issues
Policy Analysis Division, DA, PNS

Table 6.2 Distribution of corn output in Philippines and Thailand, 1989

	Philippines					Thailand	
Total	%	Yellow		White		Production	%
Luzon	902.14	19.95			Northeast	725.15	15.51
CAR	24.42	0.54			Zone 1	607.98	13.00
Ilocos	66.93	1.48			Zone 2	12.16	0.26
C. Valley	448.58	9.92			Zone 3	38.52	0.82
C. Luzon	12.66	0.28			Zone 4	66.49	1.42
S. Tagalog	222.03	4.91			Up. Cent	2494.461	53.36
Bicol	127.07	2.81			Zone 5	541.32	11.58
					Zone 6	1294.00	27.68
Visayas	542.64	12			Zone 7	659.14	14.10
W. Visayas	45.22	1			Up. North	864.363	18.49
C. Visayas	279.91	6.19			Zone 8	490.70	10.50
E. Visayas	217.06	4.8			Zone 9	225.76	4.83
					Zone 10	147.91	3.16
Mindanao	3077.22	68.05			Central	582.104	12.45
W. Mindanao	246.90	5.46			Zone 11	31.85	0.68
N. Mindanao	428.23	9.47			Zone 12	157.40	3.37
S. Mindanao	1294.20	28.62			Zone 13	293.03	6.27
C. Mindanao	1107.89	24.5			Zone 16	99.82	2.14
					South	9.085	0.19
					Zone 17	9.09	0.19
Total	4522.00	100	1610	2911		4675.163	100.00

Table 6.3 **Comparison of production and marketing cost of corn between Philippines and Thailand: high yield level ($/mt, 1989)**

	Material Cost	Labor	Land	Interest	Proc.	Prodn. Cost	Market City	City to Export Wholesale Cost		Mktg Cost	Total Cost ($/kg)	Yield (kg/ha)
A. Philippines												
Hybrid (medium technology)												
South Cotabato	34.62	31.94	21.10	11.33	5.23	104.22				65.07	169.29	3323.25
Isabela	36.13	40.40	18.90	10.98	6.15	112.56				56.64	169.20	3235.56
Bukidnon	31.50	42.77	18.38	6.92	6.67	106.24				60.60	166.84	3667.17
Nueva Viscaya	32.17	22.88	26.58	13.07	13.79	108.49				52.30	160.79	3384.26
Davao	36.82	29.85	19.05	8.81	9.00	103.53				59.60	163.13	3136.02
Lanao del Sur	41.27	34.76	21.49	14.92	10.33	122.77				64.40	187.17	3132.68
Average	35.42	33.77	20.92	11.01	8.53	109.64				59.77	169.40	3313.15
Open-Pollinated, Medium Technology												
South Cotabato	17.76	35.48	21.14	9.04	5.23	88.65				65.07	153.72	3296.00
Isabela	29.59	54.54	19.11	5.86	6.15	115.25				56.64	171.89	3093.00
Average	23.68	45.01	20.13	7.45	5.69	101.95				60.86	162.81	3194.50
B. Thailand												
Upper South (16)	16.83	42.16	7.08	3.96	10.93	80.97	13.88	11.56	11.90	37.34	118.31	3350.00
Northeast (3)	10.61	42.45	9.90	1.97	8.63	73.56	11.90	10.74	11.90	34.53	108.09	2815.63
Northeast (2)	10.10	41.81	13.47	1.95	7.48	74.81	11.90	11.56	11.90	35.36	110.16	2781.25
West (13)	16.65	41.72	8.67	2.05	8.05	77.15	11.50	11.56	11.90	34.96	112.10	2731.25
Northeast (1)	10.04	43.90	11.08	2.09	8.15	75.26	11.90	11.56	11.90	35.36	110.62	2709.38
Average	12.85	42.41	10.04	2.40	8.65	76.35	12.21	11.40	11.90	35.51	111.86	2877.50
Ratio: Philippines/Thailand												
A. Hybrid	2.76	0.80	2.08	4.58	0.99	1.44				1.68	1.51	1.15
B. Open-Pollinated	1.84	1.06	2.00	3.10	0.66	1.34				1.71	1.46	1.11

Source: IFPRI, survey
Office of Agricultural Economics

Table 6.4 Comparison of corn production and marketing cost between Philippines and Thailand: Medium yield level ($/ton, 1988)

	Current	Labor	Land	Interest	Proc.	Prodn. Cost	Market City	City to Export Wholesale	Cost	Mktg Cost	Total Cost ($/kg)	Yield (kg/ha)
A. Philippines												
Hybrid (Low Technology)												
South Cotabato	38.33	36.50	24.22	15.34	5.24	119.63				65.07	184.70	2260.00
Isabela	38.69	51.09	21.43	13.27	6.15	130.63				56.64	187.27	2065.60
Bukidnon	37.72	59.02	21.42	14.68	6.67	139.51				60.60	200.11	2065.60
Nueva Viscaya	34.43	23.92	31.36	18.25	13.79	121.75				52.30	174.05	2424.68
Davao	51.34	35.42	21.90	7.68	9.00	125.34				59.60	184.94	1919.72
Average	40.10	41.19	24.07	13.84	8.17	127.37				58.84	186.21	2147.12
B. Thailand												
Upper Central (7)	5.35	47.51	10.04	2.24	7.95	73.09	12.69	9.91	11.90	34.50	107.59	2512.50
Lower North (6)	5.29	47.12	9.49	2.13	7.10	71.12	12.69	9.91	11.90	34.50	105.62	2502.08
Lower North (8)	5.99	47.42	8.81	2.11	7.41	71.74	11.50	10.74	11.90	34.13	105.87	2470.31
Upper North (10)	6.26	43.61	10.35	2.05	7.93	70.20	11.50	11.56	11.90	34.96	105.16	2445.83
Lower Northeast (4)	7.43	51.16	15.70	2.40	6.98	83.66	11.90	10.74	11.90	34.53	118.19	2281.25
North (9)	5.77	47.22	11.64	2.17	7.20	74.00	11.50	11.56	11.90	34.96	108.96	2263.75
Northeast (5)	6.00	50.33	12.14	2.35	7.80	78.63	12.69	9.91	11.90	34.50	113.13	2262.50
Average	6.01	47.77	11.17	2.21	7.48	74.64	12.07	10.62	11.90	34.58	109.22	2391.18
Ratio:												
Philippines/Thailand	6.67	0.86	2.16	6.27	1.09	1.71	0.00	0.00	0.00	1.70	1.70	0.90

Source: IFPRI survey
Office of Agricultural Economics

Table 6.5 Comparison of corn production and marketing cost between Philippines and Thailand: Low yield level ($/ton, 1988)

	Current	Labor	Land	Interest	Proc.	Prodn. Cost	Market City	City to Export Wholesale	Cost	Mktg Cost	Total Cost ($/kg)	Yield (kg/ha)
A. Philippines												
Open-Pollinated, low technology												
South Cotabato	14.63	32.66	22.38	5.68	5.23	80.58				65.07	145.65	2782.00
Isabela	24.53	58.57	23.04	4.97	6.15	117.26				56.64	173.90	1680.00
Bukidnon	50.22	77.04	33.66	10.35	6.67	177.94				60.60	238.54	750.00
Average	29.79	56.09	26.36	7.00	6.02	125.26				60.77	186.03	1737.00
B. Thailand												
West (12)	5.96	50.89	13.55	2.42	8.73	81.55	11.50	8.26	11.90	31.65	113.20	1938.00
Central (11)	6.60	55.82	13.54	2.55	8.01	86.51	11.50	8.26	11.90	31.65	118.16	1853.00
South (17)	7.82	74.98	12.89	3.21	13.10	112.00	13.88	13.22	11.90	38.99	150.99	1784.00
Average	6.80	6[illegible].56	13.33	2.72	9.95	93.35	12.29	9.91	11.90	34.10	127.45	1858.00
Ratio: Phil/Thai												
OP, Low/Thai	4.38	0.93	1.98	2.57	0.60	1.34	0.00	0.00	0.00	1.78	1.46	0.93

Source: IFPRI survey
Office of Agricultural Economics

Table 6.6 Production and consumption of yellow corn in Philippines and Thailand

	Output	Export	Domestic Disappearance	Output	Import	Domestic Disappearance
1980	2998.00	2175.00	823.00	401.00	218.50	619.50
1981	3448.00	2574.61	873.39	575.00	256.30	831.30
1982	3002.00	2830.70	171.30	614.00	342.20	956.20
1983	3552.00	2658.68	893.32	835.00	520.60	1355.60
1984	4226.00	3144.61	1081.40	953.00	182.70	1135.70
1985	4934.00	2781.99	2152.01	1084.00	250.90	1334.90
1986	4309.00	4013.24	295.76	1103.00	5.60	1108.60
1987	2781.00	1649.18	1131.82	1554.00	49.70	1603.70
1988	4675.00	1214.50	3460.50	1610.00	25.00	1635.00

Sources: Agricultural Statistics of Thailand, various issues
Policy Analysis Division, DA, PNS

7. SUPPLY RESPONSE IN THE PHILIPPINE LIVESTOCK INDUSTRY

Betina V. Dimaranan and Mark W. Rosegrant

7.1 Introduction

Unlike most agricultural commodities, livestock products face an elastic demand with respect to income. In developing countries like the Philippines, the income elasticity of demand for livestock products is higher compared to cereals and compared to income elasticities of demand in developed economies (Sarma and Yeung). Consumption of pork and poultry therefore increases rapidly with increases in income. Although the modest average annual growth in per capita income in the Philippines of 2.95 percent since 1970 was checked by the economic crisis beginning in 1983, real per capita income has exhibited an average growth of 3.6 percent in 1987 to 1989. With the prospect of an upward trend in real income, the demand for livestock products will continue to grow relatively rapidly.

The livestock sector, consisting of poultry, hogs, cattle and carabao, contributes over one-fifth of the gross value added of agriculture. Aside from the role of livestock products in nutrition as major sources of protein, livestock production is also a source of income and employment. Besides providing draft power and serving as a capital asset, livestock also convert many agricultural wastes and by-products into food in the rural sector. Pork and poultry meat production comprise roughly 75 percent of total meat production.

Transformations in commercial production operations, which began in the 1960s for poultry and in the 1970s for pork, occurred with the importation of superior breeds and production technology from more temperate countries. This brought about rapid growth in commercial poultry and pork production relative to backyard production. Demand for corn and soybean meal, the major ingredients in commercial feeds, increased. Although initially self-sufficient in corn production, the Philippines has resorted to importation to meet the growing demands of the livestock industry for yellow corn. Because domestic production of soybeans has historically been low, soybeans and soybean meal also are imported. Aside from implementing various corn production programs, in its desire to achieve self-sufficiency in corn production, the government has controlled imports through a monopoly and protected the corn and soybean producers by keeping domestic prices above world prices. The growth of poultry and pork production has become constrained by the availability and price of feed inputs. Although poultry and pork producers have also received protection through high tariffs, they have had to pay higher prices for feed grain inputs as a result of the government's pricing and trade policies.

Because of its dependence on imported feed inputs, the livestock industry, particularly commercial poultry and hog production, is heavily influenced by government policy regarding the major feed inputs, corn and soybeans. It is therefore important to determine how the pork and poultry production responds to changes in the prices of these major feed inputs and to output

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prices. The supply response of poultry and livestock producers should be understood in order to provide more information in the evaluation of the government's pricing policies. Studies which adequately model and estimate the response of meat supply to changes in input and output prices in the Philippines have been lacking (Unnevehr and Nelson, 1986). This chapter, in separately estimating the supply response functions for total, commercial and backyard pork and poultry meat production and evaluating supply elasticities to output and input prices, contributes to narrowing this gap, and provides livestock supply response parameters for analysis of the impact government policies on the livestock sector.

7.2 Literature Review

Considerable attention has been given to the analysis of livestock supply response in developed countries, but very little analysis has been done in developing countries. The time lag in production, the treatment of inventory and the identification of relevant variables are just some of the considerations which complicate the modeling and estimation of livestock supply response. Early studies on livestock supply involved the use of the cobweb model to explain cycles in production. The geometric distributed lag model formulated by Nerlove (1958), which allows for both adaptive expectations and partial adjustment formulations, later became a common analytical tool in estimating agricultural supply response.

Dean and Heady (1958) applied both the cobweb model and the Nerlovian supply response model to their analysis of spring and fall farrowings in the U.S. Meilke, Zwart and Martin (1974) compared the geometric distributed lag and the Almon-type polynomial lag in estimating quarterly supply response functions for hogs in the United States and in Eastern and Western Canada.

Tryfos' (1974) model, which clarifies the interdependence between livestock supply and inventories, involved the simultaneous estimation of inventory and supply equations. The hog inventories on feed were considered by Hayenga and Hacklander (1970) as determinants of hog supply. Arzac and Wilkinson's (1979) and Holt and Johnson's (1988) recursive models of hog supply begin with a specification of hog inventory.

Most models of hog or poultry supply include only the corn price [Folwell & Shapouri, Arzac & Wilkinson, Stillman] feed price [Meilke, Zwart & Martin, Tryfos, Chavas, Chavas & Johnson, Stillman, Holt & Johnson] or the ratio of output to corn price [Dean & Heady] to represent production costs. Heien (1975 & 1976), however, included wage rates in the poultry/ meat processing industry as a determinant of poultry or hog production.

Poultry supply response has often been estimated with quarterly data [Arzac & Wilkinson, Chavas & Johnson, Chavas, Stillman] and quarterly [Meilke, Zwart & Martin, Arzac & Wilkinson, Stillman, Holt & Johnson] or semi-annual data [Dean & Heady, Tryfos] has often been used for hogs. Folwell and Shapouri (1980) had separate specifications for spring and fall sow farrowings. Separate equations were also used to determine broiler production in each quarter.

Recent studies have emphasized the use of a priori knowledge of biological and physiological processes in livestock production in defining the lag structures in livestock supply response models. Chavas and Johnson (1982), Chavas (1982) and Stillman (1985) estimated poultry supply response at the different production stages such as placement of chicks, hatching and production. Similarly Holt and Johnson (1988) and Stillman traced hog supply response through the different stages of hog production.

The constraints imposed by data availability and the presence of commercial and backyard sectors in livestock production should be considered in modeling hog and poultry supply responses in the Philippines. Because of the lack of detailed data, supply response must be undertaken at a more aggregate level, without disaggregation by production processes. In a recent study, Costales (1990) estimated hog and poultry supply response functions for the backyard, commercial and aggregate levels. Deflated output and corn prices were used as determinants of hog or chicken inventory at the different levels. The results revealed that for both hogs and poultry, inventory is more responsive to corn price than to output prices and the commercial sector is more responsive than the backyard sector to corn prices. The study here focuses instead on production, which is most directly policy-relevant, rather than inventory.

7.3 Supply Response Model

In agriculture, the supply response to a change in a causal variables is usually distributed over time. The existence of distributed lags have been attributed to technical constraints, institutional rigidities, and subjective or psychological reasons.

Acknowledging the fact that a lag occurs between the economic decision-making period and the final impact of a change in a given variable, Koyck formulated a geometric lag model which allows past experience to be of infinite duration but gives more weight to more recent information, with the weights declining geometrically with time, as shown in equation (1).

$$Q_t = \alpha + \beta(P_{t-1} + \lambda P_{t-2} + \lambda^2 P_{t-3} + \ldots) + e_t \qquad 0 \le \lambda \le 1 \tag{1}$$

where Q_t is the quantity supplied, P_t is the price of output, λ is the weight coefficient, α and β are parameters and e_t is a random error term. Lagging equation (1) by one period, multiplying through by λ and calculating $Q_t - \lambda Q_{t-1}$ we have:

$$Q_t = \alpha(1-\lambda) + \lambda Q_{t-1} + \beta P_{t-1} + e_t \tag{2}$$

The geometric lag model has been rationalized in two different ways, by the adaptive expectations model and by the partial adjustment model.

In the adaptive expectations model, the quantity supplied is a function of expected output price (P_t^*).

$$Q_t = \alpha + \beta P_t^* + e_t \tag{3}$$

The expected price is not directly observable but based on the idea that current expectations are revised in proportion to the error associated with previous levels of expectations, P_t^* is represented by a weighted average of the actual price in the preceding period and the value of P expected in that period.

$$P_t^* = (1-\lambda)P_{t-1} + \lambda P_{t-1}^* \tag{4}$$

where $0 \leq \lambda \leq 1$ is the coefficient of expectations.

In the partial adjustment or habit persistence model, the optimal or desired level of output (Q_t^*) is a linear function of actual lagged prices:

$$Q_t^* = \alpha + \beta P_{t-1} + e_{t1} \tag{5}$$

The value of Q_t^* is not directly observable, but it is assumed that an attempt is being made to bring the actual level of Q to its desired level. However, such an attempt is only partially successful during any one period for reasons stated earlier on. The relationship between the actual and the desired level of Q may be specified as follows:

$$Q_t - Q_{t-1} = \delta(Q_t^* - Q_{t-1}) + e_{t2} \tag{6}$$

where $0 \leq \delta \leq 1$ is the adjustment coefficient which shows the rate of adjustment of Q_t to Q_t^*.

The adaptive expectation and the partial adjustment model can be combined into a compound geometric lag model such as the Nerlovian supply response model.

Nerlove (1958) originated the work on the dynamics of supply. In his model he considered an annual crop that is planted in a period before the output price is realized. The long-run desired output is assumed to be a linear function of the expected output price at time t.

This can be represented as:

$$Q_t^* = \alpha + \beta_1 P_t^* + \beta_2 Z_t + u_t \tag{7}$$

where Z_t is a vector of some exogenous factors affecting supply at time t.

Nerlove postulated that past prices govern producers' expectations about "normal" price levels with greater weight being placed on the more recent prices since forces that created that price are more likely to operate in the future. Nerlove represented price expectation as a

weighted moving average of past prices where weights decline geometrically with time. It is based on the concept that the expected "normal" price for farmers is equal to last period's expected "normal" price plus or minus some degree of adjustment depending upon the elasticity of expectation and last period's actual price. This can be written as:

$$P_t^* = P_{t-1}^* + (1-\lambda)(P_{t-1}-P_{t-1}^*) \qquad 0 \le \lambda \le 1 \tag{8}$$

where P_t^* is the farmer's expectation of the long-run "normal" price at time t and P_{t-1} is the actual price at time t-1. 1-λ is a constant and is called the coefficient of expectation.

$$Q_t - Q_{t-1} = \delta(Q_t^* - Q_{t-1}) \qquad 0 \le \delta \le 1 \tag{9}$$

Equation (9) implies that the actual output in each period is adjusted as a fraction of the difference between the desired (long-run) output and the previous period's actual output (partial adjustment model). The closer δ is to one, the slower the adjustment will take place while the closer δ is to zero the more rapid the adjustment would be. After substituting the values of Q_t^* and P_t^* given by (8) and (9) into (7) we have a structure that describes dynamically a supply response model.

$$Q_t = \alpha + (1-\delta)Q_{t-1} + \beta_1 \delta \sum_{i=1}^{\infty} 1 \cdot \lambda(\lambda)^{i-1} P_{t-1} + \beta_2 Z_2 + e_t \tag{10}$$

This model reduces to a pure adaptive expectations model if $\delta = 1$ and to a pure partial adjustment model if $\lambda = 0$, and to a simple regressions model if $\delta = 1$ and $\lambda = 0$.

7.4 Empirical Model and Data

The study uses the classical Nerlovian supply response model which takes into account the partial adjustment of quantity supplied to a change in price and the adaptive adjustment to price expectations. The basic model used to estimate poultry supply response is:

$$CP_t = a_0 + b_1 CP_{t-1} + b_2 PB_{t-1} + b_3 PC_{t-1} + b_4 PS_{t-1} + b_5 TT + u_t$$

where:

CP_t = poultry meat production
PB_t = price of chicken
PC_t = price of corn
PS_t = price of soybeans
TT = time trend
u_t = random disturbance term

and t-1 denotes a lag of one period. The basic equation used to estimate hog supply response is:

$$PP_t = a_0 + b_1PP_{t-1} + b_2PH_{t-1} + b_3PC_{t-1} + b_42PS_{t-1} + b_5TT + u_t$$

where:

PP_t = pork production
PH_t = price of pork

with the other variables as defined in the poultry supply equation.

The lagged production variable is used to capture the partial adjustment of production in response to price changes. Current production is expected to exhibit a positive relationship with lagged production. Output and input price which prevailed during the last period are the basis of price expectations. A positive relationship is expected between output price and production since a higher output price indicates greater profitability of the production activity and thus encourages more production. Higher input prices, on the other hand, represent higher production costs and lower profitability and thus reduce production. Hence, a negative relationship is expected between production and corn and soybean prices. The trend variable is used to represent the impact of technological improvements which have evolved through time and which could be expected to increase production because of this effect on production efficiency.

Since different supply responses could be expected from the backyard and commercial sectors of both hogs and poultry production because of the difference in the production techniques used, supply response at the backyard, commercial and aggregate levels are estimated in the study using annual data from 1970 to 1989. Estimates of supply response are made using three alternative data sets compiled by the Policy Analysis Division (PAD) of the Department of Agriculture, by the Food and Agriculture Organization (FAO), and by the United States Department of Agriculture (USDA). All three data sets are based on original data collected by the Bureau of Agricultural Statistics (BAS).

However, only the Policy Analysis Division (PAD) reports pork production estimates at the three levels; the data from FAO and USDA are reported only for the aggregate level. For pork, backyard and commercial production were estimated from the aggregate level data reported by FAO and USDA by applying the relative proportions of backyard and commercial production in the PAD data to the aggregate levels reported by FAO and USDA. For poultry production, PAD data disaggregated into commercial and backyard levels was available for 1980 to 1989. Total production for 1970 to 1979 was estimated based on the head slaughtered data. Commercial and backyard production for 1970 to 1979 was then computed by applying the relative proportions of backyard and commercial beginning inventory data to total production. Backyard and commercial production estimates for FAO were computed by applying the relative proportions of PAD backyard and commercial poultry production to the aggregate level data reported by FAO.

The prices used are the average annual prices reported by the Bureau of Agricultural Statistics. For a complete series from 1970 to 1989, retail level prices were used instead of wholesale level price. Retail prices of inputs and outputs were all highly correlated to the respective wholesale prices, with correlation coefficients mostly greater than 0.99, when evaluated for the years when wholesale prices were also available. Annual average price of pork loin was the retail price of pork used since, compared to the other retail cuts, pork loin prices move more closely with carcass value since pork loin represents a larger proportion of carcass weight. Average retail price of chicken in Metro Manila was used in lieu of the unavailable average chicken price for the entire Philippines. The average retail price of yellow corn was used since yellow corn is more predominantly used in feed production than white corn. The average retail price of soybeans was used as a proxy for the price of soybean meal since this was not available. All prices were deflated by the consumer price index (1985 = 100). The data used for the analysis of poultry and pork supply response are shown in Tables 1 and 2, respectively.

Taking account of poultry production at the backyard, commercial and aggregate levels, and using PAD and FAO data, the following supply response equations are estimated:

MPTPP = f(MPTPP1, DPBRM1, DPCR1, DPSR1, TT)
MPCPP = f(MPCPP1, DPBRM1, DPCR1, DPSR1, TT)
MPBPP = f(MPBPP1, DPBRM1, DPCR1, DPSR1, TT)

MFTPP = f(MFTPP1, DPBRM1, DPCR1, DPSR1, TT)
MFCPP = f(MFCPP1, DPBRM1, DPCR1, DPSR1, TT)
MFBPP = f(MFBPP1, DPBRM1, DPCR1, DPSR1, TT)

where:

MPTPP = PAD Total Poultry Meat Production, 1000 MT
MPCPP = PAD Commercial Poultry Meat Production, 1000 MT
MPBPP = PAD Backyard Poultry Meat Production, 1000 MT
MFTPP = FAO Total Poultry Meat Production, MT
MFCPP = FAO Commercial Poultry Meat Production, MT
MFBPP = FAO Backyard Poultry Meat Production, MT
DPBRM = Average Retail Broiler Price, pesos/kg, Manila, deflated
DPCR = Average Retail Price of Yellow Corn Grain, pesos/kg, Philippines, deflated
DPSR = Average Retail Price of Soybeans, pesos/kg, Philippines, deflated
TT = Time Trend (1970 = 1.0)

Similarly, hog supply responses at the commercial, backyard, and aggregate levels using PAD, FAO and USDA data, were measured using the following equations:

PTPP = f(PTPP1, DPHRL1, DPCR1, DPSR1, TT)
PCPP = f(PCPP1, DPHRL1, DPCR1, DPSR1, TT)
PBPP = f(PBPP1, DPHRL1, DPCR1, DPSR1, TT)

FTPP = f(FTPP1, DPHRL1, DPCR1, DPSR1, TT)
FCPP = f(FCPP1, DPHRL1, DPCR1, DPSR1, TT)
FBPP = f(FBPP1, DPHRL1, DPCR1, DPSR1, TT)

UTPP = f(UTPP1, DPHRL1, DPCR1, DPSR1, TT)
UCPP = f(UCPP1, DPHRL1, DPCR1, DPSR1, TT)
UBPP = f(UBPP1, DPHRL1, DPCR1, DPSR1, TT)

where:

PTPP = PAD Total Pork Production, 1000 MT
PCPP = PAD Commercial Pork Production, 1000 MT
PBPP = PAD Backyard Pork Production, 1000 MT
FTPP = FAO Total Pork Production, 1000 MT
FCPP = FAO Commercial Pork Production, 1000 MT
FBPP = FAO Backyard Pork Production, 1000 MT
UTPP = USDA Total Pork Production, 1000 MT
UCPP = USDA Commercial Pork Production, 1000 MT
UBPP = USDA Backyard Pork Production, 1000 MT
DPHRL = Average Retail Price of Pork Loin, pesos/kg, Philippines, deflated
DPCR, DPSR and TT are as defined in the poultry supply response model

The short-run elasticities of supply to output and input prices are computed at the means of prices and production. Both short-run and long run elasticities are also evaluated for the more recent years, using the average of 1987 and 1988 values. These parameters are the most relevant for policy purposes. Short-run supply elasticities (ϵ_s) with respect to prices are computed using the standard formulation. Following from the geometric lag model (equation 2), the long run elasticity is computed as $\epsilon_l = \epsilon_s/(1-\lambda)$, where λ is the parameter of the lagged dependent variable.

7.5 Results and Discussion

This section presents the results of the estimation of poultry and hog supply response at the aggregate commercial, backyard levels using PAD and FAO production data for poultry and PAD, FAO and USDA production data for hogs. The equations were estimated by ordinary least squares (OLS) and by generalized least squares (GLS) using Zellner's seemingly unrelated regression (SUR), with correction for serial correlation where appropriate.

7.5.1 SUR Estimations

One purpose of the analysis was to test whether there are differences in the responsiveness of commercial and backyard sectors due to differences in production techniques employed in these two sectors. However, although there may be differences in price response, there may be no strong distinction between the effects on these two sectors of other non-included random exogenous factors, which directly or indirectly affect production, and which are captured in the error term. Since their error terms could therefore be contemporaneously correlated, the commercial, backyard and aggregate level supply equations were estimated as a system using Zellner's generalized least squares (GLS) estimator for seemingly unrelated regressions (SUR) in addition to OLS estimation. The gain in efficiency yielded by the Zellner estimator over OLS increases directly with the correlation between disturbances from the different equations and decreases as the correlation between the different sets of explanatory variables increases (Johnston).

SUR estimations with and without correction for autocorrelation was performed. An iterative Prais-Winsten method was chosen over the standard Cochrane-Orcutt procedure in correcting for autocorrelation. More efficient estimates are obtained from the former method since unlike the latter method all observations including the first term are transformed using the estimated ρ. In addition to correcting for autocorrelation, the SUR regressions were run in both restricted and unrestricted form.

It is also logical to expect that the absolute change in total production in response to a change in output or input price is the sum of the absolute changes in backyard and commercial production. The coefficient of output (input) price in the aggregate level estimates should be the sum of the coefficients of output (input) price in the backyard and commercial level estimates. It could also be expected that the coefficient of adjustment at the three levels would all be equal. These expected relationships between the coefficients of the backyard, commercial and aggregate level equations could be imposed as restrictions in the SUR system estimation. It has been shown that the restricted feasible GLS estimator is more efficient than the unrestricted counterpart if the restrictions imposed are valid (Srivastava). The validity of the set of restrictions, such as that shown below for FAO poultry supply response was investigated using the Wald test:

DPBRM1(2) + DPBRM1(3) = DPBRM1(1)
DPCR1(2) + DPCR1(3) = DPCR1(1)
DPSR1(2) + DPSR1(3) = DPSR1(1)
TT(2) + TT(3) = TT(1)
MFCPP1(2) = MFBPP1(3) = MFTPP(1)

Numbers (1), (2) and (3) refers to the aggregate, commercial and backyard levels equations, respectively.

The computed Wald chi-square statistics were used to test the validity of the restrictions for each SUR system. These were compared against a test statistic of 16.812 for 1.0 percent

significance level and 6 degrees of freedom. Except for poultry supply response measured with correction for autocorrelation using PAD data, the Wald chi-square statistic turned out to be insignificant at the 0.01 level for all sets of hog and poultry supply response equations. This indicates the validity of imposing such restrictions on the SUR system equations.

7.5.2 Poultry Supply Response

Tables 7.3-7.8 show the results of OLS and SUR estimations of poultry supply response using PAD and FAO data. The FAO data showed a significant level of autocorrelation so the results with corrections for autocorrelations are shown.

