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An Intertemporal, Multi-region General Equilibrium Model of Agricultural Trade Liberalization in the South Mediterranean NIC s, Turkey, and the European Union

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Abstract

With the aid of an intertemporal, multi-region general equilibrium model, we study issues of agricultural trade liberalization, growth and capital accumulation in the context of a world economy moving towards a multi-polar structure. We specifically focus on Turkey, the European Union, the Middle East, and the Economies in Transition; and study alternative scenarios of formation of customs unions and increased trade orientation.

The model is based on intertemporal general equilibrium theory with Ramsey-type dynamics. The world economy is fully endogenized within a 9-region specification, with Turkey, EU, Middle East and the Transition Economies constituting as one of the indigenous regions. A key feature of the model is its explicit recognition of both the commodity and foreign capital flows across regions in an endogenous setting, and its explicit portrayal of the out-of-steady state dynamics under an intertemporal optimization framework. We explore the short- versus the long-run economic impacts of alternative trade and investment policies on agricultural production, foreign trade, resource allocation, accumulation, consumer welfare, and income distribution in the regions of analysis. Our results reveal significant gains from increased bilateral trade between the identified regions, and further underscore the crucial importance of financing commodity trade deficits in sustaining the accumulation patterns.

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Introduction

Currently, the post-Uruguay world economy is widely viewed as moving towards a multi-polar structure based on regional trade agreements (RTAs). Indeed, now almost every country in the world is either a direct member or an associate of an RTA, and it is reported that nearly 60 percent of world trade is transacted now within such blocs (Schiff and Winters, 1998). The emphasis of the world trading regime seems to have shifted from one in which trade relations between nations were almost entirely multilateral to one in which the existing –and quite open- multilateral system co-habits with various preferential trading blocs and RTAs.

Thus, as such, there is now a growing interest on the economics of formation of customs unions and free trade blocs. At face value, it is not clear that the current trends on RTAs will constitute a welfare-improving outcome, or not. The theoretical debate on the welfare effects of a customs union dates far back to Viner (1950), who had pointed out that the net effects could be ambiguous. Accordingly, a customs union could result in both beneficial *trade creation* among its members, as trade barriers within the group were reduced, and also *trade diversion*, in which the increased trade between the member countries might occur at the expense of trade formerly with (probably lower cost) third countries. In particular, Kruger (1999) states that.

> "if the increase in trade within the customs union comes at the expense of trade formerly with third countries now outside the agreement, then the outside countries suffer, unless the countries comprising the newly formed preferential trade agreement were sufficiently small so as not to affect world prices of their traded commodities. (Furthermore), … the welfare effects for the countries within the preferential trade agreement are ambiguous. The reduced tariff means that the price that (the consumers) pay is lower, but the national treasury suffers because it has lost the tariffs that would have been charged and instead pays the higher cost of imports. If gains to consumers outweigh the added amount paid to producers in the high cost partner country, the result can be a net welfare gain for the country; otherwise, the result can be a net welfare loss for the country within the preferential trading agreement" (Krueger, 1999:115).

It can be argued that RTAs can be regarded as a first step towards achieving more openness in the world commodity markets. It is not clear, however, what the intrinsic outcomes would be given the changed patterns of trade due to pressures of trade diversion. In fact, it would be virtually difficult to argue that the proliferation of the RTAs is a

counterpart of the welfare analytics of a freer trade regime (Fernandez and Portes, 1998). (See also the surveys in Bhagwati, Greenaway and Panagariya, 1998; and Bagwell and Staiger, 1998). Existing economic studies tackling the issue have faced an inadequate theoretical framework; and in the absence of a well-developed theory of regional trade zoning and formation, most analysts relied on simulation-based, applied general equilibrium modeling techniques to assess the impact of free trade blocs on output, accumulation, trade, and consumer welfare.[1]

The motivation of the current study derives from this growing body of modeling paradigm to analyze the nexus of these issues. In this preliminary version, we exclusively focus on the effects of extending the trade policy reform initiatives over Turkey, EU, Middle East and the so-called Economies in Transition. We investigate the likely effects on fiscal balances, capital accumulation, and on growth in an intertemporal equilibrium framework. The prevalence and nature of the linkages between globalization of the financial markets and regional capital accumulation patterns, and their effects on production and trade balance are extensively analyzed. Account is also given on issues of bilateral trade and capital flows among the identified regions and other large trading blocks of the global economy.

The model is based on intertemporal general equilibrium theory with Ramsey-type dynamics. The world economy is fully endogenized within a 9-region specification, with Turkey, EU, Middle East and the Transition Economies constituting as one of the indigenous regions. A key feature of the model is its explicit recognition of both the commodity and foreign capital flows across regions in an endogenous setting, and its explicit portrayal of the out-of-steady state dynamics under an intertemporal optimization framework. The rest of the paper is organized as follows: In section II we give a broad review of the recent history of the MENA (Middle East and North Africa) countries' macroeconomic adjustments under their trade integration experience with the EU, and highlight specific traits of their trade patterns. We introduce our modeling approach and discuss the main attributes of our economic structures in section III, and study various issues of trade liberalization under alternative

[1] See, for instance, Smith and Venables (1988), and Mercenier (1995) on Europe; Behar (1995) and Diao and Somwaru (1996) on MERCOSUR; Kehoe and Kehoe (1994) on NAFTA. For a recent review of the political economy issues surrounding the RTAs, see the symposium on "Regionalism and Development" held in the *World Bank Economic Review*, 12(20), May, 1998.

policy scenarios in section IV. We provide summary conclusions in Section V, and document our data-base and sets of algebraic equations as Appendices.

Recent Macroeconomic Performance of the MENA Region and Its Trade with the EU

The countries of the Middle East and North Africa (MENA) have had to confront key developments that have coloured the past two years on the global and regional levels: the crisis in Southeast Asia; the negotiation of a number of bilateral Free Trade Agreements with Europe; and the inauguration of the Arab Free Trade Area with several preferential customs and tariff treaties concluded among Arab countries. Different members of the MENA region have also been affected to varying degrees by the stalled peace process and its implications for security and economic cooperation. For petroleum producers, gains achieved on their terms of trade in 1996 and 1997 were reversed with the sharp downturn in oil prices in 1998. On the global front, the MENA region has been largely immune to the disruptions in trade and financial flows that have resulted from the Southeast Asian crisis. Whereas imports by the crisis countries have dropped sharply and are projected to further decline by 20 to 30 percent in 1998.

On the regional front, an increasing number of MENA countries have opted for rapid liberalization and integration in the world market for trade, finance and investment. The process of transition has been boosted by the successful completion of domestic stabilization and adjustment programs, with a shift of gears from policies for macro stability, to policies for private sector-led growth. The result of opening up the trade regime and dismantling state-owned monopolies are highly visible for the few early reformers, with their share of manufacturing in non-oil exports rising to the same range as for East Asia and Central European countries.

The EU's share of MENA exports stands on the average 25%, and EU accounts for about 44% of MENA imports. Both of these ratios are expected to rise as more countries in the region sign trade agreements with the EU, despite the rigid conditions that the EU has imposed on the rules of origin for most of its South Med partners. Intra-regional trade among MENA countries is also expected to rise from its share of 9.5 percent in 1996, as benefits from the Arab Free Trade are materialized.

The interplay of such integration agreements, however, is subject to the strict observation of WTO rules and conditions, given that all key MENA countries are now WTO members. The rapid liberalization of trade in services will in many ways be fundamental to the smooth functioning of cross border trade in any MENA regional agreement. Equally important will be the harmonization of national regulatory systems as they touch on transport, banking and communications. The share of services in total exports of goods and services is significantly high in MENA countries, averaging 34 percent in 1996, and is dominated by tourism and remittances. The impact of the GATT will be a function of the MENA region's commitments to be WTO and these have been more comprehensive for some members as compared to others. Typically, MENA countries are committed to respect GATT rules in the financial, construction and tourism related sectors, and their level of commitment is considered higher than the average for developing countries.

On the domestic policy front, the MENA region is now clearly divided between those fast moving economies that early liberalized their markets and are now reaping the benefits of transformation and those economic systems that persist in closed, centralized and increasingly vulnerable environments. Successful economies are now beyond the stage of stabilization and structural adjustment, having put in place consistent policy and institutional frameworks that encourage private sector players to respond to the necessities of global integration. These countries now boast modern capital markets, sound banking systems, fully convertible currencies and clearly scheduled reductions in trade barriers.

