

PN ABR-363

87653

Kingdom of Morocco

Ministry of Agriculture
And Agrarian Reform

USAID/Morocco

Agriculture and Natural
Resources Office

**CEREALS MARKETING REFORM PROJECT
(CMRP--PHASE I)**

**TRADE MODELING IN SUPPORT OF MOROCCAN
CEREALS MARKET REFORMS MOROCCO**

by

Philip Abbott

December 1991

PRCC--3

TRADE MODELING IN SUPPORT OF MOROCCAN CEREALS MARKET REFORMS

Morocco began an agricultural structural adjustment reform program in June of 1985. Morocco's current account and budget deficits had both expanded rapidly in the early 1980s and were financed largely by foreign debt. International Monetary Fund and World Bank loans permitted rescheduling of that debt, but structural reforms in Morocco's trade regime, including exchange rate devaluation and liberalization of trade policies, were required as conditions of those loans. The agricultural sector, which had been heavily controlled by parastatal agencies, was among the more important contributors to the structural and trade imbalances, and programs were initiated (PASA1 and PASA2¹) to correct these problems.

The cereals sector was among the most problematic agricultural sectors. The Office National Interprofessionnel des Cereales et des Legumineuses (ONICL) held monopoly control over international trade in cereals, granting licenses to traders in order to control both quantities and prices of cereals in Morocco. It intervened in domestic markets to subsidize consumers, through payments to millers and regulations on prices and marketing margins charged in domestic cereals trade. It also sought to protect producers through subsidized procurement campaigns. Floor prices were announced for all cereals, but ONICL intervened mainly to support bread wheat prices. Producers also received subsidies on fertilizer, but distribution was erratic and rationed. The pattern of prices which emerged was believed to distort production incentives and has encouraged an expansion of bread wheat production at the expense of maize and barley. The ONICL ran serious deficits and was in arrears in its payments to mills and farmers. Food subsidies reached 2.79 billion dirhams in 1985, or 2.6 per cent of GNP, and cereals subsidies amounted to over 60 percent of the food subsidy budget.

While the parastatal controlling Moroccan agricultural exports, the Office de Commercialisation et d'Exportation (OCE) was dismantled, eliminating its monopoly control on agricultural exports and freeing state controlled prices, the ONICL has continued to function with minor changes. This reflects the Moroccan government's concerns of maintaining food security for consumers and adequate incentives to agricultural producers in a largely rural country. Urban consumers have shown a sensitivity to higher cereals prices, rioting in 1981 and

¹Programme d'Ajustement dans le Secteur Agricole (PASA) was implemented in two phases, the first from 1985-87 and the second starting in 1987.

1984 when prices were increased. Yet Mateus, Behrman, Pines and Schneider have argued that Morocco's food subsidy program ineffectively targets the needy populations -- only 16 percent of the subsidy goes to the poorest 30 percent of the population. Subsidizing the consumer price to everyone also had the effect of reducing incentives to producers by lowering private market prices. Wide fluctuations in world prices and the subsidies Morocco has been able to negotiate from exporters now put Moroccan producer prices well above the prices paid at the Moroccan border for its principal cereal import, bread wheat. Policy makers in Morocco do not wish to see self-sufficiency in grains fall further, becoming more reliant on supplies from a volatile and distorted world market.

* The structural adjustment program proposed for the cereals sector was to eliminate food subsidies to consumers by 1990 and to establish a weak link between the Moroccan cereals sector and the world market. ONICL's monopoly was to be eliminated, as were the existing bans on trade in maize and barley. ONICL regulation of millers' and distributors' margins were also to be eliminated, permitting free trade both internally and externally for cereals. Hence, cereals reforms were to include both price adjustments and major institutional changes. The private sector was to be given greater control and freed from extensive regulation by the ONICL.

The objectives of the ONICL (and the Moroccan government) have always been somewhat contradictory, and the demands of the agricultural structural adjustment program have compounded that problem. Salinger and Metzger summarize the following four objectives now recognized for cereals policy:

- protect Moroccan producers in the face of a distorted world market, due to subsidies offered by exporting countries to their producers,
- guarantee minimum income to Moroccan producers to limit rural to urban migration,
- minimize the cost of this protection on the state budget, and
- preserve the buying power of consumers.

