A monograph on agriculture and food policies in Morocco : 1969-1991

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A Monograph on Agriculture and Food Policies in Morocco (1969–1991)

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Abstract. This monograph on agricultural and food policies in Morocco discusses the effects of agricultural policy and the main forces governing public intervention and market forces during the period 1969-1991. The overall economic environment is described, and certain features of supply, demand, marketing and trade of agricultural food and non-food items are quantified, in order to identify and evaluate the economic factors underlying trends and directions in production, consumption and prices. The study includes marine and forest resources as a linkage between the agriculture/food sector and other renewable natural resources.

The study period covers different agricultural and food policy regimes, although it was difficult to analyze subperiods coinciding with socioeconomic plans or specific policy sets. The usual procedure was to consider the overall study period and then to compare the government interventionist era of the 1970s and early 1980s with the post-1983 period of structural adjustment policies. Little aggregate data was available for the second period, during which time major changes took place in the agricultural and food economy.

The results obtained, while useful in considering adjustments to agricultural policies, have been used primarily to recommend future directions for economic research. Medium- and long-term research topics are proposed as useful means to evaluate different economic scenarios and to suggest appropriate adjustment actions. The study also emphasizes that microeconomic cross-section, time series and properly aggregated data are major factors of economic success, affecting research and the content and nature of agricultural and food policy formulation and implementation.

This monograph is comprised of seven interdependent parts. Section I contains a general overview of the Moroccan economy. Section II focuses on the agricultural sector. Sections III and IV discuss economic performance and prices. Section V concentrates on the economics of forest and marine resources as examples of renewable biological stocks. Section VI contains an evaluation of agricultural and food policies. Section VII discusses implications for economic research.

Introduction

Few studies of agricultural and food policies in Morocco have described the main characteristics of the national economy and carried out basic economic analyses of the sectors involved. The most recent academic studies on Moroccan agriculture are by El Khyari (1987), Quarouach (1987), and Akesbi and Guerraoui (1991). Other studies have been conducted by the World Bank (IBRD), by the Ministry of Agriculture and Land Reform (MARA), and by others in connection with the application of new agricultural policies in various reform projects. The World Bank included Moroccan agricultural pricing policies in a comparative study of more than 20 countries for the period 1985-1988. Prices and incentives in the Moroccan agricultural sector have also been progressively described in order to set structural adjustment programs in agriculture.

Such studies have often been limited to agriculture and have not included other renewable natural resources. Furthermore, measurement and quantification have not often been emphasized, nor has evaluation of agricultural economic policies always been done with appropriate quantification and hypothesis-testing techniques. These investigations had defined goals and were not designed to cover related issues.

This monograph constitutes another contribution to the characterization of agriculture and food policies in Morocco. The period 1969-1991 was chosen in order to review policy changes in the 1970s and 1980s and to capture early signals from the 1990s, as structural adjustment policies begin to replace the interventionist government policies of earlier eras.

A main purpose of this monograph is to enhance agricultural economic research in Morocco. While agriculture and food policies must respond to real problems, they must also be based on adequate data and measurements. Economic research can contribute to the practical side of policy making by setting bases for the actions of government and private agents.

Ex-ante identification and evaluation of likely policies and actions are necessary steps towards insuring appropriate performance. Economic analysis is equally important for success. Medium- and long-term investigations provide insights into the costs and benefits of different choices and help in setting the foundations to monitor direct and indirect effects of public and private actions. Consumption, marketing and trade are important dimensions to consider when studying the agriculture and food sectors. Their integration can be improved by using appropriate monitoring techniques, such as multimarkets and computable general equilibrium models. This monograph is designed to assist in developing sectoral and overall models to identify and monitor economic performance.

The data used in this study were mainly aggregates obtained from official publications. Microeconomic data, when available, were used to enhance the quality and nature of the analysis. Although reliable microeconomic data were not available in some areas, most economic components could be characterized appropriately and consistently for the objectives of this study. In instances where aggregate data were lacking, it was necessary to present and analyze short series in comparison to other variables. Officially published data for 1990 and 1991 were unavailable at the time of writing; for these years information was gathered from reports and newspapers. Consequently, most of the analyses cover the period 1969 to 1989.

Descriptive statistics, regression techniques, and time series investigations were the major analytical tools used in this study. The use of dummy variables was tested in evaluating the impacts of structural adjustments. For policy evaluations, the primary technique applied was the use of protection coefficients adjusted for exchange rate distortions, import tariffs and export taxes. Relevant results from other studies were also included.

Results of analyses are displayed in tables in the Appendix. Where these tables contain equations, a) generally only the equations with coefficients that were significant at the 1% or 5% level are shown, b) t refers time in years, and c) t2 refers to time squared and d) figures in parentheses beneath the coefficients are the associated t-statistics.

I – Overview of the Moroccan Economy

This overview describes the major characteristics of the Moroccan economy as a preliminary to the study of its food and agriculture policies during the period 1969-1991.

1. Geography and Natural Resources

Morocco, situated in the northwest corner of Africa, is bounded by the Mediterranean Sea and the Atlantic Ocean on the north and west, by Algeria on the east, and by Mauritania on the south. Its total area is 710,850 km^2 (*Annuaire Statistique*, 1990) and includes several zones, among which are agricultural plains and river valleys, plateaux, and the Atlas and Rif mountain chains.

Location, size, climate and geomorphology contribute to the diversity of the Moroccan economy. Climatic conditions in the northwestern and southwestern plains are favorable for agriculture, and many advanced techniques have been applied in these areas. Fishing activities benefit from 3,500 km of coastline and over nine million hectares of marine space under Moroccan control (*Maroc Maritime*, 1990). Other zones of Morocco have mainly semi-arid and arid agriculture, with 20 million hectares devoted to livestock production under extensive traditional grazing systems. Forests, totalling almost seven million hectares, are

scattered among the different zones. Morocco's primary mineral resource is its large and high quality stock of phosphates.

Agriculture, fishing and mining have generated an important primary sector in the Moroccan economy and have induced the growth of other sectors.

2. Population and Demography

The diversity of natural conditions has influenced human settlement patterns and the location of economic activity in Morocco. Population growth and development are concentrated in the northwest plains and the irrigable river valleys of the southwest and northeast. Population densities are lower behind the central mountain chain, in the southern and eastern areas of the country where there are fewer natural resources. These disparities have generated migration flows from the latter regions to zones of relatively higher resource endowment. Cities like Casablanca are also important poles of attraction for migrants. The development of industrial activities and services has greatly benefited from population growth and migration as well as from favorable physical resource bases.

According to official population surveys conducted in 1960, 1971 and 1982, the population growth rate has been close to 3% per year. Rural population growth rates are lower than urban, although the rural share of total population is higher than the urban share. While literacy and quality of life indicators have generally shown improvement in general since 1960, rural areas lag behind urban in these categories.

A. Population and Age Profile

Morocco's total population in 1960 was 11.6 million, with 29.3% in urban and 70.7% in rural areas. By 1971, it had reached 15.5 million, 35.2% urban and 64.8% rural, and by 1982, population totalled 20.9 million, 42.7% urban and 57.3% rural. The average annual population growth rate was 2.72% (standard deviation=1.10) for the study period 1969-1988. Urban population rose more rapidly than rural. The respective growth rates averaged 4.40% (standard deviation=1.58) and 1.61% (standard deviation=0.60), implying nearly identical levels of growth rate variability (38%) through time. The employed population grew at an average rate of 3.06% (standard deviation=2.33).

Annual employed, urban and rural population during the study period were relatively constant over this time (the anomaly in 1982 is due to a data adjustment). Migration from rural to urban areas and from Morocco to Europe has been an import mechanism of population redistribution. This phenomenon contributes to the disparity between rural and urban population growth rates and implies a spatial adjustment of human resources. Noin (1970) found the data base for migration flows in Morocco was poor, although there were limited sources describing seasonal migrations towards Maghreb and European countries and internal migration from rural to urban areas. Rural-to-urban migration has since been the subject of a number of monographs, the most recent being a characterization of rural employment by the Ministry of Planning (1986).

About 90% of the all Moroccans are under age 44. Almost 60% are under age 24, nearly 16% are age 4 or younger, and less than 5% are 65 or older. The means, standard deviations and coefficients of variation for different age groups indicate that this age profile changed little over the study period.

B. Quality of Life Indicators

According to World Bank data (IBRD, 1986 and 1987), life expectancy at birth in Morocco rose from 48 years for men and 51 years for women in 1965 to 57 years for men and 61 years for women in 1984/85. It can be inferred from the same source that overall life expectancy at birth increased from 51.9 to 60.4 years from 1970-1987.

Health indicators show that, while the population per physician increased from 12,120 in 1965 to 17,230 in 1981, the number of individuals per nurse dropped from 2,290 to 900 in the same period.

School enrollment at all levels increased from 1965 to 1983. Primary enrollment rose from 78% to 97% of the relevant age group, secondary enrollment grew from 11% to 29%, and enrollment in higher education increased from 1% to 6%.

The working age population (15-64 years) was 50% of total population in 1965 and 52% in 1984. With a high population growth rate, employment has been a growing problem, especially in urban areas. An official estimate in 1985 put formal unemployment at 20% of the labor force. This problem is exacerbated by rural seasonal underemployment and rural migration to cities. Migration abroad has been an important response to labor market conditions in Morocco and constitutes a significant source of foreign exchange earnings. Between 1970 and 1975, 30,000 to 35,000 Moroccan workers emigrated to Europe.

Urban population increased from 32% of the total in 1965 to 44% in 1985. The largest cities accounted for 16% of urban population in 1960 and 26% in 1980.

3. Macroeconomy

In addition to its population and natural resources, other influences on Morocco's economy have been both the economics of the market and, with an important public sector, government intervention. Several socioeconomic plans have been executed since 1960. The development of private investment has been a constant political goal, as have been the objectives of agricultural development, export promotion, food self-sufficiency, human capital accumulation and income distribution. Until 1983, public investment was the most important instrument used to achieve planned goals. Given the socioeconomic objectives underlying government involvement in the economy, it was considered necessary to subsidize a long list of items, including agricultural inputs and consumer foodstuffs, in order to protect industrial enterprises and support urban consumers.

Over twenty years such policies significantly increased the share of public expenditures financed through borrowing from international and regional financial institutions. This increase in public indebtedness has led to important economic adjustments since 1983, with reforms aimed mainly at reducing government expenditures and increasing incentives for the private sector. Instruments tried since 1983 include exchange rate devaluations, export promotion, privatization of some public enterprises, reform of investment procedures for foreign and local private agents, and reduction of the subsidies on some food items. Although health care and education are still primarily public services, the private sector is becoming increasingly involved in these sectors.

A. Macroeconomic Measures

The Moroccan economy has undergone rapid changes since the country's independence in 1956, and the growth of gross domestic product (GDP) has fluctuated widely. Five phases between 1970 and 1988 can be distinguished. The years 1970-1972 had an annual average growth rate of 1.6% in real GDP and a decline averaging -1.2% in real GDP per capita. The highest average growth rates, 7.7% in total GDP and 4.1% per capita, occurred during 1973-1977. This phase was also characterized by highly variable growth rates of both GDP and GDP per capita, related to external shocks such as the sharp rise in oil prices in 1973 and the decline in phosphate prices mainly in 1974. The years 1974-1979 averaged lower growth rates of 2-3%. Slower growth, averaging under 2% annually in real per capita GDP, was observed from 1978 onward. In the 20 years 1969-1988, real GDP increased from 1,300 to 1,700 dirham (dh) per person, an average growth of 1.5% per year; GDP per employed population grew from 2,800 to 3,400 dh, a 1.1% annual average growth but with large variability.

With regard to the shares of resources and expenditures devoted to the economy, these 20 years can be divided into two major eras. While public consumption averaged 2% of GDP during 1969-1974, it exceeded 20% during 1975-1982 and averaged about 17% during 1983-1988. Throughout the two decades, private consumption was in the 60-65% range, decreasing about 10 percentage points during 1974-1977 and increasing in the 1980s to about 70%. Investment's share in the GDP increased from 11% in 1969 to 34% in 1977, then dropped to 25% in 1978 and 21% by 1983. The level then fluctuated around 25% through 1988. Trade, relatively stable at around 5% of GDP until 1975, increased to 20% in 1982 and declined to 7% in 1988.

The fluctuations of public and private consumption, investment and trade give an idea of the changes that occurred in the Moroccan economy during the study period and emphasize the imbalances from period to period. Socioeconomic plans as an expression of government intervention might be at the origin of the changes; it happens that the first period coincides with the 1968-1972 plan, the second with the

1973-1977 plan, the third with the 1978-1982 plan and the last period mainly with the adoption of the structural adjustment program. External shocks, however, were also important factors of variation. Such shocks occurred in 1973, 1974 and 1979-1980, while a severe drought affected the economy in 1981-1985.

B. Sectoral Composition of the GDP

Commerce, agriculture, manufacturing and government sectors had the highest individual shares in Morocco's GDP, around 15% each, while energy, construction, transportation and import taxes accounted for around 4% each. In aggregation, agriculture/manufacturing/handicrafts was the leading sector, followed by commerce/transportation and then by government. While the manufacturing/handicrafts share of GDP remained steady over time, agriculture was more variable. It remained at almost 20% of GDP until 1973, then declined to about 11% through 1985 (mainly due to a prolonged period of drought) before regaining the 1973 level by 1988.

These sectoral shares seem to reflect the 1973 shock, with increases in commerce and government contributions to GDP after that year. Commerce's share peaked at 24% in 1976 and then experienced a steady decline, to 12% by 1988. Government's share of GDP rose through 1986, reaching 20% before falling back to 15% by 1988.

C. Foreign Trade

Both exports and imports increased over the study period, with, in most cases, important levels attained after 1983. Imports, however, often increased at a higher rate than exports, leading to a trade deficit; large trade and payment imbalances accumulated in the Moroccan economy.