The SUR estimation of poultry supply response provided generally similar results to the OLS estimations in terms of the signs of the coefficients and the relative responsiveness to price changes. Supply is more responsive to output than to input price changes and the commercial sector is more price responsive than the backyard sector. Estimated elasticities are somewhat lower for the systems approach. Results for the two data sets are remarkably similar, although the FAO data show a relatively higher response to output price, and lower response to input price. The greater efficiency which can be gained from SUR as compared to OLS estimations are empirically demonstrated by the lower standard errors which resulted in greater significance of all coefficient estimates. Although the soybean price was still found to be insignificant in some equations, considerable improvements in the significance of the other variables were observed, especially for lagged production and the time trend variable. The positive and significant sign for the lagged production variable shows that the partial adjustment mechanism is at work in poultry production. The positive sign for the trend variable represents the positive response of production to technological changes that have occurred through time in the industry. Average aggregate short run supply elasticities from the systems equations, valued at 1987/88 levels, are 0.50, -0.31, and -0.16 for poultry price, corn price, and soybean price, respectively. The corresponding long run aggregate supply elasticities are 0.95, -0.59, and -0.30, respectively. These elasticities are consistent with theory and empirical evidence from other studies.

7.5.3 Hog Supply Response

Tables 7.9-7.14 show the results for OLS and SUR estimations of hog supply response. Although the results of the SUR estimation of hog supply response were similar to that of the OLS estimation in terms of the signs of the coefficients and the relative responsiveness of production to output and input price changes, the gains in efficiency achieved from SUR estimation were also apparent in the generally more significant coefficient estimates, especially for lagged production and the trend variable. This also indicates a partial adjustment of hog production to the optimal quantity in response to a price change a positive reaction to technology.

The expected signs of the price variables were obtained from the aggregate and backyard level hog supply response estimations. However, for commercial production, a negative sign for output price and a positive sign for soybean price was obtained from

estimations using any of the three data sets. Corn and soybean prices were found to be insignificant determinants of commercial production. With FAO data, lagged production turned out to be negative and insignificant for the aggregate and backyard levels but the R^2s for all levels were relatively higher than that for PAD data. The results obtained from estimations using USDA and FAO data were generally better than that from the data sets in terms of the signs and significance levels of the coefficient estimates, and goodness of fit.

Although not altogether discounting the possibility of a multicollinearity problem, the negative sign consistently obtained for output price in the commercial sector may be attributed to other important determinants of commercial production which have not been captured by the model and which distort the response to prices. In particular, commercial hog production could have been adversely affected by investment difficulties arising from shocks which the capital market experienced during crisis periods in the economy such as the early 1980s. The negative sign could also be attributed to the quality of the commercial production data and the price data used. Annual pork prices for the national level are simple averages of monthly regional price data. Since commercial hog production is more concentrated in regions near metropolitan centers, simple average national level data may not be as representative of the prices faced by commercial producers as that faced by the more dispersed backyard producers.

The unexpected signs obtained for the commercial sector estimations prevent a straightforward comparison of the relative responsiveness of the commercial and backyard hog sectors. Because of the poor commercial results, it was also inappropriate to utilize restricted SUR. However, reasonable price elasticity estimates were obtained from the results of the aggregate level estimations with both OLS and unrestricted SUR. The USDA and FAO data (which had the best fit) sets produced reasonably close aggregate supply elasticity estimates. The average long-run elasticities evaluated at the 1987/88 means of aggregate level hog production are 1.09, -0.54, and -0.28 for output price, corn price and soybean price, respectively.

7.6 Summary and Conclusions

The study estimated the supply response of hogs and poultry in the Philippines at the backyard, commercial and aggregate levels. Basic annual production data from 1970 to 1989 from the Policy Analysis Division (PAD) of the Philippine Department of Agriculture, Food and Agriculture Organization (FAO) of the United Nations and the United States Department of Agriculture (USDA) were used. Meat production was expressed as a function of lagged production, lagged deflated prices of output, corn and soybeans and a time trend variable representing technology.

The supply response equations were initially estimated using Ordinary Least Squares (OLS). However, to allow for contemporaneous correlation among the error terms of the backyard, commercial and aggregate level production, the equations for the three production levels were estimated by Generalized Least Squares (GLS) using Zellner's Seemingly Unrelated Regressions (SUR) estimator. The SUR estimation provided more efficient estimates since the

coefficient estimates were more significant than those obtained from the OLS estimations. Restrictions that limit the response of aggregate level production to be the sum of the responses of the backyard and commercial level production were imposed on the system after being tested for validity. More efficient coefficient estimates were obtained from the restricted SUR estimations as compared to those obtained from OLS and unrestricted SUR estimations. Correction for autocorrelation was performed for all equations. Price elasticities were evaluated at the variable means and elasticity estimates for more recent years were obtained using the average of 1987 and 1988 values.

Backyard, commercial and aggregate poultry production responded to the explanatory variables in the expected directions. There is a greater response to output than to input price changes. Commercial production is considerably more responsive to price changes relative to the backyard production. Based on the estimations using FAO and PAD production data, aggregate level elasticities at the 1987/88 means were 0.95, -0.59 and -0.30 for broiler price, corn price, and soybean price, respectively. This response levels fall between the corresponding average elasticity estimates for the commercial sector of 1.43, -0.92 and -0.34 and for the backyard sector of 0.66, -0.40 and -0.19.

A negative response of commercial level hog production was consistently observed in estimations using either of the three data sets. This prevented a comparison of the relative responsiveness of the backyard and commercial hog sectors. However, the three production data sets provided reasonably close price elasticity estimates. Average long-run supply elasticities evaluated were 1.09, -0.54 and -0.28 for pork price, corn price, and soybean price respectively.

This study has demonstrated an approach in the estimation of Philippine livestock supply response which considers the difference in the responsiveness of the backyard, commercial and aggregate level production while also taking into account the correlation between the three sectors arising from the effect of other exogenous factors. Since more efficient estimates are obtained from the restricted SUR estimation relative to that from OLS and unrestricted SUR estimations, this approach also provides more reliable price elasticity estimates. It is important to consider these elasticity estimates in the formulation and evaluation of government policies regarding livestock and the key inputs, corn and soybeans. The estimates show that supply response of livestock to output and input prices is very large. This should be taken into consideration in formulating government policies which affect livestock prices such as import tariffs which protect the livestock producers and price ceilings which favor the consumers. They should also be considered by policy-makers as they try to strike a balance between protecting corn producers and encouraging greater livestock production. Thus, the estimated livestock supply elasticities could be used with the knowledge of the responsiveness of consumers to livestock prices and with the responsiveness of corn producers to corn prices in weighing the relative effects of a particular government policy on these sectors. This analysis is undertaken in the next chapter.

Table 7.1 Data used in the estimation of poultry supply response

Year	MPTPP	MPCPP	MPBPP	MFTPP	MFCPP	MFBPP	PBRM	PCR	PSR	CPI	TT
1970	145	28	117	95695	18528	77167	3.15	0.46	1.36	10.0	1.0
1971	151	29	122	104604	20226	84378	5.00	1.06	1.44	12.2	2.0
1972	135	26	109	112147	21645	90502	5.12	0.81	1.76	13.2	3.0
1973	139	27	112	120419	23235	97184	6.06	0.90	2.71	15.4	4.0
1974	135	23	112	125610	21795	103815	7.95	1.32	3.64	20.6	5.0
1975	136	24	112	135791	24134	111657	8.52	1.44	3.77	22.0	6.0
1976	133	24	109	135158	24622	110536	8.86	1.43	4.64	24.0	7.0
1977	121	34	87	134162	37432	96730	10.65	1.48	4.95	26.4	8.0
1978	167	49	117	133405	39589	93816	11.36	1.50	5.57	28.4	9.0
1979	157	37	120	204600	47751	156849	12.33	1.61	5.99	33.3	10.0
1980	218	85	133	225524	55858	169666	13.46	1.81	5.98	39.4	11.0
1981	260	132	128	255280	84539	170741	15.21	2.10	6.19	44.6	12.0
1982	269	139	130	296887	99402	197486	14.92	2.24	6.17	49.1	13.0
1983	284	142	142	282998	91889	191110	15.72	2.34	6.86	54.0	14.0
1984	273	138	135	184720	58435	126285	24.66	3.71	8.91	81.2	15.0
1985	219	89	130	190190	46578	143612	28.86	5.11	12.71	100.0	16.0
1986	223	88	135	199855	48018	151837	29.33	4.95	12.46	100.8	17.0
1987	215	84	131	209048	49247	159802	39.90	5.12	12.23	104.6	18.0
1988	255	114	141	237024	67420	169604	36.45	5.19	12.23	113.7	19.0
1989	305	154	151	255073	72806	182267	38.22				20.0

Source: Bureau of Agricultural Statistics; Policy Analysis Division, Department of Agriculture, Philippines; FAO

Table 7.2 Data used in the estimation of hog supply response

Year	PTPP	PCPP	PBPP	FTPP	FCPP	FBPP	UTPP	UCPP	UBPP	PHRL	PCR	PSR	CPI	TT
1970	432	65	367	369	55	314	369	55	314	4.41	0.46	1.36	10.0	1.0
1971	469	68	401	374	54	320	374	54	320	6.18	1.06	1.44	12.2	2.0
1972	507	71	436	318	44	274	318	44	274	6.51	0.81	1.76	13.2	3.0
1973	748	75	673	358	36	322	358	36	322	7.00	0.90	2.71	15.4	4.0
1974	476	67	409	372	52	320	372	52	320	10.41	1.32	3.64	20.6	5.0
1975	491	67	424	323	44	279	323	44	279	10.95	1.44	3.77	22.0	6.0
1976	518	53	465	325	33	292	325	33	292	10.88	1.43	4.64	24.0	7.0
1977	339	54	285	289	46	243	289	46	243	12.50	1.48	4.95	26.4	8.0
1978	468	106	362	318	72	246	318	72	246	13.07	1.50	5.57	28.4	9.0
1979	510	121	389	377	90	287	377	90	287	14.95	1.61	5.99	33.3	10.0
1980	586	117	468	412	82	330	412	82	330	15.85	1.81	5.98	39.4	11.0
1981	560	141	419	455	115	340	455	115	340	17.01	2.10	6.19	44.6	12.0
1982	554	152	401	392	108	284	392	108	284	18.62	2.24	6.17	49.1	13.0
1983	600	152	449	452	114	338	452	114	338	21.30	2.34	6.86	54.0	14.0
1984	570	115	455	539	115	455	440	89	351	31.94	3.71	8.91	81.2	15.0
1985	531	127	404	397	95	302	430	103	327	39.82	5.11	12.71	100.0	16.0
1986	537	117	420	460	100	360	478	104	374	41.29	4.95	12.46	100.8	17.0
1987	487	98	389	500	100	400	489	98	391	43.42	5.12	12.23	104.6	18.0
1988	529	121	408	570	131	439	520	119	401	50.84	5.19	12.23	113.7	19.0
1989	568	119	449	575	120	455	575	120	455		5.94		125.8	20.0

Source: Bureau of Agricultural Statistics; Policy Analysis Division, Department of Agriculture, Philippines; FAO; U.S. Department of Agriculture

Table 7.3 Total, commercial and backyard poultry supply response, PAD data, 1970-1989, OLS estimation

DEPENDENT VARIABLE: MPTPP PAD TOTAL POULTRY MEAT PRODUCTION

VARIABLE NAME	ESTIMATED COEFFICIENT	T-RATIO 13 DF	SHORT RUN ELASTICITY AT MEANS	SHORT RUN ELASTICITY 1987-1988	LONG RUN ELASTICITY 1987-88
MPTPP1	0.658	2.697			
DPBRM1	4.169	1.621	0.734	0.523	1.529
DPCR1	-20.243	-2.078	-0.545	-0.342	-1.000
DPSR1	-3.196	-0.987	-0.236	-0.128	-0.374
TT	2.444	1.320			
CONSTANT	56.217	0.464			

R-SQUARE = 0.878 R-SQUARE ADJUSTED = 0.830

DEPENDENT VARIABLE: MPCPP PAD COMMERCIAL POULTRY MEAT PRODUCTION

VARIABLE NAME	ESTIMATED COEFFICIENT	T-RATIO 13 DF	SHORT RUN ELASTICITY AT MEANS	SHORT RUN ELASTICITY 1987-1988	LONG RUN ELASTICITY 1987-88
MPCPP1	0.677	2.812			
DPBRM1	2.554	1.148	1.186	0.669	2.071
DPCR1	-12.079	-1.401	-0.858	-0.426	-1.319
DPSR1	-1.667	-0.611	-0.324	-0.140	-0.433
TT	1.990	1.263			
CONSTANT	6.670	0.078			

R-SQUARE = 0.848 R-SQUARE ADJUSTED = 0.789

DEPENDENT VARIABLE: MPBPP PAD BACKYARD POULTRY MEAT PRODUCTION

VARIABLE NAME	ESTIMATED COEFFICIENT	T-RATIO 13 DF	SHORT RUN ELASTICITY AT MEANS	SHORT RUN ELASTICITY 1987-1988	LONG RUN ELASTICITY 1987-88
MPBPP1	0.163	0.606			
DPBRM1	1.217	1.492	0.345	0.292	0.349
DPCR1	-7.896	-2.638	-0.342	-0.256	-0.306
DPSR1	-2.326	-2.280	-0.276	-0.179	-0.214
TT	0.816	1.501			
CONSTANT	29.020	2.513			

R-SQUARE = 0.797 R-SQUARE ADJUSTED = 0.719

Table 7.4 Total, commercial and backyard poultry supply response, PAD data, 1970-1989, SUR estimation

DEPENDENT VARIABLE: MPTPP PAD TOTAL POULTRY MEAT PRODUCTION

VARIABLE NAME	ESTIMATED COEFFICIENT	T-RATIO 13 DF	SHORT RUN ELASTICITY AT MEANS	SHORT RUN ELASTICITY 1987-1988	LONG RUN ELASTICITY 1987-88
MPTPP1	0.478	3.181			
DPBRM1	3.657	1.748	0.644	0.458	0.877
DPCR1	-21.843	-2.742	-0.588	-0.369	-0.707
DPSR1	-4.319	-1.700	-0.318	-0.173	-0.331
TT	3.175	2.221			
CONSTANT	125.670	1.468			

R-SQUARE = 0.872

DEPENDENT VARIABLE: MPCPP PAD COMMERCIAL POULTRY MEAT PRODUCTION

VARIABLE NAME	ESTIMATED COEFFICIENT	T-RATIO 13 DF	SHORT RUN ELASTICITY AT MEANS	SHORT RUN ELASTICITY 1987-1988	LONG RUN ELASTICITY 1987-88
MPCPP1	0.485	3.040			
DPBRM1	2.174	1.191	1.010	0.570	1.107
DPCR1	-13.830	-1.963	-0.982	-0.488	-0.948
DPSR1	-2.527	-1.153	-0.491	-0.212	-0.412
TT	2.608	2.095			
CONSTANT	48.585	0.745			

R-SQUARE = 0.840

DEPENDENT VARIABLE: MPBPP PAD BACKYARD POULTRY MEAT PRODUCTION

VARIABLE NAME	ESTIMATED COEFFICIENT	T-RATIO 13 DF	SHORT RUN ELASTICITY AT MEANS	SHORT RUN ELASTICITY 1987-1988	LONG RUN ELASTICITY 1987-88
MPBPP1	0.350	2.288			
DPBRM1	1.382	2.096	0.392	0.332	0.511
DPCR1	-7.929	-3.202	-0.344	-0.257	-0.395
DPSR1	-1.990	-2.509	-0.236	-0.153	-0.235
TT	0.655	1.530			
CONSTANT	97.280	2.983			

R-SQUARE = 0.789

WALD CHI-SQUARE STATISTIC = 1.714 (6 D.F.)

Table 7.5 Total, commercial and backyard poultry supply response, PAD data, 1970-1989, SUR estimation with restrictions

DEPENDENT VARIABLE: MPTPP PAD TOTAL POULTRY MEAT PRODUCTION

VARIABLE NAME	ESTIMATED COEFFICIENT	T-RATIO 13 DF	SHORT RUN ELASTICITY AT MEANS	SHORT RUN ELASTICITY 1987-1988	LONG RUN ELASTICITY 1987-88
MPTPP1	0.306	2.207			
DPBRM1	3.160	1.516	0.557	0.396	0.571
DPCR1	-23.714	-2.988	-0.638	-0.400	-0.576
DPSR1	-5.448	-2.168	-0.401	-0.218	-0.314
TT	3.800	2.696			
CONSTANT	195.860	2.373			

R-SQUARE = 0.858

DEPENDENT VARIABLE: MPCPP PAD COMMERCIAL POULTRY MEAT PRODUCTION

VARIABLE NAME	ESTIMATED COEFFICIENT	T-RATIO 13 DF	SHORT RUN ELASTICITY AT MEANS	SHORT RUN ELASTICITY 1987-1988	LONG RUN ELASTICITY 1987-88
MPCPP1	0.306	2.207			
DPBRM1	1.811	1.000	0.842	0.474	0.683
DPCR1	-16.161	-2.323	-1.147	-0.570	-0.821
DPSR1	-3.437	-1.596	-0.668	-0.288	-0.415
TT	3.025	2.492			
CONSTANT	95.047	1.519			

R-SQUARE = 0.820

DEPENDENT VARIABLE: MPBPP PAD BACKYARD POULTRY MEAT PRODUCTION

VARIABLE NAME	ESTIMATED COEFFICIENT	T-RATIO 13 DF	SHORT RUN ELASTICITY AT MEANS	SHORT RUN ELASTICITY 1987-1988	LONG RUN ELASTICITY 1987-88
MPBPP1	0.306	2.207			
DPBRM1	1.348	1.864	0.383	0.324	0.467
DPCR1	-7.553	-2.758	-0.328	-0.245	-0.353
DPSR1	-2.010	-2.338	-0.239	-0.154	-0.222
TT	0.774	1.662			
CONSTANT	100.810	3.132			

R-SQUARE = 0.792

Table 7.6 **Total, commercial and backyard poultry supply response, FAO data, 1970-1989, OLS corrected for autocorrelation**

DEPENDENT VARIABLE: MFTPP FAO TOTAL POULTRY MEAT PRODUCTION

VARIABLE NAME	ESTIMATED COEFFICIENT	T-RATIO 13 DF	SHORT RUN ELASTICITY AT MEANS	SHORT RUN ELASTICITY 1987-1988	LONG RUN ELASTICITY 1987-88
MFTPP1	0.68	2.292			
DPBRM1	4437.40	1.759	0.837	0.633	1.978
DPCR1	-11674.00	-1.219	-0.337	-0.224	-0.700
DPSR1	-882.36	-0.297	-0.070	-0.040	-0.125
TT	2958.20	1.204			
CONSTANT	-46739.00	0.449			

R-SQUARE = 0.822 R-SQUARE ADJUSTED = 0.754

DEPENDENT VARIABLE: MFCPP FAO COMMERCIAL POULTRY MEAT PRODUCTION

VARIABLE NAME	ESTIMATED COEFFICIENT	T-RATIO 13 DF	SHORT RUN ELASTICITY AT MEANS	SHORT RUN ELASTICITY 1987-1988	LONG RUN ELASTICITY 1987-88
MFCPP1	0.66	0.762			
DPBRM1	1252.10	1.254	0.896	0.627	1.844
DPCR1	-2976.10	-0.825	-0.325	-0.201	-0.591
DPSR1	-251.54	-0.162	-0.075	-0.040	-0.118
TT	1147.20	0.519			
CONSTANT	-18092.00	-0.287			

R-SQUARE = 0.847 R-SQUARE ADJUSTED = 0.789

DEPENDENT VARIABLE: MFBPP FAO BACKYARD POULTRY MEAT PRODUCTION

VARIABLE NAME	ESTIMATED COEFFICIENT	T-RATIO 13 DF	SHORT RUN ELASTICITY AT MEANS	SHORT RUN ELASTICITY 1987-1988	LONG RUN ELASTICITY 1987-88
MFBPP1	0.56	1.767			
DPBRM1	2892.50	1.610	0.741	0.577	1.311
DPCR1	-8871.40	-1.242	-0.347	-0.238	-0.541
DPSR1	-788.63	-0.391	-0.084	-0.050	-0.114
TT	2257.20	1.351			
CONSTANT	-4407.00	-0.058			

R-SQUARE = 0.756 R-SQUARE ADJUSTED = 0.662

Table 7.7 **Total, commercial and backyard poultry supply response, FAO data, 1970-1989, SUR corrected for autocorrelation (with transformed variables)**

DEPENDENT VARIABLE: TPP — FAO TOTAL POULTRY MEAT PRODUCTION

VARIABLE NAME	ESTIMATED COEFFICIENT	T-RATIO 13 DF	SHORT RUN ELASTICITY AT MEANS	SHORT RUN ELASTICITY 1987-1988	LONG RUN ELASTICITY 1987-88
TPP1	0.56	4.528			
TPR1	4213.50	1.926	0.793	0.601	1.366
TPC1	-13132.00	-1.554	-0.377	-0.252	-0.573
TPS1	-2410.90	-0.906	-0.190	-0.110	-0.250
TTV	3272.30	1.874			
TCONS	9007.10	0.139			

R-SQUARE = 0.769

DEPENDENT VARIABLE: CPP — FAO COMMERCIAL POULTRY MEAT PRODUCTION

VARIABLE NAME	ESTIMATED COEFFICIENT	T-RATIO 13 DF	SHORT RUN ELASTICITY AT MEANS	SHORT RUN ELASTICITY 1987-1988	LONG RUN ELASTICITY 1987-88
CPP1	0.36	2.488			
CPR1	1187.90	1.588	0.821	0.595	0.930
CPC1	-4208.40	-1.445	-0.443	-0.284	-0.444
CPS1	-677.14	-0.577	-0.194	-0.108	-0.169
CTV	1698.10	1.536			
CCONS	4526.80	0.143			

R-SQUARE = 0.532

DEPENDENT VARIABLE: BPP — FAO BACKYARD POULTRY MEAT PRODUCTION

VARIABLE NAME	ESTIMATED COEFFICIENT	T-RATIO 13 DF	SHORT RUN ELASTICITY AT MEANS	SHORT RUN ELASTICITY 1987-1988	LONG RUN ELASTICITY 1987-88
BPP1	0.55	4.193			
BPR1	2709.80	1.706	0.695	0.541	1.202
BPC1	-8037.00	-1.307	-0.315	-0.216	-0.480
BPS1	-1529.80	-0.817	-0.164	-0.098	-0.218
BTV	2160.60	1.863			
BCONS	11407.00	0.285			

R-SQUARE = 0.764

WALD CHI-SQUARE STATISTIC = 7.329 (6 D.F.)

Table 7.8 **Total, commercial and backyard poultry supply response, FAO data, 1970-1989, SUR estimation with restrictions, corrected for autocorrelation (transformed variables)**

DEPENDENT VARIABLE: TPP — FAO TOTAL POULTRY MEAT PRODUCTION

VARIABLE NAME	ESTIMATED COEFFICIENT	T-RATIO 13 DF	SHORT RUN ELASTICITY AT MEANS	SHORT RUN ELASTICITY 1987-1988	LONG RUN ELASTICITY 1987-88
TPP1	0.54	4.736			
TPR1	3957.40	1.862	0.745	0.564	1.226
TPC1	-12170.00	-1.485	-0.350	-0.234	-0.509
TPS1	-1950.40	-0.745	-0.153	-0.089	-0.193
TTV	3580.50	2.156			
TCONS	6441.10	0.113			

R-SQUARE = 0.768

DEPENDENT VARIABLE: CPP — FAO COMMERCIAL POULTRY MEAT PRODUCTION

VARIABLE NAME	ESTIMATED COEFFICIENT	T-RATIO 13 DF	SHORT RUN ELASTICITY AT MEANS	SHORT RUN ELASTICITY 1987-1988	LONG RUN ELASTICITY 1987-88
CPP1	0.54	4.736			
CPR1	1432.00	1.982	0.989	0.717	1.560
CPC1	-5200.50	-1.865	-0.548	-0.351	-0.763
CPS1	-720.44	-0.746	-0.206	-0.115	-0.250
CTV	1227.40	1.982			
CCONS	-1069.20	-0.050			

R-SQUARE = 0.560

DEPENDENT VARIABLE: BPP — FAO BACKYARD POULTRY MEAT PRODUCTION

VARIABLE NAME	ESTIMATED COEFFICIENT	T-RATIO 13 DF	SHORT RUN ELASTICITY AT MEANS	SHORT RUN ELASTICITY 1987-1988	LONG RUN ELASTICITY 1987-88
BPP1	0.54	4.736			
BPR1	2525.40	1.585	0.648	0.504	1.096
BPC1	-6969.50	-1.130	-0.273	-0.187	-0.407
BPS1	-1229.90	-0.653	-0.132	-0.078	-0.170
BTV	2353.10	2.113			
BCONS	7390.80	0.190			

R-SQUARE = 0.764

Table 7.9 Total, commercial and backyard hog supply response, PAD data, 1970-1989, OLS corrected for autocorrelation

DEPENDENT VARIABLE: TPP FAO TOTAL POULTRY MEAT PRODUCTION

VARIABLE NAME	ESTIMATED COEFFICIENT	T-RATIO 13 DF	SHORT RUN ELASTICITY AT MEANS	SHORT RUN ELASTICITY 1987-1988	LONG RUN ELASTICITY 1987-88
PTPP1	0.028	0.064			
DPHRL1	15.868	1.518	1.314	1.247	1.283
DPCR1	-46.690	-1.920	-0.475	-0.403	-0.415
DPSR1	-13.033	-2.369	-0.530	-0.389	-0.400
TT	-0.072	-0.015			
CONSTANT	343.050	0.614			

R-SQUARE = 0.312 R-SQUARE ADJUSTED = 0.048

DEPENDENT VARIABLE: PCPP PAD COMMERCIAL PORK PRODUCTION

VARIABLE NAME	ESTIMATED COEFFICIENT	T-RATIO 13 DF	SHORT RUN ELASTICITY AT MEANS	SHORT RUN ELASTICITY 1987-1988	LONG RUN ELASTICITY 1987-88
PCPP1	0.522	0.559			
DPHRL1	-1.657	-0.396	-0.713	-0.595	-1.245
DPCR1	-0.769	-0.126	-0.040	-0.030	-0.063
DPSR1	0.817	0.460	0.118	-0.076	-0.159
TT	1.022	0.478			
CONSTANT	104.220	0.402			

R-SQUARE = 0.742 R-SQUARE ADJUSTED = 0.643

DEPENDENT VARIABLE: PBPP PAD BACKYARD PORK PRODUCTION

VARIABLE NAME	ESTIMATED COEFFICIENT	T-RATIO 13 DF	SHORT RUN ELASTICITY AT MEANS	SHORT RUN ELASTICITY 1987-1988	LONG RUN ELASTICITY 1987-88
PBPP1	0.165	0.576			
DPHRL1	12.741	2.053	1.313	1.282	1.535
DPCR1	-37.858	-1.615	-0.477	-0.418	-0.501
DPSR1	-16.264	-3.239	-0.561	-0.426	-0.510
TT	-4.018	-1.136			
CONSTANT	284.680	0.977			

R-SQUARE = 0.395 R-SQUARE ADJUSTED = 0.162

Table 7.10 **Total, commercial and backyard hog supply response, PAD data, 1970-1989, SUR corrected for autocorrelation (with transformed variables)**

DEPENDENT VARIABLE: TPP — FAO TOTAL POULTRY MEAT PRODUCTION

VARIABLE NAME	ESTIMATED COEFFICIENT	T-RATIO 13 DF	SHORT RUN ELASTICITY AT MEANS	SHORT RUN ELASTICITY 1987-1988	LONG RUN ELASTICITY 1987-88
TPP1	0.205	1.431			
TPR1	12.163	1.990	1.011	0.956	1.203
TPC1	-38.551	-1.706	-0.392	-0.332	-0.418
TPS1	-17.323	-2.899	-0.482	-0.354	-0.445
TTV	-1.792	-0.466			
TCONS	369.730	1.437			

R-SQUARE = 0.307

DEPENDENT VARIABLE: CPP — PAD COMMERCIAL PORK PRODUCTION

VARIABLE NAME	ESTIMATED COEFFICIENT	T-RATIO 13 DF	SHORT RUN ELASTICITY AT MEANS	SHORT RUN ELASTICITY 1987-1988	LONG RUN ELASTICITY 1987-88
CPP1	0.308	1.667			
CPR1	-2.372	-1.347	-1.020	-0.852	-1.231
CPC1	-3.894	-0.644	-0.204	-0.153	-0.221
CPS1	-0.202	-0.116	-0.029	-0.019	-0.027
CTV	0.558	0.433			
CCONS	194.820	97.929			

R-SQUARE = 0.686

DEPENDENT VARIABLE: BPP — PAD BACKYARD PORK PRODUCTION

VARIABLE NAME	ESTIMATED COEFFICIENT	T-RATIO 13 DF	SHORT RUN ELASTICITY AT MEANS	SHORT RUN ELASTICITY 1987-1988	LONG RUN ELASTICITY 1987-88
BPP1	0.287	2.195			
BPR1	14.788	2.716	1.524	1.488	2.087
BPC1	-35.663	-1.595	-0.450	-0.394	-0.553
BPS1	-16.624	-3.219	-0.574	-0.435	-0.610
BTV	-2.333	-0.817			
BCONS	116.980	0.715			

R-SQUARE = 0.370

WALD CHI-SQUARE STATISTIC = 4.828 (6 D.F.)