These contradictory goals have prolonged the structural adjustment process, as the government of Morocco has been reluctant to implement actions which it sees as undermining these goals.

These problems have been exacerbated by the lack of good information on the likely impacts of alternative programs and policies. Trade and policy modeling should assist Moroccan planners in predicting the consequences of proposed alternatives and monitoring policies that are

implemented. World market models should also help Morocco to plan its budgetary needs to maintain its desired level of agricultural protection at minimum cost. They may be helpful in predicting likely future prices for Morocco's cereals imports (and exports), especially if world market institutions change.

Trade Modelling - Purposes and Designs

UNCLEAR
The purpose of any trade model(s) used by the government of Morocco would be to provide information on likely outcomes in domestic markets and on budgetary and foreign exchange positions as a consequence of cereals market reform alternatives. Policies which impact the domestic market must be set in the face of conditions and constraints determined by international market conditions and trade institutions (e.g. ONICL). Exchange rate, tariff and agricultural price adjustments are determined given world market prices, and will in turn determine impacts on Morocco's agricultural sector. In addition to market prices and quantities--the standard model outcomes--information on producer income impacts, state budgetary implications in both dirhams and foreign exchange, and consumer expenditures and consumption levels (if possible by income level) is generated. Policy goals should be used to set outcome measures calculated from cereals policy/trade models. Alternative scenarios simulated under varying market intervention assumptions would predict how well those interventions meet the policy goals of the government.

OK
World market modeling would serve another function - monitoring events and potential changes in international markets which could substantially impact the cost of Morocco's cereals imports or potential for exports. Events such as ongoing GATT (General Agreement on Tariff and Trade) negotiations could substantially alter the functioning of world agricultural markets, and in turn prices at Morocco's border. European Community market integration has also severely impacted Morocco's agricultural trade prospects, although more so for crops other than cereals. Staying current with expectations on the consequences of such potentially major changes in world market conditions can be facilitated by modeling efforts.

It is unlikely that a single trade model would serve well the needs of the Moroccan government in assessing its policy alternatives and monitoring cereals markets. A first division is between models that represent the behavior of international markets (outside the Moroccan border) - world market models, and domestic/trade policy models which show how domestic

Moroccan cereals markets interact with international markets. The former would be used to follow developments in international cereals trade and predict likely outcomes of international initiatives. The latter would examine the interaction of world markets with Moroccan domestic cereals markets and institutions, subject to interventions such as quotas, tariffs, variable levies, subsidies to millers, and floor prices to producers.]

As institutions change (or are assumed to change for a proposed reform), the structure of a model would need to be adjusted to reflect actual or proposed market conditions and institutions. For example, eliminating ONICL monopoly control of cereals trade and establishing variable levies would change the form of trade intervention from quantitative controls to price controls.

Food security is a concern which is reflected in the stability of market outcomes as well as their level. Models used to date in Morocco have been static, and do not trace out the full distributions of market outcomes from proposed policies. In those models, variable levies and tariffs have identical effects since variability in world markets is ignored. Yet for many policy analyses, Monte Carlo simulations² of dynamic market outcomes would be too slow and expensive, providing much unnecessary information. Hence, both comparative static models and dynamic Monte Carlo simulation models might be useful at different times or for different policy questions.

Institutional reforms are also important components of the structural adjustment package. Trade models, at least as currently formulated, may have little to say about the consequences of such changes. Most trade modeling efforts either ignore marketing margins or treat them as fixed, assuming that competitive market structures prevail and persist. If reforms make cereals markets more efficient, those margins should fall, affecting the other outcomes of interest. Recent work on trade and marketing has started to look at institutions with market power and might be adapted to addressing questions on how cereals prices would be formed if the ONICL

² Monte Carlo simulations generate fluctuations in exogenous factors impacting cereals markets, such as production fluctuations due to weather and variations in world prices, following their known probability distributions, and repeatedly predict the consequences of those fluctuations on endogenous variables, such as domestic prices, subsidy costs, foreign exchange costs, and other outcomes of interest. The probability distributions of the outcomes (endogenous variables) are thus approximated by repeating market simulations. Many repetitions are required to generate accurate estimations of outcome distributions.

eliminated market regulations and the millers behaved as oligopolists rather than competitors. The problem of millers potentially retaining subsidies for themselves and not passing the benefits on to consumers, which the Moroccan government fears might happen under complete reform, would only occur if millers have market power and hence can control prices through collusion.

