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DEMAND MANAGEMENT OF FOOD SYSTEMS IN ASIAN AND NEAR EASTERN COUNTRIES: A SYNTHESIS

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EXECUTIVE SUMMARY

Food consumption has increased rapidly in many Asian and Near Eastern countries over the past thirty years, while in others little improvement has been recorded. There is no simple explanation for this performance. This paper explores a number of possible factors which might account for an underlying common structure of aggregate food demand in these countries. The influence of food prices and per capita incomes is shown to have a consistent influence on aggregate food demand, but these factors alone do not explain a large portion of the observed differences in food consumption. Other factors, such as the initial degree of calorie poverty and the changing share of urban dwellers in the total population, are also important. Finally, five case studies—Pakistan, India, Egypt, Thailand, and Indonesia—which explore different approaches to food system demand management are briefly summarized.

1. INTRODUCTION

Levels of food consumption have improved dramatically in many countries over the past quarter century, while in others calorie intake remains low. This paper is a synthesis of the observations regarding the food economies of twelve South/Southeast Asian and Near Eastern countries. The focus is on understanding the factors which explain the expansion path of national aggregate per capita calorie consumption. Since the time series of consumption data for most countries is contained only in national aggregate food balance sheet records, there is a limit to the extent food distribution issues can be studied over time and cross nationally. Nevertheless it is important to exploit the information contained in national aggregate level consumption data. Firstly, many food system policy interventions are motivated by issues which are defined at the national aggregate level, such as the desire for food self-sufficiency or, relatedly, concern over foreign exchange balances. Secondly, some food system policy instruments, particularly pricing policies, elicit a more generalized response from food consumers, even when they are motivated by concern for specific target groups. In a related way, it is important to analyze food system performance at the aggregate level because it is the context within which more micro-level studies must be understood or rationalized. Finally, when national per capita food consumption rises substantially from a low level relative to nutritional norms, there is a strong presumption that the condition of those who are in food poverty has also improved, since the demand for calories is generally strong amongst the poor and falls off sharply as nutritional norms are approached (see Alderman, Timmer, and Ravellion). Aggregate level analysis may provide some insight into this process.

The performance of a food system over time reflects the influence of a number of forces reflecting in the decisions of millions of food consumers. Some of these forces are captured in the growth and distribution of incomes. Others are the result of pricing policy and trade interventions. Food consumption is also influenced by institutional features, such as direct feeding and other targeted programs. Finally, there are structural factors, particularly changing demographic patterns, which influence the growth and distribution of food consumption. Although the impact of specific forces can, in theory, be measured, explaining the actual expansion path of food consumption requires a demand management perspective which integrates the influence of many forces.

The first part of this paper draws on concepts outlined in the earlier "overview" paper of applying a demand management framework to our sample of Asian and Near Eastern countries (Goldman, 1991). Food consumption expansion paths are reported for each country using the demand management identity discussed in the earlier paper. This is followed by a substantial revision of the econometric model presented earlier in a search for some common structure in the food consumption experience of these highly diverse countries. While this cross-national approach yields some important results, a more complete and satisfying analysis must take place on a country specific basis. The paper concludes with brief summaries of five national case studies.

2. FOOD CONSUMPTION EXPANSION PATHS

At the national aggregate level, per capita food consumption is supplied from domestic production and from net imports. This is captured in the following food system identity:

(1) $$C/N = Q/N * C/Q,$$

where C represents calorie consumption, Q equals domestic production of calories, and N is total population. The second term on the right hand side is the self-sufficiency ratio, where a value of one represents zero net imports. If that term is taken to the left hand side,