The process of restructuring the manufacturing sector is also well underway in the fast moving economies, based on programs of "mise á niveau" for the acquisition of modern management tools and quality and technology upgrading. The results are reflected in indicators of competitiveness across manufacturing sectors and provide positive prospects for the growth and diversification of exports. The greatest challenges to the MENA region are how to exploit its exponential growth in the labor force-expected to grow at 40 percent over the next decade-and avoid the potential dangers of unemployment.

One key development to counteract the pressures on the labor market will likely be originating by way of FDI flows. FDI flows to the region, which averaged $3 billion over the past few years, are bound to be attracted in larger volumes by the growing perception of an enabling and profitable operating environment. Five distinctive factors are now at play in

boosting the image of the MENA region. The first is the availability of local business partners in the region, with capital, entrepreneurial skills, and a keen knowledge of the domestic market. Second is the ongoing process of integration within the region and with Europe, providing opportunities for economies of scale and complementarities in the TNC production and marketing network. The third is the upturn in economic growth in the region and the sheer size of its market of 360 million people, which is expected to grow exponentially and double by the year 2030. The fourth is the development of a number of emerging stock markets in the region, several of which have been included in the IFC index and are attracting growing flows of portfolio investment. The fifth factor is the accelerating pace of privatization which has earned the annual value of privatization proceeds and which provides TNCs with attractive options as anchor investors.

Among the countries of the Region, Turkey singles out with its close ties with the EU. As a culmination point in the process of its liberalization efforts, Turkey signed a *customs union* (CU) agreement with the European Union (EU) in March 1995, which had been put into effect in January 1996. Among many other details, the CU agreement consisted of the following broad objectives: (1) all tariffs on Turkish imports of mining and industrial products from the EU were eliminated; (2) Turkey has agreed to adopt the European common external tariff rates on mining and industrial products; and (3) the existing export quotas on Turkey's textile and clothing exports to the EU under the "Voluntary Export Restraint Scheme" were eliminated. Even though no further blueprints were signed, Turkey has always interpreted the CU agreement as an initial step towards full membership to the EU club. As such, Turkey remains the single country outside the EU, with complete integration of its commodity markets under the CU.

As a consequence of the Customs Union, Turkey's weighted rates of protection for imports of industrial products originating from EU and EFTA member states have fallen from 5.9% to 0% and from 10.8% to 6% for similar goods originating from the third countries. With the implementation of the Uruguay Round reductions, Turkey's average rates for third countries will be lowered to 3.5%. Turkey is now taking steps for adaptation to the EU's preferential trade agreements concluded with third countries. It has already signed free trade agreements with the all the candidate countries from Central and Eastern Europe as well as EFTA and Israel. Negotiations with Egypt, Tunisia, Morocco and the Palestinian Authority continue, while negotiations with Malta and Jordan should start soon.

The Customs Union, as put into effect in 1995, does not cover agricultural goods; and the free circulation of agricultural products will only be realized upon Turkey's alignment of its policies to the EU's Common Agricultural Policy. However, in the period between the signing of the Ankara Agreement and the adoption of the Customs Union Decision, the EU granted certain concessions to Turkey. As a result, a large extent of Turkey's agricultural exports to the EU benefits from tariff exemptions or tariff reductions. For instance, prior to the Protocol dated 25 April 1997, 71% of the agricultural exports benefited from the exemptions and 5% benefited from the reductions. Hence in total, 76% of Turkey's exports benefited from the concessions. (Bayar, 1999).

Because of the economic and political uncertainties in the country, however, Turkey has been unable to attract much foreign investment even after the entry into force of the Customs Union. Foreign direct investment was 663 million dollars in 1989 and since then there has not been any significant rise. It was only 554 million dollars in 1997. The share of the foreign direct investment in GDP was only 0.3%. The EU is the main provider of FDI with a share of 62% in total inflow of foreign investment in Turkey. Thus, while the existing empirical evidence on the post-CU Turkey is mixed due to severe macroeconomic turbulence in the country since 1994 and the contagion following the Asian crisis, analytical studies on the post-CU Turkish trade regime have, in general, pointed out to the possibility of significant negative welfare consequences. In their inter-temporal analytical framework, Mercenier and Yeldan (1997) argued, for instance, that due to continued presence of non-tariff barriers (NTBs) and the opportunity of strategic incentives of price discrimination by the European and Turkish oligopolists, Turkey is likely to suffer welfare losses under the simple tariff harmonization episode of CU. Mercenier and Yeldan further claim that the expected welfare gains due to enhanced trade liberalization can only be materialized with elimination of the NTBs and the invigoration of the law of one price across both partners. Kose (1995), in turn, implemented a static general equilibrium framework and argued that due to the oligopolistic mark-up pricing opportunities in Turkish manufacturing, expected price adjustments following the CU may not display the warranted price flexibility. It is only in Harrison et.al.'s (1997) static, perfectly competitive setting that the analysts were able to report positive welfare gains –albeit again at quite a modest rate.

Given this historical background, we will now turn our attention to the strategic policy options in bilateral and regional trade arrangements between the main actors in the region. Before this, however, we first introduce the main ingredients of our analytical model in the next section.

The model

The model is based on dynamic macroeconomic theory with a multi-region and multi sector specification, and draws in many ways upon the recent contributions of dynamic applied general equilibrium modeling by McKibbin (1993), Mercenier and Sampaï o de Souza (1994), Mercenier and Yeldan (1997), Diao, Roe and Yeldan (1999), and Diao and Somwaru (1997). The world economy is aggregated into nine regions.[2] In each region, there are nine production sectors each of which produces a single commodity. All the regions are fully endogenous in terms of their producers and consumers' economic behavior. Furthermore, in a multi-region and multi-sector global model, commodity trade flows are kept track by their geographical and sectoral origin and destination. Countries are further linked by an Armington system so that sectoral commodities are differentiated in demand and supply by their geographical origin.

Firms in each region produce goods and conduct capital investment so as to maximize firm's valuation. Infinitely-lived households consume home produced and imported goods to maximize an intertemporal utility function. Household income is consumed or saved in the form of equity in domestic firms or foreign bonds. Home firm equities and foreign bonds are assumed to be perfect substitutes. Through equity purchases by households, the world "pool" of savings is channeled to profitable investment projects without regard to the national origin of savings. Technological change and population growth are exogenous and hence are assumed to be zero in the model.[3] The detailed description of the model is as follows:

Firms and investment

We assume that firms within each sector of every region can be aggregated into a representative firm. The representative firm operates with constant returns to scale

[2] Appendix Table 1 provides the aggregation scheme of the geographical regions.
[3] This specification has no real effects on the model, since, alternatively, we could normalize all variables in per capita terms.

technology. The value added production function for labor and capital is of Cobb-Douglas, while the intensities of intermediate goods are fixed. The representative firm chooses, at each time period, the input levels of labor and intermediate goods and makes investment decision to maximize the value of the firm. With constant returns to scale technology, the number of firms does not matter. Hence, we assume that the firm finances all its investment outlays by retaining profits so that the number of firm equities within each sector of a region remains unchanged.

A starting point for specifying the firm's optimizing behavior is the condition of asset market equilibrium, i.e., the expected returns from holding the equity in the firms must be in line with those from holding a 'safe' asset, such as foreign bonds, at any time period:

$$r = \frac{div_i}{V_i} + \frac{\Delta V_i}{V_i}$$

where r is the world interest rate, V_i is the market value of firm i, div_i is the current dividend payments, and $\Delta V_{i,t+1} - V_{i,t}$ is the expected annual gain on firm equity. Assuming an efficient financial capital market, each region faces the same world interest rate.

Firms' intertemporal decision problem can be restated more rigorously as follows: in each region's sector i, (i=1,2,…,6), the representative firm chooses the optimal investment and labor employment strategies, $\{I_{i,t}, L_{i,t}\}_{t=1,\ldots,\infty}$, to maximize the present value of all future dividend payments, taking into account expected future price of output, unit value of sector specific capital equipment, and labor wage, $\{P_{i,t}, PI_{i,t}, w_t\}_{t=1,\ldots,\infty}$, and the capital accumulation constraint. Formally,

$$Max\, V_i = \sum_{t=1}^{\infty} R_t div_{i,t} \equiv \sum_{t=1}^{\infty} R_t \left[P_{i,t} \left(f_i(K_{i,t}, L_{i,t}) - a_{i,t} \right) - w_t L_{i,t} - PI_{i,t} I_{i,t} \right]$$

subject to

$$K_{i,t+1} = (1 - \delta) K_{i,t} + I_{i,t}$$

where $R_t = \prod_{t=1}^{\infty} 1/(1+r_s)$ represents the discount factor; $I_{i,t}$ is quantity of new capital equipment built through investments at time t; δ_i is a positive capital depreciation rate; and a_t represents the capital adjustment costs and ýs assumed to be of the following form:

$$a_{i,t} = \phi_i P_{i,t} \frac{I_{i,t}^2}{K_{i,t}}.$$

Because of the presence of adjustment costs on capital, marginal products of capital differ across sectors, resulting in unequal, although optimal rates of investments. We assume that labor is perfectly mobile across sectors (but immobile internationally), and firms never face any quantity constraints. Also, the structure of newly produced capital equipment in terms of foregone sectoral goods is of Cobb-Douglas form. The foregone sectoral output used for investment purposes can be produced domestically or imported. Hence, PI_i, can be written as a function of the (Armingtonian) composite prices:

$$PI_i = \prod_j PC_j^{d_j}$$

where PC_j is the price of the composite good, I, $0<d_j<1$, and $\sum_j d_j = 1$.