Food (soft wheat, sugar, vegetable oil) and energy constituted the main commodity imports. Exported commodities included agricultural goods, phosphates and phosphate-derived products. Net trade patterns for agricultural and non-agricultural commodities are displayed in *Table 1.1.*

These patterns show that there was a decrease in net trade for non-agricultural commodities, and a small improvement occurred for agricultural goods. These trends can be better expressed by analyzing export and import data *(Table 1.2).*

The regression estimates reveal variable rates of change. Agricultural exports and non-agricultural imports had increasing rates of change; agricultural imports and non-agricultural exports showed decreasing rates. The equations were generally "U" shaped, with an increasing trend for imports, especially for non-agricultural commodities, and a decreasing trend for non-agricultural exports. The pattern for agricultural exports was one of decline at the beginning, and increase at the end, of the study period. Agricultural imports showed an increase at the beginning of the period and a decrease at the end. This behavior may be an important signal that agricultural trade has benefited from the structural adjustments of the 1980s.

II – Macrodecomposition of the Agricultural Sector

This section discusses the major characteristics of Morocco's agriculture: the composition of the agricultural sector, land distribution, productivity measures and the infrastructure in which agriculture operates.

1. Composition of the Agricultural Sector

Morocco produces many agricultural commodities. They include winter and spring crops based in rainfed areas, industrial crops located in rainfed and irrigated zones, and livestock for meat and milk production.

Livestock and cereals were the most important components of agricultural GDP (AGDP) during the study period. Livestock accounted for 50% of AGDP, and cereals for 20%. These were followed by industrial crops—sugar beets, sugarcane and cotton—then by fruits and vegetables and finally by food

legumes and forage. *Table 6.1* shows the annual magnitude and growth of the shares of each agricultural sector in overall AGDP. The equations in *Table 2.1* describe the evolution of moving averages of these shares through time.

The share of cereals/food legumes in AGDP decreased at a constant annual rate of 0.35% while the forage/livestock share grew at a constant rate of 0.46% per year during the study period. These trends can be related to drought in five of the 19 years under study; cereal and food legume shares would decrease and the supply of livestock would increase as animals were sold during the drought. The increase in forage share can be related to the fact that it is an irrigated crop. The same facts may explain why the shares of both fruits and vegetables were stationary over the study period. Fruits appeared to be almost constant over the period while vegetables fluctuated around the mean of their moving average.

2. Size and Distribution of Agricultural Land Holdings

A. Land Tenure

Different types of land ownership exist in Morocco. The distirbution of land tenure and size in 1973/74 is of five million hectares; 73% of total cropped land was privately owned, in 1.4 million traditional and modern enterprises. Communal land, owned and operated by ethnic groups, covered one million hectares and nearly 200,000 decision units. Land ownership known as *guich*, land historically given to military groups in exchange for defending neighboring cities, accounted for 320,000 hectares on which 425 farms were operated. *Habouss* has a religious status and covered 70,000 hectares with nearly 40,000 decision units. The state owned about 450,000 hectares, 6.1% of all agricultural land, representing farms recovered from colons and not distributed during land reform programs. The land is used for state-managed enterprises and agricultural research and training organizations.

Surveys in 1973/74 and 1981/82 are the unique sources of aggregated countrywide data on land distribution. (Regional data exists but is not considered in this study.) The surveys show that the total number of farms dropped from 1.5 to 1.4 million over the eight-year period. The decline was evident only for farms under five hectares; the number of farms in all other size categories increased.

Total land devoted to farms increased from 7.4 to 7.9 million hectares over the period. This growth occurred in all but the largest size category (>50 ha), where there was a loss of about 71,000 hectares. The increase in area devoted to small farms and the decrease in the number of farms produced modest growth in their average size; those less than five hectares were, on average, about 0.25 hectare larger at the end of the period, and those in the category of 5-20 hectares averaged about 0.15 hectare larger. Average farm size in the 20-50 hectare category declined from 28.4 to 27.5 hectares. The decline in area covered by farms larger than 50 hectares, combined with the increase in the number of such farms, resulted in a large drop in average size of farm in this category, from 124.5 hectares in 1973/74 to 97.1 hectares in 1981/82.

B. Area Allocated to Major Crops

The area devoted to industrial crops—sugar beets, sugarcane, cotton and vegetable oils—grew over the study period. These crops, located mainly in irrigated areas and favorable rainfed zones, benefited from government support during this time. The area devoted to citrus, a crop which was promoted in the 1950s as an important source of export earnings, remained almost constant during the period. The regression equations in *Table 2.2* describe the changes that occurred in the area annually harvested during this period.

The equations show that during the years under study the area occupied by citrus first declined, then grew, while remaining around the overall moving average mean, with a low rate of change. The areas in olive and sugarcane production increased slightly, following almost logarithmic growth. Sugar beets had a period of increase followed by a period of decline in harvested area; overall, the change was negative, showing a decline in area expansion. Peanuts and cotton followed a decreasing trend, while the area devoted to sunflowers grew logarithmically. For food legumes, only the area occupied by lentils increased; the area under chick pea cultivation decreased. For other food legumes, the area changed quadrati-

cally, first increasing, then decreasing. Cereal cultivation had heterogenous dynamic patterns: the areas in hard wheat, maize and rice decreased, but the areas in soft wheat and barley increased.

These patterns, expressing the distribution of land among agricultural commodities, are important components of the Moroccan agricultural production system.

C. Agricultural Production Systems

Cropping patterns are an important feature of agricultural production systems because they underlie the substitutions and complementarities among crops. Such relationships constitute the background for agriculture and food policy programs.

Based on aggregate production of different crops in Morocco, transformation functions were estimated to describe the system of production functions for crop interrelationships. The variety of equations estimated might be interpreted relative to different ecological areas where agriculture is conducted, making spatial and regional interpretations possible.

The production interrelationships for cereals (represented by hard and soft wheat), food legumes (represented by faba beans and chick peas), sunflowers, sugar beets, cotton, citrus, cattle, sheep, white meat and milk were modeled in two ways. The first approach used loglinear regressions, with the obtained coefficients being elasticities. The second approach estimated quadratic relationships with squared variable values. The outputs from the estimations whose coefficients were significant at the 5% and 1% levels are presented in *Table 2.3*.

The estimated systems show that of hard wheat (HW), cotton (CT), sugar beets (SB) and citrus (CS) were not likely to be related to the other commodities considered. Sugar beets and cotton showed a relationship in two loglinear equations but did not appear in any other equations. Cotton and sugar beets are produced in irrigated areas; citrus is grown mainly for foreign markets.

All other crops, except hard wheat, seemed to be interrelated. These are crops generally produced under rainfed conditions where the amount harvested varies with precipitation. The loglinear equations show that chick peas (CP) had a complementary relationship to sheep (S) and a substitution effect with milk (MK) production. Cattle (C) production appeared to complement sheep and white meat (WM) production and to be used for milk production. Sheep, cattle and chickpeas seemed to be complements. Similar directions of substitutions and complementarities were identified in the quadratic equations.

These relationships summarize the technologies in operation since 1969. They show mainly that industrial crops such as sugar beet, sugarcane and cotton could be viewed as forming a production system specific to irrigated areas. Other industrial crops such as sunflower (SF) were directly related to soft wheat (SW) and other agricultural commodities grown under rainfed conditions, possibly localized in regions where annual rainfall is around 500 millimeters. Other crops produced in dry areas, such as legumes, seemed to be related to livestock production. Hard wheat and citrus expressed well-identified and independent systems.

3. Productivity Measures

Measures of productivity were achieved through two types of analysis. In the first type, growth trends were extracted from aggregate data; the second approach consisted in surveying selected microeconomic studies and investigating how the use of inputs influenced productivity. In the latter analysis, labor plays an important role in understanding the production side and the dynamics of rural development.

A. Yield Trends

Yield is expressed by quantity of crop produced per unit area and by number of heads for animal production. Yields measured in different units were first reduced to their moving averages and then regressed on time. Time trends represent yield improvement due to technical change from 1969 to 1989. Two time periods, 1969-1974 and 1975-1989, were considered for some crops. The intent of the equations was to show whether technical change occurred for each crop. The equations whose coefficients were significantly different from zero are shown in *Tables 2.4-2.7*.

The outputs of these regressions show that, among cereals, soft and hard wheat yields increased, by 8% and 5% respectively, during the period of study; yields of barley declined by 9% and maize by 6%. Higher rates of decline were seen for food legumes. Faba bean yield dropped annually by 0.11 quintals per hectare over 1969-1989. Chick pea yield, which declined by 1.84 ql/ha over 1969-1974, increased in the period 1975-1989. Yields for lentils and green peas held stationary during 1969-1974; yields improved over 1975-1989 for lentils but declined for green peas.

Industrial crops and citrus appeared to have had similar patterns. Yield improvement was constant over the overall period for peanuts, cotton, sugar beets, sugarcane and citrus. Sunflower and olives had identical patterns. Yield increase occured later in the study period following yield decrease which appeared earlier.

Tables 2.4 and *2.5* show that barley, maize, faba beans, peas, lentils and chickpeas did not exhibit yield improvements during the period of study. All other crops except olives had continuous yield improvements.

Livestock productivity was expressed by number of heads in production, number of animals slaughtered and amount of meat produced. *Tables 2.6* and *2.7* display the dynamic systems over the study period, transformed into moving averages, for cattle, sheep, goats, white meat and milk production.

The results in *Tables 2.6* and *2.7* show declines in production of animals of all types during the study period. Beef production and the number of cattle slaughtered also declined, while there was an increase in goats and sheep slaughtered and in production of mutton and goat meat. This pattern is probably due to the prolonged drought during the 1980s, since sheep and goats are more affected by drought conditions. The increase in milk production might be due to the large number of dairy cows raised under relatively intensive conditions. Increased white meat production can also be partially attributed to the decrease in beef production.

The overall system of incentives supporting agriculture and related production needs to be investigated in order to understand the directions taken by the different agricultural commodities during the study period. Before tackling this broad dimension, it is necessary to characterize the place of labor relative to other agricultural inputs in the overall production system.

B. Input Combinations and the Role of Labor

The microeconomic studies surveyed in this section mainly describe cross-sections of farms in rainfed areas. They confirm the aggregate growth in the use of machinery, fertilizer and improved seed. According to AIRD/MARA (Associates for International Resource Development/*Ministère de l'Agriculture et de la Réforme Agraire)* (1986), the number of tractors and caterpillars grew steadily from 12,622 in 1971 to 30,575 in 1982. Improved seed, applied to 200 hectares in 1968, covered 462,000 hectares in 1983. Total supply of fertilizers grew from 410,000 in 1974 to 600,000 in 1983 and to 741,000 tons in 1990.

Azzam (1990) found that yield was positively related to farm mechanization, the use of high-yield seed varieties, and the interaction of improved seed and irrigation. This led the author to consider the possibility of substitution effects with other inputs. He chose labor to test this hypothesis, based on data from Rafsnider-Hammida (1987) and AIRD/MARA (1986) for Settat, Oulmes-Rommani and El Kelaa. He estimated agricultural labor demand to be dependent on relative labor wage, irrigation, new seed varieties, and machinery according to the equation:

Labor =	- 0.63 relative wage +	6.96 irrigation
	(-2.50)	(2.90)
	25-8.82 new varieties	-4.82 tractor/combine
	(-3.10)	(-2.40)

This relationship means that, for the data used, the demand for labor was positively related to irrigation but negatively related to the use of agricultural machinery and new seed varieties. [Such effects could be exacerbated by regional variations, as in Settat where labor demand was reduced by 3.28 (standard deviation=1.84.)] This study indicates that labor tended to be displaced by the use of new production

technologies as well as by the existence of other job opportunities outside agriculture. Furthermore, the increased demand for labor due to irrigation might have been offset by new technologies.

Another measurement of the displacement effect of new technologies is the ratio of labor costs to total production costs. This ratio was estimated in two studies (Azzam, 1990; Khrouz and Marghi, 1990). Their findings are summarized in *Table 2.8*.

These ratios show that developed technologies were labor-saving in general, and that labor displacement was an important consequence of their adoption. Industrial crops, citrus and horticultural commodities did not express clear labor-saving patterns, but improved biological and mechanical techniques tended to release labor in food legumes, cereals (except barley), and olives. Zagdouni and Benatya (1990) also noted a displacement and accumulation of unemployed labor associated with the adoption of new agricultural technologies in Chouia, located in an arid rainfed region of Morocco. They found that labor displacement and higher non-farm wages contributed to an out-migration of agricultural labor, with flows directed to Casablanca, Settat and other regions.

Technological improvements might consequently appear to be more labor-displacing in rainfed agriculture than in irrigated farming, but further detailed data are needed in order to perfect the analysis. Driouchi, El Kasmi and Bouhima (1991) noted that, in rainfed arid agriculture where family labor is important, all opportunity costs must be evaluated when studying agricultural labor displacement. Certain benefits accrue when family labor does not emigrate from the farm. The computed implicit wages, even though lower than market prevailing wages, should account for all indirect benefits in order to explain any retention of labor in the farm household. Khrouz and Marghi (1990) demonstrated the incentives for mechanization even though it releases farm labor. They observed an increase in net profits when comparing traditional non-mechanized agriculture to semi-mechanized and mechanized farming for every commodity they studied—soft wheat, sunflowers, faba beans, forage and olives. This means that important gains were made with the adoption of improved techniques, even though labor was released. Such increases, however, were not sufficient to offset the displaced labor.

Azzam (1990) estimated the percent increases in employment and output required to compensate for labor displacement in the case of cereal production in Abda, in southwestern Morocco. For maize, with a 10% labor displacement, an increase of 11% in employment opportunities or 15% in output was needed. For hard and soft wheat, increases exceeding 300% in employment and 400% in output were required. Labor displacement associated with technological improvements in barley production required increases of 284% in employment and 378% in output. This poses the problem of migration and alternatives available to displaced farm laborers, who generally move towards cities (Zagdouni and Benatya, 1990). When this flow is added to urban population growth, thereby intensifying the stresses on urban job creation and urban infrastructure, an extra agricultural problem is presented.