Good modeling seeks to develop the simplest model which captures the critical issues and behaviors for the question being addressed. Therefore, four types of trade modeling efforts are considered below. First, literature on world market modeling is reviewed and adequacy of existing models to meet Moroccan needs is addressed. Next, the domestic/trade policy models which have been implemented for Morocco are examined and alternative approaches are considered. Models and issues concerning imperfect competition in internal cereals markets, and modeling to assess food security objectives are also briefly considered. Based on this review, prioritized recommendations are made for trade modeling activities which the Direction for Planning and Economic Affairs (DFAE) might undertake.

World Market Models

World market models are used to predict the prices of cereals imports and exports at Morocco's border as events and conditions in other countries or the world trading system change. Economic actors in these models are generally countries or regions. Net export supply equations are established at borders, relating world prices to export levels for exporting countries. Importing countries are represented by net import demand functions, relating the level of imports to border prices. An equilibrium is calculated such that world prices at each country's border, linked by transportation costs, yield net exports from all sources equal to net imports going to all destinations. Multiple commodity markets are often simultaneously modeled to capture interactions among markets, with a typical level of commodity aggregation corresponding to wheat, coarse grains, and rice. Alternative scenarios vary the net trade functions based on policy changes; information on actual production, consumption, or trade; or other information whose consequences are to be investigated.

Differing procedures are used to set net trade (import demand and export supply) functions. Some modelers construct domestic supply and demand functions for each important country or region in the model, and link world prices to domestic prices through price transmission elasticities or models of policy institutions. At a given world price, the price

transmission mechanism first determines domestic price, which together with the domestic supply and demand functions determines supply, demand, and hence trade. This approach would create simple models similar to the Moroccan Multi-Market model (Aloui, Dethier and Houmy) for all major traders and link them through world market equilibrium. Other models simply estimate net trade functions at a country's border.

Thompson reviewed the state of the art in world market modelling, describing in detail the alternative models used and critical modeling issues. (Current issues) on the frontier of trade modeling include difficulty in estimating price transmission, since policies are changing, and some times those changes are endogenously related to world market conditions; the consequences of certain countries maintaining market power in trade³ (which is exercised by a parastatal such as the Canadian or Australian Wheat Boards); and the role and importance of market share determination in a manner inconsistent with perfect competition.

For Morocco, these issues are of concern as to how the international cereals markets it participates in operate, but it is unlikely that ONICL will have substantial market power in international markets, at least for wheat. The market share question may also be a concern for barley, as the discounts needed to sell the 1988 barley surplus demonstrated. The barley market is thin, and substantial discounts may be required to displace existing suppliers. Armington type models have been more successful in predicting the pattern of world prices and how it adjusts to shocks in such situations. The spatial, perfectly competitive equilibrium model is the more common form, however, and Armington models are not without critics.

* If Morocco were to engage in this sort of modeling activity, a market share approach is recommended, so that consequences of export levels on prices could be treated when needed. It is also possible to mix net trade functions with supply-demand based approaches, which would permit integrating a Multi-Market like model for Morocco with a world model. There is little benefit in actually linking these two models together if Morocco does not exert a strong influence on world prices (and that is unlikely). A better approach would be to solve a world market model first, and feed results from that model on Moroccan border prices to a domestic

³ When a country has market power in trade, it sees that the quantities it trades can change world market prices. The normal assumption is that of a perfectly competitive price taker, who sees the same world price regardless of its trade volume. A monopolist with market power raises prices by withholding supplies from the market.

model. One can also modify the domestic model to let world price vary with the domestic price according to a net export demand or import supply function at the Moroccan border, which summarizes the behavior of world markets. A world market model might then be used to map out price behavior at Morocco's border.

* Constructing and maintaining world market models is an expensive and time consuming affair relative to the resources of the DPAAE. Behavioral functions must be continuously updated with current information, and a substantial amount of data must be collected and processed to build and use such models. Fortunately, the OECD and USDA have created, published and are maintaining world market models. The USDA also will distribute the computer code for its SWOPSIM modeling system as well as much of the data needed to implement these models. If world market modeling is to be pursued, analysts should obtain the SWOPSIM modeling framework and data sets from USDA. But that is not the recommended course.