The Household and Consumption/Savings

In each region, the representative household owns labor and all private financial assets, namely, equity in domestic firms and foreign bonds. The household allocates income to consumption and savings to maximize an intertemporal utility function over an infinite horizon:

$$\text{Max} \sum_{t=1}^{\infty} \left(\frac{1}{1+\rho}\right)^t U(TC_t)$$

subject to the following current budget constraint:

$$SAV_t = w_t L_t + TI_t + div_t + r_t B_{t-1} - P_t^{TC} TC_t$$

where ρ is the positive rate of time preference; TC_t is aggregate consumption at time t; SAV_t is household savings, B_{t-1} is the stock of foreign assets, and $r_t B_{t-1}$ is interest earned from ownership of foreign bonds. P_t^{TC} is the consumer price index, and TI_t is lump sum transfer

of government revenues from excise taxes and tariffs. We assume no government saving-investment behavior. "Government" spends all its tax revenues on consumption or as transfers to the households, and hence, public sector borrowing requirement is not explicitly modeled. TC_t, the instantaneous consumption, is generated from the consumption of final goods by maximizing a Cobb-Douglas function:

$$TC_t = \prod_i C_{i,t}^{b_i}$$

subject to

$$\sum_i PC_{i,t} C_{i,t} = P_t^{TC} TC_t$$

where $C_{i,t}$ is the final consumption for good i, and the consumer shares, b_i satisfy $0<b_i<1$, and $\Sigma b_i = 1$.

The flow of savings, SAV_t, is the demand for new foreign bonds issued by other regions, which, under equilibrium, reflects current account balances of the region:

$$SAV_t = B_t - B_{t-1} = r_t B_{t-1} + FBOR_t$$

where a positive $FBOR_t$ implies a surplus in the region's foreign trade.

Equilibrium

Intra-temporal equilibrium requires that at each time period, (i) demand for production factors equal their supply; (ii) in the world, total demand for each sectoral good equal to its supply; (iii) in the world, the aggregate household savings equals zero. The inter-temporal equilibria are further constrained by the following steady state conditions:

$$r_{ss} = \frac{div_{SS}}{V_{SS}}$$

$$I_{i,SS} = \delta_i K_{i,SS}$$

$$FBOR_{SS} + r_{SS} B_{SS} = 0$$

The first equation above implies that at the steady state, the value of the firm, V_{ss}, becomes constant and hence the profits, $div_{i,ss}$, is simply equal to the interest earnings from a comparable amount of riskless assets. The second equation implies that in each sector-i, investment expenditures just cover the depreciation of sectoral capital; hence in each sector the stock of capital remains constant. Finally, the last one states that under the steady state foreign bond accumulation must be zero, i.e., that future trade deficits must be covered by interest earnings on foreign assets held.

Policy Analysis

We now utilize our analytical model to study alternatives of preferential trade agreement blocs among the countries of the MENA region, given their exiting trade patterns with the EU. As a first step we study the CU path between Turkey and the EU as was formulated in 1995. Since Turkey has already signed a CU with EU, we regard this manouver as a historically given fact and trace the new policy environments starting from the Turkish-EU trade integration. The CU agreement between Turkey and the EU which is currently in effect covers mainly industrial commodity trade, with agriculture and services being subject to a grace period. In our next step, we take this issue and expand the initial agreement to full trade liberalization between the two partners, covering all sectors. In what follows, we broaden the geographical coverage to include the Economies in Transition, and the Middle East.

We study two sets of issues: *first*, we look into the country experiences in response to bilateral trade integration with the EU, *given that Turkey had already signed a customs union with the EU.* Here we implement four alternative policy environments each corresponding a bilateral trade agreement with the EU for the following four regions: (i) Turkey; (ii) Morocco; (iii) Other Middle East Countries (OME); and (iv) Other North African Countries (ONA). With the aid of this first set of policy simulations, we try to capture the individual regional macroeconomic responses and welfare changes of each individual region, in response to their bilateral trade liberalization with the EU in the form of a customs union. More formally, under EXP-1A, we first implement a CU between Turkey and the EU by eliminating all bilateral tariffs between the two regions. Furthermore, Turkey accepts the EU tariffication structure with respect to its trade with the third party countries. Thus, Turkey and the EU acts as a unified bloc among each other, as well as with their commodity trade

vis-à-vis the rest of the world. In what-follows, we regard this experiment as a historical given fact, and implement, respectively, the same experiment for Morocco (EXP-1B), Rest of the Middle East (EXP-1C), and the North Africa (EXP-1D).

Under the *second set* of experiments, we study issues of trade integration within the MENA region itself. Here, first we look into the intertemporal macroe consequences of a customs union between Turkey, Morocco, The Rest of the Middle East, and North Africa under EXP-2A. Continuing from this environment, we extend the customs union to include the Transitional Economies and the Former Soviet Union under the simulation EXP-2B. Finally, in simulation EXP3, we look into the ultimate exercise of full trade liberalization across the globe, and eliminate all existing tariffs and subsidies in the world commodity trade. This last experiment, EXP-3, notwithstanding the political difficulties and certain country specific exceptions, nevertheless tries to capture the post-Uruguay Round trade liberalization as studied for instance in Blake, Rayner and Reed (1999), and Meilke et. al. (1996).

Our starting point is the macro general equilibrium of the global commodity and finance markets as of 1995. Our data come from a direct aggregation of the database of the *Global Trade Analysis Project (GTAP)*, version 3, in McDougall (1997). We give a broad outline of the characteristics of this data set in the Appendix Tables. We implement our policy simulation experiments via parametric changes of the relevant policy parameters and trace out the out-of-steady state transitional dynamic adjustments towards a new steady state equilibrium. Thus, we rely on the laboratory characteristics of our analytical apparatus and implement these strategic policy options as discrete simulation experiments sequentially. Since our focus is mostly on the short- to medium-run, we choose to limit our analysis exclusively on the first twenty periods of the dynamic adjustment; yet, in principle, one can extend this time horizon and portray the whole time path of the intertemporal equilibrium towards the steady state. The results of simulation experiments are reported in set of Tables 1 and 2.

We first perturb the initial equilibrium configuration by implementing, *ceteris paribus,* the CU agreement between Turkey (TUR) and the EU, and eliminate all tariffs and the non-tariff barriers between EU and TUR. Furthermore, TUR accepts the common trade policy of the EU in all its exports. The new commercial environment mainly results in

complete liberalization of the Turkish agriculture vis-à-vis Europe and achieves in attaining a major step towards releasing resources out of agriculture. Sectoral output responses clearly underscore this point, as primary agriculture and processed food manufacturing contract to release resources to export-oriented textiles and services.

The initial impact of the EXP-1A environment through elimination of tariffs is a cheapening of import costs and an overall deflation of the domestic price level in TUR. Thus, vis-à-vis EU the real exchange depreciates.[4] The decline of the domestic price level leads to an intertemporal substitution of today's consumption in favor of current investment. Thus, current consumption declines and savings and investment expand.

We observe that, *ceteris paribus*, the completion of CU causes a slight deflation of the real gross domestic product in TUR. This short impact is expected to be overcome by period 3, and the Turkish GDP rises over its initial value by 0.5% by period 10, and by 1.4% by the end of period 20. Part of this expansion is due to efficiency gains in resource allocation after lowering the average tariff protection, and part of it originates from the *level effects* of increased investment expenditures which lead to expansion of the capital stock (by as much as 3.0% by the end of period 20). Both exports and imports expand in TUR; yet the rate of expansion in the latter outweighs that of the former, and the trade deficit is expected to widen. Counterpart of this deficit is the rise in the investment-saving gap in the domestic economy. Domestic investment increases by 3.6% upon impact, and by 7.0% over a time horizon of 20 periods.

