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ABSTRACT

In this study, a dynamically recursive general equilibrium model of Morocco is used to examine alternative trade and domestic policy scenarios involving the implementation of the EU Association Agreement for the period 1998-2012. The model has a detailed treatment of the agricultural and rural economy in Morocco. The results for the trade liberalization scenarios indicate that tariff unification has small aggregate effects whereas the removal of non-tariff barriers has strong positive aggregate effects: factor incomes and household welfare expand considerably more rapidly than for the base. However, trade liberalization disfavors the rural poor, especially in rainfed areas. We simulate the introduction of complementary domestic policies with a non-distorting transfer program that fully compensates the owners of rainfed resources and skill upgrading for the rural labor force. The results indicate that, if combined with at least one of these complementary domestic policies, trade liberalization can lead to a win-win outcome: the welfare of all household groups increases significantly more rapidly than if status-quo policies are followed.

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1. INTRODUCTION

Morocco is about to start implementing an Association Agreement with the European Union (AAEU) at the same time as the country adjusts its trade policies to conform to WTO rules. A major policy question facing Morocco's policy makers is whether and to what extent they should pursue additional unilateral trade liberalization. The aggregate impact of a carefully formulated program of trade liberalization is likely to be positive. However, like other major changes in economic policy, it may have very different effects on different segments of the population. Given that Morocco's agriculture currently enjoys substantial protection, additional broad-based trade liberalization is likely to have a detrimental impact on rural households, including the bulk of the poor population. This means that policy makers may consider the introduction of complementary domestic policies that compensate those who lose from changes in trade policies. In the absence of such policies, the political feasibility of significant agricultural tariff cuts is questionable.

In this study, a dynamically recursive general equilibrium model of Morocco is used as a laboratory for analyzing alternative policy scenarios for the period 1998-2012. In order to focus on agriculture and issues of poverty, the model distinguishes explicitly between rural and urban activities and households. It has a relatively detailed treatment of agricultural and other rural production, the labor market (disaggregated into skilled and unskilled), and households (disaggregated into four types: rural poor, rural non-poor, urban poor, urban non-poor).

The basic simulation scenario assumes gradual implementation of the EU partnership without additional bilateral changes in trade policies. The first set of simulations investigates the impact of alternative scenarios for unilateral trade liberalization. In the second set of simulations, we simulate the impact of a maximum unilateral trade liberalization scenario in combination with two alternative domestic policy changes, increased rural education (enhancing the skills of the rural labor force), and a non-distorting program for cash compensation to owners of resources used in rainfed agriculture. In addition to economic indicators, the analysis of the different scenarios uses indicators of political feasibility based on the distributional results. Given the likely

uneven impact on different population groups, decisions about trade liberalization are informed not only by their economic consequences, but also by the political power of different groups.

Section 2 provides a brief background on the Moroccan economy and economic policy, with a focus on trade policy, agriculture, and rural areas. In Section 3, the CGE model and its database are presented; Section 4 is devoted to simulations while Section 5 summarizes the results and discusses policy implications. The Appendices of the paper include a mathematical statement of the static module of the model as well as additional background data.

2. BACKGROUND

Table 2.1. summarizes the sectoral structure of the national economy.[1] In terms of the economy as a whole, agriculture provides somewhat less than 20% of GDP but around 45% of total employment, attesting to its relatively high labor-intensity. Rural households derives most of their income from agriculture as 77% of rural labor is employed in agriculture. The service sectors (including the government administration) is the major employer in urban areas. If defined narrowly, Morocco's agriculture plays a relatively limited role in the country's relatively diversified foreign trade, accounting for around 8% of exports and 6% of imports; however, if agroindustrial trade is included, the shares are considerably higher. The most important agricultural exports are fish, fruits and vegetables. Wheat and sugar are the major agricultural imports (Royaume du Maroc, 1997; EIU, 1997, pp. 54-55).

<<Table 2.1>>

Since the early 1980s, Morocco has gradually reformed its economy in the direction of trade liberalization and increased reliance on market forces and the private sector. Morocco's macroeconomic management has since the mid-1980s been more successful than in most other countries in the Middle East and North Africa according to key indicators such as rate and volatility of inflation, level of the budget deficit, and stability of the real exchange rate (Page and Underwood, 1997, pp. 104-105). In the trade area, the level and dispersion of tariffs have both been reduced while quantitative restrictions (QRs) have been eliminated (Alonso-Gamo et al., p. 24; IMF 1997, p. 7). Compared to most structural-adjustment-oriented countries, Morocco was successful in combining positive growth with rapid restoration of internal and external balance (Karshenas, pp. 47-48). Nevertheless, compared to the 1970s, economic growth decelerated in the 1980s and even more so during the period 1990-96. In spite of far-reaching trade reforms, Morocco still has significant trade barriers with a high degree of dispersion of protection rates

[1] Appendix Table A.1.2 includes additional information on structural change in Morocco's economy, 1970-1996.

across sectors. Table 2.2 shows 1994 data for tariff and non-tariff barriers that are used for the model-based analysis of this paper. Non-tariff barriers are defined broadly to include all domestic price deviations that cannot be accounted for by import duties. As shown, the agricultural trade regime was, as of the mid-1990s, particularly distorted, especially for cereals and animal products.

<<Table 2.2>>

For Morocco's policymakers, rural development remains a key challenge. According to data from the early 1990s, rural per-capita consumption is around half of the urban level. While rural areas house less than 50% of the population, they account for 70% of the poor. As shown in Table 2.3, rural areas are also strongly disfavored according to other indicators such as access to electricity and safe water, literacy, and school enrollment, with the female population standing out as particularly disadvantaged. Low educational achievement is reflected in a labor force that for the most part is "unskilled" (in the sense that most jobs require no formal education). The skill gap is a major source of inequality between rural and urban areas; on average skilled workers earn 6-7 times the wage of unskilled workers (Karshenas, 1994). Relatively unfavorable rural conditions have led to rapid rural-urban migration, which provides an important outlet for the rural labor force (absorbing the bulk of its natural growth), but exacerbates urban unemployment and puts downward pressure on urban wages. The rural economy is dominated by agriculture which represents close to 80% of total employment and may account for some 60% of total rural value-added. While agricultural GDP is highly variable, since the early 1980s the sector has arrested an earlier secular decline in its share of the economy. The agricultural sector is characterized by considerable heterogeneity, perhaps most importantly between relatively prosperous irrigated zones (17% of the cultivated area in the early 1990s) and disfavored rainfed zones that, inter alia, suffer from frequent but irregular droughts. Moreover, the rainfed areas differ greatly in terms of average annual rainfall.

<<Table 2.3>>

Given the high degree of agricultural protection, the challenge of rural development is intertwined with trade policy. Currently, Morocco is in the process of implementing its Association Agreement with the EU and its GATT/WTO commitments in the Uruguay Round. The EU is the major trading partner of the countries in the Middle East - North Africa (MENA) region, receiving 25% of the region's total exports and providing 44% of regional imports (ERF, 1998, p. 64). For Morocco, EU export and import shares are even higher, in 1994 at 64% and 57%, respectively (Royaume du Maroc, 1997, p. 572). Since 1994, the EU has sought the conclusion of association agreements with most non-EU Mediterranean countries. The agreements include the establishment of a Free Trade Area (FTA) covering the EU and each non-EU partner. In line with World Trade Organization (WTO) rules, the FTAs are to be implemented gradually over transitional periods lasting a maximum of twelve years.[2]

In 1996, Morocco signed such an agreement with the EU. For industrial imports from the EU, Morocco is committed to a gradual elimination of tariff rates, and the abolishment of any quantitative restrictions, taxes, and other measures that have the same effect as tariffs. In return, Morocco will receive aid for education and infrastructure projects over a period of five years (Oneworld, 1995). With few exceptions, Morocco's non-agricultural exports will continue to enjoy unrestrained, duty-free access to the EU. In spite of a slightly improved access, Morocco's agricultural exports to the EU remain strictly regulated, with limited scope for expansion.

As a member of the WTO, Morocco is committed to respecting the rules of GATT/WTO. On the basis of the agreement of the Uruguay Round, Morocco is replacing non-tariff measures with ordinary tariffs (tariffication). For all agricultural commodities, Morocco is committed to maximum tariffs defined by the bounds it submitted, and the 24% reduction in those bounds in equal annual decrements over a period of ten years. The tariff bounds are of no economic

[2] According to Articles I and XXIV of the GATT, the establishment of Free Trade Areas and Customs Unions are permitted as long as they are based on the Most Favored Nation (MFN) principle and meet the following four conditions: a. all trade is covered by the agreement; b. tariff rates imposed on imports from a third country after forming the FTA are not on the whole higher or more restrictive than those before the FTA formation; c. the transition period to free trade does not exceed 12 years; and d. the contracting parties are promptly notified of the arrangement itself, as well as modifications or enlargement to it (ERF, 1998, p. 65).

significance since no change is required as the submitted bounds are well above the actual applied rates, which is typical of developing countries. In practice, for a significant period of time neither the GATT/WTO or the AAEU will oblige Morocco to reduce significantly the high agricultural protection that is a major source of inefficient resource allocation.

Currently, trade and rural development are two major and interrelated issues in Morocco's economic policy debate. In the trade area, the debate revolves around the impact of the implementation of the Association Agreement with the EU and of Morocco's GATT/WTO commitments in the Uruguay Round. Another major concern is whether Morocco should pursue further general import liberalization, covering agricultural imports irrespective of source and industrial imports from regions beyond the EU. Broad unilateral import liberalization may have a positive impact on aggregate economic performance. However, given the high degree of agricultural protection, the impact of broad-based trade liberalization on rural welfare is a particular concern. Liberalization may also give rise to transitional costs as labor is reallocated between different sectors.

Moroccan policy makers are well aware of the link between rural welfare and agricultural crop prices — in March 1998, in the very first decree he signed, Morocco's new prime minister Youssoufi imposed a sharp increase in tariff rates on imported wheat to counteract a recent drastic fall in world prices (EIU, 1998, p. 20). In fact, it may be more appropriate to consider agricultural trade liberalization in the context of complementary policies that compensate vulnerable rural households. As an example of policies that can be pursued in the short run, Mexico introduced an income transfer program (PROCAMPO) where farmers were compensated for reduced protection of agricultural markets. By making payments proportional to assessments of past earnings in agriculture, the program aimed at being non-distortionary in terms of current production decisions (World Bank, 1997c). In Morocco, baseline payment levels could be established on the basis of data from the 1997 agricultural census. It should be easier to administer than direct payments based on the current cropping pattern. Over a longer time horizon, options include support for an educational system that enhances the skills of the rural labor force and the development of infrastructure that facilitates the development of rural non-agricultural activities.

In this paper, we use a rural-urban CGE model of Morocco to explore the impact of different scenarios for trade reforms and complementary policies on the rural economy, the labor market, and the rural poor. For each scenario, we will also assess political feasibility, using various aggregate indicators.

