
Evaluation of Trade Integration Using the Mirage Model

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The Maghreb countries share more than geographical proximity and similarities in culture, language, and religion. Notwithstanding the differences in their sizes and income levels, the five North African countries face similar economic and political challenges arising from long-standing records of poor economic growth, high unemployment (as formally measured), and limited integration, both in the global economy and across the southern Mediterranean region (International Food Policy Research Institute and International Fund for Agricultural Development 2007).

Our study focuses on the challenge of forging greater integration among the Maghreb economies and with the outside world. Using a computable general equilibrium model, we explore the prospective impacts of bilateral and regional free trade agreements (FTAs) for the Maghreb countries in two steps. The first step consists of examining the benefits of greater south-south integration under the auspices of the Arab Maghreb Union (AMU) compared with the benefits of greater north-south integration of the Maghreb countries with the European Union and the United States. The second step extends the analysis to consider the long-run impacts of

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more intense market competition within Maghreb economies by liberalizing trade and adopting complementary economic policies: liberalization of trade in services, trade facilitation initiatives, and increased domestic investment.

After World War II, trade regimes in the Maghreb were founded on the twin models of import substitution and large public sector involvement to promote industry and modernize more rapidly. Since the 1990s globalization and international competition have sparked greater interest in trade liberalization within the Maghreb and contributed to some reduction in tariff levels and dismantling of nontariff barriers. Nonetheless, the Maghreb today maintains high levels of protection and a rigid and unfavorable business environment. Despite the region's potential, the free flow of goods and productive resources in the Maghreb remains elusive, mainly for political reasons. Thus the structure and orientation of Maghreb trade are still dominated by the traditional profile of agricultural and mineral exports and trade relations with Europe (table 7.1).¹

To quantify the impacts on the Maghreb countries of prospective FTAs and complementary economic policies, this study uses *Mirage*, a global general equilibrium model. *Mirage* is a multisector model that captures intraregional and interregional linkages among trading partners in the global economy based on the extensive Global Trade Analysis Project (GTAP 6.2) database of social accounting matrices and the MAcMapHS6-v2 database of applied tariffs.²

This chapter is organized into three sections. The first section introduces the model, lays out the decomposition of regions and sectors selected for the study, and describes the basic dimensions of protection in the Maghreb countries. The second section briefly introduces the Maghreb FTA scenarios that we consider and presents the simulation results carried out in the static and dynamic steps of the analysis. The final section highlights the major findings and conclusions.

Model and Database

The multisector and multiregion *Mirage* model was developed by the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII). The dynamic version of the model incorporates a sequential recursive framework that accounts for worldwide projections of GDP and population growth through 2020 and modifies national stocks of physical capital

1. In addition to the discussion in other chapters of this volume, see International Food Policy Research Institute and International Fund for Agricultural Development (2007).

2. For a full description of the model see Bchir et al. (2002) and Decreux and Valin (2007). For a discussion of the GTAP 6.2, see Dimaranan (2006). For a discussion of the MAcMapHS6-v2 dataset, see Bouët et al. (2006).

Table 7.1 Maghreb trade relations and exports, 2006 (percent)

Category	Algeria	Libya	Mauritania ^b	Morocco	Tunisia
WTO status	Observer	Observer	Member	Member	Member
Trade openness (2004–06) ^a	35.4	50.8	59.7	38.3	50.6
Composition of merchandise exports					
Agricultural products	0.2	0.0	41.5	20.7	12.7
Fuels and mining products	98.8	98.0	58.5	12.9	15.9
Manufactures	1.0	2.0	Negligible	64.9	71.3
Destination of merchandise exports					
European Union	52.5	75.8	75.9	73.1	80.1
United States	27.2	6.1	n.a.	1.9	n.a.
Japan	n.a.	n.a.	13.8	n.a.	n.a.
Canada	6.6	n.a.	n.a.	n.a.	n.a.
Algeria	n.a.	n.a.	2.5	n.a.	1.7
Libya	n.a.	n.a.	n.a.	n.a.	4.5
Morocco	n.a.	n.a.	n.a.	n.a.	1.0
Tunisia	n.a.	1.5	n.a.	n.a.	n.a.
Brazil	3.5	n.a.	n.a.	2.3	n.a.
China	n.a.	3.9	1.5	n.a.	n.a.
India	n.a.	n.a.	n.a.	4.3	n.a.
Nigeria	n.a.	n.a.	1.7	n.a.	n.a.
Turkey	3.4	5.3	n.a.	n.a.	n.a.
Switzerland	n.a.	n.a.	n.a.	1.3	n.a.

n.a. = not available

WTO = World Trade Organization

a. Average trade relative to GDP.

b. Mauritania's main exports are fisheries products and iron ore. Figures are for 1999.