4. Agricultural Incentives

Agricultural incentive systems are the mechanisms which have been developed to enhance agricultural efficiency and production. The major components of such systems are public goods such as infrastructure, research and marketing agencies and pricing processes, plus free markets and home consumption.

A. Irrigation Networks

In Morocco, most public investments in agriculture have been in the development of irrigation networks (El Khyari, 1987; Ezzaki, 1981). A large scale irrigation system under the authority of the *Office Régional de Mise en Valeur Agricole* (ORMVA) covers nine regions and 825,300 hectares, with a potential of 1,260,000 hectares. Medium- and small-scale systems in other areas are controlled by the *Direction Provinciale de l'Agriculture* (DPA). *Table 2.9* shows the growth in area equipped for irrigation in the ORMVA regions.

Since 1965, state-funded irrigation has been both external and internal to the farm, including water supply to farms as well as on-farm operations. Farmers' participation in this effort was set legally in 1969 through the Code des Investissements Agricoles, or Farm Investment Bill. This financial participation includes 40% of equipment costs, a direct participation fee proportional to the area irrigated, and annual fees for water use.

Direct participation is a fixed cost paid back to the government at a subsidized interest rate, after the fourth year, for farmers owning more than 20 hectares. No participation costs are paid by farmers having five hectares or less, and producers with less than 20 hectares are not charged for five hectares. Given the fact that only 2%-10% of farmers have more than 20 hectares, and that the participation does not apply in Ouerzazate and Tafilalet, the state bears a large part of participation costs.

Costs of equipment were established in 1983 (MARA, 1983) and vary by region, ranging from 17.42 dh to 35.07 dh per hectare. Similarly, charges for water consumption and water pumping have been very low and were kept constant from 1969 to 1980.

Thus, the costs for equipment, participation, water provision and water use have been heavily subsidized in large scale irrigation schemes. A recent source (*Vie Economique*, December 1991) reported the area covered by large scale irrigation at 670,000 hectares. Some 80,000 hectares were put under irrigation between 1983 and 1991, representing 13% of the total public investment for the period.

Small and medium scale irrigation schemes, using traditional and other types of irrigation networks, cover areas between 500 and 8,000 hectares in size. Such schemes are known to have equipment costs almost equivalent to large scale irrigation: 20,000 to 28,000 dh/ha (AIRD/MARA, 1986), with traditional networks at the lower end of the range.

B. Transportation Networks

In 1988, Morocco had a road network of 59,171 kilometers, 47% of it paved (1989 *Statistical Yearbook*). There were 5,364 public transportation vehicles (for 2,298,000 potential travellers) and 3,200 commercial transport vehicles capable of carrying 47-51 thousand metric tons of goods. The quasi-public enterprise *Office National des Transports* (ONT) used 68% of the commercial fleet and 70% of total capacity, primarily to transport agricultural inputs such as seed and fertilizer, agricultural outputs such as cereals, cotton, sugar beet and sugarcane, and subsidized food items such as flour, sugar and vegetable oils. ONT plays an official role in the regional distribution of food supplies and transports sugar and cotton from farm to factory. The road network also plays an important role in supporting the private agricultural sector, carrying unsubsidized foodstuffs (produce, eggs, livestock), forage, machinery and other agricultural inputs and other consumer and producer goods.

The railway system, 1,893 km in length, is controlled by another quasi-public body, the *Office National des Chemins de Fer* (ONCF). With 13,460 employees and about a million dirhams in daily receipts, ONCF plays a major role in the shipment of phosphates (20-24 million tons, 70% of total merchandise transported by rail in 1988) and in foreign trade through the ports of Casablanca, Safi, Tanger, Kenitra, El Jadida and Mohammedia. It is also important in the internal transport of agricultural goods. In 1988, ONCF carried 656,000 tons of cereals and citrus, 301,000 tons of sugar and 1,465,000 tons of fertilizer.

While air transport is not commonly used by farmers, it is important in the transport of some perishable and fragile agricultural commodities. Agricolair is a private company used for pesticide applications. There are 11 airports in the country; although published data are unavailable, one may surmise that the airport at Agadir plays a major role in agricultural exports. It is located in the irrigated Souss-Massa region and ranks second to Casablanca in cargo transport.

COMANAV, the national marine transport company, controlled 30% to 40% of the 798,000 tons of Moroccan horticultural products shipped by sea in 1988. 60% were shipped from Casablanca and 40% from other ports, mainly Agadir.

This diversity of transportation systems is a major asset in the development of agricultural markets among the regions of Morocco.

C. Research, Training and Extension Services

In Morocco, most agricultural research and training is carried out in public institutions, primarily at the Agronomy and Veterinary Institute Hassan II (IAV) in Rabat, the National School of Agriculture (ENA) in Meknes and the National School of Forestry (ENFI) in Sale.

Research at these university-level institutions has tended to reflect the goals and interests of individual researchers rather than any overall program plan. Recent trends, however, are toward program planning and coordination in agricultural research (Kaissi and Coleou, 1991), the regionalization of universities and other research and development centers, the creation of institutes of technology, and the establishment of research networks. The National Agronomic Research Institute (INRA), the *Direction de l'Enseignement Agricole et de la Recherche* (DEAR) and the National Research Center (CNR) are among the public organizations promoting these trends with national and international funding. The goals are to support research that will enhance the overall performance of Moroccan agriculture, to develop and test technologies suited to the nation's specific agricultural regions, and to implement the results of research and development in the field. Regional centers, such as INRA's Settat Aridoculture Center, should be particularly useful for developing and disseminating technological improvements in agriculture (Faraj, 1989); and specialized centers, such as the Forestry Experimental Station and the Institute of Fishery, can improve Morocco's utilization of its renewable natural resources. The aridoculture center, for example, targets rainfed and semi-arid agriculture in developing, adapting and testing agricultural machinery and new varieties of cereals, vegetables and forage. Besides this state sponsored research, more applied and short-run investigations are conducted by private organizations, such as chemical and pesticide firms and farmers' associations.

Research results from all public institutions are available to farmers through numerous annual publications (Bouayad, 1991). Morocco's agricultural extension program is carried out through marketing agencies for seed, fertilizer and other inputs, and the local extension agencies [*Centres de Mise en Valeur* (CMT) in irrigated areas and *Centres de Travaux* (CT) in other regions] of the Ministry of Agriculture and Land Reform (MARA). According to 1982 estimates of MARA's extension program, the government spent 300 dh per hectare, 70% paid as salaries to extension agents, in rainfed agriculture; in irrigated regions, the CMVs were supported with 260 million dh, 92% of which was allocated for salaries (AIRD/MARA, 1986).

D. Marketing and Credit Agencies

The government intervenes on both the input and output sides of Moroccan agriculture. On the input side, the state provides direct subsidies and support to farmers based on the Agricultural Investment Code (1969). It supports a farm mechanization program, and different agencies have been developed to distribute seed, fertilizer and credit for crop and livestock production. Two quasi-public organizations monopolize the seed distribution for cereal, sugar and vegetable oil crops. Fertilizer was marketed through private enterprises until 1970, when a firm (FERTIMA) affiliated with the Office of Phosphates (OCP) obtained the monopoly for imports. This enterprise has a duopoly power with another firm, SCE, at the wholesale level. FERTIMA and SCE also dominate the processing and distribution of fertilizer to farmers and agricultural organizations, controlling 83% of total sales. Eight other enterprises share the remaining 17%. In livestock, there are government subsidies for animal feed and state mechanisms for forage production, animal procurement, and livestock preservation from drought.

Agricultural credit is provided through state agricultural banks. A central agency, CNCA, directs agricultural financial operations through a system of regional and local agricultural banks. Low income farmers submit their projects to local banks, while middle and high income farmers are entitled to transact with regional and central agencies. Credit quotas, restrictions and interest rates differ at each banking level (Berrada, 1978); interest rates ranged from 2.5% to 14% during the study period.

Various public agencies are also involved on the output side. The Cereal and Food Legume Organization (ONICL) controls the cereal and food legumes trade with domestic price controls and a stabilization scheme for wheat and its derived products. Official marketing channels for cereals include millers, cooperative enterprises for procurement and storage (SCAM and CMA), and wholesalers, but private sector marketing is often more important. Sugar production, from cultivation to milling, is entirely controlled by the state, as are imports of sugar. The state agency COMAPRA controls vegetable oils, except olive oil, by applying high producer prices and insuring inputs and marketing of oil seed. Livestock outputs are supported by different institutions such as COMAGRI and SNDE. Although there are cooperatives for milk production and processing, Centrale Lait has the highest share in this domain.

Agricultural exports were managed through the *Office de Commercialisation et d'Exportations* (OCE) until 1985. Since then, other organizations have been developed to compete with this state agency, and producers have been allowed to export their commodities directly.

E. Pricing Incentives

There are agricultural pricing mechanisms for both inputs and outputs. These include border measures—import and export tariffs and quotas, and a licensing system applied to manage all foreign trade—and non-border measures such as input and output price supports and subsidies. Agricultural input and output prices are also influenced by the provision of public services and other infrastructure.

Cereal seed prices are set annually at three stages. Producer prices are based on the costs of production, transportation and storage plus a profit margin. Seller prices are also set with an assumed fixed profit margin. The price at which farmers buy seed is the sale price reduced by subsidies of 10 to 20%. The subsidies on cereal seeds can be identified in the public budget.

There are no budgeted public subsidies on the prices of seed to growers of sugar beets, vegetable oil, horticultural and tree crops. Sugar beet seed, however, is imported duty free, with import costs being used to estimate sales prices to the farmer. Import costs include the costs and margins of SONACOS and the Office of Irrigation. The full cost of vegetable oil seed is charged to the farmer through the COMAPRA system. The full cost is composed of a distribution margin added to production costs (production occurs at a state farm, SOGETA). The various state agencies involved in the production and distribution seed for horticultural and tree crops also charge their full costs, including margins, to the farmer.

While subsidies for these types of seeds are not part of the public budget, there may be implicit subsidies at several stages of production and marketing. Forgone import tariffs, in the case of sugar beet seed, is an example. Import quotas may also have a subsidizing effect. Private import and marketing companies must be licensed by the Ministry of Agriculture, and subsidy rates to farmers may reach 40% to 60% (as is the case with forage), with the government paying for transportation and storage fees to public organizations. Also, to assert that the cost of seed to the farmer contains no subsidy assumes that the public agencies involved in production, import and marketing are economically efficient, perform at the lowest costs, and set their margins accurately. Such hypotheses should be tested before establishing the direction and magnitude of subsidies and taxes on seed and any other input or service involving public or imperfect market structures. Fertilizer prices were fixed in 1974 in order to isolate the domestic market from world price fluctuations and increases. A system of compensation was set through the *Caisse de Compensation*, which paid the difference between the import price and an administrative reference price scale based on different types of mixes, including margins. Another system was implemented in 1979, wherein the OCP facilitated payments and transfers to the fertilizer industry. In both cases, fertilizer prices paid by farmers have been 50% lower than import prices and production costs (AIRD/MARA, 1986); thus, farmers have been subsidized based on the level of import and production costs, and have also been supported by the fertilizer industry, with a single importer and a few licensed redistributors and retailers. Removal of such subsidies, planned since 1980 and implemented in 1990, led to higher prices paid by farmers because the same structure of fertilizer importation and distribution was maintained.

Credits and subsidies also apply to farm machinery. Importers are paid their total costs plus a margin, while the sale price to farmers is subsidized. This subsidy is directly managed by the Ministry of Agriculture and paid to each dealer. Furthermore, the public treasury forgoes the tariffs on imports of agricultural equipment.

On the agricultural output side, prices are fixed annually in order to set the bases for transactions in official marketing and distribution channels. These transactions are generally related to social welfare objectives, guaranteeing prices for producers and stabilizing prices for consumers.

Price fixation occurs at different output stages. At the first stage, the price at which the farmer can sell his raw product (the price varies according to quality) is set in the often monopolistic official channel. Such is the case for bread wheat, sugar beet and sugarcane, cotton, oil seed and milk, among others. There are several problems with the pricing mechanism at this stage. The studies that establish official production costs may not be accurate representations of different production systems. The price established for

a given quality level may not reflect all the costs of producing that quality. Furthermore, a single price is established for the entire country and can be applied at any point in time between two harvests. How farmer margins are set and added to the production cost to form the proposed fixed price is therefore problematic.

The second stage of price fixation applies generally to licensed traders, storage enterprises and millers. These prices are based on the costs of transportation, storage and processing of raw goods. They should reflect real production costs and margins, including the costs of all services and goods involved in producing the final products. Similar questions about the basis of such prices can be raised for the stage at which public organizations are heavily involved and private agents must be licensed—implying that established bases may not correspond to the least costs. When imported raw agricultural products, such as soft wheat, sugar and oil seeds, compete with domestically produced ones through official channels, it is socially expensive to control real costs of production at each stage. Consequently, further inefficiencies are introduced and higher costs are imposed on both the central budget and consumers.

The last stage consists of establishing the purchase price for consumers. The fixed price to consumers includes margins set officially for both wholesalers and retailers.

Until 1985, the state agency OCE controlled producers, managed the quantity and quality of agricultural exports through marketing stations, and carried out transport and other operations, including sales abroad. Farmers were reimbursed after deductions of supplementary charges incurred between the marketing station and the point of sale. This situation changed in 1985 following the decline in payments received by producers relative to export prices. Since then, producers have been allowed to export their commodities directly.

The general mechanism for agricultural imports is to obtain a license from the appropriate state agency and to be paid the difference between the import price and the domestic price plus a margin. This is called a price perequation and permits the state to better control domestic and imported flows of the agricultural goods and to insure price stability.

III – Economic Performance Indicators

The discussion in this section focuses on the performance of five components of the Moroccan economy during the study period: indicators of growth in GDP; price indices and inflation; interest rates; exchange rates and government finance; and household expenditures. Performance and price analyses of the agricultural sector are discussed in Section IV.

1. Growth Indicators

Time series analysis permits an estimation of the processes underlying the component sectors of the Moroccan GDP. *Table 3.1* displays the results.