* An alternative to actually constructing and maintaining a model at the DPAAE is to assign an adequately trained staff member to the task of monitoring USDA and OECD modeling efforts, as well as the literature on international agricultural trade and trade modeling. The drawback to that strategy is that the commodity mix of interest in Morocco (bread wheat, durum wheat, maize and barley) differs somewhat from the standard approach in USDA and OECD models. Wheat is virtually always treated as a single, homogenous commodity and barley is generally aggregated with other coarse grains. Since Morocco only trades bread wheat to a significant extent, and since substitution possibilities force international bread and durum wheat prices as well as coarse grains prices to move closely together, existing models are probably adequate.

Domestic/Trade Policy Models

The most useful and important "trade models" for the DPAAE and Morocco are those which may be used to evaluate agricultural and trade policy alternatives under the government's control. These are fundamentally domestic policy models cast in an open economy setting. Such models could be used to compare market outcomes before and after reforms. Tariffs (variable levies), quotas (or bans on trade), and subsidies can be varied and their consequences for market outcomes and financial positions calculated. Domestic policy measures can be simultaneously varied to see how trade and domestic policies interact. What this requires is a

reasonably accurate representation of the domestic cereals markets and their linkage to international markets.

* Typical domestic/trade policy models are built around supply-demand market equilibria simultaneously determined for several commodities. Supply functions represent farmer behavior and demand functions represent consumer behavior. Equilibrium establishes the (domestic) price at which supply plus net imports equals demand. Given a market equilibrium, numerous calculations on impacts by actor (farmers, consumers, government) and on financial outcomes (budgetary costs, foreign exchange costs) are possible and useful. These may be done directly by the model determining equilibrium or may be found by using another model (e.g. a spreadsheet such as Lotus 123) with input from the equilibrium model. This latter approach was employed by Abbott and Imrani in their modeling exercise, while the former is followed in the Multi-Market model.

For closed economy (non-trade) models, an equilibrium price is found which equates supply with demand. For open economy models, not subject to quantitative restrictions, price is determined by linkages to the world market and net import quantities adjust to achieve equilibrium. With quantitative restrictions, or non-tradeable goods, domestic prices may adjust independent of world prices, or the market may behave as a closed economy under certain conditions and as an open economy under other conditions. For goods in near self-sufficiency, this regime switching can occur. At high prices the country exports, while world and domestic prices are linked. For low prices, the country switches to an importer. With finite transportation costs, there is a range between the import (cif) and export (fob) price at the country's border where it behaves as a closed economy. This may be the relevant regime for Morocco's non-traded cereals (durum wheat, maize, and barley). Of critical significance to modeling is what adjusts to achieve equilibrium -- the domestic price or net imports -- and are international and domestic prices linked or independent.

In trade models, several approaches to market adjustment may be chosen, or alternatives may be offered. Modelers often must decide a priori which goods to treat as tradeables and which to treat as non-tradeables. Model solution is much easier when the world market sets prices than when an equilibrium market price must be found. In the former case, at the domestic price calculated from the given world price, supply and demand are determined and trade is the residual. In the latter case, equilibrium is found by simultaneously solving supply,

demand and trade functions, where the trade functions are subject to quantitative restriction effects.

In the Multi-Market model, the decision was taken to treat cereals as tradeables and animal products as non-tradeables. Abbott and Imrani chose to permit quantitative restrictions on cereals trade where necessary. This critical difference was due to Abbott and Imrani's judgement at the time they built their model that Moroccan and world barley and maize prices were not linked, though bread wheat prices appeared to be, and so barley and maize were best treated as non-tradeables. Barley utilization is mostly in rural areas, and yet the Multi-Market model predicts exports. In 1988, the government had a difficult time disposing of barley surpluses in world markets, and was forced to offer substantial subsidies.

If there is an imperfectly competitive world market, and a Moroccan model is to be linked to that market, a net trade function (which depends on the border price, linked to the domestic price through marketing margins and tariffs/subsidies) is solved simultaneously with the domestic supply and demand schedules. This approach is only appropriate if Morocco is deemed not to be a small country in the international market for a specific cereal. The one possibility where this may be relevant is for barley exports, where lower prices were needed to move exports.