Table 7.11 Total, commercial and backyard hog supply response, FAO data, 1970-1989, OLS corrected for autocorrelation

DEPENDENT VARIABLE: FTPP FAO TOTAL PIGMEAT PRODUCTION

VARIABLE NAME	ESTIMATED COEFFICIENT	T-RATIO 13 DF	SHORT RUN ELASTICITY AT MEANS	SHORT RUN ELASTICITY 1987-1988	LONG RUN ELASTICITY 1987-88
FTPP1	-0.151	-0.360			
DPHRL1	14.274	3.001	1.522	1.075	1.075
DPCR1	-80.332	-3.238	-1.047	-0.664	-0.664
DPSR1	-19.947	-2.579	-0.712	-0.391	-0.391
TT	7.187	2.512			
CONSTANT	493.770	2.086			

R-SQUARE = 0.831 R-SQUARE ADJUSTED = 0.766

DEPENDENT VARIABLE: FCPP FAO COMMERCIAL PIGMEAT PRODUCTION

VARIABLE NAME	ESTIMATED COEFFICIENT	T-RATIO 13 DF	SHORT RUN ELASTICITY AT MEANS	SHORT RUN ELASTICITY 1987-1988	LONG RUN ELASTICITY 1987-88
FCPP1	0.441	0.972			
DPHRL1	-1.818	-1.512	-0.980	-0.625	-0.625
DPCR1	-1.895	-0.359	-0.125	-0.071	-0.071
DPSR1	1.032	0.566	0.186	0.092	-0.092
TT	2.036	1.428			
CONSTANT	99.680	1.153			

R-SQUARE = 0.883 R-SQUARE ADJUSTED = 0.838

DEPENDENT VARIABLE: FBPP FAO BACKYARD PIGMEAT PRODUCTION

VARIABLE NAME	ESTIMATED COEFFICIENT	T-RATIO 13 DF	SHORT RUN ELASTICITY AT MEANS	SHORT RUN ELASTICITY 1987-1988	LONG RUN ELASTICITY 1987-88
FBPP1	-0.069	-0.186			
DPHRL1	12.959	3.072	1.722	1.250	1.250
DPCR1	-51.551	-2.959	-0.838	-0.545	-0.545
DPSR1	-15.848	-2.901	-0.705	-0.398	-0.398
TT	4.904	2.183			
CONSTANT	240.630	1.658			

R-SQUARE = 0.744 R-SQUARE ADJUSTED = 0.646

Table 7.12 **Total, commercial and backyard hog supply response, FAO data, 1970-1989, SUR corrected for autocorrelation (with transformed variables)**

DEPENDENT VARIABLE: TPP — FAO TOTAL PIGMEAT PRODUCTION

VARIABLE NAME	ESTIMATED COEFFICIENT	T-RATIO 13 DF	SHORT RUN ELASTICITY AT MEANS	SHORT RUN ELASTICITY 1987-1988	LONG RUN ELASTICITY 1987-88
TPP1	0.258	1.666			
TPR1	7.678	1.799	0.822	0.578	0.779
TPC1	-27.689	-1.488	-0.363	-0.229	-0.309
TPS1	-8.472	-2.141	-0.305	-0.166	-0.224
TTV	9.455	3.994			
TCONS	139.180	1.434			

R-SQUARE = 0.859

DEPENDENT VARIABLE: CPP — FAO COMMERCIAL PIGMEAT PRODUCTION

VARIABLE NAME	ESTIMATED COEFFICIENT	T-RATIO 13 DF	SHORT RUN ELASTICITY AT MEANS	SHORT RUN ELASTICITY 1987-1988	LONG RUN ELASTICITY 1987-88
CPP1	0.234	1.517			
CPR1	-1.634	-1.447	-0.881	-0.561	-0.732
CPC1	-2.126	-0.482	-0.140	-0.080	-0.104
CPS1	0.421	0.370	0.076	-0.038	-0.050
CTV	3.011	3.769			
CCONS	107.100	2.462			

R-SQUARE = 0.883

DEPENDENT VARIABLE: BPP — FAO BACKYARD PIGMEAT PRODUCTION

VARIABLE NAME	ESTIMATED COEFFICIENT	T-RATIO 13 DF	SHORT RUN ELASTICITY AT MEANS	SHORT RUN ELASTICITY 1987-1988	LONG RUN ELASTICITY 1987-88
BPP1	0.306	2.060			
BPR1	9.318	2.527	1.245	0.899	1.295
BPC1	-29.564	-1.758	-0.485	-0.313	-0.451
BPS1	-9.084	-2.836	-0.408	-0.228	-0.329
BTV	5.578	3.305			
BCONS	52.769	0.866			

R-SQUARE = 0.832

WALD CHI-SQUARE STATISTIC = 2.856 (6 D.F.)

Table 7.13 Total, commercial and backyard hog supply response, USDA data, 1970-1989, OLS corrected for autocorrelation

DEPENDENT VARIABLE: UTPP USDA TOTAL PIGMEAT PRODUCTION

VARIABLE NAME	ESTIMATED COEFFICIENT	T-RATIO 13 DF	SHORT RUN ELASTICITY AT MEANS	SHORT RUN ELASTICITY 1987-1988	LONG RUN ELASTICITY 1987-88
UTPP1	0.474	1.494			
DPHRL1	7.216	2.699	0.783	0.568	1.080
DPCR1	-35.912	-3.046	-0.477	-0.310	-0.589
DPSR1	-6.710	-1.545	-0.244	-0.138	-0.262
TT	5.055	2.148			
CONSTANT	137.330	0.773			

R-SQUARE = 0.889 R-SQUARE ADJUSTED = 0.846

DEPENDENT VARIABLE: UCPP USDA COMMERCIAL PIGMEAT PRODUCTION

VARIABLE NAME	ESTIMATED COEFFICIENT	T-RATIO 13 DF	SHORT RUN ELASTICITY AT MEANS	SHORT RUN ELASTICITY 1987-1988	LONG RUN ELASTICITY 1987-88
UCPP1	0.437	1.229			
DPHRL1	-1.499	-1.178	-0.822	-0.541	-0.961
DPCR1	-2.584	-0.549	-0.173	-0.102	-0.181
DPSR1	0.867	0.662	0.159	0.081	-0.144
TT	1.962	1.767			
CONSTANT	92.006	1.220			

R-SQUARE = 0.874 R-SQUARE ADJUSTED = 0.825

DEPENDENT VARIABLE: UBPP USDA BACKYARD PIGMEAT PRODUCTION

VARIABLE NAME	ESTIMATED COEFFICIENT	T-RATIO 13 DF	SHORT RUN ELASTICITY AT MEANS	SHORT RUN ELASTICITY 1987-1988	LONG RUN ELASTICITY 1987-88
UBPP1	0.397	1.576			
DPHRL1	8.607	3.541	1.165	0.867	1.438
DPCR1	-32.116	-3.269	-0.531	-0.355	-0.589
DPSR1	-8.294	-2.756	-0.376	-0.218	-0.362
TT	3.540	2.273			
CONSTANT	76.152	0.721			

R-SQUARE = 0.829 R-SQUARE ADJUSTED = 0.763

Table 7.14 **Total, commercial and backyard hog supply response, USDA data, 1970-1989, SUR corrected for autocorrelation (with transformed variables)**

DEPENDENT VARIABLE: TPP — USDA TOTAL PIGMEAT PRODUCTION

VARIABLE NAME	ESTIMATED COEFFICIENT	T-RATIO 13 DF	SHORT RUN ELASTICITY AT MEANS	SHORT RUN ELASTICITY 1987-1988	LONG RUN ELASTICITY 1987-88
TPP1	0.592	5.674			
TPR1	7.461	2.803	0.814	0.587	1.439
TPC1	-28.711	-2.411	-0.384	-0.248	-0.608
TPS1	-5.106	-2.219	-0.187	-0.105	-0.257
TTV	5.507	3.620			
TCONS	12.548	0.265			

R-SQUARE = 0.938

DEPENDENT VARIABLE: CPP — USDA COMMERCIAL PIGMEAT PRODUCTION

VARIABLE NAME	ESTIMATED COEFFICIENT	T-RATIO 13 DF	SHORT RUN ELASTICITY AT MEANS	SHORT RUN ELASTICITY 1987-1988	LONG RUN ELASTICITY 1987-88
CPP1	0.319	2.419			
CPR1	-1.540	-1.612	-0.845	-0.555	-0.815
CPC1	0.006	0.002	0.004	0.002	0.003
CPS1	0.696	0.692	0.128	0.065	0.095
CTV	2.806	3.720			
CCONS	82.022	2.469			

R-SQUARE = 0.878

DEPENDENT VARIABLE: BPP — USDA BACKYARD PIGMEAT PRODUCTION

VARIABLE NAME	ESTIMATED COEFFICIENT	T-RATIO 13 DF	SHORT RUN ELASTICITY AT MEANS	SHORT RUN ELASTICITY 1987-1988	LONG RUN ELASTICITY 1987-88
BPP1	0.543	5.147			
BPR1	8.597	3.519	1.169	0.866	1.895
BPC1	-29.970	-2.801	-0.499	-0.331	-0.724
BPS1	-6.905	-3.412	-0.315	-0.181	-0.396
BTV	3.500	3.134			
BCONS	-1.126	-0.023			

R-SQUARE = 0.893

WALD CHI-SQUARE STATISTIC = 12.336 (6 D.F.)

8. FOOD DEMAND ELASTICITIES BY INCOME GROUP BY URBAN AND RURAL POPULATIONS FOR THE PHILIPPINES

Howarth E. Bouis

8.1 Introduction

This paper presents food demand elasticity estimates for the Philippines by urban and rural populations by income quartile for twelve food groups. Income and price elasticities are estimated using a new food demand estimation technique based on demand for characteristics. This new technique requires far less data than the usual econometric approaches and so may be implemented relatively quickly and cost-effectively. However, the resulting demand elasticity estimates depend directly on strong a priori assumptions made concerning food demand behavior, but assumptions which do *not* depend on assumptions of weak or strong separability. Rather quite the opposite assumption is made—that the marginal rate of substitution between two foods depends directly on the levels of consumption of *all* other foods.

The data which are required for undertaking these estimations were provided by the Food and Nutrition Research Institute (FNRI) based on their 1978, 1982, and 1987 nationwide surveys. It is useful to state at the outset that these surveys are an invaluable data resource for food policy analysis in the Philippines. There are two alternative sources of information on food consumption. First, there are several rounds of food expenditure surveys undertaken jointly by the (now defunct) Special Studies Division of the Ministry of Agriculture and the National Food Authority from the mid-1970s through the early 1980s. Second, the Bureau of Census has conducted income and expenditure surveys at irregular intervals since 1957. However, data from these food expenditure surveys will likely lead to gross overestimates of food and calorie income elasticities, unless "leakage" between foods that higher income households buy, but do not consume themselves (meals provided to guests and hired laborers, food "lent" to poorer relatives/friends, and waste), is carefully monitored in such surveys (Bouis and Haddad, forthcoming). By contrast, food recall techniques (including those used by the FNRI) developed by nutritionists measure foods actually consumed and so avoid this problem.

The paper is organized as follows. The second section presents in some detail the methodology used for undertaking the demand estimations. The third section describes food consumption patterns. The fourth section presents and discusses the demand elasticity estimates. The fifth section draws conclusions.

8.2 The Food Characteristic Demand System

8.2.1 Motivation For Developing A New Technique For Estimating Food Demand Parameters

Several studies in the literature have shown that parameter estimates can vary widely across income groups (see Alderman 1986 for a review). Demand parameter estimates may also vary significantly by region as production environments and tastes change. Such regional and income variation in consumption behavior coupled with (1) differential supply-side impacts of agricultural commodity price changes and government investment strategies on various rural groups specializing in the production of particular crops, and (2) the necessity to disaggregate the food demand parameter matrix by a relatively large number of foods, makes the task of estimating a complete food demand matrix for several regional and socioeconomic groups a nearly intractable task.[1]

The two broad methodologies available for estimation of the required food demand matrices (again, see Alderman 1986 for a review) are (1) direct econometric estimation requiring data with price variability (with or without parameter restrictions derived from demand theory) and (2) use of some type of expenditure system which makes assumptions about the form of the utility function. Direct estimation from cross-section or panel household food expenditure surveys is very data intensive and time consuming, and may introduce an array of econometric problems.[2]

Use of some type of linear or quadratic expenditure system is a much more practical alternative to direct estimation in the sense that only a priori knowledge of income elasticities for individual foods (plus a minor number of additional parameters, the specific parameters depending on the particular technique used) is required for generation of a complete set of own-price and cross-price elasticities; estimates of income elasticities and these other parameters can be estimated relatively quickly if they are not available from previous studies. However, this

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[1] For example, food demand analysis for a country with 2 regions with diverse taste preferences times 4 income groups times 4 major crops times 2 occupation groups (owners and laborers), requires estimation of 64 food demand matrices.

[2] For example, Bouis and Haddad (forthcoming) show that after control for simultaneity of an endogenous income variable and possible bias due to household fixed effects (two of the above-mentioned econometric problems), use of panel data may still lead to upwardly biased income elasticities for individual staple foods due (1) to correlation in errors in measuring quantities of foods purchased and total expenditures, and (2) to leakage between foods purchased and fed to non-household members, leakage which will be an increasing function of income. Alderman (1986) reviews other problems which include non-consumption by some households (error-term distributions are truncated), heteroscedasticity (when group cell averages have differing numbers of observations), and derviation of price information from expenditure and quantity data (errors in quantity and price data are negatively correlated).

second group of techniques depends on an assumption of either strong or weak separability between *food* groups in the utility function.[3]

For strong separability, what this assumption means is that utility derived from the consumption of an inexpensive staple (for example) depends not at all on the level of consumption of a more expensive, preferred staple. This is obviously an unacceptable assumption for households where hunger is a problem. For weak separability, the assumption is made that the marginal rate of substitution between an inexpensive and expensive staple (how the consumer reacts to changes in the relative prices of these two staples) does not depend at all on the level of consumption of nonstaples.

It is perhaps less obvious why this is an unacceptable assumption. Consider the loss in utility when a low-income household trades one peso's worth (to use Philippine currency) of the inexpensive staple for one peso's worth of the preferred staple. If there were no loss in utility, then the two goods would be perfectly substitutable. However, the low-income household is presumably consuming the inexpensive staple (and low levels of nonstaples) to keep from going hungry. Spending one peso on the preferred staple instead of the inexpensive staple would mean less "energy" (calories) in the diet (more hunger), and a relatively large loss in utility. The two staples are not very substitutable. An exogenous increase in the level of nonstaples in the diet of this low-income household, however, would lower the loss in utility (less hunger suffered) when one peso is reallocated among the two staples. The two staples become more substitutable. Thus, the marginal rate of substitution between the two staples depends very much on the level of nonstaple consumption because of the energy that nonstaples provide (energy being a "characteristic" of each food consumed), violating the assumption of weak separability.

To carry this idea of food characteristics further in the context of the previous example, typically even for low-income households, the per kilo cost of nonstaples as a group is higher than the per kilo cost of an expensive, preferred staple. If this is the case, why would a low-income household, reluctant to trade an inexpensive staple for an expensive staple to prevent hunger, consume even more expensive nonstaples? At least two reasons are possible. First, household members desire some variety in their diet—for example, some meat and vegetables to go with the bland staples that constitute most of total calories consumed. Second, there is a desire for tastes inherent in particular foods. Viewed in this way, the food consumption decision becomes one of choosing a particular basket of individual foods, each food contributing to overall energy and variety in the diet, which maximizes utility from energy, variety, and tastes of individual foods. At low levels of income, considerations of energy and variety weigh heavily in the food consumption decision, while at high incomes the food consumption decision is driven mainly by tastes of individual foods. The marginal rate of substitution between any two foods depends very much on the level of consumption of all other foods, especially at low incomes.

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[3] Assuming that the research focus is food and nutrition policy, a relatively disaggregate food demand matrix is required.

To summarize, then, an impassé is reached between the need for developing a large number of food demand matrices for policy analysis and the lack of a practical means for doing so—direct estimation because it is too data-intensive, time consuming, and the appropriate methodologies are still being debated, and an expenditure system approach because the underlying assumptions are unacceptable. A food demand system based on demand for characteristics along the lines argued in the example above provides a means out of this dilemma.

In this system, the three characteristics—energy, variety, and tastes of individual foods—are assumed to be additive in the utility function—as contrasted, for example, with additive utilities for individual food items using the Frisch technique. Energy and variety enter the utility function in such a way that utility from consumption of one food depends on the level of consumption of all other foods. By specifying an explicit functional form for these characteristics in the utility function, it turns out that the entire matrix of price and income elasticities can be derived for a system of n foods and one nonfood good from prior knowledge of just *four* elasticities in the (n+1) by (n+2) matrix of price and income elasticities. A brief mathematical exposition of the model is provided in the following section (see Bouis 1991 for a full mathematical treatment and discussion of the properties of the model).

8.2.2 Mathematical Formulation for a Food Demand Model Based on Characteristics

Utility is a function of energy, variety, and tastes (characteristics of quantities of food consumed) and of nonfood purchases. Total utility gained from these three characteristics and from nonfoods is the weighted sum of the individual utilities that these four items generate.

$$U = w_e U_e(E) + w_v U_v(V) + w_t U_t(T) + w_{nf} U_{nf}(q_{nf}) \quad (1)$$

where:

U = total utility from all food and nonfood goods,
q = quantity of a good,
i = 1,...,n are the n foods consumed,
E = a measure of energy in the diet,
V = a measure of variety in the diet,
T = a measure of tastes in the diet,
U_e = utility derived from energy,
U_v = utility derived from variety,

$$w_t U_t(T) = \sum_{i=1}^{n} w_{ti} U_{ti}(q_i)$$

$U_{ti}(q_i)$ = utility derived from the taste of q units of good i,
$U_{nf}(q_{nf})$ = utility derived from q units of the nonfood good,
w_e = weight placed on utility from energy,

w_v = weight placed on utility from variety,
w_{ti} = weight placed on taste from individual food i,
w_{nf} = weight placed on utility from the nonfood good.

Utility From Energy

$$E = \sum_{i=1}^{n} z_i q_i \tag{2}$$

where z_i = factor converting quantity of the ith food into calories (energy).
E is total calories consumed per adult equivalent.

$$U_e(E) = e_1 + e_2 E + e_3 E^2 \tag{3}$$

$$\text{where } e_1 = 0;\ e_2 > 0;\ \text{and } e_3 < 0$$

At low levels of total energy, each additional unit of energy increases utility, but at a decreasing rate. The functional form chosen, however, allows for marginal decreases in utility from additional units of energy at sufficiently high intakes of energy.

$$E_i = w_e(e_2 z_i + 2e_3 E z_i) > 0 \text{ for low-income groups} \tag{4}$$

$$\text{where} \quad E_i = \frac{\partial U}{\partial U_e(E)} \frac{\partial U_e(E)}{\partial q_i}$$

$$E_{ij} = 2w_e e_3 z_i z_j < 0 \tag{5}$$

$$\text{where} \quad E_{ij} = \frac{\partial E_i}{\partial q_j}$$

Analogous notation is used below for V_i, V_{ij}, T_i, and T_{ij}.

Utility From Taste

$$U_{ti}(q_i) = \log(q_i) \tag{6}$$
$$T_i = w_{ti}(1/q_i) > 0 \tag{7}$$
$$T_{ii} = -w_{ti}(1/q_i)^2 < 0 \tag{8}$$
$$T_{ij} = 0 \text{ for } i \neq j \tag{9}$$

Each additional unit of taste of good i, no matter what the quantity, adds additional utility, but at a decreasing rate. The first derivative is positive and the second derivative negative, then, which is similar to energy for low-income groups. However, the "across food" second derivative is zero, which may be a reasonable assumption for broad food groups.

However, for estimating a highly disaggregate food matrix in which several individual foods for a broad food group are specified (for example, if in place of an aggregate "meat" category, the food demand matrix includes individual meats such as pork, chicken, beef, fish, and other meats), (9) may be too strong an assumption. If so, this may be remedied by specifying which individual foods fall into K food broad groups and then letting:[4]

$$w_t U(T) = \sum_{i=1}^{n} \left\{ w_{ti} \log(q_i) + \sum_{k=1}^{K} w_k \cdot d_{ki} \cdot \log(G_k) \right\} \tag{10}$$

where:

$$G_k = \sum_{i=1}^{n} d_{ki} \cdot q_i \tag{11}$$

and

$d_{ki}=1$ for all i belonging to food group k; $d_{ki}=0$ otherwise.

Alternative expressions for (7) through (9) become:

$$T_i = w_{ti}(1/q_i) + \sum_{k=1}^{K} w_k \cdot d_{ki} \cdot (1/G_k) > 0 \tag{12}$$

$$T_{ii} = -w_{ti}(1/q_i)^2 - \sum_{k=1}^{K} w_k \cdot d_{ki} \cdot (1/G_k)^2 < 0 \tag{13}$$

$$T_{ij} = T_{ji} = -\sum_{k=1}^{K} w_k \cdot d_{ki} \cdot d_{kj} \cdot (1/G_k)^2 \leq 0 \text{ for } i \neq j \tag{14}$$

[4] All n individual foods need not be included in one of the K food groups. It is conceivable, though it would not be a frequent occurrence, that an individual food may be included in two or more of the K food groups. A food group could include both staple and non-staple foods (see the following section which discusses demand for "variety"), or only staple foods, or only non-staple foods.

Utility From Variety

$$U_V(V) = M/T \tag{15}$$

where:

M = nonstaple kilograms of food consumed per adult equivalent,
T = total kilograms of food consumed per adult equivalent.

$$V_i = -w_V M/T^2 < 0 \qquad \text{for } i \leq s \tag{16}$$

$$V_i = w_V(1/T)\,(1 - [M/T]) > 0 \quad \text{for } s < i < n$$

where $i = 1,\ldots, s$ are staple foods.

Each additional unit of a staple good reduces utility from variety and each additional unit of a nonstaple good increases utility from variety.

$$V_{ij} = 2M/T^3 > 0 \qquad \text{for } i,j \leq s \tag{17}$$

$$V_{ij} = (w_V/T^3)\,[2M - T] \qquad \text{for } i \leq s \text{ and } s < j < n$$

$$V_{ij} = (2w_V/T^3)\,[M - T] < 0 \quad \text{for } s < i,j < n$$

For all three sets of i and j, $V_{ij} = V_{ji}$.

Solving the Model

For any food i:

$$P_i = \frac{\frac{\partial U}{\partial U_e}}{\lambda}\left[\frac{\partial U_e}{\partial E}\,\frac{\partial E}{\partial q_i}\right] + \frac{\frac{\partial U}{\partial U_v}}{\lambda}\left[\frac{\partial U_v}{\partial V}\,\frac{\partial V}{\partial q_i}\right] + \frac{\frac{\partial U}{\partial U_T}}{\lambda}\left[\frac{\partial U_T}{\partial T}\,\frac{\partial T}{\partial q_i}\right] \quad i=1,\ldots,n \tag{18}$$

where

P_i = price of quantity i,
λ = Lagrangian multiplier derived from the budget constraint.

There are n equations associated with (18), which for the first food, a staple (not belonging to any food group k), gives:

$$P_1 = \frac{w_e}{\lambda}\left[e_2 z_1 + 2e_3 z_q E\right] + \frac{w_v}{\lambda}\left[-M/T^2\right] + \frac{2_{tl}}{\lambda}\left[\frac{1}{q_1}\right] \tag{19}$$

Shadow prices for energy and variety are given by the product of the coefficient outside the brackets times the first derivative inside the brackets, for the first and second terms in (19), respectively. The taste shadow price may be thought of as a residual, the difference between the retail price minus the shadow prices for energy and variety. Generally, shadow prices will decrease with increased consumption as the first derivative declines (but at differential rates across characteristics as income increases; see Figure 8.2). However, the marginal utility of income, λ, declines with income, tending to raise each shadow price by a constant amount.

For a specific population, P_1, E, M, T, z_1, and q_1 in (19) are observed. Deriving values for the three shadow prices for the first food, then, requires values for three unknowns: $w_e e_2/\lambda$, $w_e e_3/\lambda$, and w_y/λ. Given values for these three unknowns (which remain constant across foods), sufficient information is available to derive values for the taste shadow prices for all foods, that is w_{ti}/λ for $i=1,\ldots,n$.[5]

Similarly, in order to derive food and non-food elasticity estimates for a specific population, a sufficient requirement is designation of values for each of the elements in the bordered Hessian matrix shown below (which illustrates a four food, one non-food system):[6]

$$\begin{bmatrix} E_{11}+V_{11}+T_{11} & E_{12}+V_{12} & E_{13}+V_{13} & E_{14}+V_{14} & 0 & -p_1 \\ E_{21}+V_{21} & E_{22}+V_{22}+T_{22} & E_{23}+V_{23} & E_{24}+V_{24} & 0 & -p_2 \\ E_{31}+V_{31} & E_{32}+V_{32} & E_{33}+V_{33}+T_{33} & E_{34}+V_{34} & 0 & -p_3 \\ E_{41}+V_{41} & E_{42}+V_{42} & E_{43}+V_{43} & E_{44}+V_{44}+T_{44} & 0 & -p_4 \\ 0 & 0 & 0 & 0 & NF_{55} & -p_5 \\ -p_1 & -p_2 & -p_3 & -p_4 & -p_5 & 0 \end{bmatrix}$$

[5] Alternatively, prior knowledge of w_{ti} for a specific food may be substituted for any of the other three unknowns.

[6] see Henderson and Quandt, p.31-32. The zeros in the fifth row and fifth column of the matrix above are the result of an assumption of separability between consumption of foods and nonfoods.

Given values for $w_e e_2/\lambda$, $w_e e_3/\lambda$, and w_v/λ, values may be derived for each element in the above matrix, with the exception of NF_{55} (the second derivative of the utility function with respect to q_{nf}) which requires prior knowledge of one additional parameter, the ratio of the flexibility of the marginal utility of income over the non-food income elasticity, ϕ (see Pinstrup-Andersen et al. 1976).

A tractable means for solving for these four unknowns is first to predesignate four elasticities in the final demand matrix for which values are already known (sa_j) from direct econometric estimation. Next initial seed values for the four unknown parameters in the utility function are chosen to derive an initial food demand matrix which contains initial estimates of the four predesignated elasticities. An iterative search based on the differences between (i) these initial estimates, (ii) estimates generated by successive trials, and (iii) the predesignated target elasticities, can then be undertaken to identify the four unknown utility function parameters that generate these four target elasticities. If the complicating factor of K food groups is added (all w_k's were implicity set equal to zero in deriving (19); see equations (10) through (14)), then K+4 predesignated elasticities are required.

8.2.3 Some Implications

All four standard restrictions derived from demand theory (adding up, homogeneity, symmetry, and negativity) hold for food demand elasticities derived using the above framework. In general, demand for variety increases price response, while demand for energy and tastes decreases price response for food staples. The relative importance of shadow prices for these three characteristics varies by income group, so that price response is highest for income groups which assign a relatively high weight to marginal increases in variety.

The food characteristic framework can accommodate both the typically observed empirical result that low-income groups are most price-responsive (energy consumption is high enough for low-income groups that the shadow price for energy has fallen sufficiently that the shadow price for variety "drives" food consumption decisions), and the less frequently observed result where middle income groups exhibit the highest price response (energy consumption of low-income groups is so low that the shadow price for energy dominates food purchase decisions; for high income groups, demand for tastes of individual foods determines food purchase decisions).

In selecting which four income or price elasticities to specify (or estimate) exogenously, the best approach is to choose goods with high budget shares; the remaining elasticities, which are computed as a function of these four elasticities, are less sensitive to variations in the elasticities assumed for high budget share goods.

8.2.4 Data Requirements for Implementation

In addition to a priori knowledge of any combination of four demand elasticities and/or utility function parameters, the remaining data requirements for implementation of the

methodology outlined above are: (1) per capita quantities consumed for each food group, (2) prices paid per kilogram, (3) calorie conversion rates per kilogram, (4) total nonfood expenditures, and (5) the ratio of adult equivalents over total persons, all for the particular population for which food demand parameters are to be estimated. Only data from item (4) are *not* available from the FNRI surveys.

As stated in the introduction, the Philippine data presented below were collected using a recall technique. Food expenditure surveys tend to exaggerate the increase in calorie consumption as incomes increase (Bouis and Haddad forthcoming). Therefore, data on food quantities consumed collected using a food recall technique are to be preferred over information from a food expenditure survey. Use of food recall techniques is rare for a national sample. Before presenting the demand parameter estimates in section IV, descriptive information on food consumption patterns is provided in Section 8.3.

8.3 Patterns of Food Consumption

8.3.1 Quantities

Staple Foods. Data on food quantities consumed per capita per week (by urban/rural populations by income quartile by survey round) are presented in Table 8.1 for seventeen food groups. Five staples are aggregated into five categories: rice, corn, wheat, starchy roots/tubers, and other cereals/cereal products. Rice is overwhelmingly the dominant food staple. What may come as a surprize to some, there is no apparent strong association between income and rice consumption. Income elasticities may be slightly negative in urban areas and slightly positive in rural areas.[7] Rice consumption in rural areas is roughly 25% higher than in urban areas. Corn and starchy root/tuber consumption is much more important in rural areas than in urban areas, although income elasticities are strongly negative for rural areas. Wheat consumption is higher in urban areas than in rural areas; income elasticities are strongly positive.

Non-Staple Foods. On a percentage basis, pork, beef, and poultry consumption rise much more rapidly with income than does wheat consumption, the staple food with (apparently) the highest income elasticity. For rural populations, fresh fish income elasticities are positive, but less strongly so; fresh fish consumption rises only marginally with income for urban populations.

For all other food groups for both urban and rural populations, positive income elasticities are evident, with the exception of green, leafy and yellow vegetables, which are inexpensive sources of variety as shown in the following section.

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[7] The expectation that rice consumption will rise strongly with income is an empirical result often derived from food expenditure surveys. For an example of how recall and food expenditure surveys can generate quite different income elasticities for food staples, see Bouis and Haddad (forthcoming).

8.3.2 Prices Per Kilogram

Before discussing relative prices between food groups, it is useful to have an intuitive understanding of how these differences in prices are "interpreted" using the food characteristic demand framework. Equation (13) above shows that the (per kilo) price paid for each food is the sum of the shadow prices paid for energy, variety, and tastes of individual foods. Figure 8.1, which makes some simplifying assumptions, attempts to show this visually for a particular consumer.