(2) $$Q/N = C/N * Q/C,$$

and the identity converted to logarithmic form,

(2a) $$\ln q = \ln c + \ln s,$$

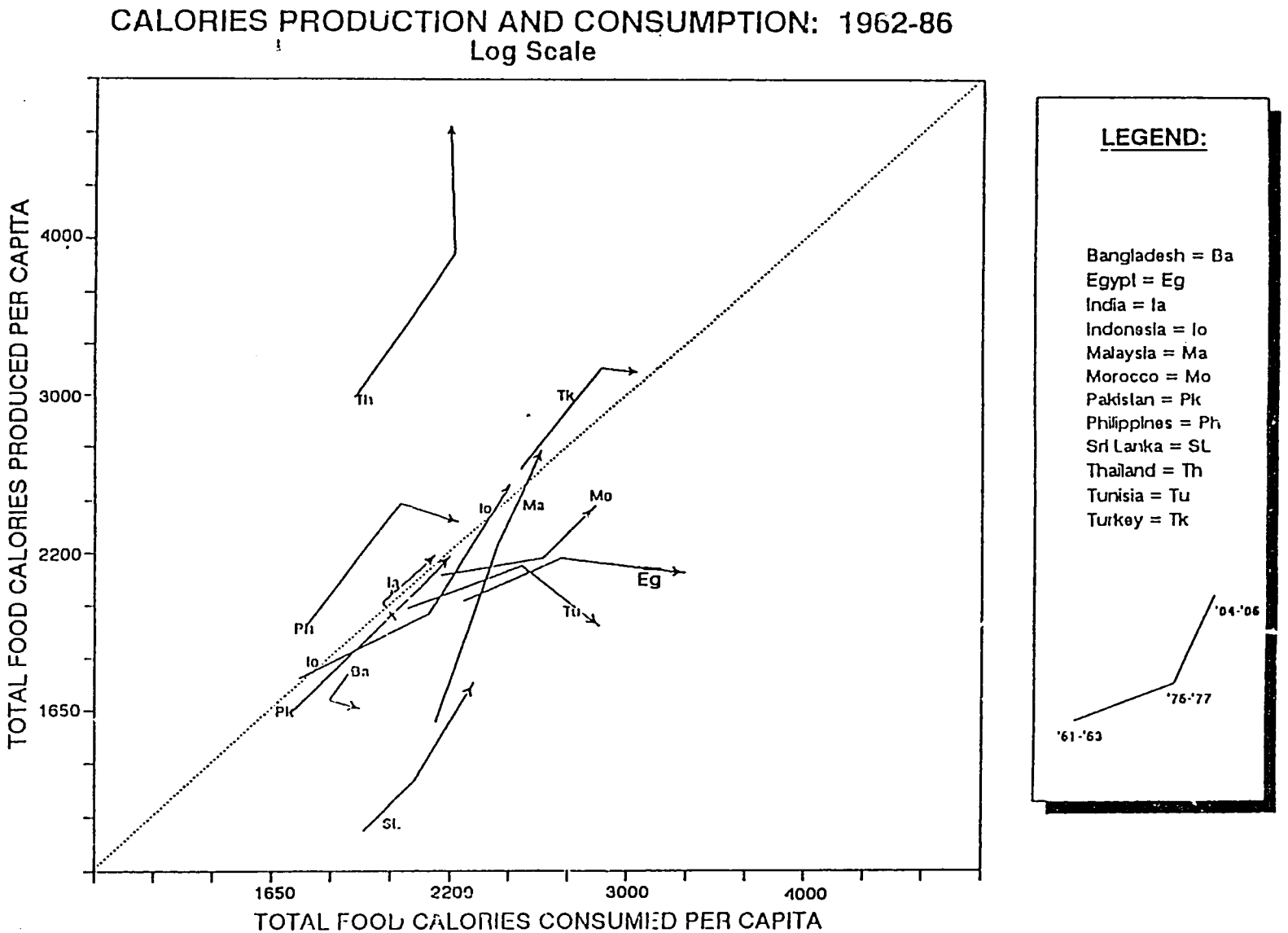
(where q, c, and s represent each of the terms in identity 2),

then the identity implies a fundamental tension in public policy management: how to allocate changes in per capita food production between augmenting domestic food consumption, on the one hand, and changing net imports, on the other.

Food system expansion paths, expressed in terms of identity 2a, are shown in Figure 1 for twelve Asian and Near Eastern countries over two periods, 1962-76 and 1976-85. Points on the 45 degree line represent zero net imports of calories. Countries above the 45 degree line, such as Thailand, are net exporters of calories and those below are net importers. Country expansion paths which are parallel to the 45 degree line represent improvements in food consumption with constant rates of calorie self-sufficiency. Movements toward the 45 degree line from below represent improvements in food self-sufficiency (at the expense of potential increases in calorie consumption). Approaching the 45 degree line from above corresponds with export substitution. Movement away from the line from below shows improvements in food consumption supported by import expansion and from above represents calorie export expansion.