The net trend is expressed in the GDP series, which experienced a constant nominal growth rate of 7% per year over the study period. The growth rate in GDP was due primarily to the performance of the government (GO) sector, which grew at a 34% annual rate; the only other growing sector, agriculture (AG), grew by 6% per year. All other sectors had stationary patterns around their means, implying declining rates (as obtained from the estimated coefficients relative to unity, 100%) ranging from 8% in commerce (CM) to 34% in mining (MN).

2. Macroeconomic Price Indices and Inflation

Average annual inflation rates for the period 1970-1989 were computed for components of the Cost of Living Index and are presented in *Table 3.2.*

The average overall rate of inflation was 6.61% annually for the period, although variation around the mean was substantial (standard deviation = 2.42). The costs of transportation and food inflated more

rapidly, exceeding 7% per year, again with high variability. The other components, housing, clothing and health, exhibited lower and less variable inflation rates.

The behaviors of the univariate series were also examined under logarithmic transformation *(Table 3.3)*. The results show that the clothing (CL) and transportation (TM) components of the index exhibited univariate stationary behavior during the study period. Housing (HS), food (FD) and health (HM) were of a higher order. Housing showed an increasing pattern; food and health had cyclical behaviors. This implies that the rate of inflation in the general index (GI) had a cyclical behavior of higher order than is evident from the estimates obtained, revealing that the study period had complex inflationary patterns for housing, food and health care which might have affected the largest shares of the consumer budget.

3. Interest Rates

Interest rates considered here are the rates charged by financial institutions to borrowers. *Table 3.4* displays the trends in general bank rates during the period 1973-1989.

For the general banking system, medium- and long-term lending rates appear to have followed stationary processes, while in comparison short-term rates were non-stationary.

Agricultural borrowing is mainly for the short and medium term. *Table 3.5* summarizes the prevailing patterns in agricultural interest rates to borrowers during the same period.

These results show that the various short-term interest rates for agriculture followed nearly identical patterns. Individuals paid a higher interest rate than cooperatives for medium-term loans. Even with this difference, both types of interest rates seemed to have followed similar patterns.

The equations in *Table 3.6* show that agricultural interest rates were directly related to general bank rates, implying that short-term bank rates drove short-term agricultural rates, and medium-term general interest rates drove medium-term agricultural rates. Note, however, that the magnitude of linkage is lower for the medium term than for the short term. Interest rate patterns are summarized in *Table 3.7*.

The trend for medium-term agricultural credit was significantly lower (at the 5% level) than that for medium-term bank rates (t-stat=2.25). There was no significant difference between the two types of medium-term agricultural loans (t-stat=0.69).

Trends in short- and long-term bank rates were nearly identical at around 0.4%. The trend for medium-term loans was higher, at 0.55%, but was not significantly different at the 1% level (t-stat=1.63). Except for agricultural warrants, trends in short-term agricultural rates appeared to be similar to the short term bank rate trend. The lower trend in agricultural warrant rates (which are short-term), 0.25%, was significantly different from the rate obtained for industrial and other crops (t-stat=2.50).

Finally, the general bank short-term interest rate appeared to be driven by the inflation rate. The following equation relates the two rates (BS = short-term interest rate, INF = inflation rate):

$$BSt = 1.008\ INFt \quad (R2 = 0.49\ \text{t-stat} = 3.68)$$

This shows that bank short-term interest rates were adjusted according to inflation. During the study period the central bank controlled lending and borrowing by setting interest rates for different money market segments. Interest rates were liberalized and set as market prices in 1988. A corollary decision adopted in 1991 removed central bank control on credit, thereby eliminating government intervention in the credit market.

4. Exchange Rates and Government Finance

A. History and Background

The Moroccan dirham (dh) was created in 1959 as a convertible currency, fixed against the French franc. Since then, monetary flows between Morocco and other countries have been controlled through the

Exchange Office, which manages foreign transactions. Management is based on prohibiting the export of the dirham and imposing quantitative restrictions and controls on the exchange of the dirham into other currencies (for example, transfers of capital abroad are taxed at the rate of 10%). Imports of foreign currencies, while not quantitatively restricted, must be submitted to the authority of the Exchange office through the banking system (Chiguer, 1988).

At the beginning of the 1960s, important changes occurred in the Moroccan economy. A rapid decrease in foreign exchange reserves, due to growth in current expenditures relative to revenues, led to borrowing which increased the total money supply from 2% to 7% (against a previous deficit which had attained 6% of GNP in 1965) and an induced inflationary pressure which grew at 5% from 1959 to 1964. Among the policies adopted in response to the situation, tourist allowances were cut and income transfers by foreign technical personnel were controlled. Imports were suspended and submitted to special authorizations; progressive duties were levied on selected luxury items and goods competing with local industries. The dirham became non-convertible in 1964.

During the period 1965-1972 a large import substitution program was developed, with important financial implications for public funds. The program was achieved over two planning periods. The first period, 1965-1967, corresponded to a stabilization plan during which an average of 27% of public resources was devoted to each sector of the economy. The second period, 1968-1972, corresponded to a five-year plan wherein agriculture and dam construction/irrigation development received respectively 43% and 29% of public resources. By the end of the era, price policies and agricultural subsidies had become major public instruments. With relative trade liberalization, the balance of payments remained stable due to high phosphate prices and workers' remittances, which covered total expenditures related to increased food imports and government subsidies. The budget deficit decreased from 6% in the previous period to 2% of GDP by 1971. Although overvalued in the mid-1960s, the exchange rate appears to have been close to its equilibrium over the period 1968-1972.

Expansion of the money supply replaced domestic borrowing after 1971-1972; money supply increased from 18% in 1971 to 29% in 1974, inducing an inflation of 44% in the Wholesale Price Index between these two years. Growth in the Consumer Price Index (CPI) appeared lower because of subsidies.

The following period 1973-1980 coincided with an increase in government expenditures and a decrease in government revenues due to lower phosphate prices starting in 1975. The dirham became overvalued, which raised imports and reduced export earnings. International price shocks exacerbated the situation. Price policies grew in importance to protect domestic producers and consumers from world prices (in agriculture, for example, input prices for fertilizer, seed, transport and the like were heavily subjected to government intervention), but costly public intervention also magnified the impact of the financial crisis. A growing foreign exchange crisis followed, with increasing overvaluation of the dirham. Measures adopted in 1973 included raising import tariffs and taxes and relating the dirham to a basket of foreign currencies, setting the exchange rate to the French franc through its convertibility to other currencies.

Re-establishment of economic equilibrium was part of the 1981-1985 plan, but trends in world prices and the value of the dollar, and prolonged drought in Morocco, intervened. Rising world prices and the value of the dollar made imports increasingly expensive, while drought reduced the amount of agricultural goods available for export. This led to further imbalances in government revenues and expenditures and in foreign trade and payments. External borrowing capacity disappeared as, despite nominal adjustments in 1980/81, the debt service ratio climbed due to the value of the dollar and the overvaluation of the dirham. A major structural adjustment program was adopted in 1983, with the dirham to be devalued by 25%, import duties to be lowered to achieve 25% of effective protection, and public expenditures for subsidies and administrative costs to be reduced to contain the budget deficit at 7% of GDP. Rescheduling Morocco's external debt was conditioned on the implementation of these policies.

The dirham was devalued by 17% almost immediately, followed by additional devaluations of 6% during 1984/85 and about 9% in 1990. Trade barriers were eased with a reduction of the number of items on List A (controlled items). A desubsidization program was implemented for consumer staples such as deluxe flour, butter and milk, and agricultural inputs such as seed and fertilizer.

Data in a World Bank report for 1990 showed an improvement in the Moroccan economy, despite a crisis in tourism. Growth averaged 5% annually from 1985 to 1989. The current balance improved, from a deficit of 8% of GDP in 1984 to 2% in 1989 and 3.6% in 1990. The budget deficit had been reduced to 3.3% by 1990, with inflation around 7%. The total value of imports, which dropped from 33.7% of GDP in 1985 to 25.4% in 1988, approached 30% in 1990. Public expenditures were reduced from around 33% of GDP in the 1980s to 27% in 1990 and government revenues stabilized; although they declined with the introduction of a value added tax in 1986, they had reached 23.1% of GDP by 1988 and 24% by 1990. The report attributes these improvements in large part to the structural adjustment policies and reforms of agricultural incentives undertaken since 1983.

The reforms have also enabled Morocco to reschedule its public and commercial external debt. This has consisted of postponing $3.2 billion of commercial debt with the London Club over a 20-year period, including 10 years of amortization, thereby saving $700 million per year in 1990, 1991 and 1992; rescheduling with the Paris Club 100% of the public debt maturing in 1990 and 1991; and postponing other debt components, such as development funds, for 20 years. In total this has permitted a savings of $1 billion in 1990 and $250 million in 1991. Nonetheless, the World Bank report underlines the fact that debt and budget deficits are still heavy burdens on the Moroccan economy. External debt reached 90.3% of GDP in 1989, and servicing it required 34% of total Moroccan exports.

B. Exchange Rate Processes

While exchange rate policies are important components of overall government financial policies, a market exchange rate also exists, established through transactions outside the banking system and distinguishable from the official exchange rate that prevails daily in the banking system. The relationships displayed in *Table 3.8* were estimated in order to capture the behavior of market and official exchange rates.

The equations show that official and market exchange rates were related in both their nominal and real forms. For the first equation, relating nominal rates, the t-statistic obtained from comparing 0.62 (standard deviation = 0.248) to 1 indicates there was no significant difference between nominal official and market rates. Consequently, market and official exchange rate first differences were equivalent. Market exchange rates seem to have been totally driven by official exchange rates. For the second equation, the t-statistics for testing the hypotheses of each coefficient being equal to one are 0.9145 and 0.6727, with standard deviations being respectively 0.25149 and 0.46081. As with nominal rates, therefore, real exchange rates for official and non-official transactions were similar.

These relationships imply that there should be no incentives to develop a parallel market for exchange, unless there are other benefits such as evasion of quotas and exchange controls set by the banking system or of transaction costs involved when using official exchange rates. Another incentive might stem from trade and tourism at the Algerian border, since the Algerian dinar is overvalued. The Union of Maghreb Nations (UMA), established in 1989, has increased population flows and the demand for foreign exchange between the two countries.

5. Household Expenditures

Two surveys of household expenditures were available for the study period. Their findings are summarized in *Table 3.9*, allowing a comparison of the budgetary shares of urban and rural households in the early 1970s and the mid-1980s.

In both surveys food was the most important item in household budgets, accounting for roughly half of total expenditures. The share declined over time, more so for rural than for urban populations, but consistently rural households spent a higher portion of their household budget on food than did urban residents. Urban households spent a higher portion than rural on housing in both surveys; for all households, this portion grew from 15% in 1971 to 20% in 1985. Changes in other expenditure categories were less marked; the portion spent on clothing declined, while the shares devoted to home furnishings, health, education and leisure increased; the overall share of transportation and communication remained unchanged, although it declined for urban residents and rose for rural households.

Table 3.10 shows the breakdown in household food budgets for the two surveys. The most noticeable changes over time were a decline in the share allocated to sugar and increases in the shares spent on vegetables and fruits. The budget portions allocated to dairy products, milk and eggs grew slightly; the portion spent on cereals dropped by about 2 percentage points; and the rural (but not the urban) population devoted less of their food budget to meat in 1985.

Data on per capita consumption of the main foodstuffs in the Moroccan diet over this period show an important shift in consumption from hard to soft wheat, which may explain the drop in budget share for cereals. The decline in meat expenditures may be explained by a lower consumption of red meats, particularly goat and beef, which appears to have been compensated by increases in consumption of white meat, eggs, fish. Consumption of sugar was stable over the period, despite the decrease in food budgets allocated to this item.

In both household expenditure surveys there were large differences among consumers with regard to monetary expenditures and budget allocations. *Table 3.11* shows expenditure patterns for the poorest and richest consumers in the rural, urban and total population. Poor consumers were defined in the surveys as those spending less than 7,200 dh per year (600 dh per month); rich consumers were those spending more than 52,000 dh per year (4,333 dh per month).

In both surveys, the poorest quartile of the population made less than 10% of consumer expenditures, while the richest 25% accounted for over half of all household spending. This inequality decreased over time; the share of expenditures by the poorest consumers increased while the share of the richest consumers decreased.

According to publications produced from the surveys, poor consumers were mainly rural (70%) and wealthy consumers were primarily urban (83%). Thus increases in consumption expenditures between 1971 and 1985 were achieved by 70% of rural households and 30% of urban, while the implied decreases in expenditure affected 83% of urban residents and the 17% of rural population classified as non-poor. In fact, Gini coefficients computed from the 1984/85 survey show a high level of inequality in consumption among ten expenditure classes. For total, urban and rural populations the values of the index were, respectively, 40.8, 41.2 and 36.4%. With these inequalities, average per capita consumer expenditure in real terms changed only slightly over the period 1971-1985 as compared to 1959-1971.

IV – Agricultural Prices

During the study period, different types of prices were operative in setting and assessing incentives for the production, consumption and marketing of agricultural goods. While prior to 1971 most agricultural inputs were freely traded, with prices set by the market, they were subject to extensive government intervention and control that started in 1972/73 and continued into the 1980s. Trade in fertilizer and seed was returned to the private sector in 1989. Land rents and custom work prices have been always set by markets, although they are subject to imperfections and influenced by the controlled prices of other inputs, such as mandated minimum wages for labor. The free market has also generally determined agricultural output prices for fruits, vegetables, food legumes, livestock and meat, again influenced by public interventions in setting margins and controlling input prices.

Otherwise, prices of almost all agricultural commodities were either directly or indirectly fixed by the government. Mechanisms seldom took the form of price guarantees; usually margins and transaction costs were implemented at the producer and consumer levels in order to implement consistent price policies. The following sections present analyses of different sets of time-series prices as univariate processes and as determinants of supply and demand. A special focus was given to traded agricultural crops, with emphases on exchange rate effects and terms of trade between urban and rural areas.