One simplification used in constructing Figure 8.1 is an assumption that the calorie conversion rate per kilo is constant across the five foods depicted (say 2,000 calories per kilo).[8] The particular individual pictured is willing to pay $1.00 at the margin (given his/her level of calorie consumption and energy expenditure) for 2,000 calories. If this particular individual's income were to increase and as his/her calorie consumption increased, his/her shadow price for energy would fall below $1.00 per 2,000 calories (even though the individual retail prices for all foods remained constant).

Each kilo of vegetables and meat provides an identical amount of variety in the diet (this is a simplifying assumption embedded in the model, and is not specific to Figure 8.1; see equation (15)). Given the particular breakdown between staple and non-staple consumption for our consumer, at the margin he/she is willing to pay $1.50 for each kilo of variety. A second simplifying assumption used in constructing Figure 8.1 is to assume that staple consumption (corn and rice) has no effect on variety in the diet; the model assumes that this shadow price is negative for staples which is difficult to show graphically (see equation (16)).[9]

Thus, the difference between the retail price and the sum of the shadow prices for energy and variety, is the premium that the consumer is willing to pay, at the margin, for the specific intrinsic characteristics ("tastes") contained in an extra kilo of that food. That premium is relatively small for inferior staples such as (in the Philippine context) corn, and relatively large for expensive meats.

Using this framework, foods tend to fall into four categories: (1) inexpensive, non-preferred staples with negative income elasticities (e.g. corn in Figure 8.1), (2) preferred staples with positive income elasticities (e.g. rice; income elasticities are typically well below 0.5 for staples which are major sources of calories, but above 0.5 for lightly consumed staples especially if the calorie cost is high), (3) inexpensive sources of variety with income elasticities below 0.5 and sometimes negative (e.g. vegetables, inexpensive meats), and (4) expensive non-staple foods for which the "taste" shadow price predominates (income elasticities above 0.5 and sometimes

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[8] In actuality vegetables tend to have about a tenth as many, and meats from one-half to two-thirds as many, calories per kilo as staples, although these fractions vary widely for individual foods. Thus, the shaded portions for "bulk" for vegetables and meats in Figure 1 should be smaller than depicted.

[9] Shadow prices for bulk may also be negative at sufficiently high levels of calorie consumption (see equation (4)).

above 1.0). Foods with highest shadow prices for taste, tend to have the highest income elasticities.

With the foregoing discussion as background, Table 8.2 presents data on prices for the seventeen food groups. These prices are indexed on the price for corn paid by the lowest income quartile in rural areas for each survey round; corn is the most inexpensive source of calories for Filipino consumers. It is seen from Table 8.2 that rice is approximately a third more expensive than corn on a per kilogram basis. Wheat is roughly twice as expensive as rice. Among the non-staple foods, vegetables and fruits are inexpensive sources of variety. Pork and beef are among the most expensive sources of variety.

8.3.3 Calorie Prices

Table 8.3 presents information on the relative calorie costs of the various food groups. Again the numbers are indexed on the price data for corn. One kilogram of corn grits provides approximately 3,000 calories; or as expressed in Table 8.3, one-third the per kilogram cost of corn buys 1,000 calories. In view of the fact that a kilo of corn grits, milled rice, and bread have approximately the same number of calories, their relative calorie costs are very similar to their relative costs per kilogram. Surprizingly perhaps, among the staple foods starchy roots and tubers turn out to be relatively expensive sources of calories. Fats and oils, while quite expensive on a per kilogram basis, are so dense in calories that the calorie cost is only marginally higher than for rice.

Fresh fish, while much less expensive than beef and pork on a per kilogram basis, have relatively few calories so that they are quite expensive sources of calories. Similarly, vegetables and fruits, while cheap sources of variety, are expensive sources of calories.

8.3.4 Calorie Sources

Tables 8.4 and 8.5 show food budget and calorie shares, respectively, for the seventeen food groups. Rice accounts for 25-30% of food expenditures for the lowest income quartile. This percentage declines rapidly at higher income levels. Budget shares for meats and dairy products increase with income. Rice accounts for two-thirds of calorie intakes of the lowest income quartile. This percentage declines to just under 50% for the highest income quartile. Calorie densities of staple foods are sufficiently high relative to non-staple foods that as a group staple foods account for over half of calories consumed by the highest income quartile, despite the fact that at the margin increases in food expenditures are spent overwhelmingly for non-staple foods.

Although the budget and calorie shares shown in Tables 8.4 and 8.5 are the manner in which food consumption data often are presented to describe food consumption behavior, what is much more instructive in terms of behavior is to show absolute calorie intakes by food group

as is done in Table 8.6. In Table 8.6, these absolute calorie intakes are aggregated also for staple and non-staple foods.[10] Note for urban populations for the 1982 and 1987 surveys how calories derived from staple foods remain virtually constant across income quartile, while all "additional" calories at the margin come from non-staple foods. In view of the fact that non-staple foods are quite expensive sources of calories (see Table 8.3), it is reasonable to conclude that at the margin these non-staple foods are being consumed for characteristics other than the calories that they happen to provide. That is, increased calorie consumption *even for low-income groups* is not a high priority factor driving food expenditure behavior (although for the 1978 survey, there is some evidence that the lowest income quartile may have had a relatively strong desire for increased calorie consumption).

Turning to rural calorie intakes for 1982 survey, intake patterns are much the same as for the urban population with one interesting difference. Note that the "mix" between staple calories and non-staple calories is somewhat different; rural consumers seem to have a greater preference for staple calories. This may be due to the higher activity levels of rural occupations; persons who exert more energy to earn income can compensate for this energy drain most cost-effectively by purchasing inexpensive sources of calories.[11] For rural populations, the 1978 and 1987 surveys suggest that at the lowest income levels, there still remained some desire for increased calorie consumption.

8.3.5 Characteristics "Driving" Food Consumption Behavior

With the empirical background provided by Tables 8.1 through 8.6, it is now possible to discuss more concretely how shadow prices for various characteristics in combination with the characteristics of specific foods together determine the level of price-responsivenss in the Philippine context. Returning to the intuitive discussion earlier in the paper on the substitutability of foods, two goods are perfectly substitutable when one peso spent on good j instead of good i leaves the consumer at exactly the same level of utility. Two goods are rarely ever perfect substitutes, so one must judge utility losses on a relative scale. Figure 8.2, which depicts a plausible pattern of changes in the relative magnitudes of the marginal utilities of energy, variety, and utility as income increases, is drawn to assist the discussion below of the nature of the substitutability of two goods.

Consider the two most commonly-eaten staples, (inexpensive) corn and (expensive) rice. At low levels of income, where energy is presumably an important consideration in the consumption decision, because rice is a more expensive source of energy, substituting one peso's worth of rice for one peso's worth of corn would represent a relatively large loss in utility. The large loss in energy utility would be compensated for somewhat by gains in variety utility, and by gains in taste utility if, say, three-fourths of a kilo of rice delivers more "taste" than one kilo

[10] For the purposes of Table 6, rice, corn, wheat, other cereals, starchy roots/tubers, sugar, and fats/oils are treated as staple foods. The treatment of sugar and fats/oils as staple foods is discussed further in section IV.

[11] This phenomenon may also be due in part to differences in relative prices between urban and rural areas.

of corn (assuming the per kilo price of corn is one peso). But overall, utility goes down by enough that corn and rice are not very substitutable, so that price response is low.

Suppose in the example just disucssed that calorie consumption was not an argument in the utility function. In evaluating the change in utility when one peso is spent on rice instead of corn, there is a gain in variety, a loss in the taste from corn, but a gain in the taste from rice. The net result may be only a small loss in utility, implying that the two goods are close substitutes. The need for energy, then, reduces the substitutability of goods with different costs per unit of energy, and so presumably reduces price response. Taste has the same effect of reducing price response, since by the definition two goods cannot provide the same "intrinsic" charactersitics, and thereby substitute for one another.

The desire for variety can have the opposite effect, that of increasing price response. Consider the case of substituting one peso of meat (an expensive source of calories) for one peso of corn at low incomes. There is an even larger loss in utility from energy than from the substitution of rice above. However, while the net overall loss is still negative, the consumer could be compensated to a considerable degree by increased variety, depending on the magnitude of the shadow price for variety. Thus, at particular levels of income (suggested in Figure 8.2 by points where the marginal utility curves for specific characteristics cross), two goods with very different characteristics may "substitute" for one another in the sense that the marginal utility losses/gains (from the very different charateristics contained in a peso's worth of either good) are about equal.

Such a framework can accomodate the frequently observed phenomenon of highest price-response by low-income groups (calorie consumption is high enough that low-income consumers have approached the middle portion of Figure 8.2; or the rank order of calorie prices for food staples varies seasonally, *and* the less frequently observed phenomenon of highest price-response for middle income groups (low-income consumers are still well to the left in Figure 8.2; see Alderman 1986 for other examples) as two special cases.

In general, however, the degree of price-responsiveness will depend not only on the "role" that a particular food plays in the overall diet (e.g. inexpensive source of calories, inexpensive source of variety, expensive source of taste), but on the price differential between that food and foods that play similar roles, as well as on the pattern of changes in relative shadow prices for energy, variety, and tastes as income changes. Theoretically, more than two patterns of price-responsiveness across income groups are possible.

8.4 Demand Estimates for the Philippines Derived Using the Food Characteristic Demand System

In this section, demand estimates, which are derived using the food characteristic demand framework, are presented for urban and rural populations disaggregated by income quartile. The quantity, price, calorie conversion, and household composition data necessary to undertake these computations are summarized in Tables 8.7A through 8.7H. Nearly all of this

information was available from the FNRI 1978 surveys. Educated guesses were made as to the non-food budget shares for each of the eight population groups.

Five additional pieces of information must be specified to a priori to implement the methodology, some combination of demand elasticities and/or utility function parameters. Strictly speaking, the four selected were (1) the food income elasticity, (2) w_v, the utility function parameter for variety, (3 and 4) b_3 and $-b_2/2b_3$, the two utility function parameters associated with utility from calorie consumption, and w_k for the one food group specified, meats. The values selected for these parameters are summarized in Table 8.8.

In practice, however, it is impossible to know a priori what are reasonable values for the utility function parameters, although $-b_2/2b_3$ has an intuitive interpretation as the point at which the marginal utility from increases in energy consumption becomes negative. Various combinations of utility function parameters were tried which generated own-price elasticities for rice in the range from -0.7 to -0.3, income elasticities for corn which were negative, and income elasticities for rice which were close to zero. The one constraint imposed upon this exercise was that the same combination of parameters had to generate the demand elasticities for rice and corn in the ranges just specified for all eight population groups.

This constraint was imposed in view of the fact that there is nothing in the theory that suggests that these parameters change across income and occupation groups, with the exception that $-b_2/2b_3$ will change depending on the level of exertion involved in earning income.[12] Put another way, it would have been possible instead to specify four elasticities a priori for each population group (based on estimates available in the literature), which in turn would have implied a unique set of utility function parameters for each population group. However, it would be very unlikely that these parameters would be the same across population groups; no explanation could then be offered for why these parameters might vary.[13]

Having imposed this constraint, it is somewhat remarkable that a set of utility function parameters associated with utility from energy and variety could be found which generated elasticity estimates for several population groups so closely in accordance with estimates found in the literature and observed consumption behavior across income groups. These demand elasticity estimates are presented in Tables 8.9A through 8.9H. It is important to point out that the estimates generated for a particular income group use no information about the pattern of

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[12] It can be surmised from Table 8 that activity levels (energy expenditures) are assumed to decline with income, and to be lower for urban occupations than rural occupations at the same income level. b_3 is varied such that b_2 remains constant.

[13] As can be seen from Table 8, the lowest income quartile for rural areas proved to be a troublesome exception, in the sense that a different value for w_v was used which generated elasticities that "conformed" with estimates generated for the remaining seven population groups. The issue of how and why utility function parameters might vary by income level and occupation is an interesting area for further research.

consumption of other income groups. Yet price and income elasticities tend to be lowest for the highest income groups as has been observed in several countries (see Alderman 1986).[14]

8.5 Conclusions

The income elasticities presented in Tables 8.9A through 8.9H for staple and non-staple foods are generally in accordance with a priori expectations. The cheapest source of calories, corn, has the lowest income elasticity. The rice income elasticity is essentially zero due to the fact that increased calorie consumption is not a priority goal of consumers at the margin. For staple foods, wheat is a relatively expensive source of calories (a "luxury" staple food) and so has a relatively high income elasticity.

Meats and dairy products generally have the highest income elasticities, which is consistent with the arc income elasticities shown in Tables 8.10A amd 8.10B. Income elasticities for fish are much lower. It is important to note that the arc income elasticities shown in these two tables in all likelihood *understate* the true values because of imprecise way that income (always difficult to measure) was estimated in the FNRI surveys.[15] Neverthess, it is remarkable that the *relative* magnitudes of the income elasticities across foods, that is a ranking of foods from lowest to highest income elasticities, is very similar comparing the arc elasticities and the estimated elasticities.

The elasticity estimates found in Tables 8.9A through 8.9H for rice, corn, wheat, pork, chicken, and eggs are those used in the rice/corn/livestock model simulations. These eight food demand elasticity matrices may be used by policy analysts for various applications, and in particular those that are concerned with the differential impacts of government policies across income groups and urban and rural populations.

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[14] That food income elasticities are low in general for the highest income groups is due in large part to an assumption that non-food income elasticity is relatively high.

[15] This is the two-way table equivalent of the well-known property of econometrics that, *ceteris paribus*, measurement error leads to coefficients that are biased toward zero. Unlike econometric estimation, the food characteristic demand methodology uses this income information only to segregate the sample into income groups to compute the cell averages reported in Tables 7A through 7H.

Figure 8.1 **Retail Price Paid for Food—Sum of Shadow Prices for Bulk, Variety, and Tastes for Individual Foods**

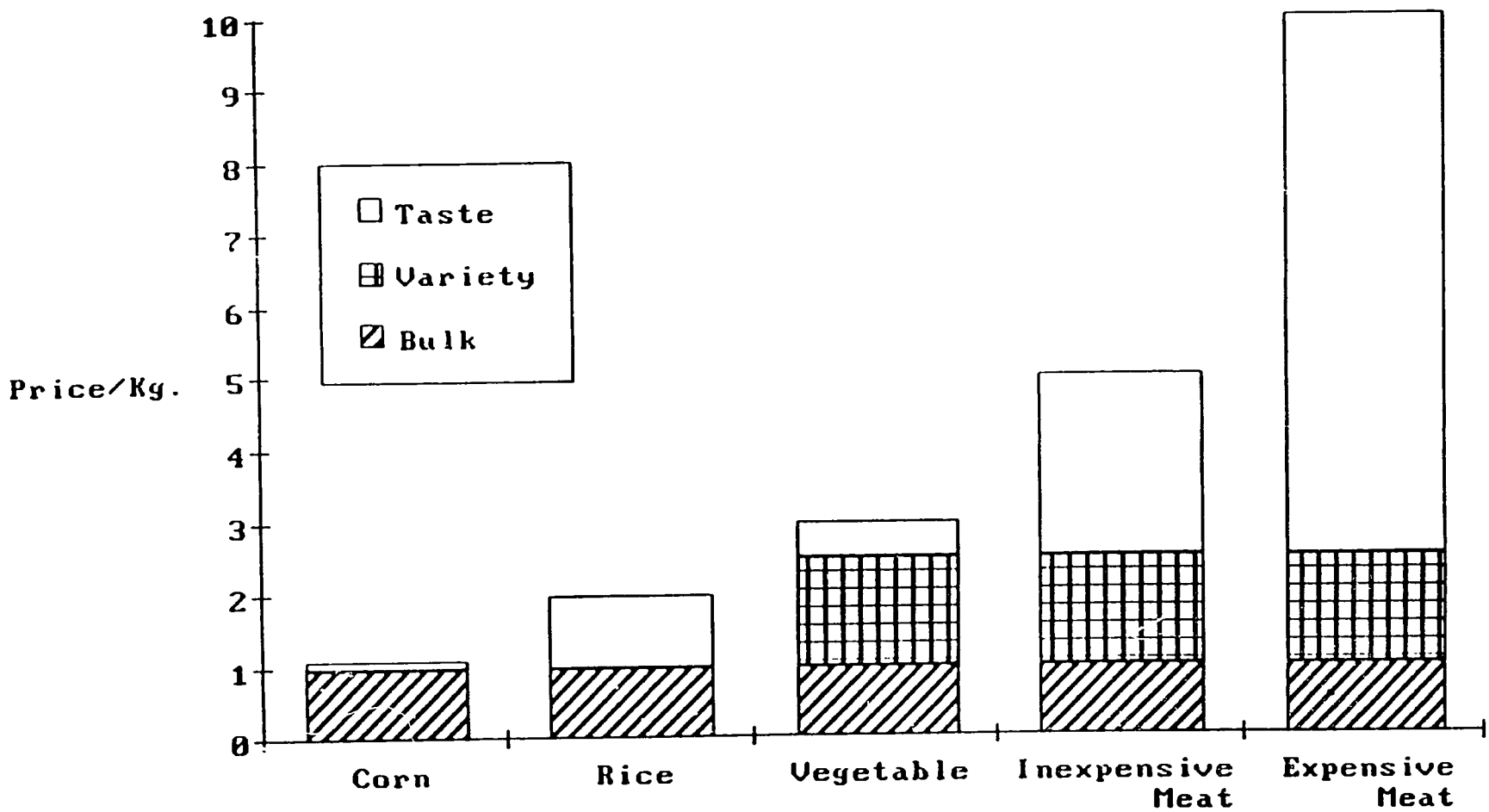

Figure 8.2 **Relative magnitudes of marginal utilities of food characteristics as income increases**

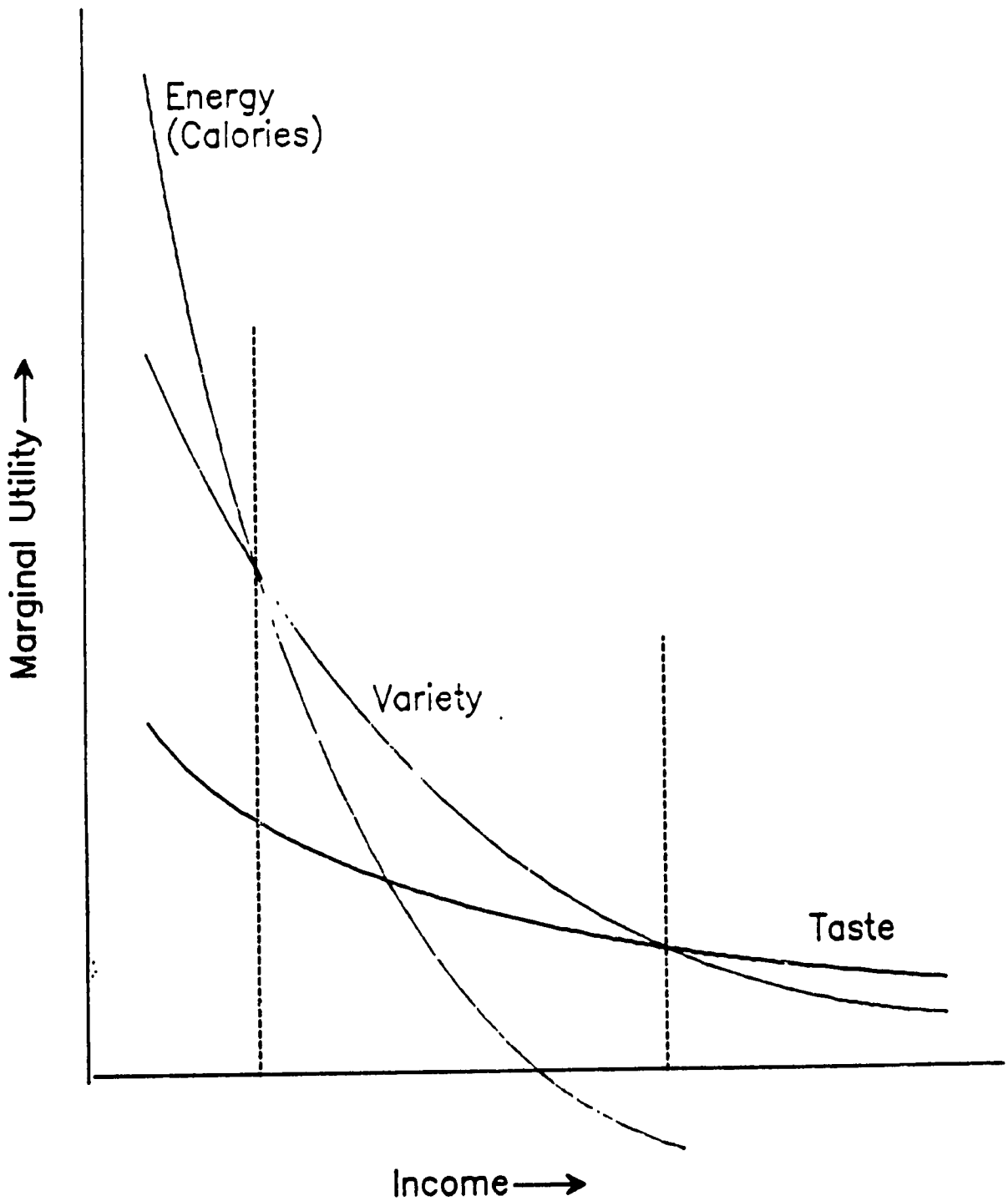

Table 8.1.a Per Capita Consumption Per Week, Urban, By Income Quartile By Year

Urban/ Rural	Year	Food Group	Quartile 1	2	3	4
			kilograms			
URBAN	1978	RICE	1.83	1.79	1.83	1.74
URBAN	1978	CORN	.11	.22	.13	.06
URBAN	1978	WHEAT/BREAD	.14	.15	.20	.27
URBAN	1978	STARCHY ROOTS/TUBERS	.22	.14	.11	.13
URBAN	1978	OTHER CEREALS/PRODUC	.08	.10	.15	.18
URBAN	1978	SUGARS/SYRUPS	.13	.19	.29	.43
URBAN	1978	FATS/OILS	.10	.08	.11	.21
URBAN	1978	FRESH FISH	.46	.51	.48	.54
URBAN	1978	PORK	.06	.07	.14	.25
URBAN	1978	BEEF	.02	.01	.03	.07
URBAN	1978	POULTRY	.01	.03	.06	.14
URBAN	1978	OTHER FISH/MEAT/POUL	.28	.30	.38	.50
URBAN	1978	EGGS	.04	.05	.08	.16
URBAN	1978	MILK/MILK PRODUCTS	.22	.26	.39	.52
URBAN	1978	GREEEN LEAFY/YELLOW	.18	.22	.19	.19
URBAN	1978	OTHER FRUITS/VEG	1.12	1.24	1.55	1.99
URBAN	1978	MISCELLANEOUS	.18	.18	.22	.26
URBAN	1982	RICE	2.05	2.05	1.92	1.73
URBAN	1982	CORN	.16	.17	.04	.05
URBAN	1982	WHEAT/BREAD	.10	.10	.18	.22
URBAN	1982	STARCHY ROOTS/TUBERS	.19	.18	.11	.13
URBAN	1982	OTHER CEREALS/PRODUC	.06	.09	.10	.13
URBAN	1982	SUGARS/SYRUPS	.13	.17	.19	.23
URBAN	1982	FATS/OILS	.13	.15	.22	.32
URBAN	1982	FRESH FISH	.43	.50	.53	.53
URBAN	1982	PORK	.10	.14	.19	.37
URBAN	1982	BEEF	.01	.02	.02	.07
URBAN	1982	POULTRY	.04	.04	.10	.16
URBAN	1982	OTHER FISH/MEAT/POUL	.36	.32	.35	.42
URBAN	1982	EGGS	.04	.06	.09	.14
URBAN	1982	MILK/MILK PRODUCTS	.16	.22	.38	.69
URBAN	1982	GREEEN LEAFY/YELLOW	.20	.22	.19	.16
URBAN	1982	OTHER FRUITS/VEG	.99	1.09	1.66	1.97
URBAN	1982	MISCELLANEOUS	.21	.25	.11	.41
URBAN	1987	RICE	1.97	1.79	1.88	1.78
URBAN	1987	CORN	.09	.11	.05	.08
URBAN	1987	WHEAT/BREAD	.07	.09	.13	.13
URBAN	1987	STARCHY ROOTS/TUBERS	.14	.12	.11	.13
URBAN	1987	OTHER CEREALS/PRODUC	.13	.19	.20	.22
URBAN	1987	SUGARS/SYRUPS	.11	.15	.20	.22
URBAN	1987	FATS/OILS	.08	.09	.11	.12
URBAN	1987	FRESH FISH	.52	.46	.53	.53
URBAN	1987	PORK	.08	.13	.22	.34
URBAN	1987	BEEF	.01	.05	.04	.08
URBAN	1987	POULTRY	.02	.08	.08	.10
URBAN	1987	OTHER FISH/MEAT/POUL	.34	.32	.41	.40
URBAN	1987	EGGS	.05	.06	.11	.11
URBAN	1987	MILK/MILK PRODUCTS	.22	.35	.34	.58
URBAN	1987	GREEEN LEAFY/YELLOW	.22	.17	.17	.17
URBAN	1987	OTHER FRUITS/VEG	.99	1.14	1.29	1.67
URBAN	1987	MISCELLANEOUS	.18	.23	.29	.26

Table 8.1.b Per Capita Consumption Per Week, Rural, By Income Quartile By Year

Urban/ Rural	Year	Food Group	Income Quartile 1	2	3	4
			kilograms			
RURAL	1978	RICE	2.11	2.32	2.45	2.31
RURAL	1978	CORN	.46	.33	.20	.20
RURAL	1978	WHEAT/BREAD	.03	.06	.07	.15
RURAL	1978	STARCHY ROOTS/TUBERS	.34	.33	.29	.22
RURAL	1978	OTHER CEREALS/PRODUC	.04	.08	.10	.08
RURAL	1978	SUGARS/SYRUPS	.10	.13	.19	.23
RURAL	1978	FATS/OILS	.06	.06	.08	.10
RURAL	1978	FRESH FISH	.31	.39	.42	.53
RURAL	1978	PORK	.02	.04	.06	.13
RURAL	1978	BEEF	.00	.01	.01	.04
RURAL	1978	POULTRY	.02	.06	.03	.07
RURAL	1978	OTHER FISH/MEAT/POUL	.26	.39	.40	.42
RURAL	1978	EGGS	.01	.03	.06	.08
RURAL	1978	MILK/MILK PRODUCTS	.07	.12	.22	.45
RURAL	1978	GREEEN LEAFY/YELLOW	.27	.27	.26	.29
RURAL	1978	OTHER FRUITS/VEG	1.20	1.53	1.65	2.03
RURAL	1978	MISCELLANEOUS	.17	.22	.20	.06
RURAL	1982	RICE	1.93	2.28	2.33	2.25
RURAL	1982	CORN	.55	.25	.18	.13
RURAL	1982	WHEAT/BREAD	.04	.06	.08	.11
RURAL	1982	STARCHY ROOTS/TUBERS	.43	.44	.26	.30
RURAL	1982	OTHER CEREALS/PRODUC	.04	.06	.10	.12
RURAL	1982	SUGARS/SYRUPS	.09	.13	.15	.22
RURAL	1982	FATS/OILS	.07	.08	.12	.15
RURAL	1982	FRESH FISH	.32	.50	.53	.64
RURAL	1982	PORK	.04	.06	.12	.20
RURAL	1982	BEEF	.01	.00	.01	.04
RURAL	1982	POULTRY	.04	.03	.06	.15
RURAL	1982	OTHER FISH/MEAT/POUL	.27	.40	.37	.46
RURAL	1982	EGGS	.02	.04	.06	.11
RURAL	1982	MILK/MILK PRODUCTS	.09	.16	.25	.69
RURAL	1982	GREEEN LEAFY/YELLOW	.34	.28	.29	.24
RURAL	1982	OTHER FRUITS/VEG	1.10	1.08	1.41	1.68
RURAL	1982	MISCELLANEOUS	.23	.30	.25	.36
RURAL	1987	RICE	2.00	2.16	2.29	2.25
RURAL	1987	CORN	.33	.19	.12	.11
RURAL	1987	WHEAT/BREAD	.03	.04	.07	.08
RURAL	1987	STARCHY ROOTS/TUBERS	.20	.18	.13	.18
RURAL	1987	OTHER CEREALS/PRODUC	.09	.11	.15	.15
RURAL	1987	SUGARS/SYRUPS	.11	.17	.18	.20
RURAL	1987	FATS/OILS	.06	.08	.10	.11
RURAL	1987	FRESH FISH	.37	.47	.53	.56
RURAL	1987	PORK	.04	.07	.12	.18
RURAL	1987	BEEF	.01	.02	.03	.11
RURAL	1987	POULTRY	.03	.05	.06	.10
RURAL	1987	OTHER FISH/MEAT/POUL	.32	.40	.39	.46
RURAL	1987	EGGS	.04	.05	.08	.10
RURAL	1987	MILK/MILK PRODUCTS	.15	.20	.32	.41
RURAL	1987	GREEEN LEAFY/YELLOW	.25	.21	.22	.22
RURAL	1987	OTHER FRUITS/VEG	1.13	1.25	1.54	1.54
RURAL	1987	MISCELLANEOUS	.22	.26	.30	.27

Table 8.2.a Price Per Kilogram, Urban, By Income Quartile By Year

Urban/ Rural	Year	Food Group	Income Quartile 1	2	3	4
URBAN	1978	RICE	1.37	1.34	1.37	1.39
URBAN	1978	CORN	1.22	1.01	1.03	.81
URBAN	1978	WHEAT/BREAD	2.60	2.66	2.79	2.83
URBAN	1978	STARCHY ROOTS/TUBERS	.41	.65	.86	1.37
URBAN	1978	OTHER CEREALS/PRODUC	2.71	2.78	2.66	3.75
URBAN	1978	SUGARS/SYRUPS	1.71	1.44	1.55	1.57
URBAN	19[illegible]	FATS/OILS	6.49	3.79	4.33	5.84
URBAN	1978	FRESH FISH	3.20	3.20	3.86	4.47
URBAN	1978	PORK	6.49	7.14	7.47	8.12
URBAN	1978	BEEF	8.66	6.49	8.12	9.09
URBAN	1978	POULTRY	9.74	6.49	6.49	8.44
URBAN	1978	OTHER FISH/MEAT/POUL	3.08	3.62	4.33	5.32
URBAN	1978	EGGS	6.49	5.57	5.96	5.93
URBAN	1978	MILK/MILK PRODUCTS	4.47	6.84	6.26	7.72
URBAN	1978	GREEEN LEAFY/YELLOW	1.00	1.05	.96	1.20
URBAN	1978	OTHER FRUITS/VEG	.85	.95	1.00	1.26
URBAN	1978	MISCELLANEOUS	2.75	3.64	4.06	5.79
URBAN	1982	RICE	1.22	1.29	1.33	1.43
URBAN	1982	CORN	1.08	.86	.69	1.19
URBAN	1982	WHEAT/BREAD	4.74	5.04	4.47	5.76
URBAN	1982	STARCHY ROOTS/TUBERS	.61	.80	1.38	1.38
URBAN	1982	OTHER CEREALS/PRODUC	1.84	3.51	4.74	4.59
URBAN	1982	SUGARS/SYRUPS	2.54	2.94	4.00	4.03
URBAN	1982	FATS/OILS	2.08	2.45	2.01	1.98
URBAN	1982	FRESH FISH	2.72	3.04	3.44	3.98
URBAN	1982	PORK	4.44	4.77	5.38	4.62
URBAN	1982	BEEF	4.15	6.92	5.53	5.39
URBAN	1982	POULTRY	3.32	4.84	5.04	5.59
URBAN	1982	OTHER FISH/MEAT/POUL	2.55	3.16	4.15	4.84
URBAN	1982	EGGS	5.81	5.53	5.75	5.39
URBAN	1982	MILK/MILK PRODUCTS	1.81	1.82	1.84	1.48
URBAN	1982	GREEEN LEAFY/YELLOW	.89	1.20	1.38	1.44
URBAN	1982	OTHER FRUITS/VEG	.88	1.12	1.09	1.22
URBAN	1982	MISCELLANEOUS	2.77	3.44	8.57	3.59
URBAN	1987	RICE	1.13	1.17	1.22	1.20
URBAN	1987	CORN	.97	1.02	1.03	1.32
URBAN	1987	WHEAT/BREAD	6.33	6.40	6.93	8.28
URBAN	1987	STARCHY ROOTS/TUBERS	.54	.65	1.13	1.21
URBAN	1987	OTHER CEREALS/PRODUC	2.11	2.34	3.23	3.62
URBAN	1987	SUGARS/SYRUPS	2.94	2.96	3.49	4.37
URBAN	1987	FATS/OILS	3.29	3.06	3.73	3.94
URBAN	1987	FRESH FISH	2.54	2.71	3.35	3.59
URBAN	1987	PORK	5.75	5.90	6.59	6.41
URBAN	1987	BEEF	5.43	5.94	6.51	6.41
URBAN	1987	POULTRY	6.03	5.75	6.90	7.11
URBAN	1987	OTHER FISH/MEAT/POUL	2.49	3.62	4.02	5.14
URBAN	1987	EGGS	5.17	4.62	4.70	4.86
URBAN	1987	MILK/MILK PRODUCTS	1.22	1.48	1.66	1.61
URBAN	1987	GREEEN LEAFY/YELLOW	.76	.98	1.21	1.21
URBAN	1987	OTHER FRUITS/VEG	.88	1.05	1.20	1.22
URBAN	1987	MISCELLANEOUS	3.20	3.56	3.62	4.50

Note: Index Price = Retail price divided by price paid for a kilogram of corn the lowest rural income group.