It is clear from Figure 1 that 30 years ago food consumption in many of these countries was substantially below the nutritional sufficiency level (about 2200 calories per person) and that dramatic improvements have been made since. Yet the individual country experiences are quite varied. Countries which began the period with severe calorie poverty had a tendency to push strongly toward nutritional sufficiency, supported by improvements in food production, and as they approach that level, foreign trade objectives (import substitution or export expansion) appear to take on greater importance. Poor countries that had less successful agricultural sectors (Bangladesh and India) were unable to escape nutritional poverty through imports. Other countries which began the period at the nutritional sufficiency level had poor agricultural

FIGURE 1


CALORIES PRODUCTION AND CONSUMPTION: 1962-86
Log Scale
TOTAL FOOD CALORIES PRODUCED PER CAPITA
4000
3000
2200
1650
TOTAL FOOD CALORIES CONSUMED PER CAPITA
1650
2200
3000
4000
Th
Tk
Mo
Ma
Io
Ia
Eg
Tu
Ph
Io
Ba
Pk
Sl.
LEGEND:
Bangladesh = Ba
Egypt = Eg
India = Ia
Indonesia = Io
Malaysia = Ma
Morocco = Mo
Pakistan = Pk
Philippines = Ph
Sri Lanka = SL
Thailand = Th
Tunisia = Tu
Turkey = Tk
'04-'06
'76-'77
'61-'63

performance but achieved a dramatic increase in per capita calorie consumption, nevertheless, through import expansion.

Expansion paths for calorie consumption from the dominate staple food (either rice or wheat for these countries) are shown in Figure 2. These are interesting by comparison with those expansion paths for total calories in Figure 1, particularly for countries with unusually large food commodity exports. For example, rice has played a relatively small role in the explosive export of calories from Thailand. Malaysia, despite its rhetorical and investment emphasis on achieving rice self-sufficiency, has retreated from that objective in recent years, relying mainly on palm oil for the dramatic calorie self-sufficiency thrust shown in Figure 1. Although Pakistan's food consumption expansion was fueled by the Green Revolution in wheat during the first period, in recent years improvements in the wheat production have been directed toward the import substitution goal; improvements in calorie consumption levels are due entirely to vegetable oil imports.

These consumption expansion paths are not exclusively the result of underlying or trending economic variables, but rather the outcome of macroeconomic forces, agricultural technical changes, demographic shifts, public and private investments, and direct pricing and administrative interventions in the food and agricultural economy. The relative importance of these factors, and others, will vary by country and by time period.

Consider, for example, three expansion path scenarios shown in Figure 3, each involving an increase in per capita calorie production. How is this production increment utilized? Scenario one assumes that demand forces at the national level, particularly per capita incomes, are stagnant and that the food price level is constant. In this case, the food production increment in a net importing country would simply substitute for imports, a vertical expansion path. In the second scenario the production increase occurs along with a robust economic environment which stimulates demand and policy makers continue to hold food prices constant. In this case, the expansion path would rotate clockwise from the vertical, depending upon the strength of the demand expansion relative to that of domestic production. If an equal proportionate increase in production and demand are accommodated through a stable food pricing policy, then the country follows a constant trade dependent expansion path (the share of imports in consumption is constant). The expansion path would parallel the 45 degree self-sufficiency line. The final scenario (2a) allows for a change in pricing policy, for example an increase in marketing subsidies, a change in border taxes, or imposition of new quantitative restrictions. Superimposing the impact of food price changes on either of the above scenarios will result in a different expansion path, the degree and direction of rotation of the expansion path will depend on direction of the price change, its order of magnitude, and the degree of consumer response. The example of scenario 2a involves the elements in scenario 2 combined with a fall in consumer prices, which further stimulates consumption and increases the share of imports. In order to understand more about the configuration of forces which underlie actual expansion paths, such as those in Figures 1 and 2, a conceptual framework and measures of factors influencing food demand are required.