The output responses of the experiment are diverse and it is hard to make generalizations given the complexity of intertemporal general equilibrium effects. Yet, the surge in TUR textiles in an attempt to exploit its leading role in exports is clearly visible. By period 20, other manufacturing industries along with services join the textiles sectors in the post-CU environment. Thus, the output responses to the CU seem to be a diversion of resources away from agriculture, food processing and investment towards industries with a higher value added content.

[4] We utilize the concept of the real exchange rate as the ratio of the domestic versus the EU consumer baskets. For a further analytical exposition of this point, see Obstfeld and Rogoff, 1996, Chp.4.

Next, we envisage a direct expansion of the CU to encompass Morocco (EXP-1B) by removing its tariffs vis-à-vis EU and Turkey. Morocco, as well faces similar adjustments along with Turkey. Its response in terms of its GDP, however, is slightly stronger (a gain of 1.4% is recorded by period 20) to reflect mostly the initially more distorted trade regime of Morocco. Investment expansion of Morocco, likewise, records a gain of 7.6% upon first period impact, to be followed by 8% over the base run path by the end of period 20. The other side of this strong investment is, however, the decline in consumption expenditures. Unlike Turkey, the Moroccan consumption path cannot recover to its base run by the end of period 20, suggesting that the welfare of consumers as of period 20 still lags behind recovery of the pre-liberalization level. The individual sectoral responses also vary. In comparison to Turkey, Moroccan agricultural sectors expand their output levels in response to trade liberalization. While in Turkey, agricultural sectors dwindle under its round of trade liberalization (EXP-1A), Moroccan agriculture stands to gain during the trade liberalization episode EXP1-B.The expansion of the sugar products is especially pronounced. Fisheries and livestock products, likewise is a very important sector of debate in the Moroccan-EU trade, and is observed to expand its out put level by 0.6% upon first period impact, and by 3.3% by period 20. The overall response of agricultural trade to the experiment is that the imports of agricultural contract by 11% in period 20, and the sector's exports rise by 15.6% by period 20. These results contrast with the Turkish agricultural imports rising by 39%, while its exports of agriculture rose by only 9.8% during its round of trade liberalization. This suggests that the Turkish agriculture have a heavier distortion relative to the rest of the economy.

Now we turn our attention to the Rest of the Middle East (OME) bloc of countries. Under experiment EXP1-C, we start from the Turkish-EU integration of EXP-1A, and leaving Morocco aside, study the individual regional response of OME by bilateral trade liberalization with the EU, followed by adoptation of the EU tariff rates against the third party regions. The liberalization of trade vis-à-vis European Union leads to an expansion of investment demand by 6.4%, capital stock by3.4%, and the aggregate GDP by 0.9% over a period of twenty periods. The expansion of agricultural exports, in particular is very strong, with a cumulative rise of 22.4% by period 20. Imports of agriculture contracts by 5.1%, and thus the agricultural economy moves into a trade surplus. The behavior of individual sectors varies. Except for vegetables and processed agricultural products, all sectors do expand, with the strongest resource pulls occurring in grains.

Similar sets of macro adjustments are observed for the North African Countries (ONA) under its round of respective bilateral trade agreements with the EU. The expansion of investment demand leads to an expansion of the capital stock and of GDP. Aggregate consumption recovery lags behind the base run as of period 20. Sector-wise, grains, processed food industries and (other) primary agriculture contract to release resources for rapidly expanding sectors –sugar products, grains and textiles.

In the next set of experiments (EXP-2A to EXP-3) we turn our attention to alternatives of RTA formation in the region. Under EXP-2A, we study the behavior of individual country blocs under a Middle Eastern RTA. Under this arrangement, Turkey, Morocco, the Rest of the Middle East and North Africa are all brought together in a customs union agreement and liberalize their trade with respect to each other. We find that individual country responses vary when contrasted with the results obtained under the EXP-1 policy environments. Turkey, in particular, is observed to lose GDP when comparison is made with its bilateral trade liberalization with European Union. Turkish investment expansion is observed to be weaker and consumption path is almost unchanged. So the difference across the two policy experiments lie on trade performance. Here, the Turkish agriculture turns into a trade surplus sector, while under the European customs union, imports of the sector have surpassed its exports severely.

The adjustment patterns of the other three regions in the new RTA bloc do not differ significantly. One minor, yet important, development from the view-point of consumer welfare is that aggregate consumption succeeds in recovering by period 20 in response to the Middle Eastern RTA. Furthermore, in the case of Morocco, agriculture ends up as a trade deficit sector, as grains and vegetables contract, and fisheries and livestock products expand.

In the following experiment, we add the economies in transition and the former Soviet Union economies to the Middle Eastern RTA. The expansion of the RTA brings forth further gains over the pervious EXP-2A for all parties concerned. However, Turkey still remains behind its performance vis-à-vis the European CU of EXP-1A. In Morocco fisheries and livestock products continue their expansion, and its agricultural imports contract over its base run path. The GDP in the other Middle East countries (OMA) is not effected differently

than its European CU of EXP-1C. The ONA region, on the other hand, increases its gains in investment and output production, with a significant surplus in its agricultural trade.

Finally, we implement a global trade liberalization scenario under EXP-3. From a regional and global viewpoint this policy maneuver is a culmination of the trade liberalization efforts. Trade preferences, thus far, are observed to be granted on a non-reciprocal basis, and clearly, much of the elements of this policy scenario are topics of the current political agenda, and we have to finesse much of the detail given the context of our aggregate schemes.

The EXP-3 environment brings very strong adjustments on the TUR economy especially with respect to its agriculture. Turkish real exchange rate depreciates by 3.1% upon impact. This adjustment is necessary to bring forth the expansion in exports (by 12.7% over period 20). The new trade environment leads to a further impetus to the TUR gross domestic product, bringing the overall gains to 2.1% over the base run in period 20. All sectors get a further slight boost over their EXP-1A level. Agricultural imports rise by almost 50% and exports by 21.1% in period 20. Grains contract by 5.4%, livestock products by 10%, and processed food industries by 1.6% upon impact. Textiles rise by 16.7%.

In Morocco, GDP is expansion is also very rapid and outpaces its experience with the EU integration under EXP-1B. Textiles is also the most visible gainer with an expansion of 9.8% in period 20. The other primary agriculture is the only sector in Morocco to contract. The overall rapid expansion of investments in Morocco leads to a substitution of current consumption with the future consumption, and the stagnation of aggregate consumption, in that respect, continues well into period 20. This result is qualified for the OMA region, where consumption is observed to recover by 0.2%. Aggregate GDP rise by 1.8% by period 20. Sugar and other primary agriculture reveal themselves as the most rapid gainers for the OMA region countries under global trade liberalization.

As for the Other North African countries, we see that the rapid expansion in investment demand generate a similar set of adjustments as in Morocco, where aggregate consumption is substituted out as of period 20. The rise in aggregate GDP by 0.7% in period 20, however, falls short of its CU experiment of 0.9% under the environment EXP-1D. We observe that non-agricultural sectors gain more relative to the agricultural sectors in North

Africa under global trade liberalization. Vegetables and other primary agriculture, in fact, contract as of period 20 to release resources for the observed expansion in textiles (by 3.9%), other manufacturing (by 4.1%), and services (by 4.0%).

Concluding Comments and Directions for Future Research

Some caveats are in order on the limitations of the study before we go on with the summary of our main findings. First, it has to be clear that, with this type of a methodology, no distinctive conclusions can be inferred about the characterization of the future path of the economy based on "calendar" dates. The policy experiments performed are basically of *comparative* nature and are meaningful only in relation to each other, rather than revealing forecasts of the future.

Second, both the consumption and production activities of the economy are modeled in very aggregate terms. The idea of a *representative* national consumer, though a common device in modern macroeconomic thinking, precludes any analysis addressing income distribution questions and may seem implausible. This specification reflects, however, our main motivation being focused mostly on the dynamics of adjustment of the macro aggregates along a transition path in response to broad policy shifts, and on processes of resource allocation which reflect changes in production efficiency. Thus, as such, many of our insights derived from the simulation exercises do not depend on detailed considerations of heterogeneity of the private sector. In similar vein, government's saving and investment behavior are not addressed; and hence, the spillover effects of public consumption and investment on the private sector are not captured. In the absence of empirical evidence on the nature and causes of such spillovers (especially in the context of a developing country), we try to avoid forming arbitrary algebraic characterizations as much as possible, and abstain from modeling the public sector as an optimizing agent.

Third, one has to note that the adjustment path as characterized by the simulation exercises reflect *equilibrium* relationships on a *smooth* time horizon, mainly in the absence of rigidities and/or structural bottlenecks. Thus, the speed of transitional adjustment of many variables to their respective equilibrium paths should not be taken as a measure of the global stability properties of the modeled economies, but rather as a direct outcome of the laboratory characteristics of a macroeconomic model with continuous, well-behaved functional forms.