1. Nominal and Real Price: Univariate Processes

A. Producer Prices

Table 4.1 displays nominal and real price processes for agricultural inputs and outputs, based on time series of such prices. Nominal producer output prices rose over the study period, at rates ranging from

1% to 9% per year. Maize and barley, under price guarantees between 1972 and 1984, had the highest rates. Prices for both types of wheat rose at the same rate (4%); soft wheat was under a fixed-price regime and hard wheat had a floor price. Cotton and sunflowers, other agricultural outputs under COMAPRA control, had rates nearly as high. Output prices of sugar beets and sugarcane (the latter grown in irrigated areas) had the lowest rates.

Nominal input prices exhibited little tendency to increase. The exception, user fees for irrigation water (WP), which rose 90% annually, was probably due to adjustments in the 1980s reducing the high level of subsidization applied during the 1970s.

In real terms (deflated by non-agricultural GDP), agricultural producer prices were generally stationary over the study period. The autoregressive coefficients were between 0.60 and 0.99 for outputs; for inputs, they ranged from 0.56 to 0.94, excluding the price of fuel which, with a coefficient of 1.20, rose substantially. Labor wages and water use fees exhibited second order autoregressive processes, implying both oscillatory and stationary patterns. This might be related to less frequent administrative revisions in their prices. Otherwise, regression equations show that only short-run price history was considered by the government when setting producer prices.

B. Consumer Prices

Nominal and real consumer prices showed the patterns presented in *Table 4.2.* The nominal consumer price for ordinary and special flour, bread, and granulated sugar exhibited stationary patterns. Vegetable oil, milk and sliced sugar price patterns were slightly above unity. Real consumer prices for the food items considered appeared to follow autoregressive processes of first order, with the estimated coefficients being outside the unit circle. This means that real consumer prices for these goods rose over the study period. The rates of increase were very low, ranging from 1% per year for ordinary flour and granulated sugar to 5% annually for milk. Butter is the only commodity to have had a stationary real price; the real price of tea did not change.

2. Price Responses

A. Supply Response

Based on official real producer prices and crop yield, supply equations were estimated using logarithmic functional forms *(Table 4.3).* Except for cotton, commodity supply responded to lagged prices. Cotton supply was affected by current prices. Soft wheat supply appeared to respond to five-year lagged prices, hard wheat to a two-year lag. The supply of rice seemed to be responsive to the fourth and second lags of its own price; milk supply was affected by current as well as by first and second lags. Sunflower supply appeared to respond to three-year lagged prices. The supply of sugarcane appeared the most responsive to price, with a short-run elasticity of 1.65 and a long-run elasticity of 12.60. Sugarcane was followed by barley, whose short-and long-run elasticities (1.12) were identical. Hard wheat supplies were more elastic in the short run than the long term; soft wheat supplies had a reverse pattern but were less elastic overall. The other commodities reviewed had identical short- and long-run price elasticities ranging from 0.03 for rice to 0.40 for maize. Supplies of soft wheat and sunflower appeared to be affected by, respectively, hard wheat and food legume production. Sunflower price increases appear to have driven a decrease in soft wheat production while positively affecting sunflower supply.

The following equations confirm these production system relationships of substitution and complementarity during the study period (quantities: SW = soft wheat, H = hard wheat, LE = legumes; prices: PS = soft wheat price, SP = sunflower price):

$$SW = \underset{(-2.00)}{-6.66} + \underset{(2.32)}{0.52}\,PS + \underset{(-1.80)}{0.45}\,FB - 0.29\,SP + 0.26\,LE + 1.12\,H$$

$$R^2 = 0.96 \qquad DW = 1.62$$

Such dynamics can be attributed to the net benefit to be accrued by each commodity.

The structure of output and input values allows comparisons among different agricultural commodities and between the crops under intervention and those subject only to market forces. *Table 4.5* displays the mean output values, standard deviations and processes followed by different commodities.

In real terms, output values appear to have been stationary, with sugar beets and rice having higher averages, and rice and sugarcane having higher variability.

Table 4.6 presents values for purchased inputs for cereals, legumes, and oil crops. The processes followed by input values for cereals, food legumes and oil crops are presented in *Table 4.7*.

Such analyses can be expanded to compute the comparative advantages of other agricultural commodities. In practice, two major indices, the nominal protection coefficient (NPC) and the effective protection coefficient (EPC), are used to account for world prices. AIRD/MARA and Agroconcept computed and published these indices in 1990. The data in *Table 4.8* was extracted from that publication. Averages and standard deviations were used for each of the coefficients and were obtained from data presented by region.

Among cereals, both coefficients indicate that, except for irrigated wheats, the prevailing domestic prices were roughly equivalent to those occurring on world markets. Irrigated wheats, with EPCs substantially greater than one, appear to have been taxed. The coefficients for sugar beet and sugarcane prices also show the existence of a taxation scheme, with a variability among regions. The situation is similar for colza and sunflowers, whose protection coefficients indicate that domestic prices were higher than those prevailing internationally. Other commodities had protection coefficients lower than one, implying that domestic prices were lower than world prices. Such was the case for citrus, an export crop, and cotton.

B. Demand Response

Price and income elasticities were derived for certain commodities. The estimated processes, based on time series data for the study period, are presented in *Table 4.9*. Income is expressed by GDP per capita; consumption is per capita, and all variables are in logarithms.

These equations show that price elasticities ranged from 0.14 for fresh vegetables to 1.95 for green peas and 1.60 for beef. Elasticities for sugar and faba beans were toward the low end of the range; soft wheat flour, vegetable oil, legumes and chick peas had mid-range price elasticities, between 0.58 and 0.76.

Income elasticities ranged from 0.13 for sugar to 9.71 for green peas. Food legumes and chick peas has high income elasticities, both over 2.0, while the income elasticities for soft wheat flour, vegetable oil, fresh vegetables, lentils and beef clustered in the 0.40-0.71 range. Faba beans had a negative income elasticity.

These figures are generally comparable to price and income elasticities found in other studies by Matteus (1985), DAI (1990), and Laraki (1990). Laraki compared elasticities between urban and rural populations. He found urban price elasticities were lower than rural for soft wheat and vegetable oil, and higher for sugar and, especially, barley. Urban income elasticities were lower than rural for vegetable oils and sugar, higher for barley; for soft wheat, the income elasticity for soft wheat was negative (-0.57) for rural populations and positive (+0.15) for urbanites.

C. Price Transmission between Markets

The relationship between wholesale price indices and the Consumer Price Index between 1980 and 1989 (the only years for which the WPI was available) was estimated as follows:

$$CPI = 1.49\ WPI\ (R2 = 0.99,\ t\text{-}stat = 27.27,\ DW = 1.79)$$

This shows that the average margin between wholesale and retail was almost 50%.

When observing the announced consumer and producer prices in different integrated markets, other relationships appeared. Incorporating transformation coefficients and goods-specific subsidy rates, and

based on consumer prices applied at different stages of the marketing process, the relationships shown in *Table 4.10* were established.

The results show that bread prices were related to the current year's flour prices and their own prices in previous years. The coefficient for ordinary flour was .35; for special flour it was .20. The equations imply that, at equilibrium, there was a markup of 13% between bread prices and ordinary flour prices, and of 95% between the prices of bread and special flour, suggesting that bread producers had no incentives to use special flour under the official price regime. Milk and butter prices exhibited markups of 36%. The equations for sliced and granulated sugar reflected the subsidization mechanism on granulated sugar.

Based on producer and consumer official real prices, certain equations were estimated (see *Table 4.11*).

These relationships show that producer prices were not completely transmitted to consumers. The most heavily subsidized items were bread and ordinary flour, followed by vegetable oil and granulated sugar. Sliced sugar and special flour were subsidized at lower rates.

Fruits, vegetables and live animals are among the few agricultural commodities traded in free markets up to the retail level (at which there is official intervention in retailer margins in order to preserve consumer prices). However, as Haymond (1990) noted, many agents intervene in the "free" markets below retail level. Furthermore, each type of agent appears to be necessary in the supply of agricultural goods. They account for their risks in the overall marketing channel by various strategies to set prices, sometimes by colluding in order to lower on-farm prices. Large farmers, such as the apple growers in the Meknes region, may counter this strategy by integrated farming, processing and marketing. Unorganized small farmers generally receive lower prices for their fruits and vegetables. In fact, extension programs have not provided advice on marketing, selling strategies and price formation to small farmers. Thus, while merchants have been operating rationally in order to preserve their profits, most farmers have been acting individually without appropriate information when selling their products.

3. Traded Agricultural and Food Items

This section focuses on Morocco's agricultural and food imports and exports. Soft wheat, sugar and vegetable oils are among the locally produced commodities that are also imported. Citrus and vegetables are among the commodities exported.

A. Agricultural Imports

Import values were first analyzed to reveal the processes governing this trade component, then the sensitivity to exchange rates was analyzed. *Table 4.12* presents the estimated equations for import processes.

All these processes were stationary, with coefficients of the first order autoregressive equations in the range of 0.56 to 0.75. The only exception was sugar, with constant import values over the study period. In comparison to non-agricultural imports, food appeared to exhibit a stationary and stable pattern.

Table 4.13 displays the estimated processes for non-food agricultural and aggregate imports.

Import values appear to have been less affected by exchange rates. *Table 4.14* displays the estimated processes that were significant at the 5% level.

Except for total agricultural imports which exhibited a high R2 and a good DW statistic, all other items showed poor performance. This might mean that although Morocco was forced to import food commodities in order to satisfy domestic demand, the value of such imports was slightly influenced by the exchange rate. Commodities most affected were soft wheat, edible oil and other food items excluding sugar.

B. Agricultural and Food Exports

Export value processes are presented in *Table 4.15.*

All the estimated processes appeared to be stationary, except for fertilizer and agricultural non-food commodities. The effects of exchange rates on exports are summarized in *Table 4.16*.

Of the commodities reviewed, citrus, an important export crop, exhibited the greatest sensitivity to exchange rates. Citrus was followed by olive oil and food legumes. Vegetables such as tomatoes and potatoes were less affected but had coefficients significantly different from zero. Coefficients for other commodities, and for total agricultural food exports, were not statistically significant.

V – Forest and Marine Resources

1. Forests

Forested land in Morocco occupies an area of 8,969,600 hectares; 60% is in natural forests, 35% is in bush and 5% is in reforestation programs. In the official statistics, forestry's contribution to the economy is low, representing about 0.4% of GDP. However, only official sales of wood are regarded in the accounting system because forests belong to the public domain. Other benefits, such as the firewood and grazing available to neighboring settlements and the effects of forests on agricultural land, are not included, nor are the indirect costs of forest degradation. El Midaoui (1990) estimated that 94% of official wood sales represents only 5.1% of the real economic potential of forests.

A. Wood and Timber

In Morocco, forestry data is limited to information on wood and timber marketed through official channels. Official sales figures for timber during the study period rose in a fluctuating pattern from 62,000m^3 in 1969 to 138,000 m^3 in 1988, with peaks in 1965 (90,000 m^3) and 1973 (138,000 m^3) and net decreases in 1979/80 (to 60,000 m^3). A study by El Midaoui (1990) showed average sales of 70,000 m^3/yr in 1958-72, 92,700 m^3/yr in 1972-83, and 125,000 m^3/yr during 1984-1988. He estimated that demand for wood and timber grew 3.58% annually, equivalent to 502,152 m^3 per year during 1984-1988. *Table 5.1* summarizes the evolution of demand, supply and imports of wood and timber from 1970 to 1988.

The domestic supply of wood and timber appeared to follow the autoregressive process:

Sup(t) = 0.77 Sup(t-1) (Q=8.99, t-stat=3.81, R2=0.53),

although official estimates of annual supplies may have been based on the one year lagged past performance of the forest, as speculated by El Midaoui (1990) in his conclusion that annual supply was underestimated by the administration.

The trend in demand, 14.91 (t-stat=7.86), progressed around an average of 253.95 thousand m^3 (t-stat=11.75); for imports the trend was 13.35 (t-stat=6.09) around an average of 199.06 thousand m^3 (t-stat=7.96). Thus the growing demand for timber and wood was increasingly met by imports as domestic supplies (part of which was exported) remained stationary. The price index for cedar showed a trend of 15.8 (t-stat=20.89, R2=0.71), indicative of the steady rise in wood and timber prices during the study period.

Official sales of wood and timber represented only about a third of the possibilities offered by the overall species cover in the national forest (Huygen, 1989). About 50% of harvested wood is undifferentiated species for firewood. Morocco has 15% of the world's cork forests, yet produces only 6% of world supply because of the low productivity of the trees. Potential timber production is estimated to be around 351,000 m^3 annually. The two major sources of timber supply, cedar and Aleppo pine, cover less than 5% of the natural forest. Cedar has a productivity of 1.19 m^3 per hectare; productivity of Aleppo pine is 0.62 m^3/ha. Other species could not supply more than 25,000 m^3 of timber per year. Artificial forests, 78% of whose wood production goes to the paper industry, could supply about 100,000 m^3 per year, an additional 30% of the total forest potential in timber. *Table 5.2* summarizes the annual potential supply of different types of wood and timber from Moroccan forests.

B. Other Forest Benefits

Since 1976, rural communities in forested areas have been given 80% of the receipts from official wood and timber sales. They also benefit from the remaining 20%, which is devoted to forest improvement. The value of other benefits accruing to these communities does not appear in the national accounts. Local residents gather firewood and timber for joint products, and forests are used for grazing and animal fodder.

Forests provide indirect benefits, difficult to quantify, to other groups and to the nation as a whole, such as their role in reducing soil erosion, providing habitat for wildlife and preserving unique species. The argan forest in southwest Morocco, for example, contains a unique and endemic species that resists the movement of sand dunes, to the benefit of adjacent agricultural plains where much of the nation's export crops are grown (Driouchi, 1987; 1989; 1990).

Morocco started a reforestation program in 1971, aiming to develop 20,000 to 25,000 hectares annually. The overall rate of afforestation has averaged 7.40% (ranging from 23% in major forestry regions to 0.33% in the east), leaving a shortfall of 131,000 hectares to date. An extra effort of 11,000 hectares per year is required to attain the planned objectives.