The first domestic trade model for Morocco was constructed by Mateus. He estimated supply and demand equations for each of the important cereals in Morocco. Those estimations remain the empirical basis for subsequent modeling efforts. Recognizing that a parastatal (ONICL) applied quantitative controls on Morocco's cereals imports, he assumed that a closed economy model was appropriate, after adding estimated fixed imports to production. He built a forecasting model which sought to explain future ONICL import levels, but then treated cereals as non-tradeables. His assumptions were an accurate reflection of the trade institutions at the time, but his model is incapable of representing the results of a reformed, open cereals sector linked to world markets.

The Multi-Market model documented by Aloui, Dethier and Houmy built upon the work of Mateus and was developed from the World Bank's trade modeling system (Braverman and Hammer). This model embodies many excellent features. Complete commodity coverage includes cereals, livestock products, animal feedstuffs and fertilizer, and constitutes 15 interacting markets. Bread wheat is also disaggregated according to markets for industrial milled

10

flour and flour from traditional mills. A base case is established, setting parameters and market data for a 1987 base year. That base case captures differing behaviors in urban and rural regions, and the dualistic interactions of urban and rural markets. An easy to learn and use interface between the analyst and computer market equilibrium is established. Complete reporting of market and financial outcomes for these markets is also provided.

Limitations to the capabilities of the Multi-Market model derive from the desire to establish a friendly user interface. In its raw form, the World bank modeling system offers the analyst a wide variety of options. Commodity coverage, what variables adjust, which goods are tradeables or non-tradeables, and what outcome measures are reported have been set in the Moroccan model, and much of its flexibility is then lost. For example, the model currently assumes all cereals are tradeables, with prices linked to the international market, subject to tariffs. But quantitative restrictions on cereals trade cannot be represented, nor can the possibility that a cereal such as barley will remain a non-tradeable. The model also can not handle world prices varying with trade levels, as the small country assumption is imposed. The Multi-Market model can represent the outcomes of complete reforms, but cannot represent the status quo or slight modifications to it. The World Bank system could be used to modify the Multi-Market model to represent these possibilities, but only by someone knowledgeable in the whole system.

This lack of flexibility and inability to represent non-tradeable cereals and quantitative restrictions led Abbott and Imrani to develop a new model. Their approach utilized a Lotus 123 worksheet, a tool familiar to DPAAE staff, as the "user interface." A fixed point algorithm was used to solve for market equilibrium in a Fortran program linked to the worksheet. This framework permitted treating quantitative trade restrictions, tariffs, non-tradeables, and the effects of transport margins on nearly self-sufficient commodities. The assumed adjustment structure could be varied, and alternative institutions investigated.

The empirical base for this model was the Multi-Market model, and hence Mateus' parameter estimates for cereals. In spite of checks on parameters for theoretical consistency, symmetry, and homogeneity done in the Multi-Market model, when Abbott and Imrani used only

the cereals market parameters, those parameters were unstable⁴. Hence, the Abbott-Imrani model used only own-price elasticities and not the cross-elasticities which represent market interactions. Their model is capable of incorporating well behaved cross-elasticities, but evidently the Multi-Market elasticities need the interactions with animal product and fertilizer markets to be stable. This is troublesome, as the animal product parameters were based on studies of U.S. and Canadian producer behaviors - not Moroccan market information.

This lack of good behavioral information for animal products was one factor leading Abbott and Imrani to limit their commodity coverage to cereals. While sensitivity analysis can examine the consequences of varying such parameters, one has little information on what are the correct ranges of parameters for Moroccan markets. One recommendation will be that better empirical estimation of model parameters, updating the work of Mateus, is needed. Commodity coverage should be limited to those commodities for which adequate data to generate estimates of behavioral relationships is available.

* Lack of information on Morocco's livestock sector and its derived demand for cereals is an important limitation to these trade modeling efforts. The goal of the Multi-Market model to include animal products and their interactions with cereals markets is appropriate, but empirical constraints make current results meaningless. A complementary effort should seek to fill this gap, possibly by developing linear programming models of feed mix alternatives for the various animal products important in Morocco. Such models have been used elsewhere to supplement information on the pattern of cereals demands and how that changes as markets are reformed. They have also been used to artificially estimate derived demand parameters, by assuming the cost minimization process adequately represents feeding behavior, and by varying prices and observing feed mix adjustments. Elasticities are then calculated from those adjustments.