3. MODEL STRUCTURE AND DATA

We will here present the rural-urban CGE model and its data sources.[3] The current model, which draws on existing economywide models of Morocco, is distinguished by an explicit separation of activities and households into rural and urban. The disaggregation aims at identifying the rural poor, as well as the factors and activities from which they earn their incomes. Hence, the model has a detailed treatment of aspects that are most closely linked to the rural economy and the welfare of the rural poor, including agricultural and other rural activities, and rural factors of production. Although the treatment of urban production is more aggregated, the model also permits an analysis of the impact on the urban poor of policies and exogenous shocks. Moreover, the resulting economywide perspective permits us to avoid the fallacy of viewing the rural economy as an isolated island. This is important since the rural and urban economies and the welfare of their households are interdependent, with numerous linkages in the markets for commodities and factors.

Model disaggregation

Table 3.1. displays the disaggregation of activities, factors, and institutions. Among the 45 *activities*, 38 are rural and 7 urban. Most rural sectors are part of crop or livestock agriculture. The non-agricultural sectors of the economy (disaggregated into the major types of industrial and service sectors) are classified as rural or urban.

[3] This presentation uses no mathematics. Table A.1.1 includes a mathematical model statement.

<<Table 3.1>>

All activities use capital and labor. Agricultural activities demand additional factors: livestock makes use of pasture-fallow land; crop activities rely on rainfed land; irrigated crop activities also use water. Outside agriculture, the labor force of each activity includes both skilled and unskilled labor whereas for all agricultural activities, except fishing and forestry, the labor force is made up of a separate category of (unskilled) agricultural labor. In crop and livestock agriculture, most activities produce multiple commodities and most commodities are produced by two activities, one in rainfed and one in irrigated areas. Fodder byproducts are produced by most crop activities. Livestock activities produce meat and milk (disaggregated by animal type) and, for the cow activities, manure. Multiple-output activities produce their commodities in fixed physical proportions.

Outside crop and livestock agriculture, each activity produces only one commodity. Given that service commodities tend to have location-specific characteristics, rural and urban service activities are viewed as producing distinct commodities. For industrial and agricultural commodities, markets are treated as integrated across regions (irrigated and rainfed agricultural zones or rural and urban regions) and with international trade.

The model includes four household types, disaggregated by region (rural and urban) and income level (poor and non-poor). The other institutions consist of the government and the rest of the world, divided into the European Union (EU) and non-EU in the area of goods trade. The rest of the world is thus disaggregated given that one purpose of the analysis is to understand the impact on rural development from Morocco's partnership agreement with the EU.

Production activities

Producers are assumed to maximize profits given their technology and the prices of inputs and outputs. As shown in Figure 3.1, the technology of the production activities is specified as a Leontief function of aggregate value-added and an aggregate intermediate input. Value-added is produced by a CES function of primary factors, and a Leontief function of intermediate input use.

In order to permit technique change in response to significant price changes for inputs, the intermediate coefficients are flexible inside agriculture but fixed for other sectors. For irrigated crop agriculture, an aggregate land-water factor is among the arguments in the CES function. This aggregate factor is produced by a set of alternative factor-aggregation activities based on Leontief technology that specifies substitution possibilities between the land and water along a linearized CES isoquant. This Leontief representation is preferred to a continuous CES function to allow for the possibility of water or land being in excess supply, with a corresponding price of zero for the non-scarce factor. The income of each factor is allocated to domestic institutions (households and government) in fixed shares, after adjustments for factor payments to and from the rest of the world (both of which are fixed in foreign currency).

<<Figure 3.1>>

Institutions

In the base year, both rural and urban *households* receive the bulk of their incomes from factor earnings in their respective regions. Compared to the non-poor, the poor in both regions depend more heavily on labor incomes in general and unskilled labor incomes in particular (See Table A.1.3 for 1994 income shares derived from the SAM.). In addition to factor income, households receive transfers from the government (the transfer received by each household is a fixed GDP share) and the rest of the world (fixed in foreign currency). Total household income is used to pay direct taxes, save and consume. Direct taxes and savings are fixed shares of household income. Consumption demand is determined by the linear expenditure system (LES).

Besides factor incomes, *government* revenue consists of taxes — direct taxes from households, indirect taxes from domestic activities, domestic sales taxes, and import tariffs (with different rates applying to EU and non-EU goods' imports). All taxes are *ad valorem*. Apart from the above-mentioned transfers to households, the government uses its income to buy a fixed quantity of consumption goods, transfers to the rest of the world (fixed in foreign currency), and

consumer subsidies (a fixed share of the consumption value for manufactured goods, representing food items).

The *rest of the world* interacts with Morocco through commodity trade and the above-mentioned transfers (which add to or deduct from the incomes of factors and domestic institutions).

System constraints

System constraints, or "closure rules" are those constraints that have to be satisfied by the economic system, but which are not considered in the decisions of any micro agent (Robinson 1989, pp. 907-908). They consist of the markets for commodities and factors as well as a set of macro aggregates.

Commodity markets

Commodities are supplied by domestic production activities and by imports. On the other side of the market, we find domestic demand and exports. Imperfect substitutability is assumed for commodities from different sources (different domestic activities, different import regions, or the outside world versus domestic producers). Commodities delivered to different destinations (domestic market vs. aggregated export market or different export markets) are imperfectly transformable.

Figure 3.2. summarizes the commodity flows that underlie the market for a commodity that is produced by two activities and is traded in both directions, both with the EU and the rest of the outside world. A separate price is associated with each commodity flow (box).

<<Figure 3.2>>

In the bottom left, production from the two activities combine to form aggregate output that, in turn, is transformed to domestic sales and aggregate exports. In the next stage, the latter

are further transformed into exports to the EU and the rest of the world. On the domestic supply side, imports from the EU and the rest of the world generate aggregate imports that, together with domestic sales, are aggregated to give the domestic composite commodity supply. On the other side of the composite commodity market, demand is made up of household and government consumption, investment, and intermediate input use. The above Figure is simplified for commodities that enter international trade in a less complete fashion (or not at all for non-traded commodities) and/or are supplied by a single domestic activity. Moreover, for imported service commodities, the first step in the aggregation is eliminated since imports are not disaggregated by source.

The functional forms for transformation and aggregation are, respectively, Constant-Elasticity-of-Substitution (CES) and Constant-Elasticity-of-Transformation (CET) functions. At each stage, the shares of commodities from different sources or to different destinations are sensitive to relative prices. These assumptions embodied in these functions — imperfect substitutability and transformability — grant the domestic price system a certain degree of independence from international prices and dampen responses of imports, exports and domestic sales to price changes.

Each box can be viewed as representing a market that, although linked to other markets, has a separate market-clearing mechanism. With the partial exception of export and import markets, each price performs the role of clearing the market — the quantities supplied and demanded are, respectively, positively and inversely related to the price. For imports, the supply side clears the market: it is assumed that Morocco is a small-country facing infinitely elastic supplies at exogenous world prices.

For most exports, it is similarly assumed that Morocco is a small country facing infinitely elastic demands at an exogenous world price: in this setting, the demand side clears the market. The only exception is for agricultural exports to the EU. A dual-regime formulation is used according to which an increase in Morocco's supply price will give rise to reduced exports along a constant-elasticity demand curve. However, a decrease in the Moroccan price will not give rise to a corresponding increase in demand. The EU will purchase the base-year quantity at the

(lower) price, in the process capturing the rent produced by the constraint. As a result, the EU pays exactly the price needed to induce Morocco to export the fixed quantities.

Factor markets

Given the medium- to long-run perspective of the current analysis, the dynamic model version assumes that each factor is mobile across the activities that use it. A market-clearing price generates demand-supply balance in the context of full resource utilization. The only exception applies to land and water in irrigated agriculture where the model allows for the fact that flexibility in technique choice may not be sufficient to assure that both factors always are fully utilized. Hence, for each factor, two regimes are possible: full employment with a market-clearing price or unemployment with the utilization level as the clearing variable. Given that the sectoral production function always demands the land-water aggregate, at most one of the two factors is unemployed at any given point in time.

Macro constraints

These constraints determine the manner in which balance is achieved for the macro aggregates associated with the accounts for the government, the rest of the world, and savings-investment. Government savings — the difference between the government's *current* revenues and *current* spending — is a fixed share of GDP. Proportional adjustments in the rate of value-added tax (uniform across all sectors) assure that the government savings target is met. Foreign savings are fixed. A flexible real exchange rate (measuring the ratio between prices of traded commodities and domestic outputs sold domestically) clears the balance of the rest of the world. As noted earlier, for each household category, savings is a fixed share of its disposable income. Hence, none of the three types of savings — government, household, and foreign — is free to equilibrate aggregate savings-investment balance. Hence, the model has a savings-driven determination of investment: aggregate investment (for gross fixed capital formation) varies endogenously to achieve savings-investment equilibrium.

The Dynamic Module

The within-period, static model is solved for 1994 (the base year for the database) and 1998 (to update the model to the base year for the model-based analysis), and every two years thereafter until 2012. Between the static-model solutions, selected parameters are updated in the dynamic (between-period) module, either using lagged endogenous variables (from solutions in previous periods) or exogenous trends. The aggregate capital stock is updated endogenously on the basis of previous investment and depreciation, interpolating for the inter-period years. Total population, supplies of skilled and unskilled labor, foreign savings, institutional payments to and from the rest of the world, and total factor productivity by activity are all updated exogenously.

Database and solution approach

The model data is based on a disaggregated SAM (a 108x108 matrix) for 1994, to which the model parameters are calibrated. The SAM was constructed on the basis of data from various data sources, most importantly: (i) disaggregated agricultural information from the Moroccan government, the World Bank, and the FAO, primarily for 1990/91;[4] (ii) a disaggregated economywide framework represented by Social Accounting Matrices (SAMs) for 1990 and 1994, an input-output table for 1990, as well as data on the 1994 policy regime — taxes, subsidies, and non-tariff barriers (Bussolo and Roland-Holst, 1993; Roland-Holst, 1996a); (iii) 1994 macro and trade data from Royaume du Maroc (1997), the RMSM data base (World Bank, 1997a), and United Nations (1998); and (iv) disaggregated population, consumption, and labor force data from Royaume du Maroc (1993, 1995, 1996, 1997), World Bank (1994, 1995, 1997a, 1997b), International Monetary Fund (1997), and Karshenas (1994). It should be emphasized that in areas where detailed information was lacking (for example regarding wage gaps across different

[4] The Moroccan government sources include MAMVA (DPAE/Division des Statistiques and DPV, AGER, DPA, and ORMVA), Ministère des Incitations à l'Economie (Direction de la Statistique), Ministère des Finances, Ministère de l'Industrie, Ministère des Travaux Publics, and Caisse de Compensation.

activities), some simplifying assumptions had to be imposed. In doing so, we were guided by the underlying premise of the analysis: the impact of trade policy on the rural economy cannot be properly assessed without a model structure that captures the salient characteristics that are related to the urban-rural divide, including large skill and wage gaps, and differences in sectoral structure.