Sources: WTO Country Profiles, 2008; WTO Trade Policy Review for Mauritania, 2002; and International Monetary Fund, *Direction of Trade Statistics*, 2007 for Libya.

each year to account for depreciation and investment growth. The dynamic version also assumes that monopolistic competition holds for some sectors, including most service sectors. Agriculture, primary commodities, and transport services, however, are assumed to be perfectly competitive with constant returns to scale. Our study obtains macroeconomic closure of the model by assuming that the balance of payments on goods and services plus foreign direct investment (FDI) is constant for each country and region.

The Mirage model uses the GTAP 6.2 database for baseline national accounts and international trade data and the MAcMap-HS6 database for

bilateral data on applied protection of goods. The GTAP 6.2 database combines national and regional input-output (I-O) tables adjusted to match international datasets on macroeconomic aggregates, bilateral merchandise and services trade, protection, and energy. The data contain detailed economic information for 96 countries and regions as well as 57 sectors representing global economic activity for 2001, the reference year. Because the GTAP 6.2 dataset includes data for only two Maghreb countries—Morocco and Tunisia—we have augmented it with social accounting matrices for Algeria, Libya, and Mauritania.³

The MACMapHS6-v2 (2004) database on protection provides equivalent measures of applied protection at the six-digit level of the Harmonized System (HS) for 5,111 products, 166 reporting countries, and 208 trading partners. The equivalent protection measure combines ad valorem tariffs and ad valorem equivalent measures of specific tariffs, tariff quotas, prohibitions, and antidumping duties. All these are measured at the bilateral level, accounting for the large number of preferential trade agreements that have been implemented through 2004. The Mirage model aggregates the MACMap bilateral measures of protection across regions and products using a weighting methodology created by CEPII and based on reference groups of countries instead of the standard import-weighted average of protection.⁴ The database is supported by reconciled data on bilateral trade averaged over 2002–04.

Regional Decomposition

Our study's geographical decomposition divides the global economy into 15 regions, including the five Maghreb countries and their main trading partners (table 7.2). Among developed countries the European Union and United States are the richest markets and the sources of the largest trade preferences for the developing world. Japan maintains extremely high protection in agriculture. In the developing world China, India, and Brazil are the largest exporters, highly protected in the case of India (table 7.2).

Table 7.3 presents the rates of protection that limit bilateral trade in agricultural products and industrial goods among the Maghreb countries, the European Union, and the United States. In our study these protection rates indicate the magnitude of applied tariffs governing intra-Maghreb

3. The I-O data for the three missing Maghreb countries were constructed from I-O data of GTAP countries with a similar economic structure. The data for Algeria and Libya were based on I-O data for Iran. Data for Mauritania were based on I-O data for Senegal. The I-O tables were adjusted to match external data on macroeconomic aggregates, bilateral trade data, and energy data specific to the three Maghreb countries.

4. This reference-group weighting scheme reduces the endogeneity bias in measuring protection and usually provides better assessments of average protection. See Bouët et al. (2006).

Table 7.2 Geographical protection and market access, 2004
(equivalent applied tariffs, percent)