FIGURE 2

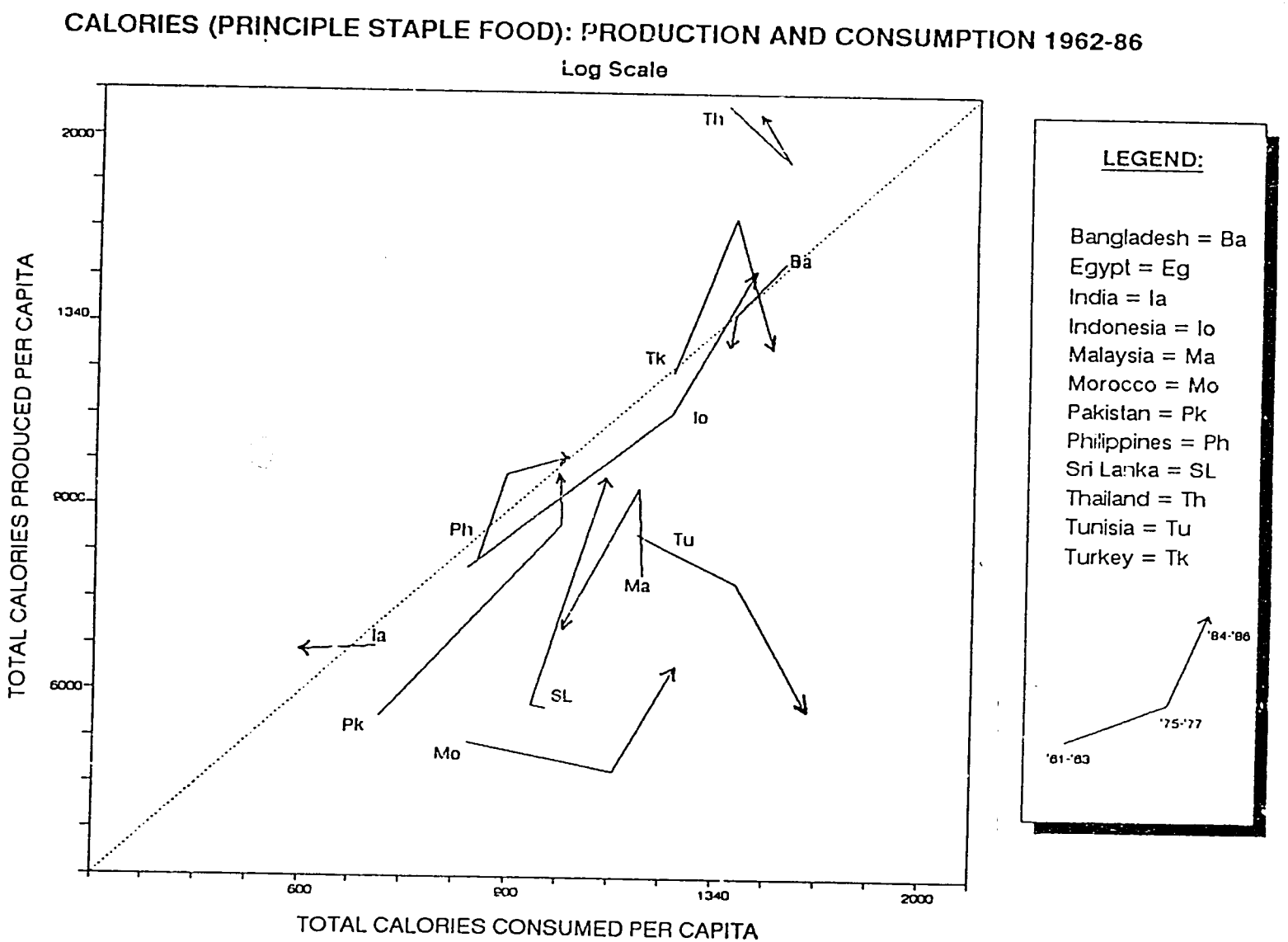
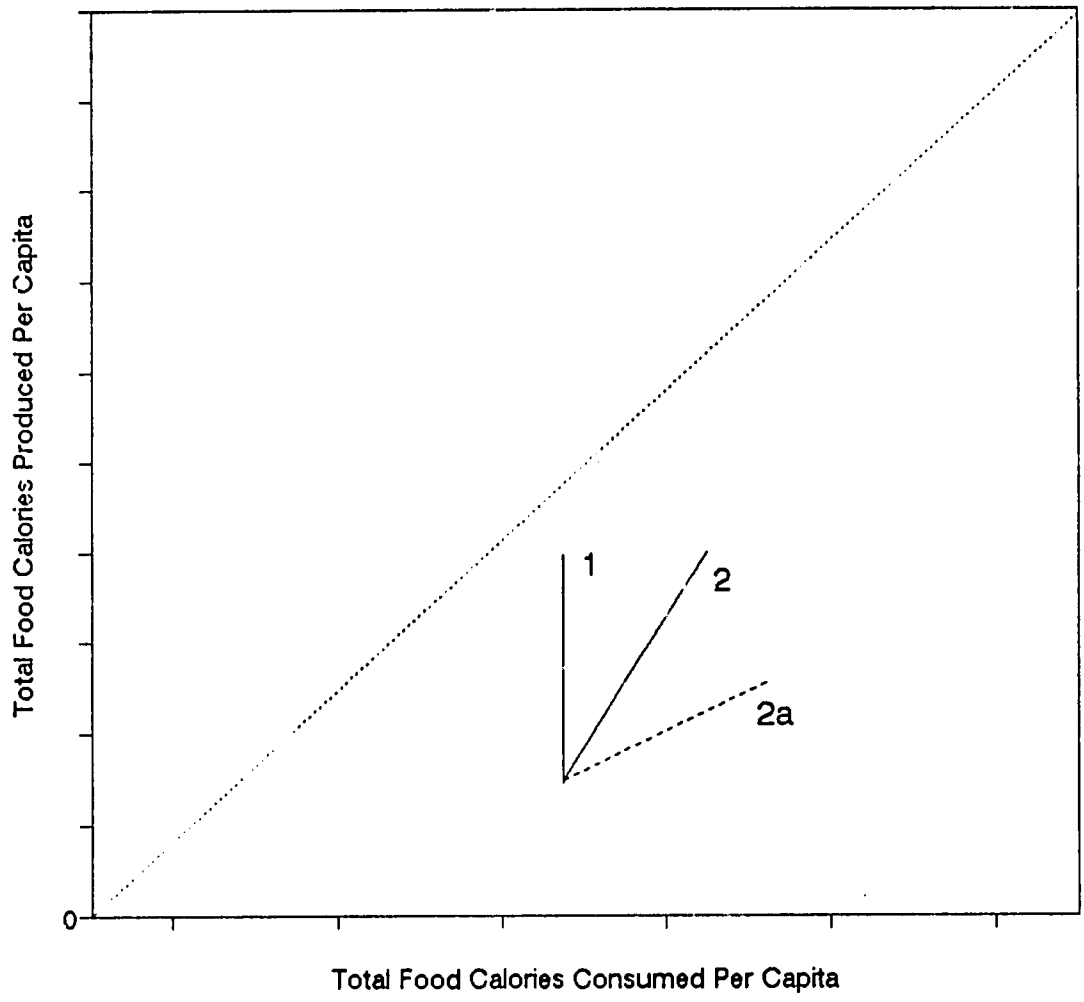