Available information was brought together in one matrix, the disaggregation of which parallels the disaggregation of the current model. Underlying the construction of such a SAM is an attempt to make the best possible use of available scattered data. Inevitably imbalances appear when data from different sources and years are integrated in one framework; a cross-entropy method was used to generate a balanced model SAM that uses all the information contained in the original data set (Thissen and Löfgren, 1998; Robinson *et al*, 1998). A macro version of the model SAM — identical to the disaggregated SAM except for the aggregated depiction of factors, household, activities, and commodities — is shown in Table 3.2. A variety of other studies of Morocco were consulted for estimates of elasticities for the Armington, CET, CES (production), LES (household consumption), and export-demand functions.[5]

<<Table 3.2>>

The current model is solved as a mixed-complementarity problem (MCP), consisting of a set of simultaneous equations that are a mix of strict equalities and inequalities but without an objective function. This approach, made feasible by the recent development of solvers, makes it

[5] The consulted studies include Aloui *et al,.* 1989; de Janvry *et al*., 1992; Goldin and Roland-Holst, 1995; Laraki, 1989, Mateus *et al.,*1988; Morrisson, 1991; and Rutherford *et al.,* 1993. In summary, the values used are: 1. Elasticity of substitution for CES value-added functions: 0.8 for all activities except Public Administration (0.19); 2. Elasticity of substitution for CES intermediate-input aggregation functions for agricultural activities: 0.5 for all activities except vegetables (2.0); 3. CES (Armington) function elasticities for aggregation of imports from different regions and of imports and domestic output: between 2 and 7 for all commodities with the higher values for grains; 4. CET function elasticities for transformation of domestic output to aggregate exports and domestic sales and of aggregate exports to exports disaggregated by region: between 2 and 5 for all commodities; 5. Elasticities for constant-elasticity export demand functions for agricultural exports to the EU and for service exports: -1.5. Household expenditure elasticities were computed on the basis of Royaume du Maroc (1993).

possible to formulate a model that combines desired features of mathematical programming models (in particular by permitting excess supplies of agricultural resources, such as water) while allowing the full range of assumptions for consumer demand, government policies, and foreign trade that appear in standard CGE models. The GAMS modeling software is used both to generate the database and to implement the model. The model is solved with PATH, a solver for mixed complementarity problems.[6]

4. SIMULATIONS

The simulations, based on the CGE model presented in the preceding section, explore the impact of alternative scenarios for trade liberalization and the potential role of complementary domestic policy changes. The first set of simulations are defined in Table 4.1.

<<Table 4.1>>

The results are summarized in Table 4.2. The simulation AAEU defines the status quo in the sense that policy changes are limited to what Morocco unambiguously made a commitment to implement in association with the EU. On the aggregate level, real GDP at factor cost grows at an annual rate of 3.7%, a rate that changes very little across the simulations that are reported in this paper.[7] Growth is biased in favor of urban production and non-agricultural sectors, in part because these do not depend on natural resources, the physical quantity of which cannot be expanded easily. (In the model simulations, the quantities of agricultural resources — land, water,

[6] For GAMS, see Brooke *et al.* (1988). Rutherford (1995) provides more information on PATH.

[7] The simulated aggregate growth rate is in line with the expectations of the World Bank, both for Morocco and the region at large (*al-Hayat*, December 16, 1998; RMSM database). Growth in aggregate real GDP at factor cost (an index of real production) varies little across the different simulations since supplies are exogenous for all factors except capital (for which supply growth is endogenous but quite similar across the different simulations given similar levels of real investment while utilization rates are permitted to vary only for irrigated resources.

and pasture-fallow areas are fixed at the 1994 level.) Changes in the allocation of labor between agriculture, rural non-agriculture, and urban activities are minor.

<<Table 4.2>>

On average, real factor incomes grow at a similar pace to GDP, with the most rapid growth for agricultural resources, both irrigated and rainfed. Household welfare grows at 2-3% per year, both on the aggregate level and for the different household groups.[8] Welfare growth is slightly biased in favor of the poor and rural areas, a reflection of the fact that growth in factor incomes is faster for agricultural resources and unskilled labor than for skilled labor and capital.[9] Rapid growth in the rents of agricultural resources, including pastures, may lead to overexploitation and environmental degradation. The result that resource incomes in irrigated agriculture grow more rapidly than for other factors points to the growing importance of efficient resource management in this area.

Imports and exports grow faster than GDP and incomes; the economy is gradually becoming more open. The agricultural trade deficit grows as domestic production, hampered by the limited resource supply, is unable to keep up with growing domestic demand. For industry, export growth is more rapid than import growth; imports from EU grow rapidly while imports from non-EU countries decline, i.e., the AAEU leads to trade diversion toward the partner countries in the free-trading area. Compared to 1998, the real exchange rate appreciates. To

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[8] The welfare index is derived from the compensating variation (defined as the amount of money which, if taken away from the household after a price and/or income change, would leave it just as well of as before the change; i.e., what the household would be willing to pay for enjoying the change). More specifically, the index was defined as the ratio between the simulated value of household consumption and the consumption value that would have left household welfare at the 1994 level (simulated consumption value minus compensating variation). In Tables 4.2 and 4.4, the household values in all columns except "1998" in Table 4.2 show the percentage annual growth rate in the welfare index between 1998 and 2012. The 1998 column shows per-capita consumption in 1998 (at 1994 prices).

[9] Note that the household are classified on the basis of their 1994 characteristics (including location, income level, and patterns of asset holdings). Labor that migrates between rural and urban employment does not change its household affiliation.

maintain savings at a predetermined share of GDP in the face of reduced tariff rates and other trends, the government collects value-added taxes at a level equivalent to 4.1% of GDP.

The other three simulations in the first set assume that Morocco implements policies that reduce the extent of price distortions caused by trade policies. For the simulation TARIFF, unification of all commodity tariffs except industrial imports from the EU at the 1994 average rate reduces protection significantly for agriculture but has less impact on the industrial protection rates facing suppliers from outside the EU. Accordingly, compared to the AAEU scenario, agricultural imports expand (most strongly for commodities from the EU, including beef) while growth in agricultural production and resource incomes slows. Growth decelerates for rural non-agriculture which, more than the urban sector, is driven by demand from agricultural production and rural households. The fact that the rural economy primarily relies on unskilled labor reduces income growth for this category. Growth in the urban economy accelerates slightly, generating higher incomes for capital and skilled labor as well as on the national aggregate factor level. Aggregate household welfare is enhanced, due to a significant improvement for urban non-poor households with small declines for other categories, an outcome that stems from the pattern of change in factor incomes. In general, the repercussions of tariff unification, including efficiency gains, are quite limited. This is not surprising since tariff unification takes place in a setting where numerous other distortions are in place.

In the simulation TARIFF+NTB, non-tariff barriers, primarily affecting agriculture, are gradually removed. The impact is much stronger than for tariff-unification alone and economic openness is enhanced significantly. The driving force is reduced prices for demanders (both consumers and producers) of agricultural commodities.

Factor incomes grow considerably more strongly for capital and skilled labor. In agriculture, resource income growth declines, especially in the rainfed subsector. A growing part of the labor force migrates away from agriculture to the urban and rural non-agricultural activities. All households groups gain except the rural poor who are unaffected. Households that rely more heavily on incomes from rainfed resources than the representative rural households in the model would be likely to see their situation deteriorate under this scenario. Rapid agricultural import expansion raises the trade deficit, as a result of which the real exchange rate depreciates,

further enhancing exports and dampening imports. Import growth engenders higher tariff revenues, reducing revenue from the value-added replacement tax to 2.2% of GDP.

Unification of tariffs at 10% (industrial imports from the EU excluded; the simulation TRADE-LIB), a significant cut, generates further exchange rate depreciation, increased openness, reduced tariff revenues, increased government reliance on the value-added tax, and reduced growth in agricultural resource incomes. Other effects are relatively minor. On the aggregate level, factor incomes and household welfare stay virtually unchanged. There are minor cuts in agricultural production and rural household welfare. The negative impact on agriculture and rural well-being is driven by the fact that, for agriculture, reduced protection is transmitted more strongly into lower domestic prices as imports are relatively highly substitutable with domestic output.[10]

Figures 4.1 – 4.4 compare the evolution over time of welfare for each household group under the last scenario (TRADE-LIB), which incorporates major trade liberalization, to the AAEU scenario. The rural poor lose while all other households groups are better off under liberalization in all periods. According to the compensating variation measure, by the year 2012, aggregate gains under TRADE-LIB exceed those of AAEU by more than 5% of the GDP of the AAEU simulation in the same year. Hence, there is scope for having the winners compensate the losers in a way that assures that both groups are better off than for the AAEU run.

Figures 4.5 – 4.9 show the evolution of disaggregated factor incomes (indexed to 100 for 1998) for the same two simulations. The figures show that, at this level, the gains are highly unevenly distributed. Households that do not have significant non-agricultural incomes would tend to lose from the reforms during the time frame considered. However, as a longer time period passes, the households are more able to develop strategies where they shift away from reliance on agricultural income.

In the second set of simulations, we juxtapose the policy changes under TRADE-LIB with complementary measures that aim at compensating rural, vulnerable losers. These actions may be

[10] In an additional simulation, TRADE-LIB was rerun but without the gradual elimination of tariffs on industrial imports from the EU. The results were very similar in most respects, including welfare effects. The only major difference was that, as expected, the new simulation showed higher tariff revenues and less reliance on the value-added tax.

considered worthwhile in their own right (since they aim at improving the welfare of rural poor) and may also serve to mitigate political resistance to trade reforms. Table 4.3 describes the content of the two simulations. For the first simulation (which aims at imitating Mexico's PROCAMPO program, cf. discussion in Section 2), part of the program cost covers administration: out of every Dirham spent on the program, 70% is transferred to farmers while 30% is spent on administration.[11] The skill enhancement program is motivated by the fact that, as noted in Section 2, the skill gap between urban and rural areas is a major source of rural-urban inequality. It assumed that the program can be achieved without economic loss by reallocating educational expenditures, for example from urban-focused higher education that produces graduates lacking skills in demand in the labor market. It should be noted that neither one of the programs is narrowly targeted to poor households: they respectively benefit all owners of rainfed resources and all rural households with unskilled labor.

<<Table 4.3>>

Selected results for the second simulation set are shown in Table 4.4. Figures 4.10-4.13 summarize the impact on household welfare. To facilitate comparisons, data for AAEU and TRADE-LIB are repeated. Compared to TRADE-LIB, the TRANSFER simulation generates gains for rural households, especially the poor, while the urban households lose. This result reflects the fact that urban households own little rainfed resources while they, like the rural households, suffer from declining factor incomes because of the value-added tax, which increases in rough proportion to the value of the transfer — in 2012 it is close to 3.8% of GDP. Figure 4.14 shows the evolution of the transfer over time. It increases gradually during the implementation of the reduction in border protection. After reaching a peak in 2004, it starts a steady but slow decline. In other respects, the transfer has a limited impact. It primarily functions as a device for income redistribution. As opposed to the TRADE-LIB scenario, the rural poor are

[11] This charge is highly approximate — it is not clear what the cost of such a program would be in Morocco, *inter alia* since it depends on the capacity of the existing administration to manage an additional program. International experience suggests that 30% is a plausible figure for the administrative cost share in well-managed public works programs (World Bank 1997c, p. 53).

now better off compared to the base scenario. However, relative to GDP, the total cost of the transfer program is substantial, suggesting the need to target such programs more narrowly, perhaps to rainfed regions with little rainfall.