Country/region	Tariffs on imports			Tariffs facing exports		
	Total	Agriculture	Industry	Total	Agriculture	Industry
EU-25	1.9	10.3	1.3	3.3	10.6	2.6
United States	2.1	3.6	2.0	5.3	18.7	3.9
Japan	3.5	28.7	1.3	5.6	15.0	5.5
Other developed countries	6.0	30.3	3.9	4.9	20.4	3.6
Algeria	13.3	16.0	13.0	1.5	12.6	1.5
Libya	21.0	13.1	21.7	1.6	6.5	1.5
Mauritania	8.7	9.2	8.7	5.6	9.0	1.6
Morocco	19.3	41.3	17.3	4.8	9.6	3.6
Tunisia	19.7	50.7	16.9	5.0	20.2	3.8
Egypt	14.4	60.0	10.3	5.3	16.6	3.7
Other Africa	13.1	21.9	11.9	4.9	12.8	3.4
China	5.4	14.6	4.6	5.4	18.3	4.9
India	18.9	55.9	14.7	6.6	18.6	5.1
Brazil	10.7	10.2	10.7	10.9	26.7	4.9
Other developing countries	8.3	18.3	7.4	4.4	19.0	3.2
<i>Memoranda items: Group averages</i>						
Maghreb countries	17.0	30.2	16.0	2.6	11.7	2.1
Developing countries	8.0	19.5	7.3	5.0	19.1	3.8
Developed countries	2.8	13.7	1.9	4.0	13.9	3.3

Source: Authors' calculations based on MAcMapHS6-v2 dataset, 2004.

trade and Maghreb trade with partners of primary interest—here, the European Union and the United States.⁵

Sectoral Decomposition

The sector decomposition in our study identifies the product categories most important to the Maghreb region (see table 7.4). The six agricultural sectors in the model include fruits and vegetables, which are major agricultural exports for Algeria and Morocco and, when combined with olive oil, account for half of Tunisia's agricultural exports. The agricultural sectors in the model also tend to be highly protected globally, including by the European Union (table 7.2). Regarding the industrial sectors in the model, fuels and mining products lead the foreign exchange earnings of

5. MAcMap zero tariffs between Morocco and Algeria correctly reflect official preferential margins between the two countries, but they do not reflect nontariff barriers to trade such as closed borders due to political tensions between the two countries. See chapter 11 in this book.

Table 7.3 Bilateral applied rates of tariff protection among the European Union, United States, and Maghreb countries, 2004 (percent)

Exporter	Importer							
	European Union	United States	Algeria	Libya	Mauritania	Morocco	Tunisia	World
Agriculture								
European Union		4.4	19.6	15.0	11.1	41.3	62.3	10.6
United States	19.1		10.7	11.6	9.2	37.3	38.5	18.7
Algeria	5.9	5.1		13.0	16.3	0.0	94.7	12.6
Libya	5.1	0.9	9.6		5.9	0.0	16.3	6.5
Mauritania	0.2	0.1	29.6	0.9		0.4	42.6	9.0
Morocco	3.9	2.2	0.0	0.0	15.7		32.1	9.6
Tunisia	33.3	2.1	25.5	8.8	12.2	17.9		20.2
<i>World</i>	10.3	3.6	16.0	13.1	9.2	41.3	50.7	
Industry								
European Union		2.2	13.4	22.7	9.3	12.3	11.5	2.6
United States	2.2		11.4	20.3	7.7	17.2	20.0	3.9
Algeria	0.0	0.7		37.4	11.0	0.0	5.6	1.5
Libya	0.7	0.8	9.8		8.8	0.0	3.5	1.5
Mauritania	0.0	0.3	6.1	0.4		0.9	20.7	1.6
Morocco	0.0	5.6	0.0	0.0	3.1		9.4	3.6
Tunisia	0.0	5.8	16.0	6.6	4.7	10.5		3.8
<i>World</i>	1.3	2.0	13.0	21.7	8.7	17.3	16.9	

Source: Authors' calculations based on MACMapHS6-v2 dataset, 2004.

Algeria, Libya, and Mauritania. The major exports of Tunisia and Morocco are mainly concentrated in unskilled labor-intensive manufactures. The sectoral decomposition also includes five service sectors: construction, domestic trade and transportation, business services, other private services, and government services.