CALORIES (PRINCIPLE STAPLE FOOD): PRODUCTION AND CONSUMPTION 1962-86
Log Scale
TOTAL CALORIES PRODUCED PER CAPITA
2000
1340
900
600
TOTAL CALORIES CONSUMED PER CAPITA
600
900
1340
2000
Th
Ba
Tk
Io
Ph
Tu
Ma
Ia
SL
Pk
Mo
LEGEND:
Bangladesh = Ba
Egypt = Eg
India = Ia
Indonesia = Io
Malaysia = Ma
Morocco = Mo
Pakistan = Pk
Philippines = Ph
Sri Lanka = SL
Thailand = Th
Tunisia = Tu
Turkey = Tk
'84-'86
'75-'77
'61-'63

Figure 3 Demand Expansion Scenarios



3. A DEMAND EXPANSION MODEL

This section reports an attempt to identify some of the most important factors at work on the demand side of the expansion paths shown in Figure 1, to determine whether this sample of countries responds to these factors in a similar fashion, and to establish the relative importance of these factors in each of the countries and time periods. It is a substantial revision of the preliminary work reported in the earlier "overview" paper. The revisions are a result both of improved model specification and the correction of data errors.

The model of food demand presented here is designed to explain the growth rate in per capita calorie consumption measured at the national aggregate level. It contains both conventional economic variables, such as income and prices, as well as structural characteristics reflecting demographic factors and nutritional adequacy. The ordinary least squares specification of the basic model is as follows:

$$C' = a + b_1 P' + b_2 Y' + b_3 N + b_4 U' + b_5 U + e \tag{3}$$

where

C' = growth rate in aggregate per capita calorie consumption as measured from FAO food balance sheets;

P' = rate of change in deflated price of the dominant staple food (either rice or wheat for these countries);

Y' = growth rate in real per capita income measured at the national level in terms of the national accounts item for "absorption", which is discussed further below;

N = a nutrition adequacy index proxied by the logarithm of a ratio of the country's aggregate per capita calorie consumption measured at the beginning of the time period relative to the WHO nutritional adequacy standard for that country (in some regressions a quadratic specification of this term was employed);

U' = the growth rate of the urban share of the population during the time period;

U = the urban share of the population at the beginning of the time period.