<<Table 4.4>>

In the simulation SKILL-UPGRADE, we explore the impact of raising the skill level of part of the unskilled rural labor force. In every year starting from 1999, the skilled rural labor force is augmented by 5%, boosting its annual growth rate for the period 1998-2012 from 3.8% to 7.7%. The rural unskilled labor force is reduced so as to leave unchanged the total labor force, cutting its growth rate from 2.4% to 2.0%. Compared to the TRADE-LIB simulation, GDP growth accelerates significantly for rural non-agricultural and urban activities, but not in agriculture since this sector only uses unskilled labor. Incomes go up for all factors except skilled labor, an indication that, in the face of supply shifts, demand for this labor type is inelastic. Welfare is boosted strongly for all households except the urban non-poor, who initially depend more heavily than others on skilled labor incomes. They see their wages decline without any change in their endowment of skilled labor.

Figures 4.15 and 4.16 show the results for two indicators of political support for the scenarios TRADE-LIB, TRANSFER, and SKILL-UPGRADE compared to AAEU. According to both indicators, total political support is a weighted average of the degree of approval or disapproval of each household group. For each non-base simulation, the degree of political approval or disapproval of each household group is measured, in each time period, by the percentage deviation of its disposable income from income under AAEU in the same period. This assumes that the population has a conception of what their conditions would have been like under an alternative, status-quo scenario. Under “dirham power," the weight of each household (indicating its political influence) is defined as its share, during each time period, in total household income. Under “people power," the household weights are population shares (Dervis *et*

al., pp. 458-466; de Janvry and Sadoulet, 1995, p. 24).[12] According to both measures, all non-AAEU scenarios are supported (since the support measures invariably have positive values) — further liberalization would be supported compared to the status quo. Support is growing significantly as long as the policy changes are implemented. SKILL-UPGRADE is most strongly supported according two both measures since it on average leads to the strongest income improvement. However, given its pro-poor character (the beneficiaries have larger population shares than income shares), it scores higher for the people-power measure. Dirham power supports TRADE-LIB more strongly than TRANSFER while people-power support for these two scenarios is virtually identical, a reflection of the relative pro-poor character of the agricultural transfer program. These summary measures provide a simplistic view of the determinants of political support. Among other things, it is possible that household attitudes should be measured at a more disaggregated level where the impact is considerably less even and most likely negative for some groups (cf. the evolution of factor incomes shown in Figures 4.5 – 4.9). Nevertheless, according to these measures, the pro-poor trade-domestic policy packages could have broad support, in particular if votes in elections play a strong role in the determination of economic policy.

5. CONCLUSION

In this paper, we use a rural-urban CGE model of Morocco to simulate the impact of alternative scenarios for trade and domestic policies. In the base scenario, the AAEU is implemented without other policy changes. For the period 1998-2012, real GDP at factor cost grows at an annual rate slightly below 4%. Rural poor and urban poor households enjoy the most rapid welfare increases, a reflection of the fact that the pattern of factor income growth is

[12] In 1998, the people-power shares of the different households (in %) are as follows: urban poor 3.6, urban non-poor 47.5, rural poor 8.8, and rural non-poor 40.1. In the same year, the dirham-power shares are urban poor 1.1, urban non-poor 66.2, rural poor 2.6, and rural non-poor 30.2. The shares do not change significantly over time.

pro-poor: agricultural resource incomes grow most rapidly followed by unskilled labor, with lower growth rates for skilled labor and capital.

The results for the trade policy simulations indicate that, in a world where policy alternatives are second-best, tariff unification has a relatively limited impact on aggregate factor incomes and household welfare. However, removal of non-tariff barriers (expressed in tariff-equivalent form) has strong positive aggregate effects. Lowering of tariffs and removal of non-tariff barriers lead to depreciation and major expansions in non-agricultural exports and agricultural imports. Growth accelerates for non-agricultural sectors but slows down in agriculture. Resources (labor and capital) move from agriculture to other parts of the economy. Aggregate factor incomes and household welfare expand considerably more rapidly than for the base.

However, trade liberalization reduces income growth for agricultural resources, especially in rainfed areas. The owners of these resources tend to be a relatively poor part of the rural population. On the household level, the trade liberalization scenarios disfavor the rural poor, who represent 70% of all poor in Morocco.

Two domestic policy scenarios aim at addressing the relatively negative impact of trade liberalization on the owners of rainfed resources and the rural poor. In one of the scenarios, we introduce a non-distorting transfer program that fully compensates the owners of rainfed resources for the losses they incur from trade liberalization compared to the base scenario. On the household level, the result is a pro-rural development pattern, with poor and non-poor rural households registering the strongest welfare improvements. Also the urban households are significantly better off than under the base scenario. However, the tax burden on the government is quite heavy (close to 3.8% in 2012), suggesting the need for targeting, perhaps by providing transfers to rainfed farmers in low rainfall zones.

In the second domestic policy scenario, we upgrade the skills of the rural labor force, approximately doubling the rate of growth for rural skilled labor (from a low base) and reducing growth for rural unskilled labor. This leads to a significant growth expansion for GDP (driven by non-agricultural expansion), aggregate factor incomes, and aggregate household welfare. In terms of household welfare, the outcome is pro-rural and pro-poor: the two rural households record the

fastest growth, followed by the urban poor while the urban non-poor face a minor growth deceleration. The overall conclusion from the model simulations of this paper is that, if combined with complementary domestic policies, trade liberalization can lead to a win-win outcome: the welfare of all household groups grows more rapidly than if status-quo policies are followed.

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TABLES AND FIGURES

Table 2.1: Structure of production and employment, 1994-1995

				Employment		
	GDP	Exports	Imports	Rural	Urban	Total
(%)						
Agriculture	18.5	7.9	5.5	77.0	6.3	44.8
Industry	26.5	51.3	75.8	9.3	27.2	17.5
Construction	4.3	–	–	4.1	7.1	5.4
Government Administration	12.2	–	–	0.9	11.5	5.7
Other services	38.4	40.8	18.7	8.7	47.9	26.5
Total	100.0	100.0	100.0	100.0	100.0	100.0
Total (bn Dh or '000 workers)	279.3	70.6	86.1	4640.2	3870.4	8510.5

Note: GDP and trade data are for 1994; employment data are for 1995.

Table 2.2. Tariff and non-tariff rates and values for Morocco, 1994.

	Non-tariff barrier (%)	Aggregate tariff rate (%)	EU tariff rate (%)	Non-EU tariff rate (%)	Aggregate tariff revenue (mn Dh)	EU tariff revenue (mn Dh)	Non-EU tariff revenue (mn Dh)
Hard wheat	60.1	16.2		16.9	40.5		40.5
Soft wheat	177.9	16.2	16.6	15.9	180.5	85.7	94.8
Barley		25.2	21.8	37.6	21.9	14.8	7.1
Maize		19.6	17.5	20.9	122.6	40.6	82
Sunflower		29.6	37.4	29.5	192.3	3.1	189.2
Other industrial crop		29.4	18.4	35.4	380.9	84.4	296.5
Vegetable		10.8	15.3		25.2	25.2	
Olives		51.1	46.7	60.8	20.8	13.1	7.8
Other fruit		63.9	78.6	61.3	15.3	2.8	12.6
Milk	44.1	98.2	97.3	99.3	9.3	5.1	4.1
Beef	162	89.7	88.9	96.7	139.2	125.2	14
Sheep-goat meat	154.8	90.9	90.6	91.1	26.6	10.3	16.2
Sheep-goat wool	158.8	92.3	94.4	91	5.1	2	3.1
Other animal	186.6	88.2	87.9	89.6	890.7	751.1	139.7
Forestry		3	19.4		7.6	7.6	
Fishing		48.3	68.5		7.9	7.9	
Mining		8.4	18.1	6.6	142.3	48.6	93.7
Petroleum		20.6	46.8	16.3	1647.8	522.8	1125
Manufacturing	2	31.6	37	22.1	16527.2	12344.9	4182.3
Total		29.6	37.2	19.8	20403.7	14095.1	6308.6

Source: Model SAM.

Table 2.3. Social and economic indicators: nation-wide and by locale (rural and urban)

	Rural	Urban	Total
Population (1994)			
mn	12.7	13.4	26.1
%	48.6	51.4	100.0
Annual population growth (1982-1994)			
Natural	2.6	1.7	2.2
Post-Migration	0.7	3.6	2.0
Poverty rate (1991)	18.0	7.0	13.1
Electricity access (1994)	9.7	80.7	46.2
Safe water access (1994)	4.0	74.2	40.1
Illiteracy rate (1994)			
Male	61.0	25.0	41.0
Female	89.0	49.0	67.0
Total	75.0	37.0	55.0
Primary school enrollment rates (1991)			
Male	56.5	86.7	69.9
Female	29.9	84.7	52.8
Total	43.2	85.7	61.3
Labor market data (1995)			
Labor force			
'000	5,024.4	4,982.1	10,006.4
%	50.2	49.8	100.0
Participation rate	39.5	36.0	37.7
Unemployment			
'000	384.2	1,111.7	1,495.9
% (of labor force)	7.6	22.3	14.9
Employment			
'000	4,640.2	3,870.4	8,510.5
%	54.5	45.5	100.0
Skilled labor (% of total)	5.6	41.1	21.7

Note: Units are in percent (unless otherwise indicated)

Table 3.1. Disaggregation of activities, factors, and institutions.

No.	Sets	Elements
45	Activities	
38	Rural	
15	Irrigated crops	Soft wheat Hard wheat Barley Maize Other cereal Legumes Fodder Sugarbeet Sugarcane Sunflower Other industrial crop Vegetable Olive Citrus Other fruit
2	Irrigated livestock	Cow Sheep-goat
13	Rainfed crops	Soft wheat Hard wheat Barley Maize Other cereal Legumes Fodder Sugarbeet Sunflower Other industrial crop Vegetable Olive Other fruit
2	Rainfed livestock	Cow Sheep-goat
3	Other agriculture	Other animal Forestry Fishing
3	Rural non-agriculture	Manufacturing Construction Other service

Table 3.1. Cont'd.