The tariff data in tables 7.2, 7.3, and 7.4 indicate that the Maghreb countries are highly protected economies. The average level of protection across all products is 17 percent, more than double the average protection among developing countries as a group (table 7.2). Within the region, Libya, Tunisia, and Morocco enforce the highest overall rates of protection, which range between 19 percent and 21 percent. Maghreb country exports face much lower rates of protection. The discrepancy in import and export protection is common to many developing countries, in part because of preferential access to markets in major developed countries granted under FTAs and nonreciprocal trade agreements such as the US Generalized System of Preferences and African Growth and Opportunity Act. However, for some Maghreb countries, such as Algeria and Libya, good market access may be the result of their specialization in exports of

Table 7.4 Applied tariffs on Maghreb imports from the European Union and United States, 2004 (percent)

Sector	Algeria	Libya	Mauritania	Morocco	Tunisia
Imports from the European Union					
Agriculture					
Grains	3.8	11.8	1.8	59.0	78.6
Other crops	9.2	5.1	9.9	11.9	37.5
Livestock and meat products	17.5	13.8	11.1	72.6	77.7
Oilseeds and vegetable oils	19.1	9.3	4.5	15.7	44.2
Vegetables and fruit	20.1	21.8	15.7	44.6	139.7
Processed food products	26.4	18.9	13.8	28.7	50.7
Industry					
Fishing	28.1	3.5	18.3	43.5	40.8
Coal, oil, and gas	6.7	71.6	5.4	1.2	4.8
Mineral products	19.7	20.2	19.2	19.1	19.1
Textiles	24.6	14.3	13.9	26.7	17.7
Wearing apparel	30.0	24.1	19.7	44.6	27.8
Leather products	17.9	13.0	9.8	36.9	22.4
Wood and paper	18.6	12.6	7.7	31.3	23.8
Petroleum and coal products	21.1	2.2	12.5	0.5	6.0
Chemicals, rubber and plastics	12.9	10.0	4.7	13.7	8.1
Metals	15.9	9.3	8.1	13.6	15.4
Motor vehicles and transport equipment	9.6	65.9	8.2	13.7	10.3
Electronic equipment, machinery	10.7	17.0	7.0	5.5	9.1
Other manufactures	25.5	40.2	18.9	9.7	24.8
Utilities	15.0	0.0	16.6	0.0	0.0
Imports from the United States					
Agriculture					
Grains	3.7	8.7	7.1	78.1	49.2
Other crops	6.3	0.8	5.7	6.0	6.6
Livestock and meat products	19.2	26.4	14.1	45.5	63.0
Oilseeds and vegetable oils	6.7	10.8	5.3	12.6	17.3
Vegetables and fruit	25.7	27.7	19.9	48.0	155.9
Processed food products	25.6	15.1	12.1	36.8	54.9
Industry					
Fishing	29.4	3.9	18.3	47.0	40.9
Coal, oil, and gas	5.3	21.9	5.0	17.5	18.2
Mineral products	14.4	14.3	12.8	24.2	27.7
Textiles	22.9	13.2	11.8	32.8	28.2
Wearing apparel	30.0	20.0	20.0	50.0	42.0
Leather products	19.1	13.1	15.5	42.6	38.2
Wood and paper	13.9	7.9	7.1	32.5	27.9
Petroleum and coal products	20.9	2.4	12.6	36.6	8.3
Chemicals, rubber and plastics	13.1	9.3	5.3	21.9	23.8
Metals	15.9	9.4	8.9	23.6	24.7
Motor vehicles and transport equipment	4.2	50.1	3.0	11.2	17.3
Electronic equipment, machinery	9.3	20.4	7.3	9.8	16.9
Other manufactures	27.6	48.3	19.6	32.0	38.3
Utilities	5.5	9.5	13.0	24.7	19.1

Source: Authors' calculations based on MACMapHS6-v2 dataset, 2004.

primary products that face little protection globally, such as fuels and petroleum products.

Agricultural protection in the Maghreb is particularly high with respect to intra-Maghreb trade (table 7.3). Algeria imposes tariffs of 30 percent and 26 percent on agricultural imports from Mauritania and Tunisia, respectively, but an average tariff of only 16 percent on agricultural imports overall. By contrast, protection of industry in the Maghreb is generally lower—except in Libya—and discrimination against intraregional trade is less prevalent.

Regarding imports from the European Union and the United States, vegetables, fruits, livestock, meat products, and grains are among the most highly protected sectors in Morocco and Tunisia (table 7.4). Algeria, Libya, and Mauritania apply relatively high tariffs on imports of vegetable and fruits as well as processed food products from the European Union and United States. Protection of unskilled labor-intensive other manufacturing is relatively high in Algeria, Libya, and Mauritania. Wearing apparel, also intensive in unskilled labor, ranks among the most protected sectors in Algeria, Libya, Mauritania, and Morocco. By contrast, the Maghreb countries face high tariffs on only a few exports to the European Union and the United States (table 7.5), though these include grain exports. Maghreb oilseeds and vegetable oils also are subject to high tariffs in the European Union, and Maghreb exports of textiles and wearing apparel face relatively high rates of protection in the United States.