This model was estimated with observations for two time periods, 1963-72 and 1975-85, for eleven Asian and Near Eastern countries:

Bangladesh	Morocco	Thailand
India	Pakistan	Tunisia
Indonesia	Philippines	Turkey
Malaysia	Sri Lanka	

The observations were standardized in growth rate terms in order to avoid the problem of exchange rate conversion, given the varied macroeconomic experiences and exchange rate regimes of the countries involved, and to reflect a medium run adjustment process. The two periods were chosen because in many of the countries they encompass very different price, macroeconomic, and agricultural growth episodes. For the purpose of model estimation two second period observations were omitted, from Thailand and Indonesia. These cases will be discussed below.

The price variable requires little explanation, except to note the difficulty of specifying an appropriate price to correspond with the dependent variable. There was not enough price data from most countries to create a calorie weighted price index, for example. The consumer food price index was available for most countries and was employed in some regression runs. Among other difficulties with this "price" is that the food component of the general consumer price index, the deflator index, is often large (though the weights are usually not reported) which dampens the variance of the deflated food price index. In the end, the price of the dominant staple food was chosen to proxy the "price" of calories. We will return to this issue further on.

Income is employed in this analysis as a conventional representation of Engle's Law. Per capita gross national product (GNP) is usually employed in aggregate studies as the income proxy. Macroeconomic analysis of stabilization problems reveals that a country's capacity to "absorb" goods and services frequently differs from measured GNP and can be sustained for lengthy time periods by foreign exchange reserves or attracting foreign savings in one form or another. In this sample, the ratio of growth rates of GNP to the national accounts measure of "absorption" (the aggregate of private consumption, general government consumption, and gross domestic investment) varies substantially among countries and between periods, reflecting large variance in macroeconomic policies. In various regression runs GNP, private consumption, and absorption were tried, with the latter producing decidedly better results.

The nutrition gap measure was introduced into this analysis to capture the notion that, on average, consumers' propensities to consume calories will be higher in countries where average nutritional deprivation is large. One way to express this is that the national average income elasticity of demand for calories will be larger in calorie poor countries. The following interpretation of the regression results will return to this issue.

Since national aggregate calorie consumption is a weighted average of rural and urban consumption with population shares as weights, the growth of aggregate consumption should reflect the urbanization process which was underway in varying degrees in the sample. The growth rate of the urban population share was employed in the regressions to reflect this idea.

The final variable, the urban population share at the beginning of each period, is discussed further on.

4. STATISTICAL RESULTS

Results from the regression analysis of the demand expansion model are shown in Table 1. The two equations shown differ by the addition of the beginning of period urban population share variable in Equation 2. Experiments with other specifications are discussed below where appropriate. The income variable, represented by the "absorption" measure from the national accounts, is positive, as expected, and significant in both regressions. Since both the dependent and the income variable are specified as period growth rates, the regression coefficient is the national aggregate Engle's elasticity measured at the mean level of sample observations. It is less than .1 in both regressions. In an alternative specification using "private consumption" from the national accounts, rather than "absorption", the elasticity is about .1 but is less significant statistically. These estimates are consistent with the low elasticities measured in a number of micro-surveys (see Behrman and Deolalikar). Ravellion has shown that even low response to income at a national aggregate level can result in impressive growth in calorie consumption among the poor when leveraged by the rapid growth in per capita income experienced in some of the sample countries. In addition this mean income response is modified by the initial degree of calorie poverty, discussed next.

The nutritional adequacy variable has the expected negative sign and strong statistical significance. It says that, income growth rate given, calorie consumption growth rates are inversely related to the degree of calorie sufficiency measured at the beginning of the period. The idea behind this variable is that consumer demand for calories is stimulated by unfulfilled energy requirements at low levels of calorie consumption and is dampened, as calorie consumption increases, by the physiological difficulty to accommodate additional bulk from starchy staple foods (Bennett's Law). With similar rates of per capita income growth, a calorie poor country exhibits a stronger propensity to consume calories from additional income than one where nutritional well-being is higher. The income and calorie deficiency variables need to be considered jointly for a fuller understanding of the role of income in calorie consumption.

The analysis confirmed the conventional notion of an inverse but quantitatively weak relation between price and aggregate calorie consumption. The inelasticity of this response is due in part to a high degree of separability between aggregate calories and other goods in consumer preferences. Price elasticities for specific foods with closer substitutes within the calorie set should be higher. In addition, the staple food prices used in this analysis are those reported in statistical bulletins. These are sometime "official" rather than actual market prices; the correspondence between the two may be closer in urban than in rural markets. Finally, there is the problem, mentioned above, with specifying an appropriate aggregate calorie price proxy. In many countries the growth in calorie consumption occurs along with a substantial degree of diet diversification. The price of the dominant staple food, which is employed here as the calorie price proxy, may not bear a close association with prices of foods which underlie the consumption expansion. The most extreme example in this sample, and the most statistically outlying country, is Pakistan, where wheat is the dominant food staple but the second period calorie expansion is led almost exclusively by vegetable oil consumption stimulated by a