2. Marine Resources

With a coastline of almost 3,500 km along two international bodies of water, Morocco has access to the marine resources of the Mediterranean Sea (500 km) and the Atlantic Ocean (more than 2,400 km). The continental shelf off the coast ranges in width from 6 to 50 marine miles, providing an overall area of some 115,000 km^2 of prime fisheries (Lahlou, 1990). The coastal and deep ocean fish stock available to Morocco is evaluated at between 1.1 and 1.6 million tons. In 1988 coastal fishing employed 48,000 fishermen and supplied 350,000 tons composed mainly of pelagic fish; boats are produced in 16 ship-building units, with an estimated 200,000 m^3 total capacity in 1988. Deep ocean fishing uses modern technology with a total capacity evaluated at almost 25 million m^3 in 1988. Quantities and values of fish produced annually are presented in *Table 5.3*.

These figures show a smooth progression in annual catch with an improvement of unitary values. Ocean fishing had a higher contribution to the progression.

Total exports also progressed steadily, following the annual catch levels. *Table 5.4* displays exports of fish and fish-derived products (fresh and frozen fish, fish flour, fish oil, algae and others) from 1980 to 1989.

The figures show that although the export quantities of fish and fish products were stationary over 1980-1989, their values increased progressively. Local consumption absorbed the remaining portion of total supply. Domestic demand increased from 77,000 tons in 1980 to more than 154,000 tons in 1988, but remained low in terms of per capita consumption. Data on fish consumption showed regional variations even though marketing and distribution systems improved. The data were not comprehensive; small scale fishing activities are carried out in many places along the coastline, providing local supplies of fresh fish that are not accounted for in the national statistical system.

Direct employment in fishing grew from 31,239 in 1981 to 48,010 in 1988, with nearly as many indirectly employed (*Maroc Maritime*, 1990). This implies that the total number of fishing-related jobs were 92,160 in 1988, providing a living for about 20,000 families.

Almost all of Morocco's foreign trade is transported by sea, and marine transportation accounts for 37% of total transportation. The fleet of the public organization COMANAV, created in 1958, has grown from 20 vessels and a carrying capacity of 64,000 tons in 1972 to a current 59 vessels capable of carrying 534,118 heavy tons. There are 18 private enterprises in marine transportation, up from four in 1972. Operating outside Morocco, they transported 1.7 million tons in 1987.

Government maritime policies include a marine investment code, in operation since 1973, and several laws designed to enhance the economic efficiency of Moroccan marine resources. The Ministry of

Fishing and Marine Commerce, created in 1985, has been a major instrument in setting strategies and promoting the development of marine resources. Besides administrative and legislative divisions, the Ministry has three operating divisions in charge of fisheries, marine commerce, and international affairs and marine training. International agreements such as the one with the EEC form a framework to enhance mutual benefits between Morocco and the European Community.

VI – Evaluation of Economic, Agricultural and Food Policies

Before evaluating Morocco's food and agriculture policies, a review of how they are generated and how they have been implemented during the study period is in order.

1. Institutional Setting

Moroccan agriculture and food policies are mainly developed by the Ministry of Agriculture and Land Reform (MARA) in coordination with other ministries and public organizations. Policy proposals can be formulated at different levels in MARA or related agencies, but are subjected to technical, administrative and institutional review by national committees and parliament before adoption. Responsibility for implementation is generally given to a single agency, usually but not necessarily within MARA.

Policies can be adopted legislatively, but most agriculture and food policies come under the aegis of three- to five-year socioeconomic plans, and hence the Ministry of Planning plays an important role in their development. They are affected by legislated policy in the form of the finance law, which is established and voted by the parliament each year. The finance law sets the annual levels of the public budget revenues and expenditures, and proposes the means and tools to achieve those levels. The annual finance law appears then to be an important factor in implementing financial and fiscal policies over more than one year.

In the past, socioeconomic plans were primarily public investment programs and implementation timetables. The current plan 1988-1992 is different in nature, focusing on structural adjustments to the economy and presenting alternative incentive scenarios and growth trajectories. This change in the nature of the planning process has not transformed the usual policy review cycle for planning; however, structural adjustment programs depend more on the mechanisms of the finance law for implementation than do public investment programs. While the financial law has thus become an important policy tool since the early 1980s, the economic and social plan has continued to be a more valuable policy package.

2. Review of Prior of Agriculture and Food Policies

Policies for agriculture and food have been included in the various three- and five-year plans enacted since 1960. The first plan 1960-1965 was conceived shortly after independence from France as a set of structural reforms and mechanisms to change colonial organizations into independent Moroccan institutions, particularly in the economic and financial arenas. The primary agriculture policy was land reform to transform colonial ownership into Moroccan public and private property rights on agricultural land.

New options followed, beginning in 1965. The 1965-1967 plan emphasized agricultural exports and import substitution options, which were largely executed during the following five-year plan 1968-1972. The agricultural sector became consequently the major policy focus for international trade, the aim being to accumulate foreign currency from agricultural exports with which to finance agricultural equipment and food imports. The planned objectives were largely attained during those years.

During the subsequent plan 1973-1977, the emphasis on agriculture was expanded with the intent that it would become not only a major source of export earnings but also a prime source of national economic growth. To that end, public expenditures and investments for agriculture, particularly for large irrigation projects, increased dramatically. This plan, however, collided with unfavorable international events. The world price for phosphate, another important export, declined, and the prices of food imports increased. It was hard to meet the objectives of the socioeconomic plan.

This failure led to a new plan 1978-1980 which again emphasized food self-sufficiency and import substitution goals. Mechanisms to insure food security were developed with the 1981-1985 plan, including measures to improve agriculture in the rainfed areas as well as on irrigated land. Successive years of drought, however, prevented the realization of these objectives, and food imports increased. In summer 1983, a structural adjustment program was adopted and the five-year plan was discontinued.

The 1986-1987 period was one of transition, with uncertainties prevailing at all levels. Climatic conditions, world markets and the external debt were the main areas of concern that led to the adoption of a new planning option to be conducted in parallel with the adjustment program.

The main economic thrusts of the current 1988-1992 plan are export promotion, import reduction, and institutional and financial reforms to the national economy. Of the instruments proposed to attain the planned objectives, two sets have been implemented in conjunction with the International Monetary Fund and the World Bank. One set is aimed at fiscal reform of the public sector, increasing government revenues and decreasing expenditures to balance the national budget, and includes the introduction of a value-added tax, a salary freeze for government workers, and reductions in subsidies and public investments. The other set, comprised of currency devaluations and trade barrier reductions, has been undertaken to reduce Morocco's financial imbalances and debt burden by enhancing exports and reducing imports.

3. Evaluation of Agricultural and Food Policies

To ascertain whether agriculture and food sectors have been affected by aggregate policies, two sets of tests were conducted. The first set analyzed the macroeconomy, differentiating between the structural adjustment period 1983-1988 and previous policy periods. The second set examined the impacts of specific mechanisms and policies designed for the food and agriculture sector.

A. Aggregate Policies and Macroeconomic Effects

Using regression techniques with a dummy variable to compare public finance effects before and after 1983, it appears that both total revenues and expenditures have increased during the structural adjustment period. Capital investment has been reduced, but so also has the total deficit. Structural adjustment policies have reduced foreign financing and increased the use of cash bills. Their impact on monetary expansion has not been significant. These results are presented in *Table 6.1.*

In applying the same procedure to macroeconomic prices, exchange rates appear to have been affected by structural adjustment policies. This is consistent with the devaluations carried out after 1983. The effects are better captured in the following relationship (ER = real official exchange rate):

$$ER = \underset{(-5.11)}{-0.13\ DUM} + \underset{(79.80)}{0.95} \quad (R2 = 0.50)$$

indicating that the exchange rate depreciation has averaged 13% annually. Neither aggregate nor component inflation rates appear to have been affected by structural adjustment policies. In fact, current inflation rates seemed to be more related to past inflation levels than to current policies (represented by a dummy variable in *Table 6.2*).

The equations demonstrate a stationary behavior for the general inflation rate and its housing component, while other components showed constant inflation rates. None of these variables have been affected by the post-1983 structural adjustment policies.

Among other macrosectors of the economy, interest rates have generally not been affected, with the exception of rates applied to loans for non-cereal crops. Non-agricultural imports have risen since the institution of structural adjustment policies, implying a slight increase in total imports. Agricultural imports have followed past patterns and have not been affected by structural adjustments. Exports have not shown any improvement and have not been affected by post-1983 policies. This implies that the trade balance has continued to deteriorate regardless of structural adjustment policies in the years considered.

B. Specific Policies and Effects on Agriculture and Food

The structural adjustment program contains several objectives that affect the agricultural sector. Among these are: a) maintaining the existing infrastructure, b) funding projects with high returns, c) opitimizing resource allocations via the pricing system, d) rationalizing the roles of public and private sectors, and e) increasing the role of the Ministry of Agriculture in planning and preserving natural resources. A variety of actions were to be taken after 1985 to achieve these objectives. On the agricultural input side, a 90% increase in the charge for irrigation water was to be instituted before 1989, and fertilizer subsidies were to be eliminated and marketing liberalized by 1989. Other envisioned actions include increasing cereal storage margins by 30%, reforming the cereal subsector, and liberalizing veterinarian services.

To evaluate the effects of structural reforms on agriculture and food policies, five agricultural subsectors, cereals, food legumes, sugar, vegetable oil and agricultural exports, were selected for further analysis.

Cereals. Among the cereals grown in Morocco, soft wheat has been historically the major target of both producer and consumer price policies. As described in Section IV, the government sets both prices. Prior to 1984, producer prices were announced at harvest time; since then the price has been set at the time of planting, which should allow producers to make more rational resource allocation decisions. Before 1985, consumer prices for soft wheat flour were maintained constant in nominal terms, implying a real price decrease and consequently larger subsidies by the public treasury. The development of two differentiated flours has since lessened subsidies on flour consumption.

At least three interest groups, consumers, producers and the public treasury, are thus affected by soft wheat policies. Consumers can be expected to oppose any price increase. Producers seek higher prices to overcome production cost increases and management inefficiencies while maintaining profits. The public treasury, under pressure by both groups, is mainly interested in minimizing expenditures on subsidies, and might consequently turn to soft wheat imports when world market prices are low, thereby contravening MARA's ongoing agricultural policies. The Ministry of the Interior therefore has many interests to balance when setting soft wheat prices.

These different interests were analyzed using official soft wheat price data. It was found that over the 1960-1987 period, soft wheat pricing policies were mainly targeted towards consumers, with the public treasury and producers ranking second and third. This is consistent with the maximization of social welfare function, based on the expected consumer, producer and government surpluses with neutrality towards risks from world prices and the domestic supply of soft wheat.

Furthermore, official pricing policies appeared to have been based on previous official prices and current world prices. Consumers therefore also benefited from naive expectations of future world market prices. More rational expectations might have led to other rankings and induced changes in grain policies.

With the advent of structural adjustment policies for agriculture, cereals were the first commodity to be considered in policy reforms. On the production side, the overall channel was reviewed in order to locate sources of inefficiencies. On the consumption side, the cereal project focused on the flour and the milling industry in order to evaluate gainers and losers from ongoing policies. Subsidies on soft wheat were regarded through the constraints created by the rationing system imposed on flour mills.

Among the structural reform actions in this sector are the elimination of subsidies on domestic flour by 1990, after increasing the extraction rate to 80% and establishing quotas among millers; the elimination of price and quality controls on all other flours before 1990; the liberalization of trade in cereals by replacing quotas with a tariff regime; and liberalization of domestic transactions in grains and flour.

Food Legumes. Food legumes were important export commodities from 1960 to 1980, when Morocco produced, at competitive world market prices, a surplus over domestic needs. This competitive position has since eroded. Production has declined in the rainfed agricultural regions, which have been adopting a crop rotation system between cereals and food legumes, and competitive alternatives exist in more favorable climatic zones. Furthermore, even where food legumes are grown for lack of other alternatives, the cost of production appears to be increasing, thereby implying a relative reduction of the Moroccan competitiveness with other countries (Driouchi, 1991).

On the consumption side, domestic consumption of food legumes was low compared to other commodities during the study period, meaning that domestic demand was more driven by population growth, price and income effects, and excesses could be exported. As foreign markets diminished and competitors and substitute crops grew, food legumes appeared to be relatively costly to develop. This rationale has led to high prices on the domestic markets. In recognition of this, MARA proposed dynamic marketing policies for food legume surpluses, and a research and development project has been designated to begin in 1992.

Vegetable Oils. Since 1972, oil seed production has been controlled by a public organization which sets production quotas, provides almost all inputs, including imported seed, and purchases the harvest at a fixed price. The processing industry also plays an important role in the subsidized retail price to consumers. This system has led to increased government expenditures.

The production of olive oil, the traditional source of vegetable fats, is segmented. Small producers and processors supply domestic consumption, at fluctuating prices since good olive harvests are biennial. The more stable production by large modern farmers and processors is mainly for export of olive oil, and exporters purchase from small producers only when domestic prices are low.

Olive oil prices are set by free market forces, whereas vegetable oil consumption is mainly driven by domestic production and oil seed imports, with price subsidies at the retail stage. This dual mechanism affects the quality and prices of different types of olive oils in the domestic market. If supply can be increased, domestic prices can be depressed and a larger flow of exports can be created, whose earnings could cover oil seed imports and induce appropriate adjustments in the domestic production of oil grains. To encourage increased production of olive oil, a policy to promote the planting of olive trees was announced in 1986. Other actions undertaken in this area have mainly consisted in liberalizing industrial and commercial mechanisms related to vegetable oils and setting a methodology for producer price fixation. This methodology should account for world prices and a tariff.