In sum, the Maghreb countries appear to enjoy relatively open access to foreign markets while maintaining highly protected domestic markets. As a consequence, establishing a series of FTAs between the Maghreb countries and the European Union or the United States might not increase Maghreb exports sufficiently to finance greater regional imports and increase real income. It remains, however, to apply the Mirage model to quantify the static and dynamic impacts of different Maghreb integration scenarios on trade and national income.

Trade Liberalization Options and Impacts for Maghreb Countries

We apply the Mirage model to the same scenarios for Maghreb integration considered in the preceding gravity model analysis (see chapter 6). The first scenario involves south-south integration under the AMU, specifying a functioning regional free trade area that permits the free circulation of goods in the Maghreb. The second involves north-south integration, realized by a number of stylized bilateral and regional FTAs between selected Maghreb countries, on the one hand, and the European Union and the United States—both separately and combined—on the other hand. The final scenario analyzes multilateral trade integration represented by a full trade liberalization scenario, in which all countries—the Maghreb countries,

Table 7.5 Applied tariffs on Maghreb exports to the European Union and United States, 2004 (percent)

Sector	Algeria	Libya	Mauritania	Morocco	Tunisia
Exports to the European Union					
Agriculture					
Grains	155.5	155.5	0.0	35.5	100.0
Other crops	0.2	0.4	0.0	0.3	1.6
Livestock and meat products	17.9	2.4	0.0	8.8	9.0
Oilseeds and vegetable oils	59.2	0.0	0.0	60.0	64.3
Vegetables and fruit	2.7	3.7	0.3	1.9	2.4
Processed food products	1.5	7.1	0.2	1.6	2.1
Industry					
Fishing	0.0	5.2	0.0	0.0	0.0
Coal, oil, and gas	0.0	0.0	0.0	0.0	0.0
Mineral products	0.0	0.0	0.0	0.0	0.0
Textiles	0.0	4.4	0.0	0.0	0.0
Wearing apparel	0.0	9.3	0.0	0.0	0.0
Leather products	0.0	0.7	0.0	0.0	0.0
Wood and paper	0.0	0.0	0.0	0.0	0.0
Petroleum and coal products	0.0	3.2	0.0	0.0	0.0
Chemicals, rubber, and plastics	0.0	1.5	0.0	0.0	0.0
Metals	0.0	0.1	0.0	0.0	0.0
Motor vehicles and transport equipment	0.0	0.5	0.0	0.0	0.0
Electronic equipment, machinery	0.0	0.1	0.0	0.0	0.0
Other manufactures	0.0	0.1	0.0	0.0	0.0
Utilities	0.0	0.0	0.0	0.0	0.0
Exports to the United States					
Agriculture					
Grains	8.3	8.3	0.0	2.9	2.6
Other crops	0.1	2.0	0.0	0.3	1.0
Livestock and meat products	2.6	0.4	0.0	1.1	2.2
Oilseeds and vegetable oils	3.9	14.7	0.0	0.9	0.1
Vegetables and fruit	8.3	7.7	0.0	3.4	8.4
Processed food products	3.6	1.1	0.1	1.7	2.0
Industry					
Fishing	0.3	1.4	0.0	0.0	0.2
Coal, oil, and gas	0.2	0.4	0.0	0.0	0.4
Mineral products	0.1	0.0	0.0	0.1	1.3
Textiles	10.0	5.9	10.4	13.3	11.1
Wearing apparel	12.4	15.6	9.9	11.5	10.6
Leather products	1.5	1.1	0.0	8.9	8.4
Wood and paper	0.3	0.6	0.0	0.1	0.0
Petroleum and coal products	1.9	2.4	0.0	1.6	1.6
Chemicals, rubber, and plastics	1.0	1.4	0.1	0.0	0.1
Metals	0.4	0.1	0.0	0.2	0.1
Motor vehicles and transport equipment	3.0	0.4	0.0	0.3	0.5
Electronic equipment, machinery	1.1	1.1	0.0	0.1	0.0
Other manufactures	2.3	3.6	0.0	0.4	1.2
Utilities	0.0	0.0	0.0	0.0	0.0

Source: Authors' calculations based on MACMapHS6-v2 dataset, 2004.

the European Union, and the United States—fully liberalize their protection against each other. The final scenario of economic integration through multilateral trade integration could not be carried out in the gravity model analysis. It is important, however, because it provides a first-best yardstick by which to judge the efficacy of the bilateral and regional FTA scenarios.