Table 8.2.b Price Per Kilogram, Rural, By Income Quartile By Year

Urban/ Rural	Year	Food Group	Quartile 1	2	3	4
RURAL	1978	RICE	1.36	1.37	1.39	1.36
RURAL	1978	CORN	1.00	1.10	.93	.90
RURAL	1978	WHEAT/BREAD	3.25	2.44	3.25	2.47
RURAL	1978	STARCHY ROOTS/TUBERS	.40	.42	.46	.61
RURAL	1978	OTHER CEREALS/PRODUC	2.17	2.71	2.78	4.72
RURAL	1978	SUGARS/SYRUPS	1.39	1.81	1.68	1.77
RURAL	1978	FATS/OILS	3.25	3.61	3.79	3.71
RURAL	1978	FRESH FISH	2.81	3.13	3.68	3.50
RURAL	1978	PORK	6.49	6.49	7.31	7.18
RURAL	1978	BEEF	.00	6.49	6.49	9.09
RURAL	1978	POULTRY	6.49	5.68	9.74	8.44
RURAL	1978	OTHER FISH/MEAT/POUL	2.98	3.66	3.76	4.33
RURAL	1978	EGGS	6.49	6.49	6.49	6.49
RURAL	1978	MILK/MILK PRODUCTS	5.20	4.20	3.77	7.31
RURAL	1978	GREEEN LEAFY/YELLOW	.51	.68	.70	.79
RURAL	1978	OTHER FRUITS/VEG	.68	.69	.86	.94
RURAL	1978	MISCELLANEOUS	2.17	2.30	3.58	4.33
RURAL	1982	RICE	1.13	1.15	1.18	1.26
RURAL	1982	CORN	1.00	.95	1.00	1.15
RURAL	1982	WHEAT/BREAD	4.98	5.19	4.84	5.53
RURAL	1982	STARCHY ROOTS/TUBERS	.40	.39	.56	.58
RURAL	1982	OTHER CEREALS/PRODUC	2.77	3.11	2.37	3.66
RURAL	1982	SUGARS/SYRUPS	2.23	2.18	3.02	3.88
RURAL	1982	FATS/OILS	2.91	3.39	2.93	3.36
RURAL	1982	FRESH FISH	2.61	2.63	2.99	2.96
RURAL	1982	PORK	4.84	5.71	5.12	4.30
RURAL	1982	BEEF	4.15	.00	4.15	4.15
RURAL	1982	POULTRY	4.15	4.15	3.63	3.56
RURAL	1982	OTHER FISH/MEAT/POUL	2.62	2.33	2.90	3.51
RURAL	1982	EGGS	5.53	5.53	6.22	6.09
RURAL	1982	MILK/MILK PRODUCTS	1.60	1.62	1.61	1.00
RURAL	1982	GREEEN LEAFY/YELLOW	.69	.83	.91	1.10
RURAL	1982	OTHER FRUITS/VEG	.69	.89	.99	.99
RURAL	1982	MISCELLANEOUS	1.89	1.93	2.96	3.03
RURAL	1987	RICE	1.11	1.24	1.15	1.16
RURAL	1987	CORN	1.00	1.01	1.38	1.13
RURAL	1987	WHEAT/BREAD	8.14	6.93	6.87	8.38
RURAL	1987	STARCHY ROOTS/TUBERS	.52	.56	.80	.84
RURAL	1987	OTHER CEREALS/PRODUC	2.09	2.15	2.63	3.10
RURAL	1987	SUGARS/SYRUPS	2.26	2.49	3.26	3.55
RURAL	1987	FATS/OILS	3.22	3.17	3.49	3.38
RURAL	1987	FRESH FISH	2.49	2.59	2.94	3.41
RURAL	1987	PORK	5.79	5.61	5.74	6.33
RURAL	1987	BEEF	5.43	5.43	5.88	6.33
RURAL	1987	POULTRY	6.33	5.43	6.43	6.98
RURAL	1987	OTHER FISH/MEAT/POUL	2.79	2.92	3.20	3.53
RURAL	1987	EGGS	5.79	4.91	5.10	5.17
RURAL	1987	MILK/MILK PRODUCTS	1.03	1.25	1.61	1.50
RURAL	1987	GREEEN LEAFY/YELLOW	.72	.78	.88	.90
RURAL	1987	OTHER FRUITS/VEG	.75	.83	.90	.98
RURAL	1987	MISCELLANEOUS	2.37	2.49	3.07	4.09

Note: Index Price = Retail price divided by price paid for a kilogram of corn the lowest rural income group.

Table 8.3.a Price Per 1,000 Calories, Urban, By Income Quartile By Year

Urban/ Rural	Year	Food Group	Quartile 1	2	3	4
URBAN	1978	RICE	.39	.39	.40	.41
URBAN	1978	CORN	.35	.30	.31	.38
URBAN	1978	WHEAT/BREAD	.71	.72	.74	.77
URBAN	1978	STARCHY ROOTS/TUBERS	.41	.62	.81	1.45
URBAN	1978	OTHER CEREALS/PRODUC	1.71	1.69	1.22	1.65
URBAN	1978	SUGARS/SYRUPS	.68	.51	.73	.88
URBAN	1978	FATS/OILS	1.00	.43	.52	1.03
URBAN	1978	FRESH FISH	5.77	5.70	7.20	7.65
URBAN	1978	PORK	1.89	1.93	1.97	2.00
URBAN	1978	BEEF	5.19	4.33	4.64	5.05
URBAN	1978	POULTRY	6.49	4.33	5.85	7.68
URBAN	1978	OTHER FISH/MEAT/POUL	4.25	4.58	4.59	5.47
URBAN	1978	EGGS	4.33	3.89	4.20	4.13
URBAN	1978	MILK/MILK PRODUCTS	4.20	7.45	7.83	9.69
URBAN	1978	GREEEN LEAFY/YELLOW	4.33	4.05	4.33	5.41
URBAN	1978	OTHER FRUITS/VEG	2.78	2.91	3.15	3.85
URBAN	1978	MISCELLANEOUS	3.10	3.95	4.06	4.99
URBAN	1982	RICE	.35	.37	.39	.42
URBAN	1982	CORN	.30	.33	.26	.92
URBAN	1982	WHEAT/BREAD	.76	.79	.81	1.00
URBAN	1982	STARCHY ROOTS/TUBERS	.57	.80	1.30	1.38
URBAN	1982	OTHER CEREALS/PRODUC	.72	1.14	1.44	1.48
URBAN	1982	SUGARS/SYRUPS	.67	.80	1.06	1.06
URBAN	1982	FATS/OILS	.45	.47	.44	.54
URBAN	1982	FRESH FISH	4.89	5.83	5.94	6.95
URBAN	1982	PORK	1.27	1.34	1.45	1.42
URBAN	1982	BEEF	2.08	5.19	4.15	4.90
URBAN	1982	POULTRY	3.32	4.15	4.70	5.84
URBAN	1982	[illegible]/MEAT/POUL	3.32	3.82	4.07	4.47
URBAN	1982	EGGS	4.15	3.83	3.93	3.85
URBAN	1982	MILK/[illegible] PRODUCTS	1.89	2.24	2.43	2.90
URBAN	1982	GREEEN LEAFY/YELLOW	3.55	4.66	6.23	6.65
URBAN	1982	OTHER FRUITS/VEG	3.11	3.36	3.38	3.78
URBAN	1982	MISCELLANEOUS	2.44	3.25	3.30	3.26
URBAN	1987	RICE	.32	.34	.35	.35
URBAN	1987	CORN	.29	.33	.60	.80
URBAN	1987	WHEAT/BREAD	.80	.79	.88	1.00
URBAN	1987	STARCHY ROOTS/TUBERS	.49	.69	1.13	1.21
URBAN	1987	OTHER CEREALS/PRODUC	1.12	1.32	1.62	1.87
URBAN	1987	SUGARS/SYRUPS	.78	.76	.93	1.16
URBAN	1987	FATS/OILS	.37	.34	.45	.46
URBAN	1987	FRESH FISH	4.47	5.12	6.29	6.42
URBAN	1987	PORK	2.04	1.60	1.89	1.90
URBAN	1987	BEEF	2.71	4.62	5.43	5.04
URBAN	1987	POULTRY	6.03	4.87	18.97	5.85
URBAN	1987	OTHER FISH/MEAT/POUL	3.06	3.70	3.07	4.19
URBAN	1987	EGGS	3.29	3.20	3.36	3.24
URBAN	1987	MILK/MILK PRODUCTS	2.53	3.09	2.95	3.04
URBAN	1987	GREEEN LEAFY/YELLOW	3.35	3.92	4.82	4.82
URBAN	1987	OTHER FRUITS/VEG	2.27	2.64	2.98	3.23
URBAN	1987	MISCELLANEOUS	3.08	3.27	3.37	3.62

Note: Price = Expenditures for a particular food (indexed by the cost of corn per kg.) divided by total calories (times 1000) provided by that food.

Table 8.3.b Price Per 1,000 Calories, Rural, By Income Quartile By Year

Urban/ Rural	Year	Food Group	Quartile 1	2	3	4
RURAL	1978	RICE	.39	.41	.41	.41
RURAL	1978	CORN	.32	.34	.30	.27
RURAL	1978	WHEAT/BREAD	.65	.59	.62	.67
RURAL	1978	STARCHY ROOTS/TUBERS	.39	.43	.46	.61
RURAL	1978	OTHER CEREALS/PRODUC	1.62	1.35	1.69	2.36
RURAL	1978	SUGARS/SYRUPS	.42	.58	.62	.72
RURAL	1978	FATS/OILS	.39	.40	.43	.42
RURAL	1978	FRESH FISH	5.15	5.65	6.49	5.79
RURAL	1978	PORK	1.95	1.77	1.83	2.16
RURAL	1978	BEEF	.00	3.25	3.25	5.68
RURAL	1978	POULTRY	4.87	3.25	6.49	6.49
RURAL	1978	OTHER FISH/MEAT/POUL	4.80	5.16	4.76	5.09
RURAL	1978	EGGS	3.25	4.33	4.87	2.36
RURAL	1978	MILK/MILK PRODUCTS	4.33	3.76	3.25	7.92
RURAL	1978	GREEEN LEAFY/YELLOW	1.95	2.59	2.89	3.60
RURAL	1978	OTHER FRUITS/VEG	1.95	2.20	2.48	2.90
RURAL	1978	MISCELLANEOUS	1.92	1.88	2.66	1.56
RURAL	1982	RICE	.33	.33	.35	.38
RURAL	1982	CORN	.28	.28	.31	.39
RURAL	1982	WHEAT/BREAD	.80	.80	.81	.86
RURAL	1982	STARCHY ROOTS/TUBERS	.40	.41	.59	.69
RURAL	1982	OTHER CEREALS/PRODUC	.66	1.08	.92	1.42
RURAL	1982	SUGARS/SYRUPS	.58	.65	.80	1.05
RURAL	1982	FATS/OILS	.35	.42	.45	.48
RURAL	1982	FRESH FISH	4.63	4.92	5.34	5.87
RURAL	1982	PORK	1.32	1.34	1.36	1.17
RURAL	1982	BEEF	2.77	.00	2.77	3.46
RURAL	1982	POULTRY	3.46	3.32	3.23	2.87
RURAL	1982	OTHER FISH/MEAT/POUL	4.15	3.91	3.66	4.66
RURAL	1982	EGGS	4.15	4.15	4.15	4.15
RURAL	1982	MILK/MILK PRODUCTS	1.73	2.07	2.08	2.37
RURAL	1982	GREEEN LEAFY/YELLOW	2.56	3.32	3.74	4.68
RURAL	1982	OTHER FRUITS/VEG	2.00	2.74	3.17	3.07
RURAL	1982	MISCELLANEOUS	1.56	2.24	2.66	3.03
RURAL	1987	RICE	.32	.36	.34	.35
RURAL	1987	CORN	.30	.33	.43	.37
RURAL	1987	WHEAT/BREAD	.86	.85	.85	.97
RURAL	1987	STARCHY ROOTS/TUBERS	.50	.56	.76	.84
RURAL	1987	OTHER CEREALS/PRODUC	.97	1.01	1.18	1.23
RURAL	1987	SUGARS/SYRUPS	.63	.75	.88	.94
RURAL	1987	FATS/OILS	.37	.37	.41	.39
RURAL	1987	FRESH FISH	4.55	4.69	5.25	6.21
RURAL	1987	PORK	1.38	1.40	1.66	1.87
RURAL	1987	BEEF	5.43	5.43	4.70	5.63
RURAL	1987	POULTRY	4.22	3.80	5.26	5.42
RURAL	1987	OTHER FISH/MEAT/POUL	3.38	3.62	3.26	3.95
RURAL	1987	EGGS	3.62	3.44	3.50	3.44
RURAL	1987	MILK/MILK PRODUCTS	2.17	2.41	2.89	2.96
RURAL	1987	GREEEN LEAFY/YELLOW	2.81	2.93	3.39	3.62
RURAL	1987	OTHER FRUITS/VEG	1.96	2.09	2.50	2.45
RURAL	1987	MISCELLANEOUS	2.11	2.20	2.54	3.11

Note: Price = Expenditures for a particular food (indexed by the cost of corn per kg.) divided by total calories (times 1000) provided by that food.

Table 8.4.a Food Budget Shares, Urban, By Income Quartile By Year

Urban/ Rural	Year	Food Group	Quartile 1	2	3	4
URBAN	1978	RICE	.25	.21	.16	.10
URBAN	1978	CORN	.01	.02	.01	.00
URBAN	1978	WHEAT/BREAD	.04	.04	.04	.03
URBAN	1978	STARCHY ROOTS/TUBERS	.01	.01	.01	.01
URBAN	1978	OTHER CEREALS/PRODUC	.02	.02	.03	.03
URBAN	1978	SUGARS/SYRUPS	.02	.02	.03	.03
URBAN	1978	FATS/OILS	.06	.03	.03	.05
URBAN	1978	FRESH FISH	.14	.14	.12	.10
URBAN	1978	PORK	.04	.04	.07	.09
URBAN	1978	BEEF	.02	.01	.02	.03
URBAN	1978	POULTRY	.01	.02	.03	.05
URBAN	1978	OTHER FISH/MEAT/POUL	.09	.09	.11	.11
URBAN	1978	EGGS	.03	.02	.03	.04
URBAN	1978	MILK/MILK PRODUCTS	.10	.15	.16	.17
URBAN	1978	GREEEN LEAFY/YELLOW	.02	.02	.01	.01
URBAN	1978	OTHER FRUITS/VEG	.09	.10	.10	.10
URBAN	1978	MISCELLANEOUS	.05	.06	.06	.06
URBAN	1982	RICE	.29	.24	.18	.13
URBAN	1982	CORN	.02	.01	.00	.00
URBAN	1982	WHEAT/BREAD	.05	.04	.06	.07
URBAN	1982	STARCHY ROOTS/TUBERS	.01	.01	.01	.01
URBAN	1982	OTHER CEREALS/PRODUC	.01	.03	.03	.03
URBAN	1982	SUGARS/SYRUPS	.04	.04	.05	.05
URBAN	1982	FATS/OILS	.03	.03	.03	.03
URBAN	1982	FRESH FISH	.13	.13	.13	.11
URBAN	1982	PORK	.05	.06	.07	.09
URBAN	1982	BEEF	.00	.01	.01	.02
URBAN	1982	POULTRY	.01	.02	.04	.05
URBAN	1982	OTHER FISH/MEAT/POUL	.11	.09	.10	.11
URBAN	1982	EGGS	.02	.03	.04	.04
URBAN	1982	MILK/MILK PRODUCTS	.03	.04	.05	.05
URBAN	1982	GREEEN LEAFY/YELLOW	.02	.02	.02	.01
URBAN	1982	OTHER FRUITS/VEG	.10	.11	.13	.13
URBAN	1982	MISCELLANEOUS	.07	.08	.06	.08
URBAN	1987	RICE	.26	.19	.16	.12
URBAN	1987	CORN	.01	.01	.00	.01
URBAN	1987	WHEAT/BREAD	.05	.05	.06	.06
URBAN	1987	STARCHY ROOTS/TUBERS	.01	.01	.01	.01
URBAN	1987	OTHER CEREALS/PRODUC	.03	.04	.04	.04
URBAN	1987	SUGARS/SYRUPS	.04	.04	.05	.05
URBAN	1987	FATS/OILS	.03	.03	.03	.03
URBAN	1987	FRESH FISH	.15	.11	.12	.11
URBAN	1987	PORK	.05	.07	.10	.12
URBAN	1987	BEEF	.00	.03	.02	.03
URBAN	1987	POULTRY	.02	.04	.04	.04
URBAN	1987	OTHER FISH/MEAT/POUL	.10	.11	.11	.12
URBAN	1987	EGGS	.03	.03	.03	.03
URBAN	1987	MILK/MILK PRODUCTS	.03	.05	.04	.05
URBAN	1987	GREEEN LEAFY/YELLOW	.02	.02	.01	.01
URBAN	1987	OTHER FRUITS/VEG	.10	.11	.11	.11
URBAN	1987	MISCELLANEOUS	.07	.08	.07	.07

Table 8.4.b Food Budget Shares, Rural, By Income Quartile By Year

Urban/ Rural	Year	Food Group	Quartile 1	2	3	4
RURAL	1978	RICE	.38	.31	.28	.19
RURAL	1978	CORN	.06	.04	.02	.01
RURAL	1978	WHEAT/BREAD	.01	.01	.02	.02
RURAL	1978	STARCHY ROOTS/TUBERS	.02	.01	.01	.01
RURAL	1978	OTHER CEREALS/PRODUC	.01	.02	.02	.02
RURAL	1978	SUGARS/SYRUPS	.02	.02	.03	.02
RURAL	1978	FATS/OILS	.02	.02	.03	.02
RURAL	1978	FRESH FISH	.11	.12	.13	.11
RURAL	1978	PORK	.02	.03	.03	.06
RURAL	1978	BEEF	.00	.00	.01	.02
RURAL	1978	POULTRY	.02	.03	.02	.04
RURAL	1978	OTHER FISH/MEAT/POUL	.10	.14	.12	.11
RURAL	1978	EGGS	.01	.02	.03	.03
RURAL	1978	MILK/MILK PRODUCTS	.05	.05	.07	.20
RURAL	1978	GREEEN LEAFY/YELLOW	.02	.02	.02	.01
RURAL	1978	OTHER FRUITS/VEG	.11	.10	.12	.11
RURAL	1978	MISCELLANEOUS	.05	.05	.06	.02
RURAL	1982	RICE	.30	.29	.25	.19
RURAL	1982	CORN	.08	.03	.02	.01
RURAL	1982	WHEAT/BREAD	.02	.03	.04	.04
RURAL	1982	STARCHY ROOTS/TUBERS	.02	.02	.01	.01
RURAL	1982	OTHER CEREALS/PRODUC	.02	.02	.02	.03
RURAL	1982	SUGARS/SYRUPS	.03	.03	.04	.06
RURAL	1982	FATS/OILS	.03	.03	.03	.03
RURAL	1982	FRESH FISH	.12	.15	.14	.13
RURAL	1982	PORK	.03	.04	.06	.06
RURAL	1982	BEEF	.01	.00	.01	.01
RURAL	1982	POULTRY	.02	.01	.02	.04
RURAL	1982	OTHER FISH/MEAT/POUL	.10	.10	.10	.11
RURAL	1982	EGGS	.02	.03	.03	.04
RURAL	1982	MILK/MILK PRODUCTS	.02	.03	.04	.05
RURAL	1982	GREEEN LEAFY/YELLOW	.03	.03	.02	.02
RURAL	1982	OTHER FRUITS/VEG	.10	.11	.13	.11
RURAL	1982	MISCELLANEOUS	.06	.07	.07	.07
RURAL	1987	RICE	.29	.28	.22	.17
RURAL	1987	CORN	.04	.02	.01	.01
RURAL	1987	WHEAT/BREAD	.03	.03	.04	.04
RURAL	1987	STARCHY ROOTS/TUBERS	.01	.01	.01	.01
RURAL	1987	OTHER CEREALS/PRODUC	.03	.03	.03	.03
RURAL	1987	SUGARS/SYRUPS	.03	.04	.05	.05
RURAL	1987	FATS/OILS	.03	.03	.03	.02
RURAL	1987	FRESH FISH	.12	.13	.13	.13
RURAL	1987	PORK	.03	.04	.06	.08
RURAL	1987	BEEF	.01	.01	.01	.05
RURAL	1987	POULTRY	.02	.03	.03	.05
RURAL	1987	OTHER FISH/MEAT/POUL	.12	.12	.10	.11
RURAL	1987	EGGS	.03	.03	.03	.03
RURAL	1987	MILK/MILK PRODUCTS	.02	.03	.04	.04
RURAL	1987	GREEEN LEAFY/YELLOW	.02	.02	.02	.01
RURAL	1987	OTHER FRUITS/VEG	.11	.11	.11	.10
RURAL	1987	MISCELLANEOUS	.07	.07	.08	.07

Table 8.5.a Calorie Shares, Urban, By Income Quartile By Year

Urban/ Rural	Year	Food Group	Quartile 1	2	3	4
URBAN	1978	RICE	.63	.57	.53	.45
URBAN	1978	CORN	.04	.07	.04	.01
URBAN	1978	WHEAT/BREAD	.05	.05	.06	.08
URBAN	1978	STARCHY ROOTS/TUBERS	.02	.01	.01	.01
URBAN	1978	OTHER CEREALS/PRODUC	.01	.02	.03	.03
URBAN	1978	SUGARS/SYRUPS	.03	.05	.05	.06
URBAN	1978	FATS/OILS	.06	.07	.07	.09
URBAN	1978	FRESH FISH	.03	.03	.02	.02
URBAN	1978	PORK	.02	.02	.05	.08
URBAN	1978	BEEF	.00	.00	.00	.01
URBAN	1978	POULTRY	.00	.00	.01	.01
URBAN	1978	OTHER FISH/MEAT/POUL	.02	.02	.03	.04
URBAN	1978	EGGS	.01	.01	.01	.02
URBAN	1978	MILK/MILK PRODUCTS	.02	.02	.03	.03
URBAN	1978	GREEEN LEAFY/YELLOW	.00	.01	.00	.00
URBAN	1978	OTHER FRUITS/VEG	.03	.04	.04	.05
URBAN	1978	MISCELLANEOUS	.02	.02	.02	.02
URBAN	1982	RICE	.63	.59	.52	.43
URBAN	1982	CORN	.05	.04	.01	.01
URBAN	1982	WHEAT/BREAD	.05	.05	.08	.09
URBAN	1982	STARCHY ROOTS/TUBERS	.02	.02	.01	.01
URBAN	1982	OTHER CEREALS/PRODUC	.01	.02	.03	.03
URBAN	1982	SUGARS/SYRUPS	.04	.05	.06	.06
URBAN	1982	FATS/OILS	.05	.07	.08	.09
URBAN	1982	FRESH FISH	.02	.02	.02	.02
URBAN	1982	PORK	.03	.04	.06	.09
URBAN	1982	BEEF	.00	.00	.00	.01
URBAN	1982	POULTRY	.00	.00	.01	.01
URBAN	1982	OTHER FISH/MEAT/POUL	.02	.02	.03	.03
URBAN	1982	EGGS	.00	.01	.01	.01
URBAN	1982	MILK/MILK PRODUCTS	.01	.02	.02	.03
URBAN	1982	GREEEN LEAFY/YELLOW	.00	.01	.00	.00
URBAN	1982	OTHER FRUITS/VEG	.02	.03	.04	.05
URBAN	1982	MISCELLANEOUS	.02	.02	.02	.03
URBAN	1987	RICE	.63	.55	.52	.46
URBAN	1987	CORN	.03	.03	.01	.01
URBAN	1987	WHEAT/BREAD	.05	.07	.08	.08
URBAN	1987	STARCHY ROOTS/TUBERS	.01	.01	.01	.01
URBAN	1987	OTHER CEREALS/PRODUC	.02	.03	.03	.03
URBAN	1987	SUGARS/SYRUPS	.04	.05	.06	.06
URBAN	1987	FATS/OILS	.06	.07	.07	.08
URBAN	1987	FRESH FISH	.03	.02	.02	.02
URBAN	1987	PORK	.02	.04	.06	.09
URBAN	1987	BEEF	.00	.01	.00	.01
URBAN	1987	POULTRY	.00	.01	.00	.01
URBAN	1987	OTHER FISH/MEAT/POUL	.03	.03	.04	.04
URBAN	1987	EGGS	.01	.01	.01	.01
URBAN	1987	MILK/MILK PRODUCTS	.01	.02	.02	.02
URBAN	1987	GREEEN LEAFY/YELLOW	.01	.00	.00	.00
URBAN	1987	OTHER FRUITS/VEG	.04	.04	.04	.05
URBAN	1987	MISCELLANEOUS	.02	.02	.02	.02