For these reasons, our results should be at best regarded as crude approximations of the long-run equilibrium effects of foreign trade policies on current account, output, capital accumulation and th real exchange rate.

The model results reveal that the expected positive outcomes from the current CU agreement between the EU and Turkey very much depend on whether the non-tariff barriers could be eliminated and a move towards a more competitive environment be sustained. The simulation results suggest that Turkish gains from bilateral trade liberalizations with the Middle East or expansion of the CU with the inclusion of the Transition Economies may be equally comparable from a pure resource efficiency viewpoint.

The adjoining of TRN to a Middle Eastern RTA especially leads to a sizable increase in the regional agricultural trade and brings forth additional gains to Morocco's and Middle Eastern gross domestic product and capital investments. Turkey, on the other hand, is observed to gain more strongly with respect to its bilateral trade liberalization with the EU.

In comparison, textiles and clothing reveal itself as the leading exporting sector in Turkey that stands to have significant gains from the trade liberalization episodes. Experiment results suggest that primary agriculture and intermediates utilize excessive resources in comparison to the first best open trade arrangements. According to our results, under the analyzed patterns of macroeconomic adjustments in response to the elimination of tariff protection, there would likely be sizable increases in trade deficits of the region's economies. This would naturally call for the feasibility of access to foreign funds to finance the import-export gap. A key concern here is the fragility of the current external position of Turkey, given the international standards.

Clearly, much of these outcomes will depend upon a host of political factors to which we cannot address in a theoretically satisfying fashion. There is a greater degree of uncertainty on the factors that will determine the impact of the enlargement of the CU, or extension of the RTAs over the Middle East and the Transition Economies. Moreover, these outcomes will as well depend on many exogenous factors, and given the complexity of issues surrounding the trade liberalization initiatives, we need a coherent framework that can take all the fundamental macro-dynamic and micro-sectoral effects into account. We believe that

the multi-region, multi-sector framework based intertemporal dynamic methodology presented here provides such an initial step in understanding these fundamentals.

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Table 1-a. Experiment Results: Country Case Study - Turkey

(Ratios to Base Run Equilibrium)

	Exp1A			Exp1B			Exp1C			Exp1D		
	Period 1	Period 10	Period 20	Period 1	Period 10	Period 20	Period 1	Period 10	Period 20	Period 1	Period 10	Period 20
Gross Domestic Product	0.998	1.005	1.014	0.998	1.005		0.999	1.007	1.016	0.996	1.001	1.008
Consumption	0.994	0.996	1.004	0.990	0.993	1.004	0.990	0.993	1.006	0.989	0.991	1.001
Investment	1.036	1.054	1.071	1.036	1.054	1.070	1.039	1.059	1.078	1.028	1.042	1.055
Capital Stock[2]	1.001		1.030	1.001	1.013	1.030	1.002	1.015	1.033	1.001	1.010	1.024
Exports	1.072	1.079	1.096	1.072	1.078	1.095	1.080	1.086	1.104	1.038	1.042	1.054
Agricultural exports	1.083	1.085	1.099	1.086	1.088	1.101	1.106	1.108	1.122	1.047	1.048	1.058
Imports	1.077	1.080	1.068	1.077	1.080	1.068	1.084	1.088	1.075	1.042	1.045	1.036
Agricultural Imports	1.399	1.400	1.393	1.398	1.400	1.392	1.416	1.418	1.410	1.342	1.343	1.337
Real Exchange Rate[1]	0.981	0.979	0.972	0.981	0.979	0.972	0.982	0.980	0.972	0.971	0.969	0.964
Output Supply												
Grains	0.983	0.985	0.995	0.983	0.985	0.995	0.985	0.987	0.998	0.991	0.992	1.000
Vegetables	0.990	0.990	0.997	0.990	0.991	0.997	0.990	0.990	0.998	0.989	0.989	0.994
Sugar	0.979	0.982	0.994	0.979	0.982	0.994	0.979	0.982	0.995	0.975	0.978	0.987
Livestock	0.876	0.878	0.885	0.876	0.878	0.885	0.878	0.880	0.888	0.885	0.886	0.892
Other agriculture	1.026	1.030	1.047	1.026	1.030	1.046	1.023	1.027	1.045	1.018	1.021	1.033
Processed food	0.982	0.986	1.000	0.982	0.986	1.000	0.983	0.988	1.003	0.983	0.986	0.997
Textiles	1.169	1.183	1.227	1.166	1.179	1.223	1.168	1.183	1.232	1.072	1.081	1.113
Other manufacturing	0.994	1.006	1.020	0.995	1.006	1.021	0.996	1.009	1.025	1.006	1.015	1.027
Services	0.999	1.008	1.016	0.999	1.008	1.016	0.999	1.009	1.017	1.001	1.008	1.014

1) Ratio of The Domestic Price Index to the Import Price Index.

2) Period 2.

Table 1-b. Experiment Results: Country Case Study -- Morocco

(Ratios to Base Run Equilibrium)

	Exp1A			Exp1B			Exp1C			Exp1D		
	Period 1	Period 10	Period 20	Period 1	Period 10	Period 20	Period 1	Period 10	Period 20	Period 1	Period 10	Period 20
Gross Domestic Product	1.000	0.999	0.999	0.993	1.008	1.014	0.999	1.000	1.000	1.000	1.000	1.001
Consumption		1.000	1.000	0.984	0.996	0.998	0.999	1.000	1.000	1.000	1.000	1.000
Investment	0.999	0.999	0.999	1.076	1.075	1.080	0.999	1.000	1.001	1.000	1.001	1.001
Capital Stock[2]	1.000	1.000	0.999	1.008	1.049	1.069	1.000	1.000	1.000	1.000	1.000	1.001
Exports	0.998	0.998	0.997	1.111	1.133	1.142	0.999	0.998	0.998	1.001	1.001	1.000
Agricultural exports	1.002	1.001	1.001	1.119	1.144	1.156	1.003	1.003	1.003	1.004	1.004	1.004
Imports	0.998	0.998	0.998	1.103	1.098	1.094	0.999	0.999	0.999	1.000	1.000	1.000
Agricultural Imports	0.996	0.997	0.996	0.903	0.894	0.889	0.996	0.996	0.996	1.000	0.999	0.999
Real Exchange Rate[1]	0.999	0.999	1.000	0.965	0.955	0.951	0.999	1.000	1.000	1.000	1.000	1.000
Output Supply												
Grains	1.001	1.000	1.001	1.001	1.020	1.029	1.000	1.000	1.001	1.000	1.000	1.001
Vegetables	1.001	1.001	1.001	0.986	1.006	1.016	1.002	1.002	1.002	1.000	1.000	1.001
Sugar	1.001	1.000	1.001	1.187	1.211	1.222	1.000	1.000	1.001	0.999	1.000	1.000
Livestock	1.000	1.000	1.000	1.007	1.024	1.032	1.000	1.000	1.000	1.000	1.000	1.001
Other agriculture	1.002	1.002	1.002	0.955	0.982	0.994	1.002	1.002	1.002	1.000	1.001	1.001
Processed food	1.000	1.000	1.000	0.991	1.010	1.019	1.000	1.000	1.001	1.001	1.001	1.002
Textiles	0.996	0.995	0.994	1.095	1.127	1.141	0.996	0.995	0.995	0.998	0.998	0.997
Other manufacturing	1.001	1.001	1.001	0.956	0.982	0.993	1.002	1.002	1.002	1.002	1.002	1.002
Services	1.000	1.000	1.000	0.992	1.008	1.015	1.000	1.000	1.000	1.000	1.000	1.000

1) Ratio of The Domestic Price Index to the Import Price Index.

2) Period 2.