Sectors	Sets	Elements
7	Urban	Mining
		Petroleum
		Electricity
		Manufacturing
		Construction
		Other service
		Public administration
7	Factors	
4	Agriculture resources	irrigated land
		water
		rainfed land
		pasture
3	Other	skilled labor
		unskilled labor
		capital
4	Households	
2	Rural	Poor
		Non-poor
2	Urban	Poor
		Non-poor
3	Other institutions	
1	Government	Government
2	Rest of the world	EU
		Other

Figure 3.1. Technology for Production Activities

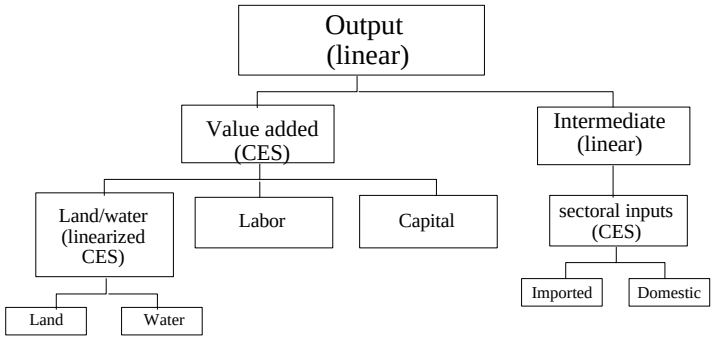
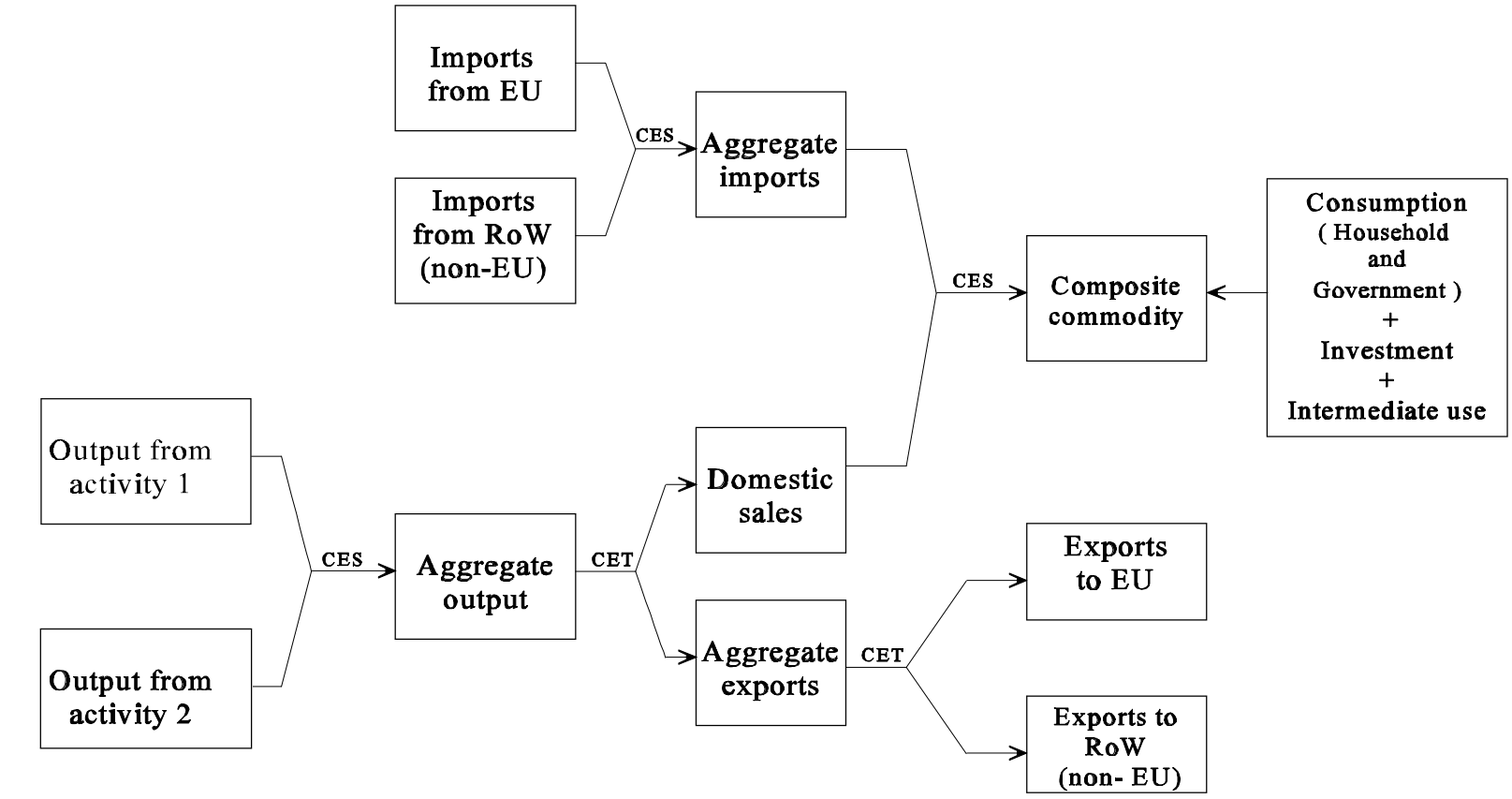


Figure 3.2. Commodity flow in CGE model



Note: CES = constant elasticity of substitution
CET = constant elasticity of transformation
EU = European union
RoW = rest of the world

Table 3.2. Macro SAM for Morocco, 1994 (billion current Dh.)

	Factors	**Institutions**			**S-I**	**Activity**	**Commodity**	**Tax/Sub/Tariff**				**Total**
	1.	2a.	2b.	2c.	3.	4.	5.	6a.	6b.	6c.	6d.	7.
1. Factors						238.35						238.35
2. Institutions												
2a. Household	232.92		7.74	21.42								262.07
2b. Government	5.38	2.02						15.21	23.70		20.47	66.78
2c. Rest of World	0.06	5.55	7.04				86.21					98.85
3. Savings-Investment		45.05	8.03	6.69								59.77
4. Activities							639.75					639.75
5. Commodities		194.24	40.78	70.75	59.77	392.12	7.97			3.20		768.81
6.Tax/Sub/Tariff												
6a. Direct Taxes		15.21										15.21
6b. Indirect Taxes						9.28	14.42					23.70
6c. Subsidies			3.20									3.20
6d. Import Tariffs							20.47					20.47
7. Total	238.35	262.07	66.78	98.85	59.77	639.75	768.81	15.21	23.70	3.20	20.47	

Table 4.1 Alternative trade policy simulations: Scenario definitions

Item	AAEU	TARIFF	TARIFF + NTB	TRADE-LIB
Industrial tariffs				
EU	AAEU*	AAEU*	AAEU*	AAEU*
Non-EU	No change	Unified at 29%**	Unified at 29%**	Unified at 10%**
Agricultural tariffs				
EU	No change	Unified at 29%**	Unified at 29%**	Unified at 10%**
Non-EU	No change	Unified at 29%**	Unified at 29%**	Unified at 10%**
Non-tariff barriers	No change	No change	Eliminated**	Eliminated**

AAEU = implementation of the Association Agreement with the European Union with status-quo policies.
TARIFF = tariff unification
TARIFF + NTB = tariff unification plus non-tariff barriers cut
TRADE-LIB = tariff unification and reduction plus non-tariff barriers cut

Notes:
* AAEU = Gradual elimination of tariffs on industrial imports from EU 1999-2010.
**Tariff unification and elimination of non-tariff barriers is done gradually 1999-2005. In 1994, the average tariff for industrial and agricultural imports was 29%.

Table 4.2. Simulation results: Alternative trade policy scenarios

	1998 value	AAEU	TARIFF	TARIFF + NTB	TRADE-LIB
		% annual growth 1998-2012			
Real GDP at factor cost (bn. 1994 Dh.)					
Agriculture	48.46	2.16	2.07	1.88	1.83
Rural non agriculture	27.21	3.43	3.23	3.40	3.48
Urban	191.06	4.07	4.04	4.08	4.11
Real factor income (bn 1994 Dh.)					
Total	265.42	3.24	3.29	4.10	4.18
Irrigated resources	6.38	6.71	6.57	6.23	5.93
Rainfed resources	20.04	5.57	5.41	3.98	3.48
Unskilled labor	37.96	3.91	3.79	4.05	4.01
Skilled labor	94.91	2.63	2.70	3.94	4.14
Capital	106.12	2.74	2.90	4.14	4.27
Labor shares (%)*					
Agriculture	43.47	43.48	42.88	39.29	38.36
Rural non agriculture	11.00	10.11	10.13	11.08	11.30
Urban	45.53	46.41	46.99	49.63	50.34
Real household per capita income ('000 1994 Dh)					
All	9.77	1.88	1.94	2.32	2.41
Urban Poor	3.08	2.66	2.58	2.95	2.96
Urban Non-poor	13.45	1.65	1.78	2.12	2.25
Rural Poor	3.00	2.86	2.71	2.71	2.60
Rural Non-poor	7.52	2.19	2.15	2.65	2.67
Real trade quantities (bn 1994 Dh.)					
Exports	80.05	4.52	4.42	4.93	5.29
Agriculture exports	5.45	-0.13	-0.23	-0.13	0.13
To EU	4.15	-0.55	-0.52	-0.72	-0.75
To non-EU	1.30	1.07	0.62	1.50	2.42
Industrial exports	43.89	5.97	5.82	6.57	7.04
To EU	28.97	5.72	5.52	6.33	6.81
To non-EU	14.91	6.45	6.36	7.01	7.48
Imports	98.12	4.17	4.08	4.52	4.81
Agriculture imports	7.86	6.20	6.32	10.25	11.38
From EU	3.32	5.61	6.28	12.17	13.32
From non-EU	4.54	6.60	6.35	8.50	9.63
Industrial imports	69.75	4.75	4.64	4.50	4.66
From EU	39.86	7.38	7.57	7.42	6.75
From non-EU	29.89	-1.11	-2.52	-2.63	0.61
Real exchange rate (index 1998 = 100)	100.00	105.02	106.94	113.74	116.37
		(% of GDP)**			
Tariffs	7.34	2.46	2.56	3.52	1.63
Value added tax	-0.42	4.09	3.86	2.21	4.03

Note: See table 4.1 for description of the simulations. *In all columns, share of labor force by aggregate sector (*not* annual growth). **Except for the 1998 column, GDP shares in 2012.