Weakness #1 A shortcoming of both the Multi-Market model and the Abbott-Imrani model is that they are static, medium to long run representations of market adjustments. Food security is a key concern of Moroccan policy makers, and food security measures are concerned with the likelihood of market disasters (low producer prices, high consumer prices, or food shortages).

⁴ Unstable parameters mean there may be no market equilibrium, or when the model is perturbed from its base values, prices diverge or cycle rather than settling on a new market equilibrium.

Market dynamics can affect the likelihood of disasters and the ability of public and private institutions to cope with those disasters. Budgetary and other constraints also come into play only as market extremes are faced. Models addressing food security issues need to take a short run perspective and map out the distributions of likely outcomes. Market averages simply do not reveal how institutions will cope with the extremes cereals markets may eventually face.

Monte Carlo simulations of dynamic models structured along the lines of the Multi-Market models are generally used to assess the adequacy of policies to achieve food security objectives.

Weakness #2 Both models also ignore stockholding which has been used by the ONICL and many other cereals marketing boards to insure food security objectives and smooth month-to-month and year-to-year market fluctuations. Both public and private stocks need to be forecast by short-run models. As private institutions evolve, and if ONICL abandons its stocks subsidies, those behaviors could change dramatically.

Not all policy issues need to be addressed in a Monte Carlo setting. The recommended approach would be to first establish a good static, long run modeling framework which adequately captures market institutions and adjustment mechanisms. Stocks behavioral rules and a Monte carlo simulation framework could then be developed around that model, with parameters adjusted to represent market dynamics and short run behaviors.

Abbott, Benirshka, and Konandreas have developed a model for food security assessment along these lines for six South Asian countries. This experience suggests that model structures must be modified to accommodate unique characteristics of individual countries, and the current modeling framework is better suited to Asian rather than Moroccan conditions. The same tools were employed in that exercise and for the Abbott-Imrani model, however, and static domestic/trade policy models could be extended along the needed lines.

Weakness #3 Another issue ignored by both Moroccan domestic/trade policy models concerns the possibility of market imperfections and potential imperfect competition in the cereals distribution and marketing systems. A literature has emerged from the industrial organization area looking at how to test for market power and how to model trade when marketing agents possess market power (Schmalensee; Carlton and Perloff). Since the Moroccan cereals sector has been subject to ONICL regulation, for now such tests would only reveal the consequences of that regulation.

Should internal trade become truly free, such models would be useful in detecting problems, but only after several years data became available subsequent to reforms. Such models might be

used, however, to consider the impacts of potential market power by distributors on the cereals sector. Assumptions could be made on distributor behavior, and models would then project how subsidies would be shared by consumers, farmers and the marketing system. This would require greater attention to marketing and distribution channels in the specification of domestic/trade policy models.

Recommended Trade Modeling Initiatives

The DPAAE could pursue several modeling initiatives which would assist in evaluating and monitoring proposed cereals market reforms, as well as monitoring events in international cereals markets which could impact on Morocco's trade and financial position. Given its limited resources, and the need for trained analysts to maintain and modify models rather than manipulate "canned" packages, only limited activities should initially be pursued. As institutions evolve and market conditions change, those analysts will need to create new models, building from existing models, which directly address critical issues.

Highest priority should be given to modifying and improving the empirical base of a domestic/trade policy model along the lines of the Multi-Market model and the Abbott-Imrani model. Such a new model would need to report results similar to those models' outputs, but commodity coverage should be limited to those for which there is an adequate empirical base. Re-estimation (or initial estimation) of parameters needed by the revised model should be undertaken to update existing estimates and insure model stability with well behaved cross-elasticities to capture product substitutions. Quantitative restrictions on trade need to be handled by the revised model structure, with the choice of whether or not they apply as an option. It is critical that any model accurately reflect the trading institutions and adjustment mechanisms found for Moroccan cereals trade. Existing models fail to do that adequately. Those models should also emphasize more details on the marketing and distribution channels within Morocco, as those are more likely to change significantly than will relationships with world markets. Interactions with international markets could be represented by including net import supply and export demand functions, or treating durum wheat, maize and barley as non-tradeables, in place of the small country assumption which models now impose. Building a world market model is not necessary to adequately capture this interaction.