Table 1-c. Experiment Results: Country Case Study -- Other Middle East Economies

(Ratios to Base Run Equilibrium)

	Exp1A			Exp1B			Exp1C			Exp1D		
	Period 1	Period 10	Period 20	Period 1	Period 10	Period 20	Period 1	Period 10	Period 20	Period 1	Period 10	Period 20
Gross Domestic Product	1.000	1.000	1.001	1.000	1.000	1.001	0.994	1.002	1.009	1.000	1.000	1.001
Consumption	1.000	1.000	1.000	1.000	1.000	1.001	0.982	0.989	0.998	1.000	1.000	1.001
Investment	1.001	1.001	1.001	1.001	1.001	1.001	1.057	1.056	1.064	1.001	1.001	1.001
Capital Stock[2]	1.000	1.000	1.001	1.000	1.000	1.069	1.003	1.019	1.034	1.000	1.000	1.001
Exports	1.001	1.002	1.001	1.002	1.002	1.001	1.022	1.029	1.036	1.002	1.001	1.001
Agricultural exports	1.009	1.010	1.010	1.007	1.007	1.007	1.195	1.208	1.224	1.012	1.011	1.011
Imports	1.002	1.002	1.001	1.002	1.002	1.001	1.038	1.035	1.026	1.001	1.001	1.001
Agricultural Imports	1.001	1.001	1.001	1.001	1.001	1.001	0.959	0.955	0.949	1.001	1.002	1.002
Real Exchange Rate[1]	1.000	1.000	1.000	1.000	1.000	1.000	0.974	0.969	0.964	1.000	1.000	1.000
Output Supply												
Grains	0.999	1.000	1.000	0.999	0.999	1.000	1.123	1.134	1.147	0.998	0.998	0.999
Vegetables	1.000	1.000	1.000	1.000	1.000	1.000	0.982	0.990	0.999	1.000	1.000	1.000
Sugar	1.000	1.000	1.000	1.000	1.000	1.000	1.023	1.034	1.047	0.999	0.999	0.999
Livestock	1.002	1.002	1.003	1.002	1.002	1.003	0.988	0.997	1.007	1.002	1.002	1.003
Other agriculture	0.997	0.997	0.997	0.995	0.995	0.995	1.029	1.041	1.056	0.995	0.995	0.996
Processed food	1.000	1.000	1.000	1.000	1.000	1.000	0.973	0.982	0.993	1.000	1.001	1.001
Textiles	0.997	0.997	0.997	0.997	0.996	0.996	1.009	1.024	1.039	0.999	0.999	0.999
Other manufacturing	0.999	1.000	1.000	1.000	1.000	1.000	0.993	1.007	1.016	1.000	1.000	1.000
Services	1.000	1.000	1.000	1.000	1.000	1.000	1.001	1.010	1.018	1.000	1.000	1.000

1) Ratio of The Domestic Price Index to the Import Price Index.

2) Period 2.

Table 1-d. Experiment Results: Country Case Study -- North African Economies

(Ratios to Base Run Equilibrium)

	Exp1A			Exp1B			Exp1C			Exp1D		
	Period 1	Period 10	Period 20	Period 1	Period 10	Period 20	Period 1	Period 10	Period 20	Period 1	Period 10	Period 20
Gross Domestic Product	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.989	1.005	1.009
Consumption	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.973	0.990	0.994
Investment	1.001	1.001	1.001	1.000	1.001	1.001	1.000	1.001	1.001	1.110	1.077	1.075
Capital Stock[2]	1.000	1.000	1.001	1.000	1.000	1.001	1.000	1.000	1.001	1.011	1.054	1.067
Exports	1.001	1.001	1.000	1.001	1.001	1.000	1.002	1.002	1.001	1.058	1.078	1.083
Agricultural exports	0.996	0.997	0.997	1.001	1.001	1.001	0.983	0.983	0.982	1.160	1.196	1.204
Imports	1.001	1.001	1.000	1.001	1.001	1.000	1.001	1.001	1.001	1.083	1.068	1.064
Agricultural Imports	1.000	1.000	1.000	1.000	1.000	1.000	1.001	1.001	1.001	0.920	0.908	0.905
Real Exchange Rate[1]	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.950	0.938	0.935
Output Supply												
Grains	1.000	1.000	1.000	1.000	1.000	1.000	0.996	0.997	0.997	1.051	1.078	1.085
Vegetables	1.000	1.000	1.000	1.000	1.000	1.000	1.001	1.001	1.001	0.958	0.980	0.985
Sugar	0.999	1.000	1.000	0.999	1.000	1.000	0.999	0.999	1.000	1.074	1.102	1.109
Livestock	1.001	1.001	1.001	1.001	1.001	1.001	1.001	1.001	1.001	0.975	0.995	1.000
Other agriculture	0.998	0.998	0.999	0.998	0.998	0.998	0.997	0.997	0.998	0.925	0.956	0.964
Processed food	1.000	1.000	1.000	1.000	1.001	1.001	1.001	1.001	1.001	0.943	0.965	0.971
Textiles	0.996	0.996	0.996	0.995	0.995	0.995	0.996	0.996	0.996	1.013	1.046	1.054
Other manufacturing	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.001	1.001	0.980	1.010	1.017
Services	1.000	1.001	1.001	1.001	1.001	1.001	1.001	1.001	1.001	1.007	1.025	1.029

1) Ratio of The Domestic Price Index to the Import Price Index.

2) Period 2.

Table 2-a. Experiment Results: Effects of Regional Trade Agreements and Global Liberalization on Turkey

(Ratios to Base Run Equilibrium)

	Exp2A			Exp2B			Exp3		
	Period 1	Period 10	Period 20	Period 1	Period 10	Period 20	Period 1	Period 10	Period 20
Gross Domestic Product	1.002	1.004	1.007	1.000	1.008	1.019	0.998	1.009	1.022
Consumption	0.999	1.000	1.004	0.989	0.993	1.008	0.986	0.991	1.009
Investment	1.013	1.019	1.024	1.044	1.067	1.089	1.047	1.077	1.103
Capital Stock[2]	1.001	1.005	1.010	1.002	1.016	1.038	1.002	1.019	1.043
Exports	1.024	1.026	1.032	1.089	1.095	1.116	1.104	1.106	1.127
Agricultural exports	1.045	1.046	1.050	1.116	1.117	1.133	1.200	1.196	1.212
Imports	1.026	1.027	1.023	1.093	1.097	1.082	1.103	1.109	1.091
Agricultural Imports	1.051	1.051	1.049	1.446	1.449	1.440	1.498	1.504	1.496
Real Exchange Rate[1]	1.000	0.999	0.997	0.982	0.980	0.972	0.970	0.970	0.961
Output Supply									
Grains	0.997	0.998	1.002	0.978	0.980	0.993	0.946	0.948	0.962
Vegetables	0.999	0.999	1.002	0.990	0.991	0.999	0.994	0.994	1.004
Sugar	0.996	0.997	1.001	0.978	0.982	0.996	1.019	1.024	1.041
Livestock	0.992	0.993	0.995	0.880	0.882	0.891	0.900	0.902	0.912
Other agriculture	0.995	0.996	1.001	1.003	1.007	1.028	1.030	1.033	1.057
Processed food	1.001	1.002	1.007	0.986	0.991	1.009	0.984	0.990	1.011
Textiles	1.008	1.012	1.025	1.174	1.189	1.245	1.168	1.177	1.241
Other manufacturing	1.007	1.011	1.016	0.998	1.012	1.030	1.003	1.018	1.039
Services	0.999	1.002	1.005	0.999	1.010	1.019	0.997	1.010	1.021

1) Ratio of The Domestic Price Index to the Import Price Index.

2) Period 2.

Table 2-b. Experiment Results: Effects of Regional Trade Agreements and Global Liberalization on Morocco

(Ratios to Base Run Equilibrium)

	Exp2A			Exp2B			Exp3		
	Period 1	Period 10	Period 20	Period 1	Period 10	Period 20	Period 1	Period 10	Period 20
Gross Domestic Product	1.002	1.003	1.004	0.993	1.009	1.016	0.992	1.012	1.021
Consumption	1.000	1.001	1.002	0.984	0.996	0.999	0.979	0.996	0.999
Investment	1.009	1.009	1.009	1.076	1.077	1.083	1.094	1.098	1.107
Capital Stock[2]	1.001	1.006	1.008	1.008	1.049	1.072	1.010	1.062	1.092
Exports	1.018	1.020	1.021	1.111	1.135	1.144	1.147	1.169	1.178
Agricultural exports	1.010	1.012	1.013	1.119	1.148	1.161	1.152	1.180	1.193
Imports	1.015	1.014	1.014	1.103	1.099	1.096	1.130	1.124	1.119
Agricultural Imports	1.022	1.021	1.021	0.903	0.898	0.893	1.076	1.064	1.058
Real Exchange Rate[1]	0.999	0.998	0.997	0.965	0.955	0.951	0.945	0.936	0.932
Output Supply									
Grains	0.995	0.998	0.999	1.001	1.017	1.027	0.964	0.988	1.000
Vegetables	0.992	0.994	0.996	0.986	1.011	1.021	0.998	1.025	1.039
Sugar	0.997	1.000	1.001	1.187	1.210	1.222	0.987	1.016	1.030
Livestock	1.000	1.002	1.003	1.007	1.024	1.033	0.995	1.017	1.028
Other agriculture	0.993	0.996	0.997	0.955	0.974	0.987	0.941	0.973	0.989
Processed food	1.000	1.003	1.004	0.991	1.012	1.021	1.005	1.029	1.042
Textiles	1.006	1.009	1.010	1.095	1.126	1.140	1.046	1.080	1.098
Other manufacturing	1.004	1.007	1.009	0.956	0.986	0.997	1.007	1.042	1.058
Services	1.000	1.002	1.002	0.992	1.008	1.015	0.997	1.019	1.028

1) Ratio of The Domestic Price Index to the Import Price Index.