Table 1 **Factors Explaining Growth Rate in Per Capita Calorie Consumption: Regression Model Results**

EQ	Constant	Price	Income	Nutrition Adequacy	Growth of Urban Population Share	Share Urban Population	Adj. R^2
1	.008 (5.28)	-.096 (-3.70)	.056 (1.96)	-.015 (-3.17)	-.134 (-2.45)	-	.69
2	.003 (1.17)	-.075 (-2.77)	.067 (2.43)	-.021 (-3.78)	-.11 (-2.05)	.012 (1.77)	.72

Note: Numbers in brackets are T values

dramatic fall in its price, relative to wheat and most other foods. Diet diversification is discussed further below.

Since national aggregate consumption is an average of rural and urban per capita levels weighted by the relative population shares, a changing share of urban population (not urban population growth) is associated with a change in national per capita consumption so long as, ceteris paribus, urban and rural calorie consumption levels differ. The regression analysis of demographic transition effects shows that an increasing urban population share is associated with a decline in aggregate per capita calorie consumption. This is consistent with household expenditure studies which show a tendency for urban residents to consume fewer calories than rural consumers at similar levels of income (see Alderman). Lower energy requirements among urban residents and a greater availability and variety of goods and services competing for incomes are possible explanations for this behavior.

The final variable, entered in Equation 2, is the share of urban population at the beginning of the period. This behaves virtually like a dummy variable for the substantially more urban Near Eastern countries. Why this variable, whose coefficient is marginally significant, should have a positive impact on growth in calorie consumption is not clear. One idea flows from the notion that the price variable employed here is more likely to represent urban than rural market behavior. Since national per capita consumption is the dependent variable, this distortion is likely to be more represented in the data from highly rural than from more urban countries. The urban share variable, which does lower the price coefficient when added to the regression, may be adjusting for this bias, reflected in the difference between the price coefficients and between the intercept terms in Equations 1 and 2. Since the magnitude of price changes is not highly correlated in this sample with demographic shares, the observed slope and intercept adjustments are consistent with conditions where rural price changes are systematically greater than those in urban areas (in other words, without the controlling urban share variable the estimated price/consumption relationship is biased upward). We have no data to confirm whether or not the condition holds in this sample of countries. This explanation aside, however, it is not clear why, holding all the other regression variables constant, the larger urban countries seem to have high calorie consumption growth rates.

5. DIET DIVERSIFICATION

An analysis of aggregate calorie consumption masks the underlying process of diet diversification which often accompanies calorie consumption growth. This was alluded to above in the discussion of measurement errors associated with the price variable. In Table 2 the commodity sources of calorie expansion between 1973-83 are broken out for twelve Asian and Near Eastern countries. In addition to staple cereals, which account for half or less of calorie expansion in five countries and no more than 65 percent in the others (Bangladesh excepted), edible oils and sugar play an important role. In most of the countries food commodities other than the five groups shown in Table 2 account for 15 to 25 percent, in the Philippines almost 40 percent, of consumption growth. In addition to these traditional calorie sources, in many of the countries considered here a process of diet diversification toward meat protein commodities is substantially underway. While the econometric analysis here has been successful in identifying a set of factors which have been important in varying degrees in this sample of diversified countries, clearly the process of consumption expansion is complex. A much richer understanding can be gained only by country specific studies.

TABLE 2 - Consumption Diversification

Contribution of Selected Food Sources to 1973-1984 Change in Per Capita Calorie Consumption

	Change in consumption (Calories)	Share of Total Change in Calorie Consumption (%)*					
		Cereals	Oils	Sugar	Roots	Pulses	Other
Bangladesh	-43	83	-109	12	9	26	79
Egypt	649	41	28	16	3	-10	22
India	218	36	24	15	15	0	10
Indonesia	458	65	18	0	7	0	10
Pakistan	95	-35	123	-28	-3	-24	67
Philippines	371	40	9	13	0	0	38
Sri Lanka	339	52	13	10	0	0	25
Morocco	271	50	10	15	7	3	15
Tunisia	512	63	7	8	1	-	21

* A negative sign indicates change in the opposite direction of change in total consumption.