Table 8.5.b Calorie Shares, Rural, By Income Quartile By Year

Urban/ Rural	Year	Food Group	Quartile 1	2	3	4
RURAL	1978	RICE	.65	.64	.63	.57
RURAL	1978	CORN	.13	.09	.05	.05
RURAL	1978	WHEAT/BREAD	.01	.02	.03	.04
RURAL	1978	STARCHY ROOTS/TUBERS	.03	.03	.02	.02
RURAL	1978	OTHER CEREALS/PRODUC	.01	.01	.01	.01
RURAL	1978	SUGARS/SYRUPS	.03	.03	.04	.04
RURAL	1978	FATS/OILS	.04	.05	.06	.06
RURAL	1978	FRESH FISH	.02	.02	.02	.02
RURAL	1978	PORK	.01	.01	.02	.03
RURAL	1978	BEEF	.00	.00	.00	.00
RURAL	1978	POULTRY	.00	.01	.00	.01
RURAL	1978	OTHER FISH/MEAT/POUL	.01	.02	.02	.03
RURAL	1978	EGGS	.00	.00	.01	.02
RURAL	1978	MILK/MILK PRODUCTS	.01	.01	.02	.03
RURAL	1978	GREEEN LEAFY/YELLOW	.01	.01	.01	.01
RURAL	1978	OTHER FRUITS/VEG	.04	.04	.04	.05
RURAL	1978	MISCELLANEOUS	.02	.02	.02	.01
RURAL	1982	RICE	.57	.64	.61	.54
RURAL	1982	CORN	.17	.07	.04	.03
RURAL	1982	WHEAT/BREAD	.02	.03	.04	.05
RURAL	1982	STARCHY ROOTS/TUBERS	.04	.03	.02	.02
RURAL	1982	OTHER CEREALS/PRODUC	.02	.01	.02	.02
RURAL	1982	SUGARS/SYRUPS	.03	.04	.05	.06
RURAL	1982	FATS/OILS	.05	.05	.06	.07
RURAL	1982	FRESH FISH	.02	.02	.02	.02
RURAL	1982	PORK	.01	.02	.03	.05
RURAL	1982	BEEF	.00	.00	.00	.00
RURAL	1982	POULTRY	.00	.00	.01	.01
RURAL	1982	OTHER FISH/MEAT/POUL	.01	.02	.02	.02
RURAL	1982	EGGS	.00	.01	.01	.01
RURAL	1982	MILK/MILK PRODUCTS	.01	.01	.02	.02
RURAL	1982	GREEEN LEAFY/YELLOW	.01	.01	.01	.00
RURAL	1982	OTHER FRUITS/VEG	.03	.03	.03	[illegible]
RURAL	1982	MISCELLANEOUS	.02	.02	.02	.03
RURAL	1987	RICE	.62	.62	.59	.55
RURAL	1987	CORN	.10	.0[illegible]	.03	.03
RURAL	1987	WHEAT/BREAD	.02	.03	.04	.05
RURAL	1987	STARCHY ROOTS/TUBERS	.02	.02	.01	.01
RURAL	1987	OTHER CEREALS/PRODUC	.02	.02	.03	.03
RURAL	1987	SUGARS/SYRUPS	.04	.05	.05	.05
RURAL	1987	FATS/OILS	.05	.06	.06	.07
RURAL	1987	FRESH FISH	.02	.02	.02	.02
RURAL	1987	PORK	.01	.02	.03	.05
RURAL	1987	BEEF	.00	.00	.00	.01
RURAL	1987	POULTRY	.00	.01	.01	.01
RURAL	1987	OTHER FISH/MEAT/POUL	.02	.03	.03	.03
RURAL	1987	EGGS	.01	.01	.01	.01
RURAL	1987	MILK/MILK PRODUCTS	.01	.01	.01	.02
RURAL	1987	GREEEN LEAFY/YELLOW	.01	.01	.00	.00
RURAL	1987	OTHER FRUITS/VEG	.04	.04	.04	.05
RURAL	1987	MISCELLANEOUS	.02	.02	.03	.03

Table 8.6.a Calorie Intakes Per Adult Equivalent, Urban, By Income Quartile By Year

Urban/ Rural	Year	Food Group	Quartile 1	2	3	4
URBAN	1978	RICE	1109	1097	1101	1022
URBAN	1978	CORN	68	136	76	21
URBAN	1978	WHEAT/BREAD	88	100	128	174
URBAN	1978	STARCHY ROOTS/TUBERS	39	26	19	22
URBAN	1978	OTHER CEREALS/PRODUC	23	28	58	71
URBAN	1978	SUGARS/SYRUPS	58	94	108	134
URBAN	1978	FATS/OILS	110	129	152	206
URBAN	1978	FRESH FISH	44	51	45	54
URBAN	1978	PORK	38	46	93	177
URBAN	1978	BEEF	6	4	9	22
URBAN	1978	POULTRY	4	7	12	27
URBAN	1978	OTHER FISH/MEAT/POUL	35	42	62	85
URBAN	1978	EGGS	11	12	21	40
URBAN	1978	MILK/MILK PRODUCTS	41	42	54	71
URBAN	1978	GREEEN LEAFY/YELLOW	7	10	7	7
URBAN	1978	OTHER FRUITS/VEG	59	72	85	113
URBAN	1978	MISCELLANEOUS	28	28	39	52
URBAN	1978	STAPLE FOODS	1495	1609	1643	1651
URBAN	1978	NON-STAPLE FOODS	272	313	426	648
URBAN	1978	TOTAL ALL FOODS	1767	1922	2070	2299
URBAN	1982	RICE	1302	1209	1199	1049
URBAN	1982	CORN	104	80	20	11
URBAN	1982	WHEAT/BREAD	110	113	184	223
URBAN	1982	STARCHY ROOTS/TUBERS	37	33	20	23
URBAN	1982	OTHER CEREALS/PRODUC	29	51	59	74
URBAN	1982	SUGARS/SYRUPS	86	112	130	156
URBAN	1982	FATS/OILS	105	146	180	210
URBAN	1982	FRESH FISH	43	47	56	54
URBAN	1982	PORK	62	90	127	216
URBAN	1982	BEEF	3	5	5	14
URBAN	1982	POULTRY	6	9	19	28
URBAN	1982	OTHER FISH/MEAT/POUL	51	48	65	81
URBAN	1982	EGGS	9	17	24	35
URBAN	1982	MILK/MILK PRODUCTS	28	33	52	62
URBAN	1982	GREEEN LEAFY/YELLOW	9	10	8	6
URBAN	1982	OTHER FRUITS/VEG	51	66	97	114
URBAN	1982	MISCELLANEOUS	43	47	50	81
URBAN	1982	STAPLE FOODS	1774	1825	1792	1745
URBAN	1982	NON-STAPLE FOODS	305	373	504	691
URBAN	1982	TOTAL ALL FOODS	2079	2198	2295	2436
URBAN	1987	RICE	1276	1156	1158	1095
URBAN	1987	CORN	57	63	15	22
URBAN	1987	WHEAT/BREAD	102	137	175	198
URBAN	1987	STARCHY ROOTS/TUBERS	28	27	20	23
URBAN	1987	OTHER CEREALS/PRODUC	44	62	69	75
URBAN	1987	SUGARS/SYRUPS	78	111	129	146
URBAN	1987	FATS/OILS	126	150	165	181
URBAN	1987	FRESH FISH	54	45	49	52
URBAN	1987	PORK	40	91	133	203
URBAN	1987	BEEF	3	12	7	18
URBAN	1987	POULTRY	4	17	5	21
URBAN	1987	OTHER FISH/MEAT/POUL	51	58	94	87
URBAN	1987	EGGS	14	17	26	30
URBAN	1987	MILK/MILK PRODUCTS	19	31	33	55
URBAN	1987	GREEEN LEAFY/YELLOW	9	8	7	8
URBAN	1987	OTHER FRUITS/VEG	71	84	91	113
URBAN	1987	MISCELLANEOUS	35	47	54	57
URBAN	1987	STAPLE FOODS	1711	1707	1730	1740
URBAN	1987	NON-STAPLE FOODS	300	409	500	644
URBAN	1987	TOTAL ALL FOODS	2011	2116	2230	2384

Table 8.6.b Calorie Intakes Per Adult Equivalent, Rural, By Income Quartile By Year

Urban/ Rural	Year	Food Group	Quartile 1	2	3	4
RURAL	1978	RICE	1272	1396	1421	1322
RURAL	1978	CORN	246	189	106	116
RURAL	1978	WHEAT/BREAD	24	41	63	95
RURAL	1978	STARCHY ROOTS/TUBERS	61	57	51	39
RURAL	1978	OTHER CEREALS/PRODUC	10	30	28	27
RURAL	1978	SUGARS/SYRUPS	56	70	88	[illegible]
RURAL	1978	FATS/OILS	82	102	127	149
RURAL	1978	FRESH FISH	29	39	41	56
RURAL	1978	PORK	12	27	39	76
RURAL	1978	BEEF	0	2	5	10
RURAL	1978	POULTRY	5	17	7	16
RURAL	1978	OTHER FISH/MEAT/POUL	28	49	54	62
RURAL	1978	EGGS	5	7	14	40
RURAL	1978	MILK/MILK PRODUCTS	15	24	43	72
RURAL	1978	GREEEN LEAFY/YELLOW	12	12	11	11
RURAL	1978	OTHER FRUITS/VEG	73	85	98	114
RURAL	1978	MISCELLANEOUS	33	47	47	30
RURAL	1978	STAPLE FOODS	1751	1885	1884	1846
RURAL	1978	NON-STAPLE FOODS	213	310	360	486
RURAL	1978	TOTAL ALL FOODS	[illegible]	2195	2244	2332
RURAL	1982	RICE	1241	1425	1440	1361
RURAL	1982	CORN	361	153	102	68
RURAL	1982	WHEAT/BREAD	40	66	91	121
RURAL	1982	STARCHY ROOTS/TUBERS	80	76	44	45
RURAL	1982	OTHER CEREALS/PRODUC	32	29	46	55
RURAL	1982	SUGARS/SYRUPS	65	82	105	145
RURAL	1982	FATS/OILS	106	112	142	184
RURAL	1982	FRESH FISH	34	43	53	58
RURAL	1982	PORK	28	43	81	130
RURAL	1982	BEEF	4	0	4	8
RURAL	1982	POULTRY	8	6	11	33
RURAL	1982	OTHER FISH/MEAT/POUL	31	43	53	62
RURAL	1982	EGGS	5	10	15	28
RURAL	1982	MILK/MILK PRODUCTS	16	23	36	53
RURAL	1982	GREEEN LEAFY/YELLOW	17	13	13	10
RURAL	1982	OTHER FRUITS/VEG	70	64	80	97
RURAL	1982	MISCELLANEOUS	52	47	50	66
RURAL	1982	STAPLE FOODS	1926	1943	1971	1980
RURAL	1982	NON-STAPLE FOODS	264	298	396	543
RURAL	1982	TOTAL ALL FOODS	2190	2242	2367	2523
RURAL	1987	RICE	1276	1355	1409	1382
RURAL	1987	CORN	201	105	70	63
RURAL	1987	WHEAT/BREAD	49	63	103	122
RURAL	1987	STARCHY ROOTS/TUBERS	37	33	24	33
RURAL	1987	OTHER CEREALS/PRODUC	36	43	63	68
RURAL	1987	SUGARS/SYRUPS	73	102	119	136
RURAL	1987	FATS/OILS	100	133	152	168
RURAL	1987	FRESH FISH	37	47	54	57
RURAL	1987	PORK	27	51	75	113
RURAL	1987	BEEF	1	4	6	23
RURAL	1987	POULTRY	8	13	14	23
RURAL	1987	OTHER FISH/MEAT/POUL	49	59	70	76
RURAL	1987	EGGS	10	13	20	27
RURAL	1987	MILK/MILK PRODUCTS	13	19	32	39
RURAL	1987	GREEEN LEAFY/YELLOW	12	10	10	10
RURAL	1987	OTHER FRUITS/VEG	80	91	101	113
RURAL	1987	MISCELLANEOUS	46	54	66	64
RURAL	1987	STAPLE FOODS	1772	1833	1940	1974
RURAL	1987	NON-STAPLE FOODS	283	360	449	545
RURAL	1987	TOTAL ALL FOODS	2055	2193	2390	2519

Table 8.7.a Input Data for Calculating Food Demand Matrix, Urban, Income Quartile 1, 1978

Food Group	Price Per Kg.	Quantity Consumed	'000 Calories Per Kg.	Share of Food Budget	Share of Total Expend.	Price '000 Calor.	Non-Staple?	Meat?
CORN	1.218	.112	3.500	.01	.01	.35	.0	.0
RICE	1.368	1.827	3.510	.25	.17	.39	.0	.0
WHEAT/BREAD	2.597	.140	3.650	.04	.03	.71	1.0	.0
VEGET/FRUIT	.873	1.302	.296	.11	.08	2.95	1.0	.0
OTHER FOODS	2.333	.721	2.068	.17	.12	1.13	1.0	.0
FRESH FISH	3.197	.455	.554	.14	.10	5.77	1.0	.0
OTHER MEAT	3.247	.280	.725	.09	.06	4.48	1.0	1.0
PORK	6.494	.063	3.444	.04	.03	1.89	1.0	1.0
BEEF	8.656	.021	1.667	.02	.01	5.19	1.0	1.0
POULTRY	9.740	.014	1.500	.01	.01	6.49	1.0	1.0
EGGS	6.494	.042	1.500	.03	.02	4.33	1.0	1.0
MILK/PRDCT	4.468	.224	1.063	.10	.07	4.20	1.0	1.0
NON-FOODS	4.364	1.000	.000	.00	.30	.00	.0	.0

Household Size = 6.9
Adult Equivalents = 5.7
Food Expenditures = 10.2
Non-Food Expenditures = 4.4
Income = 14.5

Notes:

(1) Price per kg. is indexed on the price paid for a kilogram of corn grits by the lowest income quartile in rural areas (index = 1.00 = price paid for one kilogram of corn grits).
(2) Quantity consumed is kilograms per capita per week.
(3) Price per '000 calories uses the index for the price of corn (= indexed expenditures for a food/(kgs. for a food x calories per kg.)

Table 8.7.b Input Data for Calculating Food Demand Matrix, Urban, Income Quartile 2, 1978

Food Group	Price Per Kg.	Quantity Consumed	'000 Calories Per Kg.	Share of Food Budget	Share of Total Expend.	Price '000 Calor.	Non-Staple?	Meat?
CORN	1.015	.224	3.438	.02	.01	.30	.0	.0
RICE	1.344	1.792	3.477	.21	.13	.39	.0	.0
WHEAT/BREAD	2.656	.154	3.682	.04	.02	.72	1.0	.0
VEGET/FRUIT	.968	1.456	.317	.12	.07	3.05	1.0	.0
OTHER FOODS	2.319	.686	2.531	.14	.08	.92	1.0	.0
FRESH FISH	3.202	.511	.562	.14	.09	5.70	1.0	1.0
OTHER MEAT	3.484	.287	.805	.09	.05	4.33	1.0	1.0
PORK	7.143	.070	3.700	.04	.03	1.93	1.0	1.0
BEEF	6.494	.014	1.500	.01	.01	4.33	1.0	1.0
POULTRY	6.494	.028	1.500	.02	.01	4.33	1.0	1.0
EGGS	5.566	.049	1.429	.02	.01	3.90	1.0	1.0
MILK/MILK	6.845	.259	.919	.15	.09	7.45	1.0	1.0
NON-FOODS	7.666	1.000	.000	.00	.40	.00	.0	.0

Household Size = 6.9
Adult Equivalents = 5.6
Food Expenditures = 11.5
Non-Food Expenditures = 7.7
Income = 19.2

Notes:

(1) Price per kg. is indexed on the price paid for a kilogram of corn grits by the lowest income quartile in rural areas (index = 1.00 = price paid for one kilogram of corn grits).
(2) Quantity consumed is kilograms per capita per week.
(3) Price per '000 calories uses the index for the price of corn (= indexed expenditures for a food/(kgs. for a food x calories per kg.)

Table 8.7.c Input Data for Calculating Food Demand Matrix, Urban, Income Quartile 3, 1978

Food Group	Price Per Kg.	Quantity Consumed	'000 Calories Per Kg.	Share of Food Budget	Share of Total Expend.	Price '000 Calor.	Non-Staple?	Meat?
CORN	1.025	.133	3.263	.01	.00	.31	.0	.0
RICE	1.368	1.827	3.464	.16	.08	.40	.0	.0
WHEAT/BREAD	2.783	.196	3.750	.04	.02	.74	1.0	.0
VEGET/FRUIT	.995	1.736	.306	.11	.06	3.25	1.0	.0
OTHER FOODS	2.649	.875	2.472	.15	.08	1.07	1.0	.0
FRESH FISH	3.858	.483	.536	.12	.06	7.20	1.0	1.0
OTHER MEAT	4.288	.371	.962	.10	.05	4.46	1.0	1.0
PORK	7.468	.140	3.800	.07	.03	1.97	1.0	1.0
BEEF	8.117	.028	1.750	.02	.01	4.64	1.0	1.0
POULTRY	6.494	.063	1.111	.03	.01	5.85	1.0	1.0
EGGS	5.952	.084	1.417	.03	.02	4.20	1.0	1.0
MILK/PRDCT	6.257	.385	.800	.16	.08	7.82	1.0	1.0
NON-FOODS	15.271	1.000	.000	.00	.50	.00	.0	.0

Household Size = 6.7
Adult Equivalents = 5.5
Food Expenditures = 15.3
Non-Food Expenditures = 15.3
Income = 30.5

Notes:

(1) Price per kg. is indexed on the price paid for a kilogram of corn grits by the lowest income quartile in rural areas (index = 1.00 = price paid for one kilogram of corn grits).
(2) Quantity consumed is kilograms per capita per week.
(3) Price per '000 calories uses the index for the price of corn (= indexed expenditures for a food/(kgs. for a food x calories per kg.)

Table 8.7.d Input Data for Calculating Food Demand Matrix, Urban, Income Quartile 4, 1978

Food Group	Price Per Kg.	Quantity Consumed	'000 Calories Per Kg.	Share of Food Budget	Share of Total Expend.	Price '000 Calor.	Non-Staple?	Meat?
CORN	.812	.056	2.125	.00	.00	.38	.0	.0
RICE	1.388	1.736	3.403	.10	.03	.41	.0	.0
WHEAT/BREAD	2.831	.273	3.692	.03	.01	.77	1.0	.0
OTHER FRUIT	1.253	2.177	.318	.11	.03	3.94	1.0	.0
OTHER FOODS	3.508	1.218	2.305	.18	.05	1.52	1.0	.0
FRESH FISH	4.470	.539	.584	.10	.03	7.65	1.0	1.0
OTHER MEAT	5.473	.490	.986	.11	.03	5.55	1.0	1.0
PORK	8.117	.252	4.056	.09	.03	2.00	1.0	1.0
BEEF	9.091	.070	1.800	.03	.01	5.05	1.0	1.0
POULTRY	8.442	.140	1.100	.05	.02	7.68	1.0	1.0
EGGS	5.929	.161	1.435	.04	.01	4.13	1.0	1.0
MILK/PRDCT	7.722	.518	.797	.17	.05	9.69	1.0	1.0
NON-FOODS	56.322	1.000	.000	.00	.70	.00	.0	.0

Household Size = 6.3
Adult Equivalents = 5.2
Food Expenditures = 24.1
Non-Food Expenditures = 56.3
Income = 80.5

Notes:

(1) Price per kg. is indexed on the price paid for a kilogram of corn grits by the lowest income quartile in rural areas (index = 1.00 = price paid for one kilogram of corn grits).
(2) Quantity consumed is kilograms per capita per week.
(3) Price per '000 calories uses the index for the price of corn (= indexed expenditures for a food/(kgs. for a food x calories per kg.)

Table 8.7.e Input Data for Calculating Food Demand Matrix, Rural, Income Quartile 1, 1978

Food Group	Price Per Kg.	Quantity Consumed	'000 Calories Per Kg.	Share of Food Budget	Share of Total Expend.	Price '000 Calor.	Non-Staple?	Meat?
CORN	.999	.455	3.092	.06	.05	.32	.0	.0
RICE	1.355	2.114	3.447	.38	.29	.39	.0	.0
WHEAT/BREAD	3.247	.028	5.000	.01	.01	.65	1.0	.0
VEGET/FRUIT	.649	1.470	.333	.13	.10	1.95	1.0	.0
OTHER FOODS	1.286	.707	1.960	.12	.09	.66	1.0	.0
FRESH FISH	2.804	.308	.545	.11	.09	5.15	1.0	1.0
OTHER MEAT	2.783	.245	.629	.09	.07	4.42	1.0	1.0
PORK	6.494	.021	3.333	.02	.01	1.95	1.0	1.0
BEEF	6.494	.000	-	.00	.00	-	-	-
POULTRY	6.494	.021	1.333	.02	.01	4.87	1.0	1.0
EGGS	6.494	.014	2.000	.01	.01	3.25	1.0	1.0
MILK/PRDCT	5.195	.070	1.200	.05	.04	4.33	1.0	1.0
NON-FOODS	2.515	1.000	.000	.00	.25	.00	.0	.0

Household Size = 6.6
Adult Equivalents = 5.4
Food Expenditures = 7.5
Non-Food Expenditures = 2.5
Income = 10.1

Notes:

(1) Price per kg. is indexed on the price paid for a kilogram of corn grits by the lowest income quartile in rural areas (index = 1.00 = price paid for one kilogram of corn grits).
(2) Quantity consumed is kilograms per capita per week.
(3) Price per '000 calories uses the index for the price of corn (= indexed expenditures for a food/(kgs. for a food x calories per kg.)

Table 8.7.f Input Data for Calculating Food Demand Matrix, Rural, Income Quartile 2, 1978

Food Group	Price Per Kg.	Quantity Consumed	'000 Calories Per Kg.	Share of Food Budget	Share of Total Expend.	Price '000 Calor.	Non-Staple?	Meat?
CORN	1.105	.329	3.234	.04	.02	.34	.0	.0
RICE	1.369	2.324	3.377	.32	.21	.41	.0	.0
WHEAT/BREAD	2.435	.056	4.125	.01	.01	.59	1.0	.0
VEGET/FRUIT	.685	1.792	.305	.13	.08	2.25	1.0	.0
OTHER FOODS	1.610	.819	2.103	.13	.09	.77	1.0	.0
FRESH FISH	3.131	.392	.554	.13	.08	5.65	1.0	1.0
OTHER MEAT	3.178	.329	.660	.11	.07	4.82	1.0	1.0
PORK	6.494	.042	3.667	.03	.02	1.77	1.0	1.0
BEEF	6.494	.007	2.000	.01	.00	3.25	1.0	1.0
POULTRY	5.682	.056	1.750	.03	.02	3.25	1.0	1.0
EGGS	6.494	.028	1.500	.02	.01	4.33	1.0	1.0
MILK/PRDCT	4.202	.119	1.118	.05	.03	3.76	1.0	1.0
NON-FOODS	5.287	1.000	.000	.00	.35	.00	.0	.0

Household Size = 6.1
Adult Equivalents = 4.9
Food Expenditures = 9.8
Non-Food Expenditures = 5.3
Income = 15.1

Notes:

(1) Price per kg. is indexed on the price paid for a kilogram of corn grits by the lowest income quartile in rural areas (index = 1.00 = price paid for one kilogram of corn grits).
(2) Quantity consumed is kilograms per capita per week.
(3) Price per '000 calories uses the index for the price of corn (= indexed expenditures for a food/(kgs. for a food x calories per kg.)

Table 8.7.g Input Data for Calculating Food Demand Matrix, Rural, Income Quartile 3, 1978

Food Group	Price Per Kg.	Quantity Consumed	'000 Calories Per Kg.	Share of Food Budget	Share of Total Expend.	Price '000 Calor.	Non-Staple?	Meat?
CORN	.928	.196	3.143	.02	.01	.30	.0	.0
RICE	1.391	2.450	3.360	.28	.14	.41	.0	.0
WHEAT/BREAD	3.247	.070	5.200	.02	.01	.62	1.0	.0
OTHER FRUIT	.836	1.904	.331	.13	.07	2.53	1.0	.0
OTHER FOODS	2.042	.868	2.274	.15	.07	.90	1.0	.0
FRESH FISH	3.680	.420	.567	.13	.06	6.49	1.0	1.0
OTHER MEAT	3.542	.385	.782	.11	.06	4.53	1.0	1.0
PORK	7.305	.056	4.000	.03	.02	1.83	1.0	1.0
BEEF	6.494	.014	2.000	.01	.00	3.25	1.0	1.0
POULTRY	9.740	.028	1.500	.02	.01	6.49	1.0	1.0
EGGS	6.494	.063	1.333	.03	.02	4.87	1.0	1.0
MILK/PRDCT	3.770	.217	1.161	.07	.03	3.25	1.0	1.0
NON-FOODS	12.091	1.000	.000	.00	.50	.00	.0	.0

Household Size = 5.8
Adult Equivalents = 4.8
Food Expenditures = 12.1
Non-Food Expenditures = 12.1
Income = 24.2

Notes:

(1) Price per kg. is indexed on the price paid for a kilogram of corn grits by the lowest income quartile in rural areas (index = 1.00 = price paid for one kilogram of corn grits).
(2) Quantity consumed is kilograms per capita per week.
(3) Price per '000 calories uses the index for the price of corn (= indexed expenditures for a food/(kgs. for a food x calories per kg.)

Table 8.7.h Input Data for Calculating Food Demand Matrix, Rural, Income Quartile 4, 1978

Food Group	Price Per Kg.	Quantity Consumed	'000 Calories Per Kg.	Share of Food Budget	Share of Total Expend.	Price '000 Calor.	Non-Staple?	Meat?
CORN	.896	.203	3.310	.01	.00	.27	.0	.0
RICE	1.358	2.310	3.303	.19	.06	.41	.0	.0
WHEAT/BREAD	2.474	.147	3.714	.02	.01	.67	1.0	.0
VEGET/FRUIT	.922	2.317	.311	.13	.04	2.97	1.0	.0
OTHER FOODS	2.230	.693	2.859	.09	.03	.78	1.0	.0
FRESH FISH	3.503	.532	.605	.11	.03	5.79	1.0	1.0
OTHER MEAT	4.132	.385	.818	.10	.03	5.05	1.0	1.0
PORK	7.177	.133	3.316	.06	.02	2.16	1.0	1.0
BEEF	9.091	.035	1.600	.02	.01	5.68	1.0	1.0
POULTRY	8.442	.070	1.300	.04	.01	6.49	1.0	1.0
EGGS	6.494	.084	2.750	.03	.01	2.36	1.0	1.0
MILK/PRDCT	7.305	.448	.922	.20	.06	7.92	1.0	1.0
NON-FOODS	38.501	1.000	.000	.00	.70	.00	.0	.0

Household Size = 5.7
Adult Equivalents = 4.7
Food Expenditures = 16.5
Non-Food Expenditures = 38.5
Income = 55.0

Notes:

(1) Price per kg. is indexed on the price paid for a kilogram of corn grits by the lowest income quartile in rural areas (index = 1.00 = price paid for one kilogram of corn grits).
(2) Quantity consumed is kilograms per capita per week.
(3) Price per '000 calories uses the index for the price of corn (= indexed expenditures for a food/(kgs. for a food x calories per kg.)