2) Period 2.

Table 2-c. Experiment Results: Effects of Regional Trade Agreements and Global Liberalization on Other Middle East Economies

(Ratios to Base Run Equilibrium)

	Exp2A			Exp2B			Exp3		
	Period 1	Period 10	Period 20	Period 1	Period 10	Period 20	Period 1	Period 10	Period 20
Gross Domestic Product	1.000	1.001	1.001	0.994	1.002	1.009	0.993	1.006	1.018
Consumption	1.000	1.000	1.001	0.982	0.989	0.998	0.975	0.986	1.002
Investment	1.004	1.004	1.004	1.056	1.055	1.064	1.082	1.089	1.104
Capital Stock[2]	1.000	1.001	1.002	1.003	1.018	1.072	1.004	1.028	1.054
Exports	1.005	1.005	1.006	1.023	1.030	1.036	1.046	1.052	1.061
Agricultural exports	1.063	1.063	1.064	1.181	1.192	1.207	1.324	1.339	1.362
Imports	1.006	1.006	1.005	1.038	1.035	1.026	1.064	1.061	1.047
Agricultural Imports	1.014	1.013	1.013	0.956	0.952	0.946	1.092	1.087	1.077
Real Exchange Rate[1]	1.000	0.999	0.999	0.974	0.970	0.965	0.957	0.953	0.945
Output Supply									
Grains	0.997	0.998	0.999	1.122	1.133	1.146	0.967	0.981	1.001
Vegetables	0.998	0.999	0.999	0.984	0.992	1.001	0.989	1.000	1.015
Sugar	1.001	1.001	1.002	1.023	1.034	1.047	1.073	1.090	1.112
Livestock	1.003	1.004	1.005	0.988	0.997	1.007	0.992	1.006	1.022
Other agriculture	1.003	1.004	1.005	1.016	1.028	1.043	1.046	1.064	1.089
Processed food	1.000	1.001	1.001	0.974	0.983	0.994	0.984	0.998	1.016
Textiles	1.000	1.001	1.002	1.009	1.023	1.039	0.942	0.959	0.983
Other manufacturing	1.000	1.001	1.002	0.993	1.007	1.016	1.015	1.035	1.051
Services	1.000	1.001	1.001	1.000	1.010	1.017	1.000	1.014	1.027

1) Ratio of The Domestic Price Index to the Import Price Index.

2) Period 2.

Table 2-d. Experiment Results: Effects of Regional Trade Agreements and Global Liberalization on North African Economies

(Ratios to Base Run Equilibrium)

	Exp2A			Exp2B			Exp3		
	Period 1	Period 10	Period 20	Period 1	Period 10	Period 20	Period 1	Period 10	Period 20
Gross Domestic Product	1.000	1.001	1.002	0.988	1.005	1.009	0.982	1.002	1.007
Consumption	0.998	1.000	1.000	0.972	0.989	0.994	0.961	0.982	0.989
Investment	1.010	1.007	1.007	1.108	1.077	1.075	1.122	1.091	1.090
Capital Stock[2]	1.001	1.005	1.006	1.011	1.054	1.067	1.012	1.062	1.080
Exports	1.010	1.012	1.012	1.059	1.079	1.082	1.083	1.103	1.105
Agricultural exports	1.077	1.079	1.080	1.145	1.179	1.187	1.266	1.305	1.312
Imports	1.011	1.010	1.010	1.083	1.068	1.064	1.106	1.089	1.084
Agricultural Imports	1.008	1.007	1.006	0.917	0.905	0.902	1.060	1.046	1.043
Real Exchange Rate[1]	0.995	0.994	0.994	0.949	0.938	0.936	0.917	0.906	0.904
Output Supply									
Grains	1.001	1.003	1.004	1.049	1.076	1.083	0.961	0.991	1.000
Vegetables	0.996	0.998	0.999	0.961	0.983	0.989	0.958	0.983	0.991
Sugar	0.998	1.001	1.002	1.073	1.101	1.108	0.967	0.998	1.006
Livestock	0.998	1.000	1.000	0.975	0.995	1.000	0.978	1.001	1.008
Other agriculture	0.996	0.999	0.999	0.919	0.950	0.958	0.925	0.959	0.969
Processed food	0.998	1.000	1.000	0.944	0.967	0.973	0.976	1.002	1.010
Textiles	0.995	0.998	0.999	1.008	1.041	1.049	0.995	1.029	1.039
Other manufacturing	1.000	1.003	1.003	0.980	1.010	1.017	0.997	1.032	1.041
Services	1.001	1.003	1.003	1.007	1.025	1.030	1.012	1.034	1.040

1) Ratio of The Domestic Price Index to the Import Price Index.

2) Period 2.

Appendix

List of equations

The time-discrete intertemporal utility

(The elasticity of intertemporal substitution is chosen as one)

$$U_{n,1} = \sum_{t=1}^{\infty} \left(\frac{1}{1+\mathrm{r}} \right)^{t} \ln\left(TC_{n,t}\right) + \ln\left(TC_{n,T}\right) \frac{\left(1+\mathrm{r}\right)^{1-T}}{\mathrm{r}}$$

$$TC_{n,t} = \prod_{i} CD_{n,i,t}^{a_{n,i}}$$

Intertemporal Value of Firms

$$V_{n,i,1} = \sum_{t=1}^{T} \frac{1}{\prod_{s=1}^{t} (1+r_s^D)^t} div_{n,i,t} + div_{n,i,T} \frac{\left(1+r_T\right)^{1-T}}{r_T}$$

$$div_{n,i,t} = PVA_{\mathrm{n,i,t}} L_{n,i,t}^{\mathsf{a}_{n,i}} K_{n,i,t}^{1-\mathsf{a}_{n,i}} - wl_{n,t} L_{n,i,t} - PVA_{n,i,t} \mathsf{f}_{n,i} \frac{I_{n,i,t}^2}{K_{n,i,t}} - PI_{n,i,t} I_{n,i,t}$$

Within period equations (time subscript is omitted):

Armington Composite Functions

$$PMM_{n,i} = \frac{1}{\mathsf{g}_{n,i}} \left[\sum\nolimits_{s} \mathsf{q}_{s,n,i}^{\mathsf{S}m_{n,i}} \left(\left(1+tm_{s,n,i}\right) PWM_{s,n,i} \right)^{1-\mathsf{S}m_{n,i}} \right]^{\frac{1}{\left(1-\mathsf{S}m_{n,i}\right)}}$$

$$PC_{n,i} = \frac{1}{\Lambda_{\mathrm{n,i}}} \left[\mathsf{b}_{n,i}^{\mathsf{S}mm_{n,i}} PMM_{n,i}^{1-\mathsf{S}mm_{n,i}} + \left(1-\mathsf{b}_{n,i}\right)^{\mathsf{S}mm_{n,i}} PD_{n,i}^{1-\mathsf{S}mm_{n,i}} \right]^{\frac{1}{\left(1-\mathsf{S}mm_{n,i}\right)}}$$

$$M_{s,n,i} = \mathsf{g}_{n,i}^{1+\mathsf{S}m_{n,i}} \left[\frac{\mathsf{q}_{s,n,i} PMM_{n,i}}{\left(1+tm_{s,n,i}\right) PWM_{s,n,i}} \right]^{\mathsf{S}m_{n,i}} MM_{n,i}$$

$$MM_{n,i} = \Lambda_{n,i}^{1+\sigma mm_{n,i}} \left[\beta_{n,i} \frac{PC_{n,i}}{PMM_{n,i}} \right]^{\sigma mm_{n,i}} C_{n,i}$$

$$D_{n,i} = \Lambda_{n,i}^{1+\sigma mm_{n,i}} \left[(1-\beta_{n,i}) \frac{PC_{n,i}}{PD_{n,i}} \right]^{\sigma mm_{n,i}} C_{n,i}$$