6. COUNTRY CASE STUDIES

Five demand management country case studies were carried out under the Agriculture Policy Analysis Project. The countries—Pakistan, Indonesia, Egypt, India, and Thailand—can be easily distinguished on Figure 1 since they followed such varied calorie expansion paths. Pakistan and Indonesia each experienced substantial improvement in per capita calorie consumption along with large increases in per capita calorie production. Calorie consumption in Egypt, by contrast, grew equally impressively but with no assistance from the production side. Food consumption grew slowly in India and Thailand, although per capita calorie production grew slowly in the former and very fast in the latter.

Pakistan (see Goldman, 1992) and Indonesia (see Deolalikar, 1992, and Timmer, 1992) followed the most similar demand management strategies among the five country cases. In each there is substantial evidence that agricultural growth led by cereal production had a direct impact on food consumption. Part of this impact occurred through increases in on-farm consumption of wheat and rice. In addition, agricultural growth may have generated increases in rural income beyond its direct contribution measured in GDP figures (Timmer, 1992). In the 1960's, calorie consumption in both countries was substantially below nutritional norms. Each country placed an emphasis on staple food price stabilization and on achieving food self-sufficiency, yet neither allowed the food self-sufficiency goal to dominate the competing nutritional objectives. In Pakistan when agricultural growth slowed, following the initial Green Revolution explosion, the country reverted to substantial grain imports in order to maintain stable prices and accommodate the expanding demand for calories. In recent years, with cereal consumption at high levels, demand for wheat has become insensitive to income growth. Calorie consumption and diet diversification have been promoted by the combination of rapidly expanding domestic poultry production and an aggressive government strategy to drive down the price of edible oil through massive imports of palm and soybean oil.

Both Timmer and Deolalikar emphasize the importance of a broad based rural incomes policy in supporting the more traditional pricing policy approach to food demand management. Deolalikar shows that in Indonesia, as in other countries, that calorie consumption may be less responsive to income than was earlier assumed. His study shows that, in addition to strong agricultural growth, rural transportation and health infrastructure and improvements in environmental hygiene explain a good deal of the variance in nutrient consumption.

Egypt is the other country, among those in the case studies, where per capita calorie consumption increased substantially (see Christensen, 1991). In contrast to Pakistan and Indonesia, Egypt began the period with a high level of calorie intake. Also in contrast to those countries, Egypt has experienced no per capita growth in calorie production. The Egyptian government stimulated consumption expansion through exchange rate and consumer price subsidies. This was accommodated by an import intensive strategy supported by large amounts of food assistance. These policies promoted consumption of cereals, edible oil, sugar and livestock products. Given the relatively high levels of per capita income and calorie

consumption at the beginning of the period, such a large increase in calorie consumption is somewhat unexpected. However, this pattern of price and import driven calorie expansion has occurred in other urbanized Near Eastern countries such as Morocco and Tunisia (see Figure 1). In Egypt the budgetary cost of food subsidies grew to a level where they became an important issue in macroeconomic policy. Policy reforms initiated in 1986 have resulted in higher real consumer prices, particularly for livestock products.

Among the cases studied in detail, India and Thailand experienced the slowest growth in per capita calorie consumption. The early Green Revolution period in India led to increases in per capita production of calories but no increase in per capita consumption. Deolalikar (1991) makes the case Indian food balance sheets understate the consumption of pulses, so that some increase in per capita calorie consumption may have occurred. However, the pattern shown in Figure 1 accurately reflects the Indian government's primary concern with achieving food security through import substitution and a massive build-up of cereal reserves. Once that strategy was accomplished, further increases in per capita production were placed in the market supporting a modest fall in real food prices. Despite a large Public Distribution System, Deolalikar cites inefficiency and poor targeting as reasons for its lack of important impact Indian food consumption patterns. Increases in rural incomes and lower real prices resulting from India's agricultural growth explain much of observed increase in per capita calorie consumption.

By contrast, Thailand has recorded one of the fastest agricultural growth episodes in Asia, yet consumption has stalled at about 2200 calories per person. In the earlier period, an export tax system stimulated both government revenue and low consumer rice prices, thus promoting calorie consumption (see Abel, 1991). However, in recent years this policy has been reversed due to increasing pressure from politically important farmer groups to raise domestic prices of rice and sugar, two principal calorie sources. Price increases have certainly dampened growth in calorie demand. The high levels of average per capita income and calorie consumption are also consistent with slower growth in calorie consumption. But Thailand's complete absence of consumption growth in the recent period is unusual. Although there has been important diet diversification into livestock products, important questions remain about the distribution of calorie consumption in a country which has experienced rapid but unequal growth, particularly in rural areas.

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