Figure 4.1. Household per capita income – urban poor

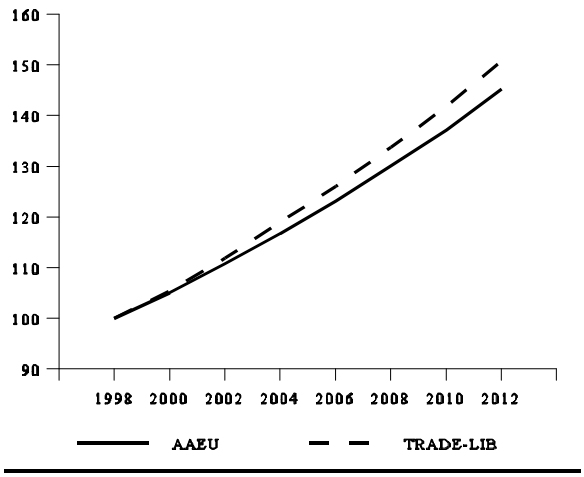


Figure 4.2. Household per capita income – urban non-poor

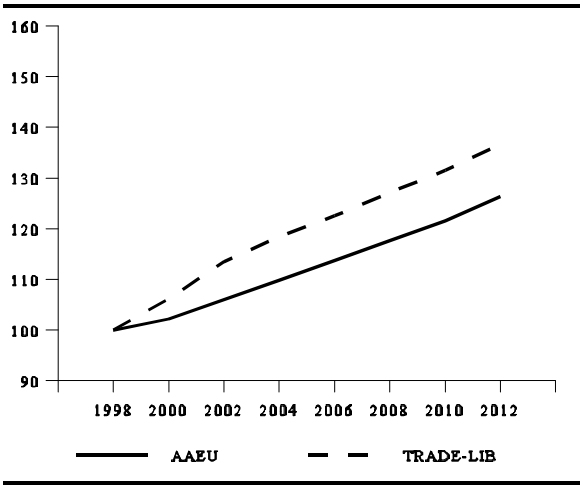


Figure 4.3. Household per capita income – rural poor

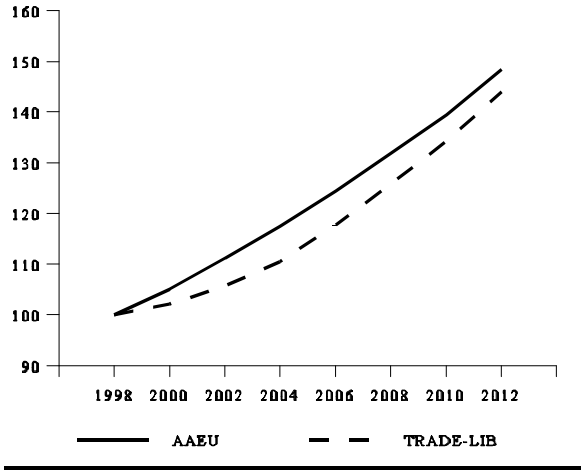


Figure 4.4. Household per capita income – rural non-poor

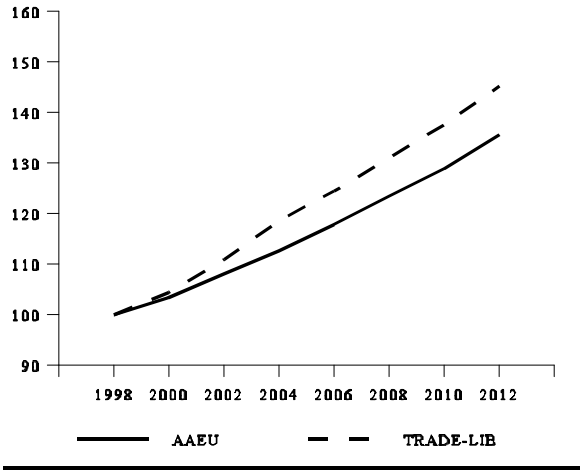


Figure 4.5. Factor income – resources in irrigated agriculture

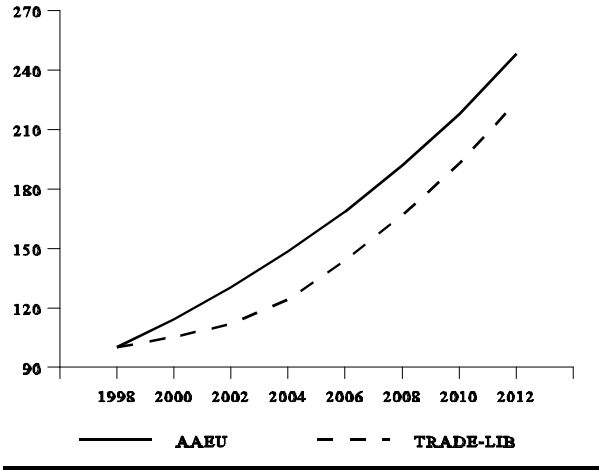


Figure 4.6. Factor income – resources in rainfed agriculture

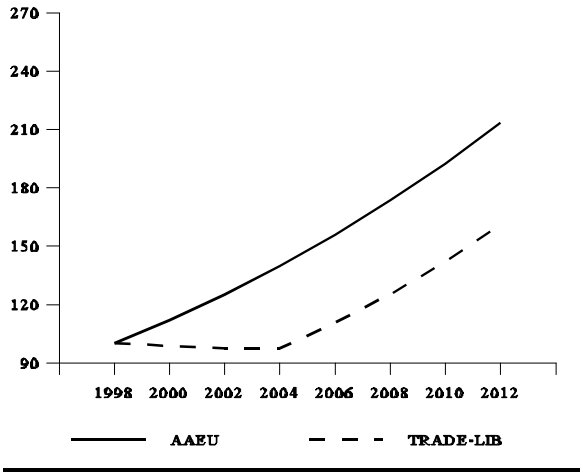


Figure 4.7. Factor income – unskilled labor

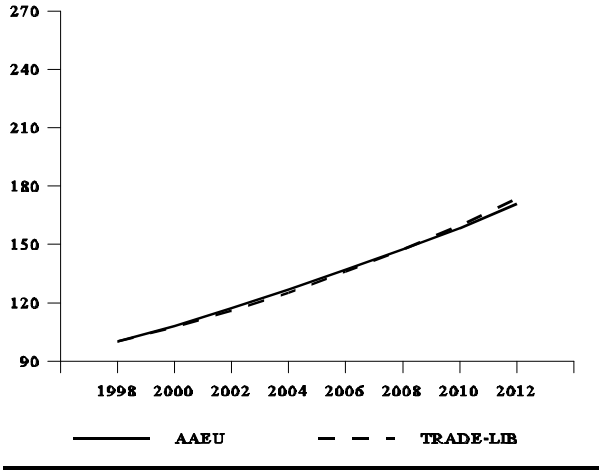


Figure 4.8. Factor income – skilled labor

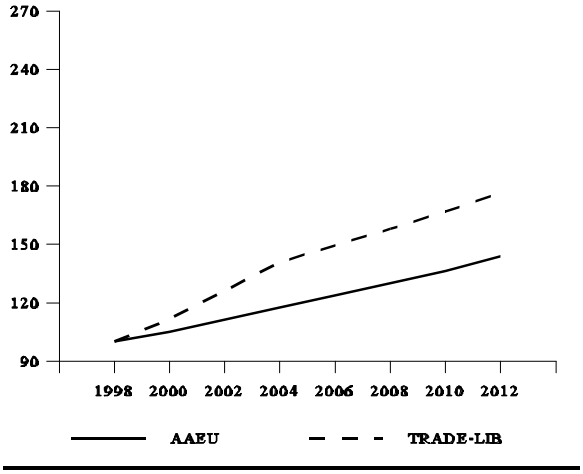


Figure 4.9. Factor income – Capital

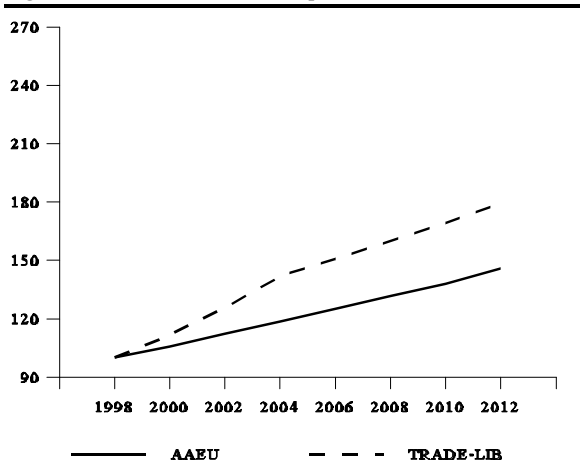


Table 4.3 Complementary policy simulations: Scenario definitions

Scenario	Description
TRANSFER Rainfed factor compensation	TRADE-LIB + transfers to owners of rainfed agricultural resources (land and pasture), in each period fully compensating for loss compared to AAEU
SKILL-UPGRADE Rural skill enhancement	TRADE-LIB + in each period, the stock of rural skilled labor is augmented by 5% with the additional labor coming from the unskilled labor of rural households

Table 4.4. Simulation results: Alternative complementary domestic policy scenarios

	AAEU	TRADE – LIB	TRANSFER	SKILL – UPGRADE
		% annual growth 1998-2012		
Real GDP at factor cost (bn. 1994 Dh.)				
Agriculture	2.16	1.83	1.80	1.86
Rural non agriculture	3.43	3.48	3.48	3.73
Urban	4.07	4.11	4.16	4.42
Real factor income (bn 1994 Dh.)				
Total	3.24	4.18	3.86	4.34
Irrigated resources	6.71	5.93	5.53	6.67
Rainfed resources	5.57	3.48	3.09	4.08
Unskilled labor	3.91	4.01	3.71	4.49
Skilled labor	2.63	4.14	3.93	4.03
Capital	2.74	4.27	3.89	4.45
Labor shares (%)*				
Agriculture	43.48	38.36	38.03	37.34
Rural non agriculture	10.11	11.30	11.30	11.18
Urban	46.41	50.34	50.67	51.49
Real household per capita income (‘000 1994 Dh.)				
All households	1.88	2.41	2.34	2.57
Urban Poor	2.66	2.96	2.72	3.46
Urban Non-poor	1.65	2.25	2.07	2.08
Rural Poor	2.86	2.60	3.03	3.83
Rural Non-poor	2.19	2.67	2.78	3.33
Real trade quantities (bn 1994 Dh.)				
Exports	4.52	5.29	5.25	5.60
Agriculture exports	-0.13	0.13	0.12	-0.16
To EU	-0.55	-0.75	-0.76	-0.93
To non-EU	1.07	2.42	2.41	1.89
Industrial exports	5.97	7.04	6.99	7.43
To EU	5.72	6.81	6.76	7.14
To non-EU	6.45	7.48	7.43	7.96
Imports	4.17	4.81	4.78	5.04
Agriculture imports	6.20	11.38	11.32	11.93
From EU	5.61	13.32	13.23	13.79
From non-EU	6.60	9.63	9.59	10.27
Industrial imports	4.75	4.66	4.65	4.89
From EU	7.38	6.75	6.73	6.99
From non-EU	-1.11	0.61	0.60	0.82
Real exchange rate (index 1998 = 100)	105.02	116.37	116.41	116.55
		(% of GDP)**		
Tariffs	2.46	1.63	1.61	1.67
Value added tax	4.09	4.03	8.04	4.07
Transfers and compensations			3.75	

Note: See Tables 4.1 and 4.3 for definitions of the simulations. *In all columns, share of labor force by aggregate sector (*not* annual growth). **Except for the 1998 column, GDP shares in 2012.