CET Functions

$$PEE_{n,i} = \frac{1}{\kappa_{n,i}} \left[\sum_s \chi_{n,s,i}^{-\sigma x_{n,i}} \left(1-te_{n,s,i}\right) PWM_{n,s,i}^{1+\sigma x_{n,i}} \right]^{1/(1+\sigma x_{n,i})}$$

$$PX_{n,i} = \frac{1}{\Gamma_{n,i}} \left[\eta_{n,i}^{-\sigma e_{n,i}} PEE_{n,i}^{1+\sigma e_{n,i}} + (1-\eta_{n,i})^{-\sigma e_{n,i}} PD_{n,i}^{1+\sigma e_{n,i}} \right]^{\frac{1}{1+\sigma e_{n,i}}}$$

$$E_{s,n,i} = \kappa_{s,i}^{-(1+\sigma x_{s,i})} \left[\chi_{s,n,i} \frac{PEE_{s,i}}{(1-te_{s,n,i}) PWM_{s,n,i}} \right]^{-\sigma x_{s,i}}$$

$$EE_{n,i} = \Gamma_{n,i}^{-(1+\sigma e_{n,i})} \left[\eta_{n,i} \frac{PX_{n,i}}{PEE_{n,i}} \right]^{-\sigma e_{n,i}} X_{n,i}$$

$$D_{n,i} = \Gamma_{n,i}^{-(1+\sigma e_{n,i})} \left[(1-\eta_{n,i}) \frac{PX_{n,i}}{PD_{n,i}} \right]^{-\sigma e_{n,i}} X_{n,i}$$

Value Added and Output Prices

$$PVA_{n,i} = \frac{1}{A_{n,i}^{\alpha_{n,i}} \alpha_{n,i}^{\alpha_{n,i}} (1-\alpha_{n,i})^{(1-\alpha_{n,i})}} Wl_n^{\alpha_{n,i}} Wk_{n,i}^{(1-\alpha_{n,i})}$$

$$PVA_{n,i} = (1-tx_{n,i}) PX_{n,i} - \sum_j PC_{n,j} IO_{n,i,j}$$

Factor Market Equilibrium

$$\alpha_{n,i} PVA_{n,i} X_{n,i} = Wl_n \cdot L_n$$

Private Demand System

$$CD_{n,i} = \frac{a_{n,i}(Y_n - SAV_n)}{PC_{n,i}}$$

$$INTD_{n,i} = \sum_j IO_{n,i,j} X_{n,j}$$

$$INVD_{n,i,j} = \frac{\varepsilon_{n,i,j} PI_{n,j} I_{n,j}}{PC_{n,i}}$$

Household Income

$$Y_n = Wl_n \cdot L_n + rB_n + TI_n + \sum_i div_{n,i}$$

Commodity Market Equilibrium

$$C_{n,i} = CD_{n,i} + INTD_{n,i} + \sum_j INVD_{n,j,i}$$

Trade surplus

$$FB_n = \sum_i \sum_s (PWM_{n,s,i} M_{n,s,i} - PWM_{s,n,i} M_{s,n,i})$$

Dynamic Difference Equations:

Euler Equation for Consumption

$$\frac{Y_{n,t+1} - SAV_{n,t+1}}{Y_{n,t} - SAV_{n,t}} = \frac{1+r_{t+1}}{1+\mathsf{r}}$$

Non-Arbitrage Condition for Investment

$$q_{n,i,t} = PI_{n,i,t} + 2PVA_{n,i,t}\mathsf{f}_{n,i}\left(\frac{I_{n,i,t}}{K_{n,i,t}}\right)$$

$$(1+r_t)q_{n,i,t-1} = Wk_{n,i,t} + PVA_{n,i,t}\mathsf{f}_{n,i}\left(\frac{I_{n,i,t}}{K_{n,i,t}}\right)^2 + (1-\mathsf{d}_{n,i})q_{n,i,t}$$

Sectoral Capital Accumulation

$$K_{n,i,t+1} = (1-\mathsf{d}_{n,i})K_{n,i,t} + I_{n,i,t}$$

Foreign Asset Formation (debt if negative)

$$B_{n,t+1} = (1+r_t)B_{n,t} + FB_{n,t}$$

Terminal Conditions (Steady State Constraints):

$$\mathsf{d}_{n,i}K_{n,i,T} = I_{n,i,T}$$
$$r_T V_{n,i,T} = div_{n,i,T}$$
$$r_T B_{n,T} + FB_{n,T} = 0$$
$$r_T = \mathsf{r}$$

Welfare Criterion (Equivalent Variation Index)

$$\sum_{t=1}^{T}\left(\frac{1}{1+r}\right)^{t}\ln\left[\hat{TC}_{n,t}(1+\psi_{n})\right]=\sum_{t=1}^{T}\left(\frac{1}{1+r}\right)^{t}\ln TC_{n,t}$$

where, $\hat{TC}$ is base year full consumption for good i. Thus, this equation states that the welfare gain resulting from the policy shocks is equivalent from the perspective of the representative consumer to increasing the reference consumption profile by ψ percent.

Glossary

Parameters

Λ_i shift parameter in Armington function for good i

Γ_i shift parameter in CET function for i

A_i shift parameter in value added function for i

A_k shift parameter in capital good production function

a_i share parameter in private consumption demand function for i

α_i share parameter in value added function for i

β_i share parameter in Armington function for own good i

η_i share parameter in CET function for own good i

ε_{ij} share parameter in capital good production function for input-i, sector-j

σm_i elasticity of substitution in Armington function for i

σe_i elasticity of substitution in CET function for i

IO_{ij} input-output coefficient for i used in j

ρ rate of consumer time preference

δ_i capital depreciation rate

ϕ_i capital installation adjustment cost parameter

Exogenous variables

L labor supply

tm_i tariff rate for i

tx_i indirect tax rate for i

r world interest rate

Endogenous variables

PWM_i world import price for good i

PD_i own good price for i

PX_i producer price for i

PC_i composite good price for i

PVA_i price of value added for i

PI_i unit price of investment quantity in sector i

q_i shadow price of capital in sector i

div_i dividends of sector i

Wl wage rate

Wk_i marginal product of capital in sector i

L_i labor allocated to work

X_i output of good i

C_i total absorption of composite good i

D_i own good i

M_i import good i

E_i export good i

TC aggregate private consumption

CD_i private consumption demand for composite good i

$INVD_{ij}$ investment demand for composite good i, from sector j

$INTD_i$ intermediate demand for composite good i

Y household income

SAV household savings

K_i capital stock in sector i

I_i investment quantity in sector i

FB new purchases of foreign assets

TI transfers (set at a given ratio of GREV)

V_i value of the firm.

Table A1. Aggregation Structure

Regions of the CGE Model	GTAP Data Base
Asia	Japan, Korea, Indonesia, Malaysia, Phillipines, Singapore, Thailand, Vietnam, China, Taiwan, Hong Kong, India, Sri Lanka, Rest of South Asia
European Union	United Kingdom, Germany, Denmark, Sweden, Finland, Rest of EU
EFTA and Economies In Transition	European Free Trade Area, Central European Associates
Former Soviet Union	The former Soviet Union
Turkey	Turkey
Morocco	Morocco
Rest of Middle East	Rest of the Middle East Countries
Rest of North Africa	Rest of North Africa
Rest of the World	Australia, New Zeland, Canada, USA, Mexico, Centrl America and the Caribbean, Venezuela, Colombia, Rest of Andean Pact, Argentina, Brazil, Chile, Uruguay, Rest of South America, Soyuth African Customs Union, Rest of Southern Africa, Rest of Sub-Saharan Africa, Rest of the World

Regions of the CGE Model	GTAP Data Base
Grain crop agriculture	Paddy rice, Wheat, Cereal grains
Vegetables, fruits and oil	Vegetables, Fruits, Nuts, Oil seeds,
Sugar	Sugar cane, Sugar beet
Other Agriculture	Plant-based fibers, Crops nec,
Animal Products	Bovine cattle, Sheep and Goats, Horses, Animal products nec, Raw milk, Wool silk-worm cocoons, Fishing
Processed Food	Meat products nec, Vegetable oils and fats, Dairy products, Processed rice, Sugar Processing, Food Products nec, Beverages and Tobacco Products
Textiles and Clothing	Textiles, Wearing apparel, Leather products
Producer Manufacturing	Wood products, Paper products and publishing, Petroleum and coal products, Chemical, rubber and plastic products, Mineral products nec, Ferrous metals, Metals nec, Metal products, Motor vehicles and parts, Transport equipment nec, Electronic equipment, Machinery and equipment nec, Manufactures nec
Other	Coal, Oil, Gas, Minerals nec, Electricity, Gas manufacture and distribution, Water, Construction, Trade and transport, Financial business and recreational services, Public admin and defense, education and health, Dwellings

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