Sugar. Sugar has been a major target of self-sufficiency plans in Morocco because the difference between domestic supply and high domestic demand must be imported. The problem with this commodity is that it requires large amounts of support from the public treasury, both in capital investment in irrigation projects (sugarcane and sugar beets are mainly grown in irrigated areas) and sugar processing plants, and in the subsidies that pervade the entire channel from farmers to processors to consumers. Attempts to reduce this burden would in all likelihood cause domestic production to decline and domestic consumer prices to rise. On the production side, farmers would have fewer incentives to grow sugar beets in regions such as Tadla and Doukkala, even though they have been involved in controlling sugar quality. Furthermore, according to AIRD (1986, 1988), some sugar mills are economically inefficient, producing at very high costs compared to world prices. On the consumption side, any increase in sugar prices might be opposed by urban consumers and might induce social problems.

This is a very old debate in Morocco. When it was a protectorate, the French administration opposed domestic production of sugar, arguing that Morocco lacked a clear comparative advantage in the commodity. The opposing argument was that, given the high level of domestic demand, local production would reduce the dependence on France, which controlled the main sources of world supply. With Morocco gained independence, domestic sugar production became a major political goal. Large scale irrigation was promoted in order to enhance national self-suffiency in food, including sugar. According to Horton (1985), local raw sugar was cheaper than on world markets in some years and more expensive in others. Horton also showed that world prices were affected by government interventions in producing countries, and were generally lower than would have to prevail in order to insure profits to EEC sugar producers. For Morocco, the study concluded that it would be rational to account for world prices in order to manage the economic issues related to sugar production, consumption and imports. It also recommended that the sugar subsector should not be expanded and not benefit from further public investments, and that major efforts should be oriented towards improving the economic efficiency of existing processing plants in order to reduce the social costs imputable to this commodity.

Under the current mandates of structural adjustment and reduced public expenditures, only one possibility is offered. It consists in reducing government subsidies on the production side in order to enhance productivity at all levels, including irrigation organizations, farmers and sugar mills. This option should

account for the various interests operating in the domain. The continued participation of public organizations and bureaucrats who control the stages of sugar production should be justified on economic grounds. The interests of sugar producers, faced with pressures to switch to other, possibly more profitable, crops, should be addressed, as well as the concerns of merchants and intermediaries who benefit from the current sugar processing and distribution system. Finally, consumers in general, who pay taxes through sugar prices in order to finance public investments, are very sensitive to increases in the price of sugar.

Large investments have already been made in domestic sugar production. Without expanding this effort, it appears important to manage public and private interests rationally in order to reduce the social costs of sugar. Such is also the case for sugar imports, which should be implemented by managing excess demand in ways to reduce the costs to the economy. The practical actions to be taken in these directions would consist in maintaining the current capacity of sugar processing plants but prohibiting the expansion of mills operating at less than 100% of capacity, and setting unique prices and margins for all processing units. Charges to the government could be decreased by privatizing some units, enhancing the economic performance of each sugar mill and reducing public expenditures. Eliminating consumer subsidies and liberalizing the sugar sector would be considered at a later stage.

Dairy and Meat. Milk and dairy supplies have benefited from improvements in the production of forage and animal feed, and improved animal selection and breeding. The dairy processing industry is highly concentrated, with fixed prices set annually at the production stage, and until 1987 the public treasury also subsidized the price of certain animal feeds produced by sugar and flour mills. Morocco is now self-sufficient in milk but not in butter and derived products. Planned structural adjustments in this subsector include the production of UHT milks, the elimination of seasonal milk price variations for producers (AIRD/MARA and Agroconcept, 1990), and the elimination of consumer price controls on milk.

Except during prolonged drought, Morocco has also been self-sufficient in meat production, although retail prices have increased dramatically during the past few years. The structural adjustment program may have affected this area through reforms in other sectors; reform-induced price increases in animal feed could be expected to increase production costs for milk and meat. Furthermore, as public services have been turned over to local communities, it has been necessary to increase marketing taxes applied to animals and other locally managed transactions. Structural adjustment should continue to affect animal production. The actions to be executed include liberalization of veterinarian and artificial insemination services.

C. Policy Effects on Agricultural and Food Exports

Morocco has a comparative advantage for vegetables, fish and citrus in world trade. The major recent changes in this sector are mainly exogenous to Morocco, relating to European Economic Community (EEC) reforms since the early 1980s. With the expansion of the EEC to Spain and Portugal, which are competitors in Mediterranean fruits, Morocco has faced growing institutional and technical constraints in exporting to Europe. It has been difficult to develop new markets outside the EEC due to transportation costs and non-tariff barriers in potential markets such as the United States, Canada and Japan. The analysis of agricultural export processes in Section IV indicated a stationary trend *(Table 38).* Nonetheless, exports of citrus and vegetable products increased from 1990 to 1991, citrus by 53% (*La Vie Economique*, December 1991), and exports of fish increased by 233%.

Structural reform in the agricultural export sector has consisted in allowing agricultural exporters to operate outside the public export monoply (OCE) since 1985. Macroeconomic reform measures elsewhere are also assumed to have enhanced exports and returns to producers.

D. Other Policy Instruments

In addition to commodity-specific policy instruments, measures designed to reform the overall economy have also had ramifications in the agricultural and food sectors. Mechanisms to reform input pricing policies, emphasizing market mechanisms instead of public pricing, have been applied in the cases of animal feed and fertilizer. In agriculture, the rationalization of public services has resulted in the transfer of some local extension services to the private sector and farmers' organizations. Regional agricultural

groups are being promoted to address agricultural development and farmers' interests, and the public sector roles is becoming that of research, innovation, development, extension and coordination. IBRD (World Bank) financial credits have been obtained to support a national agricultural research system, linkages to diffuse new technologies, and a national extension system to respond to farmers' needs. Training in agriculture has been expanded at primary and secondary levels and extended at the university level, in order to enhance the technical abilities of trainees and increase the practical experience of students.

Such reforms, although ambitious, may not always be appropriate to the intent of the new policies. For example, it is not appropriate to substitute a private monopoly for government intervention, yet this was the case when fertilizer was privatized in 1989. It would have been more appropriate to promote new enterprises before reforming fertilizer pricing, since otherwise, a few organizations can set higher prices. Also, a single farmers' organization, such as the apple growers in the Meknes region, cannot attain the same achievements as a public institution unless many competing groups of farmers are formed in different regions.

General fiscal policy instruments also affect the food and agricultural sectors. Local organizations and communities involved in regional development are entitled to a large share of revenues generated by the new value-added tax, and much of the revenue from a specific sector is turned back to that sector; thus, for example, revenues from the sale of wood and timber are allocated to developing and preserving forests and forestry.

Other instruments of reform include the elimination of agricultural taxes by the year 2000 and the creation (in 1986) of an agricultural development fund which coordinates and allocates resources to agricultural producers. The objective of this fund is to develop agriculture while reducing public financial support of production units (Akesbi and Guerraoui, 1991). Reforms are also underway to induce higher performance in marine resources, a sector which has been subjected to many public interventions.

E. Direct and Indirect Policy Effects

In their study of 18 countries, Krueger, Schiff and Valdes (1988) showed that most developing economies discriminate against their agricultural sectors. This conclusion was based on the authors' estimates of the impacts of sector-specific (direct) and economywide (indirect) policies on agricultural incentives. Direct effects were measured by the proportional difference between producer and border prices. The measurement of indirect effects had two components: the impacts of the unstainable portion of current account deficits and industrial protection policies on real exchange rates, and thus on the price of agricultural commodities relative to non-agricultural and non-traded goods; and the impact of industrial protection policies on the relative prices of agricultural commodities. For most of the nations in the study, it appeared that the direct effects were equivalent to a tax on exportable goods and a subsidy on importables, and the effect was to stabilize domestic producer prices. The indirect effects were equivalent to a tax on agriculture; indirect effects exceeded the direct effects. The authors estimated, for example, that Moroccan soft wheat, an import substitute, encountered direct impacts of -7% and indirect impacts of -12% during 1974-1979. Direct impacts disappeared for the 1980-1984 period, and indirect impacts dropped to -8%. Total impacts for 1974-1979 were thus -19%, declining to -8%, due entirely to indirect impacts, for 1980-1984.

The objective of this section is to capture direct and indirect effects on other agricultural commodities, plus forest and marine resources, based on the data analyzed earlier in this monograph.

Agricultural and Food Commodities. From the nominal protection coefficients displayed in *Table 4.8*, it appears that agricultural commodities experienced direct price effects in 1984. The nominal protection coefficients (NPCs) ranged from 1.10 to 1.77 for import substitutes (soft wheat, sugar beets, sugarcane, sunflowers and cotton), and from -0.85 to -0.90 for export crops, indicating that prices for both import substitutes and export crops were depressed by direct agricultural policies. Commodities such as barley, maize and olives had small NPCs, implying that they also were under the effect of direct policies.

To estimate the indirect effects of macroeconomic policies, this study considered exchange rate effects, import tariffs and quantitative restrictions to protect industry. Using the exchange rates together with data on supply and demand for foreign currency and with tariffs at 20% and export taxes at 10%, it was pos-

sible to estimate equilibrium exchange rates for the period 1980-1986. The results show that prevailing real exchange rates were overvalued at levels ranging from 9.78% to 36.47%. These figures permit an evaluation of the indirect effects of protection and exchange rate policies for the reference year 1984. *Table 6.3* summarizes the direct, indirect and total price effects for different agricultural commodities. The same approach was used for the period 1969-1988 based on data gathered for this study, but export crop prices could not be included for comparison with *Table 6.4*. These results are presented in *Table 6.4*.

Table 6.3 shows both direct and indirect taxation schemes tended to impose negative protection on export crops. The coefficients for navels and clementines (citrus) best express the magnitude of the negative protection. Other commodities such as barley were also directly and indirectly taxed through pricing and macroeconomic policies. Colza was highly protected through price policies and indirectly taxed through macroeconomic effects; the net effect was protection for this commodity. Olives grown under rainfed conditions were taxed relative to the same crop produced under irrigation. All other commodities appeared to have been protected even though some showed negative direct effects. The import substitute commodities (sugar, sunflowers and cotton) showed positive direct and indirect effects; the indirect effects of macroeconomic policies were higher than the direct effects of agricultural pricing mechanisms. The picture, although painted for a single year, demonstrates how prevailing policies discriminated among export and import substitute crops. *Table 6.5* shows how this pattern changed over the study period.

The table shows a general pattern of declining rates of indirect taxation in the earlier years, a shift to protection in the late 1970s to mid-1980s, and increasing rates of protection thereafter. The shift occurred earliest, in 1975/76, for sunflowers, followed by sugar beets in 1976/77; hard wheat, soft wheat and rice in 1979/80; maize and sugarcane in 1983/84; and barley in 1984/85. Milk showed an insignificant decline from the constant and stable indirect taxation effect of 99% in the 1970s. Cotton showed increasing rates of protection through the entire period.

The general pattern was consistent with Kreuger, Schiff and Valdes's findings of discrimination among agricultural commodities, mainly between import substitutes and export crops. While the latter were taxed at similar rates to purely domestic commodities, the former were heavily and progressively protected. Furthermore, protected commodities were those under price fixation mechanisms (albeit adjustments were in place at this stage), while taxed commodities, except milk, were those with prices set by the market.

These findings also appear consistent with the long-run effects of agricultural policies that favor irrigated agriculture over rainfed agriculture. This conjecture can be bolstered by the findings in *Table 6.6* (other data do not discriminate between rainfed and irrigated agriculture, except for industrial crops), which show that rainfed olives and barley were still taxed in 1984.

The remaining question is to ascertain whether the agricultural sector as a whole is taxed or protected, hypothesizing that taxation through macroeconomic policies might be expected to decrease with the implementation of structural adjustment policies since 1983. A first-cut attempt to answer this question can be made by comparing the area under irrigation with the area in rainfed agriculture, with livestock and export crops being added to the rainfed area. Indirect price effects were regressed on a dummy variable taking the value 0 for years before 1983 and 1 thereafter. The results for ten agricultural commodities are presented in *Table 6.5*. All the estimated coefficients showed positive impacts, that adjustments increased the protection of the goods under consideration. Cotton and sunflowers were the most affected, followed by soft and hard wheat, sugar beets and sugarcane. The lowest impact was on two types of milk. There was a significant decrease in the taxes on maize and barley, indicating they may therefore become protected.

Forest and Marine Resources. The same methodology was used to capture the direct and indirect price effects on wood produced by Moroccan forestry activities, and the indirect price effects on fish harvested by the Moroccan fishing industry.

Table 6.6 displays the price effects on various wood categories. The results showed negative direct and indirect price effects, with high amplitudes of taxation. Taxation ranged between 0.13 and 0.24 from indi-

rect effects and was 0.20-0.22 from direct effects, implying total effects approaching 50%. Both direct and indirect effects decreased through the study period, implying total levels of taxation above 40% in the 1970s and below 40% in the 1980s.

Table 6.7 displays the indirect price effects on fishing. Only indirect price effects were modeled; to do so for direct effects would have required using more appropriate border prices, since Morocco is a net exporter of fish.

For three types of fish, indirect price effects appeared to be negative, with magnitudes ranging from 22% to 25% over the period 1980-1988. This implies high levels of taxation, assuming that, as Morocco is a net fish exporter, nominal direct price effects would be negative. The amplitude of taxation decreased over time.

Both forest and marine resources, as represented by wood and fish, appeared to be taxed at high but progressively decreasing rates during the period under consideration. Similar trends were found for rainfed agriculture, but not for irrigated crops. It could thus be concluded that Morocco has been taxing most heavily the flow of goods obtained from its natural resource base. Such policies could be seen to favor conservation of natural and biological resources, however, since price depression leads to lower harvests in order to insure profits.

Direct, indirect and total effects for woods were regressed on a dummy variable which differentiated between pre- and post-1983. The outputs, displayed in *Table 6.8*, imply that structural adjustment programs were the main mechanisms reducing taxation, although with negative constant terms and low rates of decrease, this reduction may not have been apparent in the initial years of implementation. Category PSC1 wood was most sensitive, followed by PSC2, PSC3 and PSC4. For the average of the wood categories (PSCM), the indirect effect showed an 11% rate of tax reduction and a constant of -0.22. The direct effect was 2%, with the same constant. Thus the implementation of structural adjustment policies had more influence on indirect price effects than on direct effects in the forestry sector.