Figure 4.10. Household per capita income – urban poor

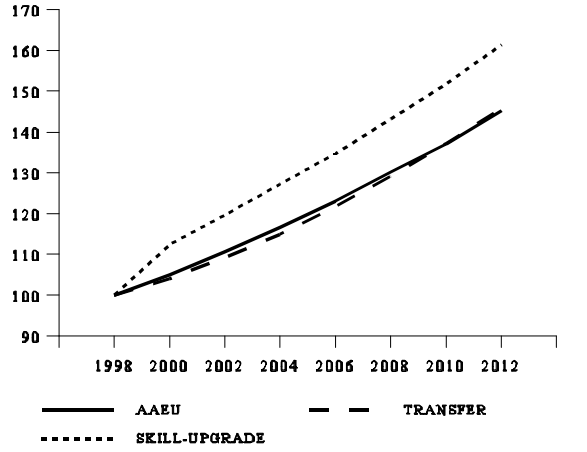


Figure 4.11. Household per capita income – urban non-poor

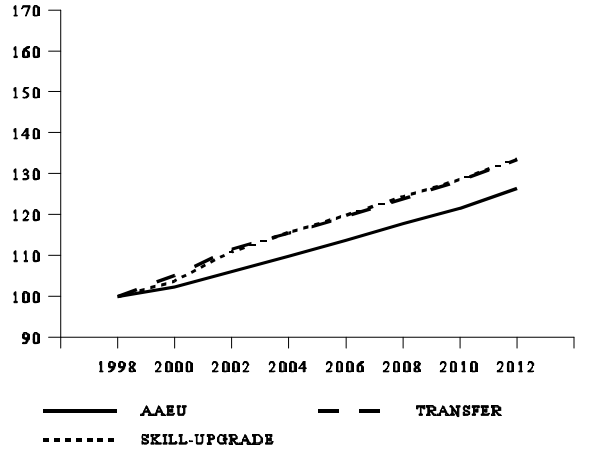


Figure 4.12. Household per capita income – rural poor

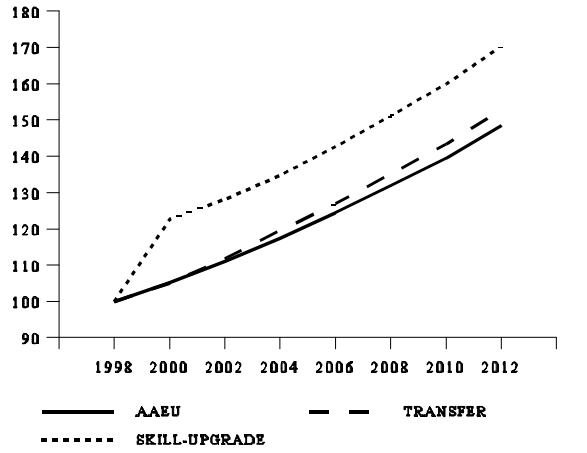


Figure 4.13. Household per capita income – rural non-poor

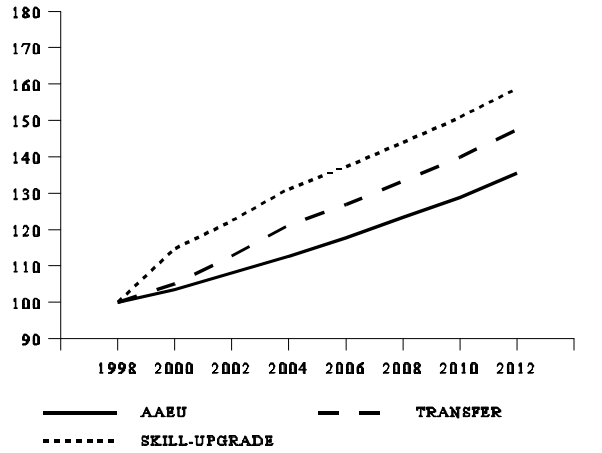


Figure 4.14. Government transfers to owners of rainfed for TRANSFER scenario (% of GDP)

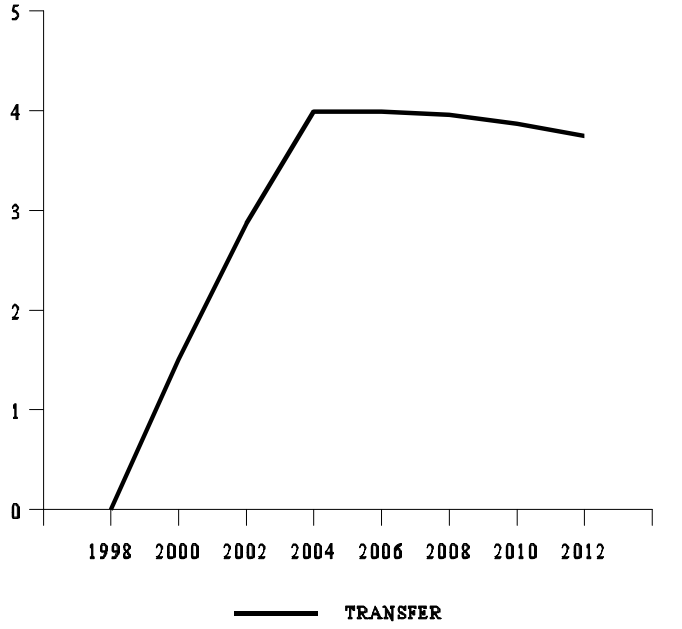


Figure 4.15. Political support – Dirham power

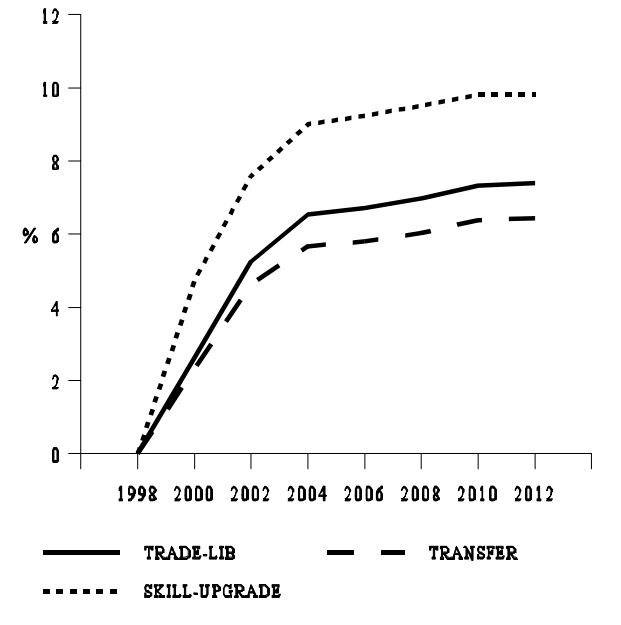
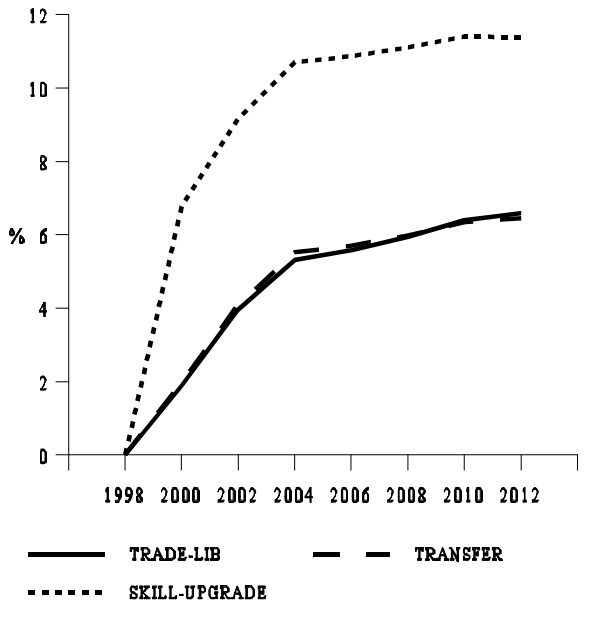


Figure 4.16. Political support – people power



APPENDIX

Table A.1.1. Mathematical Statement of the static module of the Morocco Rural-Urban CGE Model[1]

SETS	
$a \in A$	activities (=A')
$a \in APRD\ (\subset A)$	production activities
$a \in AFAG\ (\subset A)$	factor-aggregation activities
$c \in C$	commodities
$z \in Z$	factors and institutions (domestic and rest of the world) (=Z')
$f \in F\ (\subset Z)$	factors (=F')
$f \in FA\ (\subset F)$	aggregate factors
$f \in FAFE\ (\subset FA)$	aggregate factors with full employment
$f \in FAUN\ (\subset FA)$	aggregate factors with (potential) unemployment
$f \in FD\ (\subset F)$	disaggregated factors (*irrigated land, water*)
$i \in I\ (\subset Z)$	domestic institutions (households and government)
$h \in H\ (\subset I)$	households
$(a,a') \in MA$	mapping: production activity a is linked to factor-aggregation activity a'

PARAMETERS	
$\bar{f}^{sav}$	foreign savings (foreign currency)
$\bar{p}_c^{we}$	world price of exports (foreign currency)
$\bar{p}_c^{wm}$	world price of imports (foreign currency)
$\bar{p}^{d}$	price index for domestic output (non-tradables)
$\bar{q}_f^{s}$	supply of (aggregate or disaggregate) factor f
$\bar{q}_c^{dst}$	stock change for commodity c
$\bar{q}_c^{g}$	government consumption
$\bar{q}_c^{inv}$	fixed investment demand for c
$t_{zz'}$	transfer to institution/factor z from institution/factor z'
$\bar{w}_f^{min}$	minimum wage for (potentially unemployed) aggregate factor f
α_{fa}^{f}	quantity of disaggregated factor f per unit of factor-aggregation activity a
α_{ca}^{a}	intermediate input c per unit of production activity a
γ_{ac}	yield of commodity c per unit of production activity a
θ_{if}^{y}	share of domestic institution i in income of aggregate factor f
θ_h^{trg}	nominal GDP share transferred from government to household h
θ_h^{sav}	share of post-tax income of household h to savings
θ_h^{mtb}	share of non-tariff-barrier rent to household h
σ_c	rate of household consumption subsidy for commodity c
τ_h^{h}	direct tax rate for household h
τ_a^{a}	indirect tax rates for activity a
τ_c^{m}	import tariff rate
τ_c^{mtb}	rate of non-tariff barrier
τ_c^{s}	rate of sales tax
ω_c^{a}	weight of commodity c in domestic sales price index

Table A. 1.1 (con't)