Capturing the linkages between the cereals and livestock sector is also important, but information on that linkage is now poor. A key complementary effort, which does not strictly fall under trade modeling, would be to model livestock feed mix choices in Morocco. Demand for cereals depends strongly on derived feed demand, which can significantly affect the barley and maize markets. Domestic/trade policy models should only incorporate livestock/feed interactions if an adequate empirical base is established, however. Linear programming livestock feed mix models have been used elsewhere to artificially generate the parameters needed by a domestic/trade policy model. Their construction in conjunction with this modeling effort is recommended.

Second (lower) priority should be given to extending the domestic trade policy model to address food security concerns. Stockholding behavioral models should be introduced and short run market dynamics represented. A Monte Carlo simulation framework should be utilized to generate the probability distributions of market outcomes and examine the capability of market institutions to cope with extreme situations under realistic constraints.

The third priority would be to extend the domestic/trade policy model to examine imperfect competition in the Moroccan marketing and distribution system. Varying assumptions on market power and behaviors of marketing agents, millers and distributors would be used to project changes in marketing margins and their impacts on market outcomes as reforms proceed. This effort will be constrained by the availability of data on margins. It is relevant only if there is evidence suggesting the possibility of collusion by millers and distributors.

Lowest priority should be given to construction of yet another international market model. Construction of a world market model is a major undertaking, and good models have been created and are being maintained by OECD and USDA. A better strategy is for a trained DPAE analyst to monitor events in international agricultural markets and to keep up with the literature on international agricultural trade.

Trade modeling efforts, especially those focused on the Moroccan cereals markets and their interactions with international markets, should improve the information on which both domestic agricultural and trade policies are set, ultimately leading to better agricultural policies for Morocco.

REFERENCES

Moroccan Domestic/Trade Policy Models

Abbott, P. "Agricultural Trade Modeling for Morocco." USAID/OICD Trip Report, Rabat, Morocco, April 1990. (Abbott-Imrani model)

Aloui, O., J.J. Dethier and A. Houmy. "L'Impact de la Politique d'Ajustement sur les Secteurs des Cereales et de l'Elevage au Maroc." Departement de la Planification et des Affaires Economiques, Ministere de l'Agriculture et de la Reforme Agraire and Banque Mondiale, Rabat, Morocco, November 1989. (Multi-Market model).

Mateus, A. "Policies for Agricultural Growth in Moroccan Grain Markets: An Econometric Dynamic Model." Annex to: Groupe de Travail sur la Politique de Prix et d'Incitations dans le Secteur Agricole et Associates for International Resources and Development. La Politique de Prix et d'Incitations dans le Secteur Agricole: Rapport Final et Annexe. Ministere de l'Agriculture et de la Reforme Agraire, Rabat, Morocco, April 1985.

World Agricultural Trade Models

Organization for Economic Cooperation and Development (OECD). "MTM Model Specification and Elasticities." OECD, Paris, 1988.

Ronigen, V. and P. Dixit. "Modeling Bilateral Trade Flows with the Static World Policy Simulation (SWOPSIM) Modeling Framework," ERS Staff Report No. AGES861124, USDA, Washington DC, December 1986.

Ronigen, V.O. and K. Liu. "The World Grain, Oilseeds and Livestock (GOL) Model -- Background and Standard Components." IED Staff Report, USDA, Washington, DC, April 1983.

Ronigen, V., J. Sullivan and P. Dixit. "Documentation of the Static World Policy Simulation (SWOPSIM) Modeling Framework." ERS Staff Report No. AGES9151, USDA, Washington DC, September 1991.

Agricultural Trade Modeling

Abbott, P., M. Benirshka and P. Konandreas. "Public Sector Interventions and Food Security: Evaluation Using Static and Stochastic Simulation Models." Documentation prepared for an FAO study on "Estimating Optimum Reserve Stock Levels in South Asian Countries," West Lafayette, IN, USA, April 1991.

Abbott, P.C. "Modeling International Grain Trade with Government Controlled Markets." American Journal Agricultural Economics. 61:1, February 1979, 22-31.

Blandford, D. "Modeling the Linkage Between Domestic and International Markets." Cornell Agricultural Economics Staff Paper No. 86-24, Cornell University, Ithaca, NY, August 1986.