Table 8.8 **Prior Assumptions as To Food Income Elasticities and Values for Utility Function Parameters**

Urban/ Rural	Income Group	Food Income Elasticity	Calorie-Related Parameters $b_2/2b_3$	Calorie-Related Parameters b_3	Variety Parameter w_v	Meat Food Group Parameter w_k
URBAN	1	0.67	-3.000	-0.10000	0.80	0.50
URBAN	2	0.58	-3.000	-0.10000	0.80	0.50
URBAN	3	0.48	-3.000	-0.10000	0.80	0.50
URBAN	4	0.39	-3.000	-0.10000	0.80	0.50
RURAL	1	0.74	-3.000	-0.10000	0.65	0.50
RURAL	2	0.63	-3.000	-0.10000	0.80	0.50
RURAL	3	0.52	-3.000	-0.10000	0.80	0.50
RURAL	4	0.44	-3.000	-0.10000	0.80	0.50

Table 8.9.a Food Demand Elasticity Estimates, Urban, Income Quartile 1

Food Group	CORN	RICE	WHEAT/ BREAD	VEGET FRUIT	OTHER FOODS	FRESH FISH	OTHER MEAT	PORK	BEEF	POUL- TRY	EGGS	MILK/ PRDCT	NON- FOODS	INCOME
CORN	-1.59	1.15	.27	-.20	.52	-.03	.01	.09	.01	.00	.02	.05	.03	-.33
RICE	.06	-.66	.22	-.20	.41	-.06	-.01	.07	.01	.00	.01	.03	-.01	.14
WHEAT/BREAD	.09	1.44	-2.39	.73	-.22	.05	.00	-.08	-.01	.00	-.01	-.03	-.04	.47
VEGET/FRUIT	-.03	-.48	.23	-.96	.71	.02	.03	.04	.00	.00	.01	.03	-.04	.44
OTHER FOODS	.03	.41	-.07	.47	-1.73	-.06	-.05	-.04	-.01	.00	-.01	-.05	-.12	1.28
FRESH FISH	-.01	-.14	.02	.02	.04	-1.41	.60	.10	.03	.02	.06	.36	-.03	.34
OTHER MEAT	.00	-.05	.01	.04	.02	.97	-1.80	.10	.03	.02	.06	.36	-.03	.28
PORK	.01	.19	-.09	.03	-.19	.25	.15	-1.72	.00	.00	.01	.08	-.13	1.41
BEEF	-.02	-.24	-.05	-.10	-.13	.04	.02	-.01	-1.34	.00	.00	.01	-.18	1.99
POULTRY	-.02	-.28	-.05	-.11	-.13	.00	.00	-.01	.00	-1.28	.00	-.01	-.19	2.08
EGGS	-.01	-.18	-.05	-.07	-.12	.16	.10	.00	.00	.00	-1.48	.05	-.16	1.75
MILK/PRDCT	-.01	-.12	-.03	-.03	-.07	.44	.27	.04	.01	.01	.02	-1.65	-.11	1.24
NON-FOODS	-.02	-.29	-.04	-.11	-.10	-.15	-.10	-.02	.00	.00	-.01	-.06	-.86	1.77

Table 8.9.b Food Demand Elasticity Estimates, Urban, Income Quartile 2

Food Group	CORN	RICE	WHEAT/ BREAD	VEGET FRUIT	OTHER FOODS	FRESH FISH	OTHER MEAT	PORK	BEEF	POUL- TRY	EGGS	MILK/ PRDCT	NON- FOODS	INCOME
CORN	-1.46	1.22	.29	-.23	.72	.00	.05	.11	.01	.01	.02	.04	.07	-.83
RICE	.10	-.68	.18	-.18	.43	-.06	.00	.06	.00	.01	.01	.01	-.01	.12
WHEAT/BREAD	.14	1.00	-2.02	.59	-.14	.04	.00	-.05	.00	-.01	-.01	-.01	-.04	.52
VEGET/FRUIT	-.05	-.37	.17	-.93	.57	.01	.02	.03	.00	.00	.01	.01	-.05	.58
OTHER FOODS	.08	.57	-.04	.48	-1.75	.00	-.02	-.04	.00	.00	-.01	-.01	-.06	.80
FRESH FISH	-.01	-.08	.02	.05	.06	-1.25	.57	.11	.02	.04	.07	.33	-.01	.09
OTHER MEAT	.00	-.02	.00	.05	.02	.92	-1.70	.08	.02	.03	.06	.28	-.02	.30
PORK	.03	.18	-.06	.04	-.15	.25	.12	-1.59	.00	.01	.01	.07	-.09	1.18
BEEF	-.01	-.08	-.03	-.03	-.08	.23	.12	.01	-1.47	.01	.01	.07	-.11	1.35
POULTRY	-.01	-.08	-.03	-.03	-.08	.23	.12	.01	.00	-1.46	.01	.07	-.11	1.35
EGGS	-.01	-.05	-.03	-.01	-.07	.33	.17	.02	.01	.01	-1.57	.10	-.09	1.18
MILK/PRDCT	-.02	-.16	-.02	-.05	-.07	.19	.10	.01	.00	.01	.01	-1.34	-.12	1.46
NON-FOODS	-.03	-.19	-.03	-.09	-.08	-.13	-.07	-.02	.00	-.01	-.01	-.04	-.93	1.62

Table 8.9.c Food Demand Elasticity Estimates, Urban, Income Quartile 3

Food Group	CORN	RICE	WHEAT/ BREAD	VEGET FRUIT	OTHER FOODS	FRESH FISH	OTHER MEAT	PORK	BEEF	POUL- TRY	EGGS	MILK/ PRDCT	NON- FOODS	INCOME
CORN	-1.24	.93	.26	-.22	.59	-.06	.04	.18	.01	.01	.02	.01	.03	-.57
RICE	.05	-.54	.18	-.15	.40	-.06	.01	.12	.01	.00	.01	-.01	.00	-.03
WHEAT/BREAD	.06	.78	-1.65	.44	.04	.04	.00	-.04	.00	.00	.00	.01	-.02	.34
VEGET/FRUIT	-.02	-.27	.13	-.88	.43	.00	.02	.04	.00	.00	.01	.01	-.03	.56
OTHER FOODS	.03	.37	.00	.31	-1.36	-.01	-.02	-.03	.00	.00	-.01	-.01	-.04	.75
FRESH FISH	-.01	-.09	.02	.03	.04	-1.42	.56	.17	.03	.07	.10	.43	.00	.07
OTHER MEAT	.00	.00	.00	.04	.02	.65	-1.59	.14	.02	.06	.08	.36	-.01	.24
PORK	.02	.22	-.03	.06	-.06	.27	.18	-1.58	.01	.02	.03	.14	-.04	.76
BEEF	.00	-.02	-.02	-.01	-.05	.18	.12	.03	-1.41	.02	.02	.10	-.05	1.10
POULTRY	.00	-.05	-.01	-.01	-.03	.27	.19	.05	.01	-1.50	.03	.15	-.05	.96
EGGS	.00	.00	-.01	.01	-.03	.33	.24	.06	.01	.03	-1.59	.18	-.04	.80
MILK/PRDCT	-.01	-.09	-.01	-.02	-.03	.28	.20	.06	.01	.02	.04	-1.37	-.05	.96
NON-FOODS	-.01	-.13	-.02	-.06	-.06	-.09	-.07	-.03	.00	-.01	-.01	-.05	-.98	1.52

Table 8.9.d Food Demand Elasticity Estimates, Urban, Income Quartile 4

Food Group	CORN	RICE	WHEAT/ BREAD	VEGET FRUIT	OTHER FOODS	FRESH FISH	OTHER MEAT	PORK	BEEF	POUL- TRY	EGGS	MILK/ PRDCT	NON- FOODS	INCOME
CORN	-.89	.36	.25	-.32	.48	-.12	-.01	.28	.02	.00	.03	-.04	.00	-.02
RICE	.01	-.45	.18	-.12	.39	-.07	.01	.20	.01	.00	.02	-.02	-.01	-.16
WHEAT/BREAD	.01	.57	-1.31	.34	.21	.03	.02	.02	.00	.01	.01	.02	.01	.07
OTHER FRUIT	-.01	-.12	.09	-.90	.27	.00	.01	.05	.00	.00	.01	.00	.04	.55
OTHER FOODS	.00	.20	.03	.17	-1.07	-.01	.00	.01	.00	.00	.00	.00	.04	.62
FRESH FISH	.00	-.07	.01	.02	.03	-1.46	.51	.24	.06	.11	.16	.43	.00	-.03
OTHER MEAT	.00	-.01	.00	.02	.02	.45	-1.45	.16	.04	.08	.11	.30	.02	.27
PORK	.01	.21	.00	.08	.03	.27	.21	-1.48	.02	.05	.06	.17	.02	.35
BEEF	.00	.02	.00	.01	.00	.19	.1[illegible]	.06	-1.38	.03	.05	.13	.05	.68
POULTRY	.00	-.02	.00	.00	.00	.21	.16	.07	.02	-1.37	.05	.14	.05	.69
EGGS	.00	.04	.00	.03	.02	.40	.31	.14	.03	.07	-1.63	.26	.02	.30
MILK/PRDCT	.00	-.04	.00	.00	.00	.24	.19	.08	.02	.04	.06	-1.29	.05	.66
NON-FOODS	.00	-.04	-.01	-.02	-.03	-.04	-.03	-.02	.00	-.01	-.01	-.03	-1.01	1.26

Table 8.9.e Food Demand Elasticity Estimates, Rural, Income Quartile 1

Food Group	CORN	RICE	WHEAT/ BREAD	VEGET FRUIT	OTHER FOODS	FRESH FISH	OTHER MEAT	PORK	BEEF	POUL- TRY	EGGS	MILK/ PRDCT	NON- FOODS	INCOME
CORN	-1.51	1.26	.06	-.21	.71	.02	.03	.02		.01	.01	.02	.06	-.47
RICE	.15	-.78	.03	-.17	.34	-.05	-.03	.01		.00	.00	.00	-.07	.55
WHEAT/BREAD	.22	.75	-2.00	.32	-.40	-.08	-.08	-.02		-.01	-.01	-.02	-.19	1.51
VEGET/FRUIT	-.17	-.66	.03	-1.04	.96	-.02	-.01	.00		.00	.00	.00	-.13	1.04
OTHER FOODS	.32	1.20	-.03	1.09	-2.74	.03	.02	-.01		.00	.00	-.01	-.02	.16
FRESH FISH	-.05	-.21	.00	.01	-.02	-1.40	.78	.04		.04	.03	.14	-.09	.75
OTHER MEAT	-.03	-.15	.00	.02	-.02	1.00	-1.60	.04		.04	.03	.15	-.08	.60
PORK	-.05	-.30	-.02	-.10	-.29	.13	.10	-1.56		.00	.00	.01	-.30	2.37
BEEF*														
POULTRY	-.12	-.60	-.02	-.16	-.25	.07	.05	.00		-1.39	.00	.01	-.35	2.76
EGGS	-.10	-.51	-.02	-.14	-.26	.09	.07	.00		.00	-1.44	.01	-.33	2.64
MILK/MILK	-.11	-.53	-.01	-.14	-.23	.18	.15	.00		.01	.00	-1.50	-.31	2.48
NON-FOODS	-.09	-.43	-.01	-.12	-.15	-.12	-.10	-.01		-.01	.00	-.02	-.72	1.79

* No beef consumption reported.

Table 8.9.f Food Demand Elasticity Estimates, Rural, Income Quartile 2

Food Group	CORN	RICE	WHEAT/ BREAD	VEGET FRUIT	OTHER FOODS	FRESH FISH	OTHER MEAT	PORK	BEEF	POUL- TRY	EGGS	MILK/ PRDCT	NON- FOODS	INCOME
CORN	-1.15	.97	.07	-.11	.44	.00	.02	.04	.00	.02	.01	.02	.06	-.40
RICE	.10	-.54	.05	-.12	.30	-.03	-.02	.02	.00	.01	.00	.01	-.04	.25
WHEAT/BREAD	.17	1.11	-1.91	.47	-.10	.01	.00	-.02	.00	-.01	.00	-.01	-.06	.36
VEGET/FRUIT	-.06	-.40	.05	-.82	.60	.00	.00	.01	.00	.00	.00	.00	-.12	.73
OTHER FOODS	.10	.62	-.01	.55	-1.80	-.02	-.02	-.02	.00	-.01	.00	-.01	-.12	.74
FRESH FISH	-.02	-.16	.00	.01	-.01	-1.44	.72	.06	.01	.08	.04	.21	-.09	.58
OTHER MEAT	-.02	-.12	.00	.02	-.01	.85	-1.59	.06	.01	.08	.04	.20	-.09	.57
PORK	.00	-.02	-.02	-.05	-.16	.19	.16	-1.58	.00	.01	.01	.04	-.27	1.69
BEEF	-.04	-.28	-.02	-.10	-.15	.14	.12	.00	-1.47	.01	.00	.03	-.33	2.07
POULTRY	-.03	-.25	-.02	-.08	-.14	.21	.17	.01	.00	-1.53	.01	.05	-.30	1.91
EGGS	-.05	-.34	-.02	-.11	-.15	.13	.10	.00	.00	.01	-1.43	.03	-.34	2.17
MILK/PRDCT	-.03	-.20	-.01	-.05	-.10	.44	.36	.03	.00	.04	.02	-1.71	-.23	1.43
NON-FOODS	-.05	-.33	-.01	-.10	-.11	-.11	-.09	-.01	.00	-.01	-.01	-.03	-.82	1.69

Table 8.9.g Food Demand Elasticity Estimates, Rural, Income Quartile 3

Food Group	CORN	RICE	WHEAT/ BREAD	VEGET FRUIT	OTHER FOODS	FRESH FISH	OTHER MEAT	PORK	BEEF	POUL-TRY	EGGS	MILK/ PRDCT	NON-FOODS	INCOME
CORN	-1.12	1.12	.12	-.10	.52	.00	.04	.06	.01	.01	.02	.06	.15	-.88
RICE	.05	-.45	.07	-.09	.29	-.03	-.01	.03	.00	.00	.01	.02	-.02	.13
WHEAT/BREAD	.08	.96	-1.64	.35	-.05	.01	.00	-.02	.00	.00	.00	-.02	-.07	.40
OTHER FRUIT	-.02	-.26	.05	-.78	.44	.01	.01	.01	.00	.00	.00	.01	-.11	.64
OTHER FOODS	.04	.46	-.01	.39	-1.46	-.01	-.02	-.01	.00	.00	.00	-.02	-.14	.79
FRESH FISH	-.01	-.14	.00	.01	.00	-1.49	.62	.06	.01	.03	.07	.34	-.11	.62
OTHER MEAT	.00	-.05	.00	.03	.01	.72	-1.56	.07	.02	.03	.07	.38	-.06	.35
PORK	.01	.13	-.02	.00	-.09	.19	.18	-1.53	.00	.01	.02	.09	-.21	1.23
BEEF	.00	-.06	-.01	-.03	-.07	.20	.20	.01	-1.51	.01	.02	.10	-.25	1.40
POULTRY	-.02	-.20	-.02	-.07	-.09	.07	.06	.00	.00	-1.27	.01	.03	-.32	1.82
EGGS	-.01	-.15	-.01	-.05	-.07	.19	.18	.01	.00	.01	-1.45	.10	-.27	1.52
MILK/PRDCT	.00	.04	.00	.04	-.01	.65	.64	.06	.02	.03	.07	-1.35	-.07	.39
NON-FOODS	-.02	-.20	-.01	-.07	-.07	-.07	-.07	-.01	.00	.00	-.01	-.04	-.91	1.48

Table 8.9.h Food Demand Elasticity Estimates, Rural, Income Quartile 4

Food Group	CORN	RICE	WHEAT/ BREAD	VEGET FRUIT	OTHER FOODS	FRESH FISH	OTHER MEAT	PORK	BEEF	POUL-TRY	EGGS	MILK, PRDCT	NON-FOODS	INCOME
CORN	-1.07	1.05	.15	-.13	.49	-.02	.02	.11	.01	.01	.05	.03	.08	-.76
RICE	.06	-.48	.09	-.10	.29	-.04	.00	.06	.00	.01	.03	.01	-.01	.08
WHEAT/BREAD	.07	.76	-1.49	.41	.05	.03	.02	-.01	.00	.00	-.01	.01	-.02	.18
VEGET/FRUIT	-.02	-.17	.07	-.76	.28	.02	.02	.02	.00	.00	.01	.02	-.06	.55
OTHER FOODS	.05	.58	.01	.40	-1.38	.02	.01	-.01	.00	.00	.00	.01	-.04	.34
FRESH FISH	.00	-.05	.01	.05	.03	-1.32	.55	.15	.03	.07	[illegible]	.46	.01	-.09
OTHER MEAT	.00	-.02	.00	.04	.01	.63	-1.50	.11	.02	.05	.07	.33	-.03	.28
PORK	.02	.17	-.01	.04	-.02	.27	.17	-1.45	.01	.02	.03	.14	-.07	.69
BEEF	.00	-.01	-.01	.00	-.02	.16	.10	.02	-1.29	.01	.02	.08	-.11	1.04
POULTRY	.00	-.03	-.01	.00	-.02	.18	.11	.03	.01	-1.30	.02	.09	-.11	1.02
EGGS	.01	.15	-.01	.04	-.02	.31	.19	.05	.01	.02	-1.50	.16	-.07	.65
MILK/PRDCT	.00	-.04	.00	.00	-.01	.23	.14	.04	.01	.02	.02	-1.25	-.10	.97
NON-FOODS	-.01	-.07	-.01	-.03	-.03	-.04	-.03	-.01	.00	.00	-.01	-.02	-.98	1.24

Table 8.10.a Comparison of Arc Income Elasticities Between Income Groups and Income Elasticity Estimates, By Income Group By Food, Urban

Food	Income Group	Arc Income Elasticity Between Income Group 2	3	4	Estimated Income Elasticity
Rice					
	1	-.01	.00	-.00	0.14
	2		-.01	.02	0.12
	3			-.03	-0.03
	4				-0.16
Corn					
	1	.68	.05	-.04	-0.33
	2		-.15	-.41	-0.83
	3			-.30	-0.57
	4				-0.02
Wheat/Bread					
	1	.07	.10	.07	0.47
	2		.16	.28	0.52
	3			.20	0.34
	4				0.07
Vegetables/Fruits					
	1	.08	.09	.05	0.44
	2		.10	.20	0.58
	3			.13	0.56
	4				0.55
Other Foods					
	1	-.03	.05	.05	1.28
	2		.16	.28	0.80
	3			.20	0.75
	4				0.62
Fresh Fish					
	1	.08	.02	.01	0.34
	2		.01	-.06	0.09
	3			.06	0.07
	4				-0.03
Other Fish/Meat/Poultry					
	1	.02	.08	.06	0.28
	2		.15	.30	0.30
	3			.16	0.24
	4				0.27
Pork					
	1	.08	.31	.22	1.41
	2		.53	1.02	1.18
	3			.41	0.76
	4				0.35
Beef					
	1	-.23	.09	.17	1.99
	2		.82	1.02	1.35
	3			.77	1.10
	4				0.68
Poultry					
	1	.68	.89	.67	2.08
	2		.82	1.27	1.35
	3			.62	0.96
	4				0.69
Eggs					
	1	.11	.26	.21	1.75
	2		.47	.73	1.18
	3			.47	0.80
	4				0.30
Milk/Milk Products					
	1	.11	.18	.10	1.24
	2		.21	.49	1.46
	3			.18	0.96
	4				0.66

Table 8.10.b Comparison of Arc Income Elasticities Between Income Groups and Income Elasticity Estimates, By Income Group By Food, Rural

Food	Income Group	Arc Income Elasticity Between Income Group 2	3	4	Estimated Income Elasticity
Rice					
	1	.06	.04	.01	0.51
	2		-.00	.05	0.25
	3			-.04	0.13
	4				0.08
Corn					
	1	-.17	-.13	-.05	-0.43
	2		-.10	-.40	-0.40
	3			.02	-0.88
	4				-0.76
Wheat/Bread					
	1	.62	.35	.36	1.39
	2		.42	.25	0.36
	3			.76	0.40
	4				0.18
Vegetables/Fruits					
	1	.14	.07	.05	0.96
	2		.07	.06	0.73
	3			.15	0.64
	4				0.55
Other Foods					
	1	.10	.05	-.00	0.15
	2		-.04	.06	0.74
	3			-.14	0.79
	4				0.34
Fresh Fish					
	1	.17	.09	.06	0.69
	2		.09	.07	0.58
	3			.18	0.62
	4				-r.09
Other Fish/Meat/Poultry					
	1	.62	.39	.45	2.18
	2		.55	.33	1.69
	3			.95	1.23
	4				0.69
Pork					
	1	-	-	-	-
	2		1.02	.99	2.07
	3			1.04	1.40
	4				1.04
Beef					
	1	1.03	.08	.20	2.18
	2		.06	-.50	1.91
	3			1.04	1.82
	4				1.02
Poultry					
	1	.21	.13	.05	0.55
	2		.04	.17	0.57
	3			.00	0.35
	4				0.28
Eggs					
	1	.62	.83	.42	2.42
	2		.51	1.24	2.17
	3			.23	1.52
	4				0.65
Milk/Milk Products					
	1				
	2	.43	.50	.46	2.28
	3		.71	.82	1.43
	4			.74	0.39
					0.97

9. POLICY ALTERNATIVES FOR THE CORN LIVESTOCK SECTOR: A SIMULATION ANALYSIS

Howarth E. Bouis and Mark W. Rosegrant

9.1 Introduction

Previous chapters in this report have presented detailed analyses of the performance and efficiency of different aspects of the corn-livestock sector. The purpose of this chapter is to analyze alternative directions for an integrated pricing and trade policy for the sector. It is necessary to take an integrated approach to sectoral policy in order to pursue the goals of increased efficiency and competitiveness of this sector; a piecemeal approach which considers corn (and rice) production and pricing policy in isolation from livestock production and price policies will result in inappropriate policies because of the close linkages within the sector.

As was shown in Chapter 6, the corn/livestock sector in the Philippines has developed as a relatively high cost industry compared to the industry in Thailand, due in significant part to the historical policies of maintaining a high degree of input and output price protection through restrictive import policies, combined with relatively poor and declining infrastructure and support services. The poultry and hog industries pay 30-35 percent more for mixed feeds than their counterparts in Thailand, Malaysia, and Indonesia. Since feed costs account for 65-85 percent of the total costs of livestock production (Chapter 4), this represents a considerable tax on the livestock industry. Corn is a major contributor to high feed prices: it contributes 40-60 percent of the material costs of feed ratios, and has been priced as high as 70 percent over the world price (and an average of around 40 percent higher in the past three years). To compensate for these high costs, the government has also protected the livestock industry with import tariffs, resulting in high prices to consumers and reduced consumption.

Despite these distorted prices, it was shown in Chapters 3 and 4 that corn, poultry, and pork have a comparative advantage as import substitutes and that pork has a strong potential to be competitive as an export commodity if sanitary and quality improvements can be made. The competitiveness of these industries would also be enhanced by improvements in marketing and distribution. While constraints in research and extension, seed distribution, and farm level technology do exist, the available evidence indicates that the most serious structural problems are in post-harvest technology, transportation and marketing, due to underinvestment and restrictive policies in these areas (Chapters 3-6). Removal of these structural barriers would greatly improve the competitiveness of the corn/livestock sector.

Trade protectionism to maintain domestic prices above world prices, such as has been followed in the corn/livestock sector, can impose significant costs to the economy. Trade policies which protect some commodities or sectors at the expense of others cause resources to shift from more efficient production activities to less efficient ones. Protective trade policies also penalize consumers through increased domestic prices. Removal of trade barriers will

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usually result in more efficient allocation of resources in production, and will provide net welfare gains. Chapter 7 shows the high responsiveness of hog and chicken supply to output and input prices, suggesting the potential gains from realignment of prices.

In this chapter, alternative price and trade policy scenarios are examined to assess the degree to which there are gains to the liberalization of trade in the cereal and livestock sector. In the remainder of this chapter we will discuss the agricultural supply/demand model to be used in examining different policies, describe the assumptions underlying alternative policy scenarios, present the results for the different scenarios, and assess the implications of these results.

9.2 Description of the Cereal and Livestock Supply/Demand Model

An integrated cereal and livestock sector partial equilibrium supply/demand model is utilized to analyze the impact of alternative policies. The model includes eight commodities, rice, corn, wheat, pork, chicken, eggs, coconuts and sugar. The results presented here will concentrate on the first six commodities. For any specified set of policy parameters, the model projects the annual values over a 10-year period for rice and corn area, yield and production, by technology; rice and corn consumption and net imports; wheat consumption and imports; and pork, chicken, and egg production, consumption, and imports.

A descriptive overview of the structure and operation of the model will provide an understanding of the important economic relationships in the model. Each annual iteration of the model begins by estimating domestic production for the present period for each of seven commodities, rice, corn, coconuts, sugar, pork, chicken, and eggs. A standard distributed-lag formulation is used such that past prices, past production, and various exogenous variables are the right-hand side variables in these supply equations. Thus, domestic production and present period prices are not determined simultaneously, simplifying solution of the model.

Domestic production of rice, corn, pork, chicken and eggs are added to net imports of these commodities to give total supplies available for domestic consumption, and wheat imports determine the availability of wheat for consumption. These supplies are equated with demand to solve the model for the values of either endogenous price or net import variables. Exogenous and endogenous price variables and technology shift variables then determine domestic production in the following period and the process is repeated recursively for successive annual iterations.

Domestic production of rice, corn, coconuts, and sugar is computed by multiplying areas harvested for these crops times yields. Areas for all four crops are determined using a distributed lag formulation which includes past prices and yields as arguments. Yields and prices for coconuts and sugar are specified exogenously. In determining aggregate yields for rice and corn, production areas are allocated among various technologies, defined by the presence (or absence) of irrigation, the variety grown (modern or traditional), and season (wet or dry), depending on exogenous specification of government emphasis on irrigation investments and extension services to disseminate modern varieties.

Fertilizer response functions are associated with each technology. These response functions shift outward depending on the rate of technological change assumed for that crop and technology. Aggregate fertilizer demand is determined from exogenously specified fertilizer prices and output prices for rice and corn and then this aggregate demand is allocated among the various technologies for rice and corn. Substituting these fertilizer use levels into the fertilizer response functions gives yields. Multiplying yield times area gives production for individual technologies, and summing over all the technologies gives total production.

Standard distributed lag functions are used to determine domestic production of pork, chicken and eggs. Lagged output prices and the lagged input price of corn are used as arguments in these functions, which are disaggregated by backyard and commercial sectors.

Once production levels have been computed, six demand equations need to be solved in the present period, including rice, corn for human consumption, corn for livestock consumption, wheat, pork, chicken, and eggs. These six equations contain eleven potential unknowns: six demand levels and five prices. Setting domestic production plus net imports equal to demand adds five new equations to the system and five new unknowns: the net import levels for these commodities. This gives eleven equations in sixteen unknowns.

Five variables must therefore be specified exogenously in order to be able to solve this system of equations. In general, prices or net imports for any or all of the six commodities—rice, corn, wheat, pork, chicken, and eggs—may be specified exogenously as policy instruments of the government or solved for as endogenous variables. If net imports of a particular commodity are specified exogenously, then its price becomes endogenous and vice-versa.

In most of the model simulations described below, prices of all commodities are specified exogenously to simulate the effects of alternative price and trade policies. Endogenous variables in the model, then, are a) aggregate consumption of rice, corn for human consumption, corn for livestock consumption, pork, chicken, and eggs; and b) net imports of rice, corn, and wheat, pork, chicken, and eggs. Lagged endogenous variables are domestic production levels of rice, corn, coconuts, sugar, pork, chicken, and eggs.

9.3 Alternative Policy Scenarios

This report has documented the main government policies toward the corn livestock sector in the Philippines and the impacts of these policies on the competitiveness of the sector. Distortions in price and trade policy have been identified as key problems for the sector. In this section, the sectoral impacts of alternative price and trade policies will be examined. The main part of the analysis is done by using the cereal and livestock supply/demand model to simulate three alternative price and trade scenarios, supplemented by additional simulations described below.

The first scenario is a baseline simulation with constant prices incorporating average 1988/90 policies. Domestic rice price is therefore set at 15 percent above world price; corn price is 40 percent above world prices; wheat price is 20 percent above world prices; pork prices are equal to world prices; and chicken and egg prices are 30 percent above world prices.

The second scenario simulates full trade liberalization for rice, corn, wheat, pork, chicken, and eggs. Under this scenario, domestic commodity prices are phased down to world price levels over a three-year period. For example, corn price is reduced by 40 percent over a three-year period

The third scenario is establishment of a uniform 20 percent tariff across the six commodities. Domestic prices for each commodity are phased to a level 20 percent above world prices over a three-year period. Pork prices, which are competitive with world prices despite existing 30 percent tariffs, are assumed to remain constant.

Additional scenarios described below are also simulated to assess the impact of policies designed to maintain target levels of imports, and to examine the effects of increased efficiency in corn marketing. Other key assumptions in the simulations include the following.

Income and Population Growth. The analysis is undertaken assuming a population growth rate of 2.3 percent per annum, and an annual growth rate in per capita income of 4 percent. Summary results are also presented for a sensitivity analysis with 6 percent per capita income growth.

Investment and Technological Change. In each of the scenarios, the assumptions regarding the underlying irrigation investment and technology trends are the same, and are based on trends in the mid- to late-1980s. Under the constant price scenarios, these assumed rates of change in investment and technology generate growth rates in yields of rice and corn of 1.7 percent and 3.6 percent, respectively. The annual rate of increase in hog production under constant prices is 6.3 percent, and for chicken and eggs, the annual rate of increase is simulated to be 7.6 percent.

It should be noted that assumption of alternative rates of underlying investment and technological change *do not* affect the *relative* impacts of the alternative price and trade models. Instead, different rates of underlying production growth shift the impacts of the alternative policies by the same magnitude, so the comparisons across policies are unaffected. For example, if slower rates of production growth are assumed in the livestock sector, projected imports of livestock increase by nearly equal amounts, and imports of corn decrease by comparable amounts across scenarios, leaving relative import levels across scenarios virtually the same.

9.3.1 Results of Alternative Policy Scenarios

Production. The impacts of the different price and trade policies on rice and corn area, yield, and production, and on pork, chicken, and egg production, are shown in Table 9.1. Description of comparative results across scenarios will be based on projected results for the year 2000. As shown in Table 9.1, the effects of price changes on yields are modest, but significant shifts can be seen in area harvested to the two crops. Trade liberalization in cereals and livestock, which reduces corn price by 40 percent, causes a seven percent decline in area and a reduction in production by about 600,000 mt compared to the baseline levels for 2000. Since the rice price declines less than the corn price, rice area increases slightly compared to the constant policy scenario, and total rice production stays nearly the same.

With a shift to a uniform tariff policy, corn price is reduced by 20 percent, which results in a reduction in production of a little over 400,000 mt relative to the constant price case. Rice production, however, increases by nearly 800,000 mt due to the increase in the rice price implied by the 20 percent tariff, and the decline in the corn price.

Full trade liberalization in cereals and livestock therefore results in a modest (about 4 percent) projected reduction in total rice and corn production in the year 2000. However, liberalization also acts as a strong stimulus for pork production. As shown in Table 9.1, liberalization, by sharply reducing the price of corn and soybeans while the pork price stays constant (since the pork price is already competitive with world prices), boosts pork production by 284,000 mt, or 22 percent. Chicken and egg production are virtually unaffected by trade liberalization, since the effects of the reduction in corn price are offset by 30 percent declines in the prices of chicken and eggs. The reduction in corn prices thus permits sustaining the same growth rate in chicken and egg prices despite the sharp decline in chicken and egg prices.

Establishment of a uniform 20 percent tariff (scenario 3) causes a slight increase in total grain production, with increases in rice production offsetting modest declines in corn production. Compared to the constant price scenario, the uniform tariff policy acts as a stimulant across the board for livestock production, because feed prices decline more than output prices. Pork production increases by 11 percent, chicken production by 8 percent and egg production by 10 percent due to the shift from current levels of protection to a uniform tariff.

Consumption. Trade liberalization in cereals and livestock induces significant increases in per capita consumption of food, and an increase in meat and egg consumption relative to cereals (Table 9.2). Per capita food consumption of rice and corn decrease slightly, while wheat consumption increases substantially, resulting in a three percent overall increase in per capita cereal consumption. The impact on meat and egg consumption is much more dramatic, with an overall increase of 5.4 kg/capita, or more than 17 percent. With persistent protein and micronutrient deficiency problems in the Philippine diet, these changes would be significant improvements in nutritional status.

The shift to a uniform tariff policy has a less dramatic effect on consumption because prices are not reduced to the same extent. Per capita cereal consumption actually decreases by three percent compared to the constant price scenario, due mainly to the increase in the price of rice. Per capita consumption of meat and eggs increases by 6 percent.