Static Analysis

Our static analysis abstracts from the dynamic features of the Mirage model and assumes perfect competition in all sectors. Trade policy changes are assumed to occur instantaneously. The economic impacts that the model estimates reflect changes to trade and other variables arising from the tariff reforms of each Maghreb integration scenario relative to the state of the world before the tariff changes.

Impacts on Total Exports

Under the AMU scenario the changes in total exports simulated by the model are modest, ranging from 0.5 percent in Morocco to 4.4 percent in Tunisia (table 7.6). The limited EU bilateral FTAs with the three major Maghreb countries—Algeria, Morocco, and Tunisia—can result in considerable export gains: according to the model, around 43 percent for Tunisia, 37 percent for Morocco, and 8 percent for Algeria. They also result in greater export gains than the limited US bilateral FTAs with the same three Maghreb countries. When the EU and US bilateral FTAs are extended to allow Mauritania and Libya simultaneous free access to the Algerian, Moroccan, and Tunisian markets, export gains for all Maghreb countries are greater, though only marginally so. In general these simulation results show that Maghreb exports face higher initial tariffs in the European Union than they do in the United States. Export gains for Morocco and Tunisia are larger under the EU bilateral FTAs because of the relatively high EU tariffs on fruits, vegetables, oilseeds, and vegetable oils.

When the EU and US bilateral FTAs are expanded to become free trade areas—that is, regional FTAs combining full Maghreb regional integration with reciprocal free trade with the European Union or United States—additional export gains are small for the three major Maghreb countries, but more significant for Libya and Mauritania. However, the hypothesized EU-US-Maghreb FTA is the most beneficial to total Maghreb exports, second only to the trade benefits of full trade liberalization (table 7.6).

Impacts on Bilateral Trade

The EU-Maghreb FTA diverts imports from the United States, but mainly creates trade in exports for the European Union and the Maghreb countries

Table 7.6 Static analysis: Impacts on exports, terms of trade, and national income under Maghreb integration scenarios (percent)

Country	Arab Maghreb Union	EU and US bilateral FTAs				EU and US regional FTAs			Full trade liberalization
		EU-Maghreb		US-Maghreb		EU- Maghreb	US- Maghreb	EU-US- Maghreb	
		Limited	Extended	Limited	Extended				
Total exports									
Algeria	1.2	8.1	8.9	1.0	2.1	8.8	2.1	8.6	10.6
Libya	1.3	-0.1	2.2	0.0	1.3	11.0	1.4	9.0	13.1
Mauritania	0.6	0.0	0.6	0.0	0.5	4.1	0.8	3.8	4.3
Morocco	0.5	37.1	37.5	4.4	4.8	37.4	4.8	39.8	47.8
Tunisia	4.4	42.7	45.9	4.0	8.2	45.4	8.2	-1.0	47.8
Terms of trade									
Algeria	0.1	-0.9	-0.8	-0.1	0.0	-0.9	0.0	-1.1	-1.3
Libya	0.1	0.0	0.2	0.1	0.2	-0.7	0.1	-0.9	-0.4
Mauritania	0.0	0.1	0.2	0.0	0.0	-1.1	0.0	-1.4	-2.2
Morocco	0.0	-6.0	-5.9	-0.7	-0.6	-6.0	-0.6	-6.1	-8.1
Tunisia	-0.1	-2.0	-1.8	-0.7	-0.8	-2.0	-0.8	-0.3	-4.1
National income									
Algeria	0.0	-0.8	-0.8	-0.2	-0.2	-0.8	-0.2	-0.9	-0.6
Libya	-0.1	0.0	0.0	0.0	-0.1	-1.3	-0.1	-1.3	-1.1
Mauritania	-0.1	0.1	-0.1	0.0	-0.1	-1.0	-0.2	-1.1	-0.6
Morocco	0.0	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.1	0.8
Tunisia	0.2	1.0	1.4	-0.5	-0.2	1.4	-0.2	-0.1	2.6

FTA = free trade agreement

Source: Static MIRAGE model results.