The same methodology was applied to estimate the impact of adjustment policies on indirect price effects for marine resources. The outputs displayed in *Table 6.9* show that coastal benthic fishing (CBF) was the most sensitive to the implementation of the new policies, followed by industrial coastal fishing (ICF). High sea fishing (HF) was not affected by structural adjustment policies, maintaining an average taxation level of 24%.

These studies indicate that implementation of adjustment policies reduced the indirect effects on forestry and fishing (except high sea fishing). Decreases in taxation would be expected to increase the rate of harvest, implying less conservation of forest and marine resources, although the situation should not lead to further degradation in cases where taxation was shifted to protection (positive total effects). Among agricultural commodities, structural adjustments appeared to have high impacts by increasing protection on import substitutes and decreasing taxation on local domestic commodities.

These findings suggest that capital investments should be concentrated on irrigated agriculture rather than on rainfed agriculture, forestry or marine resource industries. In fact, human and physical capital might be removed from the latter sectors. Such trends underlie population migrations from rural and rainfed areas to cities.

VII – Implications for Economic Research

This study has raised important issues concerning an agricultural economy where self-sufficiency has been a consistent goal and where major imbalances have led to the adoption of more liberal orientations. Due to the lack of data, particularly of relevant disaggregated cross sections, some of these issues could not be adequately addressed. The information would have been useful in testing hypotheses related to further effects of structural adjustment programs. The reforms have not yet been fully implemented, and economic research has a large role to play in monitoring and guiding the process toward greater economic efficiency in agriculture, food and natural resource utilization.

1. Supply Side

In the absence of other alternatives available to farmers, it appears that publicly supported agricultural commodities expanded in area during the government interventionist era. Investment in infrastructure, particularly irrigation systems, and development of pricing instruments were important policy tools.

Pricing mechanisms seem not to have had instantaneous impacts on supply in most commodities studied, although that may be the expectation when price levels are set. Supply lagged price in the cases of sugar beets, sugarcane, sunflowers, cereals and milk. Cotton was the only commodity in the study whose price instantaneously affected the supply level. Milk production, although under the prevailing price, was also affected by its first- and second-year price lags. Fertilizer prices (and hence fertilizer policies, since the government set prices) had a major effect on supply of hard wheat, maize and sunflowers. Without more disaggregated data to test related hypotheses, this first set of supply side results seems to contradict the self-sufficiency argument.

These findings also imply that technological improvements had low impacts at the aggregate, a hypothesis confirmed through analyses of crop yields and dairy and meat herd sizes. Why were agronomic research outputs not totally expressed by the aggregate data? How are they expressed? Why did the accumulation of human capital in agricultural universities and research centers have no significant impact on agricultural output? Public and private institutions have been accumulating credits in the areas of agronomic research and human capital formation since the early 1960s; each year new crop varieties are introduced and many highly trained scientists are added to the list of potential agricultural researchers. Is it a matter of efficient use of the available human capital and techniques, or is it related to difficulties in applying theory and technology to Moroccan agricultural realities?

There are a few signals coming from private agricultural enterprises where the use of imported techniques appears to have been the main reason for increased returns to land and capital. Such businesses operate under imperfect conditions, so their signals may not be appropriate for formulating useful research hypotheses; however, some export crops and commodities that are not under intervention schemes have also performed relatively better even though prices were controlled by official marketing boards. The mismatch of poor crop performance and high applications of technology and human capital seems to reside among import substitutes and local commodities. This suggests that either the technologies in use, are unsuited to most agricultural endeavors in these subsectors, a hypothesis that has been implicit in implementing the 1986 extension plan. The plan's goal, to enhance farm profits by diffusing agricultural technologies and improving farmers' skills and knowledge, has been implemented through a rural education program making extensive use of audio-visual techniques. While the data are not yet available to do a formal and statistical evaluation of results, general evidence suggests that the program has certain weaknesses. The information it provides appears to be too general, and farmers often seem to have a better sense of what works locally than do the extension technicians and their broad-scale recommendations. Also, cost/benefit evaluations of recommended technologies have often been done for only the short term, not accounting for medium-, long-term or indirect effects, and farmers seem to be relatively more aware of these ramifications. Therefore, why does the official extension system pretend to operate mainly in the domains of import substitutes and local agricultural commodities? It is clear that the system has little interest in export crops, fruits and vegetables. Does this mean that diffusion and extension programs are means to promote the acceptance of controlled crops and agricultural commodities among farmers? Or is the extension program mainly for societal purposes, to insure minimal returns to small farmers and thereby alleviate rural poverty? We have no direct answers to these questions.

All existing signals emphasize the need to free markets and minimize market imperfections in order to encourage farmers to adopt high-profit commodities and technologies. The exceptions may be sunflower and other vegetable oil crops, due to their high official prices, but the side effect of lowered soil fertility should be taken into account when evaluating programs that promote these crops. All the other commodities being promoted are outside official intervention mechanisms. Crops like bananas (developed under a high tariff system without further intervention) and food vegetables are very significant cases where all economic agents involved in the channel can become dynamic adopters if returns are insured.

Thus, in addition to the gaps in our understanding of Morocco's overall agricultural economy, there is a large set of relevant microeconomic and sector-specific issues needing further research. The entire

channel from farmer to consumer in Morocco should be better understood in order to enhance the economic efficiency of agriculture. Research on commodity-derived products could help guide development in the industrial sector. The medium- and long-term effects of agricultural technologies should be explored before innovations are recommended for adoption, and Morocco's natural resource base should be better characterized so that future development takes place in an ecologically sound manner.

To help guide liberalization reforms, research on agricultural production conditions and the level of competition in the food processing industry is needed. It is also important to design economic means to promote research and development efforts in new agricultural products and in processing, packaging and marketing techniques, as means of enhancing competition in the agricultural sector.

Baseline studies of Morocco's natural resources and ecology are vitally important. A thorough understanding of prevailing conditions is necessary to every aspect of research in agriculture and natural resource extraction. This is a dimension which should remind researchers and developers of the danger of short-sighted actions for immediate returns and short-term productivity. We do not know all the ramifications of the intensive use of soil coupled with heavy applications of water, fertilizers and pesticides in Morocco, for example. Soil degradation from erosion and salt accumulations may, over the long run, increase the cost of farming. The development of wells, while administratively and technically encouraged, may have lower long-term benefits as water use charges increase (Ambri, 1990). Such increased production costs would be expected to increase agricultural output prices and decrease the nation's comparative advantage for its traditional export crops.

We do not know all the costs and benefits of preserving or harvesting natural forests, of converting forests to cropland, or of using forest land for grazing. Ongoing economic research is needed to assess the direct and indirect costs and benefits to society of these actions. The case of the argan forest in southwest Morocco is instructive. The forest is a unique and irreplaceable natural resource, and its trees are particularly able to stabilize the sand dunes that might otherwise overrun a major vegetable and fruit producing area some distance away. Preservation of the forest therefore could be considered to confer benefits on society as a whole and on certain segments of the economy. Private farmers in the immediate vicinity of the forest, however, may accrue benefits (possibly only in the short term) by cutting the forest. With the development of irrigation through canals and wells, they would have more land to cultivate, and they might increase pesticide costs since the forest hosts *ceratitis capitata*, the Mediterranean fruit fly. Such competition among resource uses exists in many regions of Morocco. It is important to develop economic cost/benefit models that focus on these issues, including the externalities, in order to set a rational basis for social and individual actions.

In summary, risk, uncertainty and the dynamic nature of farming and natural resource management require more focus on suitable economic models of supply at both the macroeconomic and microeconomic levels.

2. Demand Side

Data on domestic demand for agricultural commodities is available from budget/consumption surveys conducted every ten years since 1960. The results of analysis for this study showed that many agricultural commodities behaved at the aggregate as if they were normal goods. With a growing population and subsidies on many consumer staples, demand for food increased steadily. Further research on a disaggregate basis is needed to expand our knowledge of food consumption in Morocco.

Signals in this and other studies indicate that consumption patterns may differ between the urban and rural segments of the population. Production and consumption are integrated for many rural residents (Driouchi and Rafsnider, 1989), and it is known that urban and rural populations consume cereals of different types and in different proportions. The quality and variety of foodstuffs in household budgets may also differ. It has been shown that the time spent in food preparation differs between urban and rural populations and among family members (Driouchi, El Kasmi and Bouhima, 1991). This could be a source of implicit and explicit revenues for many consumers.

The precise dimensions of all these differences have not been well delineated, and detailed analyses would enrich our overall understanding of food consumption patterns and the true determinants of

demand. There is room for further economic analyses in the decennial household budget surveys. Although not substitutes for refined investigations, the results could be presented as sets of microeconomic analyses that permit reaggregation in useful ways—by region, by commodity group, or by population segment, for example. Data collection and analyses could be a joint effort between ministries, research centers, and universities.

Economic studies on consumption should be precursors to government reform projects. The cereal project, for example, aims to liberalize the cereal sub-sector. To do so, the current state of cereal marketing and milling should be thoroughly understood. Millers currently produce two types of flour in order to take advantage of both market liberalization and government subsidies. How does this segmentation affect flour consumption by various population groups? The substitutions and complementarities among cereal products need more definition. Another example relates to food legumes. Because consumption of these commodities is low, research to propose new derived products has been neglected (Driouchi, 1991).

Research on the interactions among foodstuffs could lead to better predictions of the demand for specific items; both imports and exports could then be better managed. Research on environmental issues such as the chemicals used in pesticides and food processing/preservation could lead to better regulation of the quality of the foods available in the market.

3. Marketing and Trade

The results of this study indicate that public intervention in agriculture has led to social inefficiencies that cannot be alleviated easily while markets are imperfect. Economic research is needed to clarify the socially optimal institutional setting for various types of goods. Some purely public goods should perhaps remain the responsibility of government even if private agents could be chosen to manage them. Purely private goods and services can be considered to be most efficiently provided by individual entreprises only if perfect competition is assumed. These two extreme cases point to relevant questions for research as well as the tools required for institutional development. What institutions would best support the provision of both public and private goods in Morocco? What market imperfections currently exist, and how can they be overcome? What types of risk are faced in different market segments? Market risk and imperfect or missing markets may be important dimensions to consider when proposing new investment opportunities.

With regard to trade, more research and analysis of Morocco's comparative advantage in the world market is needed. This requires data bases and analysis of different components such as transportation, exchange rates and prices.

VIII – Summary and Conclusions

The objective of this study was to characterize Moroccan agricultural, food and natural resource policies implemented during the last twenty years. In this process it was possible to distinguish clearly the effects on these sectors of the two major public policy sets that have guided economic development since 1970: the interventionist set by which the government was the major investor and most dynamic economic agent, dominating supply, demand and marketing until 1983, and the ongoing policies of structural reform and economic liberalization that have come to the fore since then. Privatization, liberalization, undervaluation of the currency and private investment are becoming consistent goals of government ministeries. Decentralization and the reduction of public expenditures and subsidies are becoming important tools. Foreign debt has also been an important factor in economic policies in that debt restructuring and new loans have been contingent on the adoption of structural reforms.

The study concentrated on analyzing the nature and magnitude of the time series available through the official data reporting system; hence most of the results cover the period 1969-1989. Overall economic and demographic trends were included in order to comprehend the environment in which the Moroccan agriculture, forestry and fishing sectors operate. Forests and marine resources were also included in the study as examples of renewable natural resources. The major emphasis, however was on the supply, demand and marketing of agricultural commodities. The effects of various reform instruments were cap-

tured in analyses of domestic marketing and trade, and simple hypotheses concerning the type of effects were then tested. Among the features derived in the process, aggregate behavioral parameters integrating public and private agricultural and food decisions were stressed.

The results of this study can be used as a basis for a sectorial computable equilibrium model or for multimarket modelling. Directions for other economic research efforts were also outlined. They include suggested topics for analysis in the macroeconomy, the microeconomics of the agriculture, food and natural resource subsectors, and the interactions among them. The need for research on medium- and long-term effects of policy alternatives was emphasized.

Characterization of the supply side was conducted in three ways. The first consisted in describing the overall environment for agriculture and food. Macroeconomic conditions were important factors to explain the structure in which farmers, processors and merchants operate. The second consisted in analyzing trends in agricultural production. Here, a major finding was that no significant overall improvement has occurred in aggregate supply. The third type of analysis was the identification of factors which might have affected supply of different agricultural commodities, and indicated that economic policies and programs during the interventionist era contained biases against rainfed agriculture, marine resources and forestry (with implied conservation effects), and that agricultural import substitutes appeared to be more protected than export and local crops.

On the demand side, the demographic factors affecting demand were described in the first part of the document, and major aggregate results obtained through budget consumption surveys were presented. Estimation of demand equations for major agricultural commodities was carried out at the aggregate level, and price and income effects were identified for most of the goods considered. Price behavior, inflation, and standard of living indicators were analyzed in order to identify likely effects of inflationary trends on consumers.

Trade and marketing received less attention in this study because there is a large body of literature elsewhere covering these topics. The major contributions in this document are analyses of margin formation between wholesale and retail levels and of the ramifications of government intervention. Trade in agricultural goods and food during the study period appeared to have been under the dual influence of local prices and exchange rate regimes. While food imports increased steadily, exports followed a constant pattern. This was due to increases in excess domestic demand for food items in Morocco and the constant supply of exportable agricultural items, coupled with import reductions imposed by the EEC, whose member nations were traditionally the chief market for Moroccan exports. In the 1990s, attempts are being made to develop new markets in North America, Asia and Japan. These efforts should increase the nation's agricultural exports.

Fruits, vegetables and livestock were included in the study as examples of free markets where many economic agents intervene. Contrary to what is commonly assumed, merchants and speculators appeared to play considerable roles in supplying these commodities year-round. They compensated for their risks by paying lower prices to farmers and colluding in order to increase profits.

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~ Appendix ~

List of Tables