Braverman, A. and J. Hammer. "Computer Models for Agricultural Policy Analysis." Finance and Development 25(2), June 1988, pp. 34-37.

Bredahl, M.E., W.H. Meyers and K.J. Collins. "The Elasticity of Foreign Demand for U.S. Agricultural Products: The Importance of the Price Transmission Elasticity." American Journal Agricultural Economics. 61:1, February 1979, 58-63.

Carlton, P.W. and J.M. Perloff. Modern Industrial Organization. Scott, Foresman and Co., Glenview, IL, USA, 1990.

ERS, USDA "Estimates of Producer and Consumer Subsidy Equivalents: Government Intervention in Agriculture, 1982-87." ERS Statistical Bulletin, USDA, March 1990.

Gardiner, W.H. and P.M. Dixit. "Price Elasticity of Export Demand: Concepts and Estimates." ERS Staff Report AGES860408, USDA, Washington, DC, May 1986.

Kreuger, A. "Trade Policy in Developing Countries." In Handbook of International Economics, R. Jones and P. Kenen, eds., North Holland, Amsterdam, 1984, 519-69.

Schmalensee, R. "Inter-Industry Studies of Structure and Performance." In R. Schmalensee and R.D. Willig, eds., Handbook of Industrial Organization, Volume II. North Holland, Amsterdam, 1989.

Thompson, R.L. "A Survey of U.S. Developments in International Agricultural Trade Models." Bibliographies and Literature of Agriculture 21, ERS, USDA, Washington DC, September 1981.

World Bank. "Trade and Pricing Policies in World Agriculture." In World Development Report 1986, World Bank, Washington, DC, 1986, 61-153.

Useful References on Morocco

Agro Concept. "Evaluation Economique du Systeme de Commercialisation." Ministere de l'Agriculture et de la Reforme Agraire, Rabat, Morocco, April 1986.

Direction de la Planification et des Affaires Economiques. "Echanges Commerciaux des Produits Agricoles et Alimentaires 1986." Ministere de l'Agriculture et de la Reforme Agraire, Rabat, Morocco, March 1988.

Direction de la Planification et des Affaires Economiques. "Analyse de l'Evolution Recente du Commerce Exterieur Agricole du Maroc." Ministere de l'Agriculture et de la Reforme Agraire, Rabat, Morocco, October 1987.

Direction de la Planification et des Affaires Economiques. "Les Systemes de Protection de la Production Locale Vis-A-Vis des Importations." Ministere de l'Agriculture et de la Reforme Agraire, Rabat, Morocco, September 1987.

Direction de la Plannification et des Affaires Economiques, Associates for International Resources and Development, and Agro Concept. Etude de la Politique de Prix et d'Incitations dans le Secteur Agricole: Phase II. Ministere de l'Agriculture et de la Reforme Agraire, Rabat, Morocco, January 1990.

Division des Affaires Economiques, Service des Statistiques et de la Documentation. "Prix a la Production des Cereales et Legumineuses, Campagne Agricole 1986-87." Ministere de l'Agriculture et de la Reforme Agraire, Rabat, Morocco, January 1989.

Economist Intelligence Unit. Morocco: Country Profile 1990-91. The Economist Intelligence Unit Limited, London, 1991.

Gardner, G. and D. Skully, "The Conduct of Wheat Marketing in North Africa." ERS Staff Report No. AGES860808, USDA, Washington DC, September 1986.

Groupe de Travail sur la Politique de Prix et d'Incitations dans le Secteur Agricole et Associates for International Resources and Development. La Politique de Prix et d'Incitations dans le Secteur Agricole: Rapport Final et Annexe. Ministere de l'Agriculture et de la Reforme Agraire, Rabat, Morocco, January 1986.

Mateus, A., J. Behrman, J. Pines, and R. Schneider. "Morocco: Compensatory Programs for Reducing Food Subsidies." World Bank Report # 6172-MOR, Washington, DC, April 1986.

Metzler, J. and L. Salinger. "Reform de La Politique Commerciale Agricole au Maroc: Systeme des Prix de Reference: Rapport Final - Note de Synthese." Associates for International Resources and Development, Cambridge, MA, October 1991.

Tyner, W. and S. Benaissa. "Policy Reform to Liberalize Domestic Marketing and Foreign Agricultural Trade in Morocco." DPAE working paper, Rabat, Morocco, April 1987.