Table 7.7 Static analysis: Impacts on bilateral trade of EU and US regional FTAs with the Maghreb countries (percent)

Exporting country	Importing country						
	European Union	United States	Algeria	Libya	Mauritania	Morocco	Tunisia
EU-Maghreb FTA							
European Union		-0.3	38.5	53.9	19.2	73.4	56.1
United States	0.2		-20.3	-12.7	-15.2	-24.3	-25.2
Algeria	9.3	4.0		7.3	12.5	-3.5	173.2
Libya	7.3	8.0	29.4		-8.9	-10.2	243.0
Mauritania	3.3	4.8	4.0	-1.9		16.8	98.9
Morocco	48.1	19.9	-20.5	-9.4	74.7		81.2
Tunisia	63.8	-4.5	71.3	-2.6	16.2	47.6	
EU-US-Maghreb FTA							
European Union		11.1	33.3	51.2	16.9	70.9	-1.3
United States	12.3		6.2	-7.5	1.0	56.3	-2.2
Algeria	9.5	8.8		5.8	12.9	-6.5	8.4
Libya	9.2	13.1	29.1		-7.3	-12.2	12.2
Mauritania	3.2	7.1	0.5	-3.9		14.2	0.9
Morocco	48.6	43.9	-21.0	-10.6	72.0		25.0
Tunisia	0.2	1.1	-39.7	-36.5	-22.7	-33.7	

FTA = free trade agreement

Source: Static MIRAGE model results.

(upper panel of table 7.7). Except for Tunisia's trade with the United States, Maghreb exports to both the European Union and the United States increase. Trade in the Maghreb is also enhanced, but Libya's increased imports from the European Union and Algeria must be weighed against its reduced imports from the United States and the other Maghreb countries.

Expanding the EU-Maghreb FTA to include the United States increases US trade (lower panel of table 7.7). Tunisia's exports to the United States grow at the expense of its exports to other FTA partners. Tunisia increases its imports from the region and decreases its imports from the European Union and the United States. The other Maghreb countries show the same pattern of trade changes with the European Union as found for the EU-Maghreb FTA, but increased trade with the United States comes at the expense of intra-Maghreb trade.

Impacts on Terms of Trade and Real Income

Morocco and Tunisia generally see their terms of trade worsen under the Maghreb integration scenarios (table 7.6). However, this does not trans-

late into real income losses for Tunisia, except under the FTAs involving the United States. Full trade liberalization results in terms of trade losses for the Maghreb countries owing to induced increases in world agricultural prices and lost trade preferences, particularly in the EU market. Terms of trade losses under the FTAs result from trade diversion effects that reflect the substitution of goods from inefficient producers for erstwhile imports from efficient producers. The US FTAs appear to result in smaller terms of trade losses than do the EU FTAs.

Overall the static analysis results suggest negative but small impacts on the Maghreb's terms of trade and real income. The Maghreb countries are not likely to gain much from south-south integration. The north-south FTAs benefit the Maghreb countries in GDP and exports gains, but also divert more trade and negatively affect terms of trade and real income. The impacts are greater and more substantial for the agrarian economies of Morocco and Tunisia than they are for the oil-exporting economies of Algeria, Libya, and Mauritania.

Dynamic Analysis

In our dynamic analysis we simulate the Mirage model following a sequential and dynamic recursive set-up. The model is first solved for one period; then the values of the model variables determined at the end of the first period are used as the initial values in the next period. In addition, selected sectors in the model—including textiles, wearing apparel, petroleum and coal products, and all services except domestic trade and transport—are assumed to be imperfectly competitive.⁶

The dynamic Mirage model generates a baseline extending from 2001 to 2020 based on World Bank projections of GDP and population levels through 2020.⁷ In our application of the model the timeline to implement changes in tariffs and other policy instruments spans 2009 to 2018 and the simulation results reflect deviations from the baseline at the end of the period, 2020.