Trade balances. Rice imports decrease slightly with trade liberalization, as the decline in consumption offsets a drop in production. Wheat consumption and imports increase by 20 percent with the decline in domestic wheat prices (Table 9.3). Corn accounts for the major increase in imports, due in about equal amounts to the increase in demand for corn for livestock feed and the decrease in production due to the decline in corn price with liberalization.

With full trade liberalization, chicken and egg move from a modest export position to significant imports, due to the rapid increase in demand for these products due to increase demand. However, pork shifts from an import position to projected significant levels of exports.[1]

With establishment of a uniform 20 percent tariff, the projected imports of rice decrease from 1.2 million mt to 318,000 mt in 2000, since the 5 percent increase in the price of rice, combined with the 20 percent decline in corn price, boosts rice production and reduces consumption. Corn imports increase substantially relative to constant policies, due to a drop in production and increased demand, particularly from increased demand from the livestock industry. Wheat imports increase slightly. Pork changes from a small import to a small export situation, while the trade balances for chicken and eggs remain nearly the same, since production and consumption increase by about equal amounts.

The relative results across scenarios are not dependent on the particular assumptions regarding income or population growth. Table 9.4 summarizes per capita consumption and imports across scenarios, assuming a 6 percent annual increase in per capita income. The rapid rate of income growth boosts per capita consumption for all commodities (except corn, which has a negative income elasticity of demand with respect to income), and therefore increases imports (or reduces exports), particularly of the income-elastic meat and eggs. However, the comparative outcomes of the alternative scenarios are qualitatively the same as for the 4 percent per capita growth scenario.

Import Costs, Total Consumption, and Value of Production. The commodity-specific results described above can be summarized across commodities in terms of the net cost of imports, the gross domestic value of production, total consumption, and total domestic

[1] As was discussed in Chapter 4, pork has the potential to be an exportable commodity. In order to realize this potential, investments must be made to improve quality and establish foot and mouth disease-free production. If export potential is not achieved, so that all domestically produced pork is consumed domestically, alternative simulations indicate that the pork price would decline by 9%, domestic production would decline by 8%, and consumption would increase by 12%.

expenditures on food. These results are summarized in Table 9.5 for the three scenarios and two projected rates of income growth.

The results clearly show the superiority of a policy of trade liberalization over the current policies of high levels of protection for corn, chicken, and eggs, and more modest levels of protection for rice and wheat. For the base run, trade liberalization actually reduces the projected net costs of imports by 13 percent compared to current price and trade policies. This reduction in costs is primarily the result of transforming low cost imports of corn into high valued pork exports (or saving of imports).[2] Thus, one of the main concerns expressed about trade liberalization, that it would drastically increase foreign exchange costs, does not hold true.

The other large gains from trade liberalization are shown clearly in Table 9.5. The gross value of domestic production increases sharply, by 13 percent compared to the value of production under current policies, as the reductions in the value of domestic production of corn and rice are more than offset by increases in the value of pork, chicken, and egg production. The total consumption effects of trade liberalization are also shown in Table 9.5. Cereal consumption increases only slightly, but expenditures for cereals decline by 14 percent. Thus, consumers eat a greater amount of cereals for a much lower level of expenditures. Total consumption of meat and eggs increases by more than 17 percent, at a total food expenditure virtually the same as for the constant policy scenario.

Establishment of a uniform 20 percent tariff policy, by reducing overall levels of protection relative to existing price and trade policies, also yields substantial economic gains. The net cost of imports is cut by more than half, due to reduced rice imports and substantial increases in pork production, which displace imports and generate exports (Table 9.5). The gross domestic value of output increases by 10 percent compared to the first scenario. Changes in food consumption and expenditures compared to the existing price policy scenario, however, are not large, with a modest increase in meat and egg consumption and expenditures offset by a decrease in food consumption and expenditures.

Compared to full trade liberalization, the uniform tariff policy reduces the cost of imports, but at the expense of domestic consumers. Uniform tariffs raise the cost of food to consumers relative to the trade liberalization scenario, so consumption of cereals is reduced by 5 percent and meat consumption cut back by 9 percent, while total expenditures are 6 percent higher than under full cereal and livestock trade liberalization. The gross value of domestic production is also lower than for the trade liberalization scenario.

[2] If the Philippines is unable to achieve export capability in pork, the price, consumption, and production changes described in footnote 1 for trade liberalization would result in a net cost of imports of ₱21.84 billion, only slightly higher than the current policy.

9.3.2 Simulation of Imposition of Trade Restrictions

Scenario 1 simulated restrictions on trade through maintenance of the existing price structure, which discourages trade by maintaining domestic prices above world prices. An alternative strategy for limiting trade is to impose direct quantitative restrictions on commodity imports, such as the corn import ban which has been utilized in the Philippines. An additional simulation was done to assess the impact of imposition of trade restrictions to limit rice imports to base year levels, to permit only 2 percent annual growth in wheat imports, and to ban imports of corn, pork, chicken, and eggs. With import levels set exogenously, commodity prices are then determined endogenously in the model to clear domestic markets at the fixed import levels.

Results indicate that the economic effects of this restrictive trade policy relative to trade liberalization are even more negative than maintenance of the existing price structure. In order to balance domestic supply and demand with restricted imports, cereal prices increase dramatically. Rice prices increase by 27 percent over base year prices, to more than 45 percent above world prices; corn prices increase by 34 percent, to a full 87 percent above world prices; and wheat prices increase by 23 percent, to 47 percent above world prices. Meat and egg prices increase by 3-10 percent from base levels.

Due to these changes in prices, cereal consumption is 10 percent below the levels achieved with trade liberalization, and meat consumption declines by 20 percent relative to the liberalization scenario indicating severe deterioration in quality of diet. The value of domestic production also drops sharply. In the year 2000, the projected value of domestic production is only ₱156.58 billion, or 17 percent less than the results under trade liberalization. The drastic drop in value of domestic production is caused primarily by the drop in livestock production due to the increase in the price of corn.

9.3.3 Reduction in Marketing Margins

A final simulation was done to assess the impact of investment and policy changes to reduce marketing margins in corn. The analysis simulated a reduction in the marketing margin by one-third, a reduction which appears achievable given the comparative analysis with Thailand (Chapter 6). Reduction in the marketing margins enables a higher farm price to be maintained at any given wholesale price of corn. Other assumptions were set to simulate the trade liberalization scenario.

The results indicate that investment and policy reforms to reduce marketing margins can have a strong impact on corn production. The simulated reduction in marketing margins induces an annual 540,000 mt increase in corn production, an 8 percent increase, by the year 2000. This boost in corn production reduces imports of corn by nearly 25 percent. To the extent that even greater reductions in marketing margins can be achieved, production gains will be larger.

9.4 Price Stabilization

While trade liberalization produces considerable gains to the economy, the concern remains that liberalization also opens the economy to excessive fluctuations in world prices, which are then directly transmitted to domestic prices. Instability in prices can increase production risk, limiting adoption of new technology and input levels, thereby lowering production levels; can destabilize incomes and food consumption of farmers and the poor (Anderson and Hazell, 1989); may destabilize government revenues from tariffs and taxes; and reduce aggregate investment due to long term risk.

These concerns may be strengthened in the case of corn in the Philippines by the fact that the variability in real domestic corn prices has been somewhat less than the variability in real world prices of corn, with a coefficient of variation in prices of 0.27 in domestic corn price, compared to 0.45 for real world corn prices.

The supply/demand model, which assumes price certainty and risk neutral farmers, cannot be used to analyze the economic gains from price stabilization policies. However, there is a large literature which has analyzed these issues. In general, the evidence indicates that gains from stabilization of agricultural prices are quite small. The main impacts are distributional, with shifts in benefits from producers to consumers, or vice versa, depending on the stabilization schemes employed, probability distributions of prices, and other factors (Newberry and Stiglitz, 1981; Spriggs and Van Kooten, 1988).

Nevertheless, the government may prefer to stabilize prices if a movement toward trade liberalization is contemplated, in order to maintain confidence in the stability of prices during the period of transition, and reduce the risk of low incomes for small corn farmers. In this case, it is crucial that the cost of stabilization be minimized. Based on a series of case studies and review of literature, Knudson and Nash (1990) derive principles for the design of stabilization programs. The key principle is that the stabilization program should avoid handling the commodity.

The evidence shows that attempts to stabilize prices using governmental agencies to buy, store, and sell commodities have been extremely costly, in terms of both the government's budget and the efficient operation of the economy. Recent studies of the operations of the National Food Authority have essentially agreed with these general findings, arguing that the operations of NFA have reduced the profitability of private sector marketing activities to the extent that investments in milling, storage, handling, and transport are discouraged, contributing to inefficiency and high costs in marketing (AYC Consultants, 1989).

Knudson and Nash point out that the experiences of most countries indicate that, for the stabilization of the price of traded goods, variable tariffs represent an effective and less costly alternatives to marketing agencies. In developing countries, variable tariffs have been most often used to stabilize domestic prices and maximize the revenues from export crops. However, Thailand and Papua New Guinea have utilized variable tariffs on import crops as well.

In broad outline, a variable levy system is to collect a levy (l_m) equal to the difference between the targeted domestic price (P_d^*) and the import cost of a unit of that commodity (P_w).

$$l_m = P_d^* - P_w$$

Determination of the target price is a policy decision, and the targeted domestic price of corn (P_d^*) can be based on a level equal to the marginal cost of the desired quantity of domestically produced corn at the main market center; can be set equal to the domestic equivalent of the estimated long term world prices, if full trade liberalization is desired; or can be based on a desired domestic support price. The unit import cost of corn is the c.i.f. price of corn plus the handling charges to the main market center. The quality of imported corn should be standardized to make it comparable to the domestic product, and to begin the process of providing incentives for higher quality domestic corn.

In its most flexible form, the variable levy is adjusted on a daily basis. As P_w varies each day, the import tariff (l_m) will also vary each day. In order to implement this system, a commercially accepted world price, e.g., Chicago price or Bangkok price, should be used as basis for calculating the unit import cost of corn. This price is public information and the formula for adjusting this price to the unit import cost should also be announced to make the determination of the unit import cost (P_w) transparent to the importer and other participants in the market. Therefore, given the targeted domestic price (P_d^*) the calculation of levy (l_m) will also be transparent. Alternatively, a modified form of a variable levy can be used which would adjust the levy at specified intervals.

9.4.1 Advantages of the Variable Levy System

The variable levy for corn is an appropriate tool to stabilize the price of corn, as it regulates the market by controlling the price and letting the quantity of domestic production and imports adjust to this controlled price. In contrast, quantity control measures such as import quotas, restrict the quantity of supply and can seriously constrain the expansion of the livestock industry.

A variable levy system is transparent to all participants, allowing the decision makers to become more efficient in their planning. An established target price of corn allows the farmers and livestock producers to make the proper allocation of their resources. An import quantity control system, on the other hand, is not transparent, and decisions to import at the wrong time can seriously destabilize prices. Once the system is established, the cost of administration of a variable levy system should be relatively low, due to the limited cost in gathering information. In contrast, the determination of the targeted quantity of supply requires a substantial amount of information to make the system run properly. The high administrative costs of quota systems are shown by the process of lobbying and bargaining over levels of allowable imports, which occurs each lean corn season in the Philippines.

9.4.2 Disadvantages

A variable levy system is an import tariff system which can be raised as a multilateral trade issue as a form of inappropriate protection. However, in the case of the Philippines, the counter argument is that a variable levy system is part of the process toward liberalization, because a levy represents a tariffication of existing trade barriers. In addition, a targeted domestic price which is temporarily moderately higher than the world price can be partially defended based on the need to first remedy the long term structural problems in transportation, infrastructure, and other areas arising from past failures to provide appropriate public goods and services. In summary, a variable levy system is more desirable than a quantity control measure both in terms of administrative efficiency and in terms of efficiency for the feed and livestock producer.

9.5 Conclusions

In this chapter, a cereal and livestock supply/demand model for the Philippines was described, and utilized to examine the impacts of alternative price and trade policies on the corn/livestock and related sectors, including rice, corn, wheat, pork, chicken, and eggs. In particular, the removal of distortions in price and trade policy, which have been identified as key problems for the sector, were assessed. The supply/demand model was utilized to simulate three alternative price and trade scenarios, including constant price policies maintaining existing levels of price protection; full trade liberalization; and establishment of a 20 percent uniform tariff policy across commodities.

The results confirm that trade protectionism to maintain domestic prices above world prices, such as has been followed in the corn/livestock sector, imposes significant costs to the economy. Full trade liberalization sharply increases the value of domestic production; substantially raises the consumption of cereals, meats, and eggs while reducing consumer expenditures on these items; and maintains or lowers the net cost of imports.

Establishment of a moderate, uniform tariff across the six commodities, by reducing overall levels of protection, also yields substantial economic gains. The net cost of imports is cut by more than half and gross domestic value of output increases compared to the first scenario. Changes in food consumption and expenditures compared to the existing price policy scenario, however, are not large, due to continuation of moderate levels of protection. Compared to full trade liberalization, the uniform tariff policy reduces the cost of imports, but the cost is borne by domestic consumers through higher prices, lower consumption, and higher total food expenditures. The gross value of domestic production is also lower than for the trade liberalization scenario.

It should be noted that the supply/demand model uses a partial equilibrium approach, which does not capture the effects of changes in the agricultural sector on the non-agricultural sector. Nevertheless, the comparative results shown here are likely to be robust, since the general equilibrium effects should reinforce the direction of change induced by the partial,

sectoral level effects. Thus, for example, the additional income generated by increased domestic production due to trade liberalization should further boost production in the agricultural and/or non-agricultural sectors when used for consumption or investment purposes.

The analysis also showed that investment and policy reforms to reduce marketing margins can have a strong impact on corn production. By maintaining farmer incentives even with declining wholesale prices of corn, reductions in marketing margins can be a powerful spur to domestic production, and sharply reduce import requirements.

While trade liberalization produces considerable gains to the economy, liberalization may also open the economy to excessive fluctuations in world prices, which are then directly transmitted to domestic prices. The impact of low corn prices on the income of relatively poor small farmers is a particular concern. In general, the evidence indicates that gains from stabilization of agricultural prices are quite small. The main impacts are distributional, with shifts in benefits from producers to consumers, or vice versa, depending on the stabilization scheme employed, probability distributions of prices, and other factors.

Nevertheless, the government may prefer to stabilize prices if a movement toward trade liberalization is contemplated, in order to maintain confidence in the stability of prices during the period of transition, and to protect small corn farmers from excessively low prices. With possibly small total benefits from stabilization, it is crucial that the cost of stabilization be minimized. The evidence shows that attempts to stabilize prices using governmental agencies to operate buffer stocks have been extremely costly, in terms of both the government's budget and the efficient operation of the economy. The experiences of most countries indicate that for the stabilization of the price of traded goods, variable tariffs represent effective and less costly alternatives to marketing agencies.

Table 9.1 Projected area, yield, and production of rice and corn, and production of pork, chicken, and eggs with four percent per capita income growth, under alternative price scenarios[a]

	Rice			Corn			Pork	Chicken	Egg
	Area (1000ha)	Yield (mt/ha)	Prodn.[b] (1000mt)	Area (1000ha)	Yield (mt/ha)	Prodn.[b] (1000mt)	Production, 1000mt		
Scenario 1[a]									
Base	3,341	2.65	8,842	3,607	1.23	4,420	793	385	160
1995	3,294	2.89	9,520	3,743	1.46	5,476	999	527	220
2000	3,254	3.15	10,250	3,912	1.75	6,846	1,293	799	336
Scenario 2									
Base	3,341	2.65	8,842	3,607	1.23	4,420	793	385	160
1995	3,358	2.84	9,527	3,520	1.43	5,049	1,189	523	213
2000	3,303	3.08	10,167	3,626	1.71	6,211	1,577	791	323
Scenario 3									
Base	3,341	2.65	8,842	3,607	1.23	4,420	793	385	160
1995	3,590	2.84	10,193	3,567	1.45	5,159	1,104	556	228
2000	3,571	3.07	10,952	3,704	1.73	6,404	1,440	857	354

[a] Scenario 1 is a baseline simulation with constant prices incorporating 1989/90 policies. Domestic rice price is 15 percent above world price; corn price is 40 percent above world prices; wheat price is 20 percent above world prices; pork prices are equal to world prices; chicken and egg prices are 30 percent above world prices.
Scenario 2 is full trade liberalization for rice, corn, wheat, pork, chicken and eggs. Domestic commodity prices are phased down to world price levels over a three-year period. For example, corn price is reduced by 40 percent over a three-year period.
Scenario 3 is establishment of a uniform 20 percent uniform tariff across commodities. Domestic prices are phased to a level 20 percent above world prices over these year period, except pork, which remains at world price.

[b] Production of rice and corn is domestic production net of waste and seeds.

Table 9.2 Projected per capita consumption of rice, corn, pork, poultry, and eggs with four percent per capita income growth, under alternative price scenarios[a]

	Rice	Corn			Wheat	Pork	Poultry	Egg
		Food	Feed	Total				
	kg/capita							
Scenario 1								
Base	95.9	19.0	54.0	73.0	24.6	13.2	6.4	2.7
1995	97.8	18.8	63.7	82.5	26.6	15.4	7.7	3.2
2000	99.7	19.7	75.9	95.6	28.7	17.9	9.4	3.7
Scenario 2								
Base	95.9	19.0	54.0	73.0	24.6	13.2	6.4	2.7
1995	96.1	20.6	71.7	92.3	32.1	14.7	11.4	4.6
2000	97.9	19.4	84.4	103.8	34.7	17.1	13.8	5.5
Scenario 3								
Base	95.9	19.0	54.0	73.0	24.6	13.2	6.4	2.7
1995	91.8	21.2	69.4	90.6	27.6	15.4	8.9	3.6
2000	93.6	20.5	82.0	102.5	29.8	18.0	10.7	4.3

[a] Scenarios are described in Table 9.1.

Table 9.3 Projected domestic production consumption, and net imports of rice, corn, wheat, pork, chicken and eggs, with 4 percent per capita income growth, under alternative price scenario[a]

	Rice (milled)			Corn			Wheat			Pork			Chicken			Eggs		
	Prod	Cons	Import	Prod	Cons	Import	Prod	Cons	Import	Prod	Cons	Import	Prod	Cons	Import	Prod	Cons	Import
	1000 mt																	
Scenario 1																		
Base	5,437	5,803	623	4,103	4,419	327	0	1,489	1,489	793	797	49	385	385	0	160	160	0
1995	5,850	6,621	768	5,082	5,586	504	0	1,800	1,800	999	1,039	40	527	523	-4	220	213	-6
2000	6,295	7,518	1,220	6,354	7,211	857	0	2,165	2,165	1,293	1,350	57	799	705	-93	336	283	-53
Scenario 2[c]																		
1995	5,860	6,506	644	4,686	6,062	1,376	0	2,176	2,176	1,189	995	-195	523	774	251	213	314	101
2000	6,251	7,388	1,133	5,764	7,831	2,067	0	2,617	2,617	1,577	1,292	-285	791	1,045	254	323	416	93
Scenario 3[c]																		
1995	6,268	6,215	-56	4,789	6,138	1,349	0	1,870	1,820	1,104	1,046	-58	556	600	44	228	246	17
2000	6,735	7,057	318	5,943	7,735	1,792	0	2,249	2,249	1,440	1,358	-82	857	809	-47	354	325	-28

[a] Scenarios are described in Table 9.1.

[b] Production of rice and corn is domestic production net of waste and seed.

[c] Base year same as scenario 1.

Table 9.4 Projected per capita food consumption and net imports of rice, corn, wheat, pork, chicken, and eggs, with 6 percent per capita income growth under alternative price scenarios[a]

	Rice (milled)		Corn		Wheat		Pork		Chicken		Eggs	
	Food Cons	Imports	Food Cons	Imports	Food Cons	Imports	Food Cons	Imports	Food Cons	Imports	Food Cons	Imports
	kg/cap	1000mt	kg/cap	1000mt	kg/cap	1000mt	kg/cap	1000mt	kg/cap	1000mt	kg/cap	1000mt
Scenario 1												
Base	95.9	623	19.0	327	24.6	1,489	13.2	4	6.4	0	2.7	0
1995	98.7	830	17.5	411	27.5	1,867	16.5	121	8.5	47	3.4	12
2000	101.5	1,362	16.2	598	30.9	2,331	20.8	275	11.3	51	4.4	-2
Scenario 2[b]												
1995	97.0	705	18.9	1,288	33.4	2,258	15.8	-118	12.5	321	5.0	128
2000	99.8	1,272	15.9	1,622	37.4	2,819	19.9	-77	16.7	-468	6.5	169
Scenario 3[b]												
1995	92.6	2	19.9	1,259	28.7	1,941	16.6	23	9.7	103	3.9	29
2000	95.3	451	17.4	1,553	32.1	2,424	20.9	137	12.9	119	5.1	31

[a] Scenarios are described in Table 9.1.

[b] Base year same as scenario 1.

Table 9.5 **Projected total cost of imports and gross domestic value of production, rice, corn, wheat, pork, chicken, and eggs, year 2000**

	Net Cost of Imports[a]	Gross Domestic Value of Production[b]	Cereals		Meat and Eggs	
			Food Cons.	Expenditure on Food	Food Cons.	Expenditure on Food[c]
	(Bil ₱)	(Bil ₱)	(1000mt)	(Bil ₱)	(1000mt)	(Bil ₱)
A. Baseline Income Growth - 4 percent						
Scenario 1	20.56	166.21	11,166	82.35	2,338	134.27
Scenario 2	17.87	188.08	11,439	70.73	2,753	135.16
Scenario 3	9.40	183.31	10,856	80.87	2,492	136.66
B. Rapid Income Growth - 6 percent						
Scenario 1	41.65	166.21	11,217	83.12	2,751	137.41
Scenario 2	42.42	188.08	11,550	71.77	3,250	158.64
Scenario 3	32.42	183.31	10,924	81.94	2,937	160.36

[a] Valued at world prices.

[b] Gross domestic value of production for rice, corn, pork, chicken, and eggs valued at world prices, less cost of corn as input to pork, chicken, and eggs.

[c] Valued at domestic wholesale prices.

10. CONCLUSION AND SUMMARY OF POLICY IMPLICATIONS

Mark W. Rosegrant

This report has documented the main government policies toward the corn livestock sector in the Philippines and the impacts of these policies on the competitiveness of the sector. Distortions in price and trade policy have been identified as key problems for the sector. Despite these distorted prices, corn, poultry, and pork have a comparative advantage as import substitutes and pork has a strong potential to be competitive as an export commodity if sanitary and quality improvements can be made. Correction of price distortions would enhance the competitiveness and productivity of the corn/livestock sector. The efficiency of the sector would be further strengthened by improvement in structural problems in marketing and distribution. While constraints in research and extension, seed distribution, and farm level technology do exist, available evidence indicates that the most serious structural problems are in post-harvest technology, transportation and marketing, due to underinvestment and restrictive policies in these areas. Removal of these structural barriers would greatly improve the competitiveness of the corn/livestock sector.

Based on this study, an integrated set of four broad policy reforms affecting the corn-livestock sector would lead to significant economic benefits. The four areas of policy reform are trade liberalization, real exchange rate devaluation, increased public investment in and deregulation of marketing and transportation, and stabilization of corn prices.

10.1 Trade Liberalization

Trade protectionism to maintain domestic prices above world prices, such as has been followed in the corn/livestock sector, entails significant costs to the economy. Trade policies which protect some commodities or sectors at the expense of others can cause resources to shift from more efficient production activities to less efficient ones. Protective trade policies also penalize consumers through increased domestic prices. Removal of trade barriers will usually result in more efficient allocation of resources in production, and will provide net welfare gains. These effects were confirmed in the analysis of the impacts of alternative price and trade policies on the corn/livestock and related sectors, including rice, corn, wheat, pork, chicken, and eggs. The impacts of removal of distortions in price and trade policy were analyzed using a cereal and livestock supply/demand model to simulate three alternative price and trade scenarios, including constant price policies maintaining existing levels of price protection; full trade liberalization in cereals and livestock; and establishment of a 20 percent uniform tariff policy across cereal and livestock commodities.

The results confirm that maintaining trade protectionism imposes significant costs to the economy. Full trade liberalization sharply increases the value of domestic production; substantially raises the consumption of cereals, meats, and eggs while reducing consumer expenditures on these items; and maintains or lowers the net cost of imports compared to

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existing policies. Full trade liberalization generates the largest projected economic benefits among the three policies.

Establishment of a moderate, uniform tariff across the six commodities, by reducing overall levels of protection also yields substantial economic gains. The net cost of imports is cut by more than half and gross domestic value of output increases compared to the first scenario. Changes in food consumption and expenditures compared to the existing price policy scenario, however, are not large, due to continuation of moderate levels of protection. Compared to full cereal and livestock trade liberalization, the uniform tariff policy reduces the cost of imports, but the cost is borne by domestic consumers through higher prices, lower consumption, and higher total food expenditures. The gross value of domestic production is also lower than for the trade liberalization scenario.

Although the projected net benefits of a moderate uniform tariff policy are not as high as complete trade liberalization, this policy would provide substantial benefits compared to the existing system of protection. A move toward a moderate uniform tariff policy would preferably be seen as a step toward full trade liberalization in corn and livestock. Such a policy could provide short term protection of the sector while productivity-enhancing and cost-reducing technology development policies and public investment policies in infrastructure are instituted in conjunction with liberalization of other industries which play a critical role in the cost structure of the corn/livestock sector, such as the inter-island shipping industry. The moderate tariff levels could then be reduced as improvement in sectoral efficiency occur.

10.2 Real Exchange Rate Devaluation

Trade and price policy has a direct impact on the competitiveness of these commodities on world markets. In addition, competitiveness is also influenced indirectly through government policies that affect the real exchange rate. In the Philippines, the indirect effects of trade and macroeconomic policies have caused overvaluation of the real exchange rate, which in turn lowers the competitiveness of the agricultural commodities. As was shown in this analysis, the overvaluation of the exchange rate arising from protection of domestic industry has resulted in negative indirect protection in recent years, reducing the competitiveness of the corn/livestock sector.

In order to maintain the competitiveness of the corn/livestock sector if full trade liberalization is adopted, the real exchange rate should be adjusted to the long term equilibrium level as prices in the corn/livestock sector are adjusted toward world price levels. If the real exchange rate remains overvalued, nominal equality of domestic and world prices will leave the corn/livestock sector at a disadvantage relative to world prices.

10.3 Public Investment and Policy in Marketing and Transportation

This report has shown that Philippine corn markets are relatively competitive and well-integrated but that structural problems persist Structural rigidities in the market arise from poor

physical farm-to-market linkages, inadequate transportation, and high costs of arbitrage that impair the full, complete, and rapid price adjustments between markets and efficient integration of markets.

The findings of the study suggest that there would be substantial benefits from development of better physical infrastructure to effectively link production points to market centers. The analysis also showed that investment and policy reforms to reduce marketing margins can have a strong positive impact on corn production and can significantly reduce corn imports. By maintaining farmer incentives even with declining wholesale prices of corn, reductions in marketing margins can be a powerful spur to domestic production. There would also be significant benefits from improvement of public market information services to ensure the timely dissemination of accurate and reliable information.

Increased efficiency in cargo handling services from open competition, accompanied by investments in the port facilities, and improvement in the availability of inter-island vessels to transport corn, can sharply reduce trading and distribution costs. Deregulation in ports and shipping, already underway, should be vigorously pursued.

Another area where public investment could have a major payoff is in the control or eradication of foot and mouth disease. The eradication of FMD is not only beneficial for potential hog exports but in maintaining a healthy population of the ruminant animals (beef and carabao) as well. It would be desirable therefore to strengthen further the current program of the Department of Agriculture in the eradication of the FMD. Hog-producing regions identified by the Bureau of Animal Industry as FMD-free zones should be used as an initial basis for negotiations in obtaining international certification of export worthiness in pork. Bilateral government agreements between the Philippines and Asian importers of pork (Japan, Hongkong, and Singapore) should be pursued more vigorously.

10.4 Price Stabilization

While trade liberalization produces considerable gains to the economy, the concern remains that liberalization also opens the economy to excessive fluctuations in world prices, which are then directly transmitted to domestic prices. The quantifiable benefits of price stabilization may not be as high as the other policy areas described above, but stabilization is a potentially important complementary policy, particularly if the government moves to liberalize trade in corn and livestock. Effective stabilization of prices would provide assurance against short term disinvestment in corn and livestock during a transitional phase toward liberalization, and would protect farm incomes from excessive downward fluctuations in prices.

In general, the evidence from existing price stabilization schemes in both developing and developed countries indicates that gains from stabilization of agricultural prices are quite small. The main impacts are distributional, with shifts in benefits from producers to consumers, or vice versa, depending on the design of the stabilization scheme employed, probability distributions of prices, and other factors. Nevertheless, the government may prefer to stabilize

prices if a movement toward trade liberalization is contemplated, in order to maintain confidence in the stability of prices during the period of transition toward trade liberalization. If a price stabilization policy is adopted, it is crucial that the costs of effective stabilization be minimized. In order to keep the costs of stabilization down, experience in developing countries indicates that variable taxes or levies are preferable to government buffer stock schemes.

The evidence shows that attempts to stabilize prices using governmental agencies to manage buffer stock schemes have been extremely costly, in terms of both the government's budget and the efficient operation of the economy. Recent studies of the operations of the National Food Authority have essentially agreed with these general findings, arguing that the operations of NFA have reduced the profitability of private sector marketing activities to the extent that investments in milling, storage, handling, and transport are discouraged, contributing to inefficiency and high costs in marketing.

The experiences of most countries indicate that for the stabilization of the price of traded goods, variable levy policies represent effective and less costly alternatives to marketing agencies. Design and implementation of an appropriate variable levy system for corn and livestock should be considered in an integrated fashion with trade liberalization policies.

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