VARIABLES	
e^{g}	government expenditures
e_h^{h}	household consumption expenditures
gdp	nominal GDP at market prices
g^{sav}	government savings
p_a^{a}	output revenue per unit of production activity a
p_c^{d}	price of domestic output sold domestically
p_c^{e}	price of exports
p_c^{m}	price of imports
p_c^{q}	price of composite good
p_a^{va}	value-added (net) price for production activity a
p_c^{x}	average producer price
p_{ac}^{xac}	producer price for commodity c from production activity a
q_a^{a}	level of (production or factor-aggregation) activity a
q_c^{d}	domestic sales of domestic output
q_c^{e}	exports
q_{fa}^{f}	demand for (aggregate/disaggreg.) factor f from (prod./factor aggreg.) activity a
q_{ch}^{h}	consumption demand for c from household h
q_c^{int}	intermediate input demand for c
q_c^{m}	imports of c
q_c^{q}	supply of composite commodity c
q_c^{x}	total output of commodity c
q_{ac}^{xac}	production of commodity c from production activity a
r	exchange rate (units of foreign currency per unit of domestic currency)
w_f	wage of (aggregate/disaggregate) factor f
y_f^{f}	income of aggregate factor f
y^{g}	government income
y_{if}^{if}	income of domestic institution i from aggregate factor f
y_h^{h}	income of household h

Functions	
CES(•)	constant elasticity of substitution
CET(•)	constant elasticity of transformation
LES(•)	linear expenditure system

Table A.1.1 (con't)

EQUATIONS

#	Equation	Domain	Description
Price Block			
1	$p_c^m = \bar{p}_c^{wm} (1 + \tau_c^m + \tau_c^{ntb}) r$	$c \in C$	import price in domestic currency
2	$p_c^e = \bar{p}_c^{we} r$	$c \in C$	export price in domestic currency
3	$p_c^q = \frac{(p_c^d q_c^d + p_c^m q_c^m)}{q_c^q} (1 + \tau_c^s)$	$c \in C$	average demand price of composite commodity
4	$p_c^x = \frac{(p_c^d q_c^d + p_c^e q_c^e)}{q_c^x}$	$c \in C$	average producer price of commodity c
5	$p_a^a = \sum_{c \in C} \gamma_{ac} p_{ac}^{xac}$	$a \in APRD$	gross price for production activity
6	$p_a^{va} = p_a^a (1 - \tau_a^i) - \sum_{c \in C} \alpha_{ca}^i p_a^q$	$a \in APRD$	value added (net) price for production activity
Supply and Trade Block			
7	$q_a^a = CES[q_{fa,a}^f]$	$a \in APRD$	level of domestic production activity
8[2]	$q_{fa}^f = CES^*[w_f, p_a^{va}]$	$f \in FA$ $a \in APRD$	demand for aggregate factor f from production activity a
9	$q_c^{int} = \sum_{a \in APRD} \alpha_{ca}^i q_a^a$	$c \in C$	intermediate input demand
10[3]	$\sum_{f \in FD} w_f \alpha_{fa}^f \geq w_{lw} \quad \left[q_a^a \geq 0 \right]$	$a \in AFAG$	MC ≥ MR for factor-aggregation activity a
11	$q_{fa}^f = \alpha_{fa}^f q_a^a$	$f \in FD$ $a \in AFAG$	demand for disaggregated factor f from factor-aggregation activity a
12	$q_{lw,a}^f = \sum_{a' \in AFAG \mid_{(a,a') \in MA}} q_{a'}^a$	$a \in APRD$	mapping of factor-aggregation activities to production activity a
13	$q_{ac}^{xac} = \gamma_{ac} q_a^a$	$a \in APRD$ $c \in C$	output of commodity c from production activity a

Table A.1.1 (con't)

14	$q_c^x = CES[q_{ac}^{xac}]$	$c \in C$	output aggregation function for commodity c
15	$q_{ac}^{xac} = CES^*[p_{ac}^{xac}, p_c^x]$	$a \in APRD$ $c \in C$	demand for commodity c from production activity a
16	$q_c^x = CET[q_c^e, q_c^d]$	$c \in C$	CET function transforming output to exports and domestic sales
17	$\frac{q_c^e}{q_c^d} = CET^*\left[\frac{p_c^e}{p_c^d}\right]$	$c \in C$	FOC for output transformation
18	$q_c^q = CES[q_c^m, q_c^d]$	$c \in C$	CES function aggregating imports and domestic sales to composite supply
19	$\frac{q_c^m}{q_c^d} = CES^*\left[\frac{p_c^d}{p_c^m}\right]$	$c \in C$	FOC for commodity aggregation
Institution block			
20	$y_f^f = \sum_{a \in APRD} w_f q_{fa}^f$	$f \in FA$	income of aggregate factor f
21[4]	$y_{if}^{if} = \theta_{if}^f (y_f^f - \bar{t}_{row,f} r)$	$i \in I$ $f \in FA$	income of domestic institution i from aggregate factor f
22	$y_h^h = \sum_{f \in FA} y_{hf}^{if} + \theta_h^{hg} gdp + \bar{t}_{h,row} r + \theta_h^{ntb} \sum_{c \in C} \tau_c^{ntb} \bar{p}_c^{wm} q_c^m r$	$h \in H$	household income
23	$e_h^h = (1 - \theta_h^{sav})(1 - \tau_h^d) y_h^h - \bar{t}_{row,h} r$	$h \in H$	household consumption expenditure
24	$q_{ch}^h = LES^*[(1 - \sigma_c) p_c^q, e_h^h]$	$c \in C$ $h \in H$	household consumption demand
25[5]	$y_g = y_{gov,f}^{if} + \sum_{h \in H} \tau_h^d y_h^h + \sum_{c \in C} \tau_c^s (p_c^d q_c^d + p_c^m q_c^m) + \sum_{a \in APRD} \tau_a^i p_a^a q_a^a + \sum_{c \in C} \tau_c^m \bar{p}_c^{wm} q_c^m + \bar{t}_{gov,row}$		government income
26	$e^g = \sum_{c \in C} p_c^q \bar{q}_c^g + \sum_{h \in H} \theta_h^{hg} gdp + \bar{t}_{row,gov} r + \sum_{c \in C} \sum_{h \in H} \sigma_c p_c^q q_{ch}^h$		government expenditure
27	$gdp = \sum_{c \in C} \sum_{h \in H} p_c^q (1 - \sigma_c) q_{ch}^h + \sum_{c \in C} p_c^q \bar{q}_c^{inv} + \sum_{c \in C} p_c^q \bar{q}_c^{dst} + \sum_{c \in C} p_c^q \bar{q}_c^g + \sum_{c \in C} p_c^{we} q_c^e r - \sum_{c \in C} \bar{p}_c^{wm} q_c^m r$		nominal GDP

Table A.1.1 (con't)

System Constraint Block

28	$q_c^q = q_c^{int} + \sum_{h \in H} q_{ch}^h + \bar{q}_c^g + \bar{q}_c^{inv} + \bar{q}_c^{dst}$	$c \in C$	market equilibrium for composite commodity (S=D)
29	$\bar{q}_f^f = \sum_{a \in APRD} q_{fa}^f$	$f \in FAFE$ $f \neq lw$	market equilibrium for fully employed aggregate factors (S=D)
30	$\bar{q}_f^f \geq \sum_{a \in APRD} q_{fa}^f \quad \left[w_f \geq \bar{w}_f^{\min} \right]$	$f \in FAUN$ $f \neq lw$	market equilibrium for potentially unemployed aggregate factors (S≥D)
31	$\bar{q}_f^f \geq \sum_{a \in AFAG} q_{fa}^f \quad \left[w_f \geq 0 \right]$	$f \in FD$	market equilibrium for disaggregated factors (S≥D)
32	$\sum_{c \in C} \bar{p}_c^{wm} q_c^m + \sum_{z \in Z} \bar{t}_{row,z} = \sum_{c \in C} \bar{p}_c^{we} q_c^e + \sum_{z \in Z} \bar{t}_{z,row} + \bar{f}^{sav}$		current account balance (in foreign currency)
33	$\sum_{h \in H} \theta_h^{sav} (1 - \tau_h^d) y_h^h + (y^g - e^g) + r\bar{f}^{sav} = \sum_{c \in C} p_c^q (\bar{q}_c^{inv} + \bar{q}_c^{dst})$		savings-investment balance
34	$\bar{p}^d = \sum_{c \in C} \omega_c^d p_c^d$		price index for domestic output (numéraire)

1. The following notational convention is used: Superscripts are part of variable/parameter names; subscripts are set indices. Variables are written as one or more base-level Latin letters without a bar. Parameters appear as Greek letters or as Latin letters with a bar.
2. CES*, CET*, LES* indicate relationships derived from the respective functions.
3. Complementary constraints are shown in brackets in the equation column. *lw* = the aggregate factor irrigated-land-water, an aggregation of the disaggregated factors *irrigated land* and *water*
4. *row* = rest of the world
5. *gov* = government

Note: The mathematical statement is simplified. The following aspects has been suppressed:
(i) domain controls (limiting equations and variables to subsets of the sets indicated); (ii) wage distortion factors (permitting wage differences across activities); and (iii) special treatments of markets for aggregate factors (permitting rural-urban migration and activity-specificity); (iv) price-responsiveness of selected intermediate input coefficients; (v) disaggregation of imports and exports by source and destination (EU vs. non-EU), respectively; and (vi) constant-elasticity demand curves for selected export commodities-regions in place of fixed export prices. The full model is described in section 3.

Table A.1.2. Economic growth and structural change, 1970-1996

	Real Growth (% per year)			Share of GDP (%)		
	1970-80	1980-90	1990-96	1970	1980	1996
GNP per capita	2.9	1.5	1.0			
GDP at market prices	5.6	3.8	2.7	100.0	100.0	100.0
Agriculture	2.2	3.8	2.8	19.9	18.4	20.4
Industry	5.9	3.2	2.1	27.0	30.9	30.5
Services	6.8	4.2	3.0	53.1	50.6	49.1
Domestic Absorption	6.2	3.4	3.0	103.9	110.5	104.8
Private Consumption	5.4	3.1	4.4	73.4	68.0	67.8
Government Consumption	10.9	4.7	0.1	12.0	18.3	16.4
Gross Investment	7.0	3.4	0.3	18.5	24.2	20.6
Fixed Investment	7.2	3.7	0.9	14.9	22.2	20.4
Resource gap				-3.9	-10.5	-4.8
Exports of Goods & Services	3.4	6.7	3.4	17.6	17.4	25.1
Imports of Goods & Services	6.3	4.6	3.1	21.6	27.9	29.9
Openness (Trade/GDP)				39.2	45.3	55.0

Notes: * Real growth computed at 1987 prices.

** Share data computed at current prices.

Source: WDI 1997, RMSM, December 1997.

Table A.1.3. Household incomes disaggregated by source (1994, in percentages)

	Urban Poor	Urban Non-Poor	Rural Poor	Rural Non-Poor
Irrigated resources	-	0.3	4.9	5.1
Rainfed resources	-	1.1	33.5	15.3
Unskilled labor	73.6	7.2	37.0	19.3
Skilled labor	10.6	42.1	-	13.0
Capital	-	40.5	15.8	31.0
Government Transfers	4.2	2.4	2.3	4.3
Rest of the World Transfers	11.6	6.5	6.4	11.9
Total	100.0	100.0	100.0	100.0