Modeling Complementary Policies

As mentioned above, the dynamic analysis considers the additional impacts of several complementary economic reforms expected to accompany Maghreb economic integration in the long run. Before presenting

6. Introducing imperfect competition is costly in terms of computational complexity in the Mirage model. Thus only a few sectors of the model are assumed to involve imperfect market conditions (i.e., aspects of monopolistic competition).

7. World Bank, *World Development Indicators 2007*, available at www.worldbank.org (accessed August 5, 2008).

the results, we briefly outline these complementary reforms and how they appear in the model.

Services Trade Liberalization. Services constitute an important and growing component of global trade. Barriers to trade in services are difficult to quantify because they emanate from domestic laws and regulations that vary widely across countries. These barriers restrict or prevent service firms from operating efficiently in foreign markets.

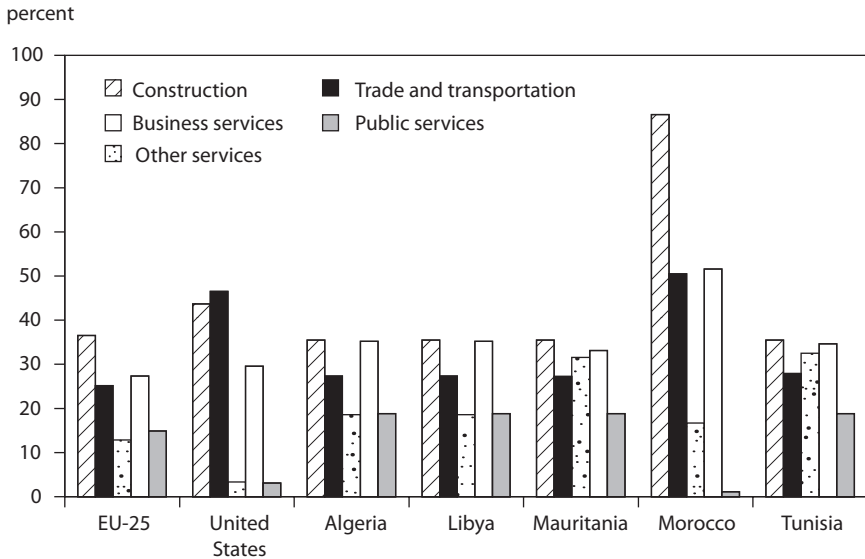
Our study depicts barriers to trade in services as quantitative restrictions on imports of construction, business services, trade and transportation, government services, and other services. Although these restrictions are imposed by the importing countries, they act as taxes on the service exports of partner countries, reducing the number of service firms abroad. We expect that lowering or eliminating the export taxes improves competition by increasing the number of exporting firms and reducing the price of imported services. We also expect liberalizing services to generate larger economic gains for service-importing countries than for service-exporting countries (Decreux and Fontagné 2006; Berisha-Krasniqi, Bouët, and Mevel 2006).

CEPII has collected data on the protection of services from two sources. The first source uses bilateral gravity equations to estimate the ad valorem equivalent of trade barriers in services (Park 2002). The second source is a set of trade restrictiveness indices constructed by the Australian Productivity Commission (Kalirajan 2000, McGuire 1998). Figure 7.1 presents the structure of protection for services in Maghreb countries based on these two sources. Computing the levels of protection as simple averages of the protection indices reported by the two sources, figure 7.1 shows that trade and transportation as well as the category of other services are less protected in the European Union and the United States than they are in the Maghreb.⁸ Construction and business services are highly protected in all countries, especially the United States and Morocco. The dynamic analysis assumes that protection rates for services in the Mirage model are reduced by 50 percent to complement the EU-US-Maghreb FTA.

Trade Facilitation. The World Trade Organization (WTO 2008) specifies that negotiations in trade facilitation “shall aim to clarify and improve relevant aspects of Articles V, VIII, and X of the GATT [General Agreement on Tariffs and Trade] 1994.” More specifically WTO members in the negotiations are directed to clarify and improve GATT Article V (freedom of transit), Article VIII (fees and formalities connected with importation and

8. Data on services trade for Libya and Mauritania are not available. The structure of the services barriers in these two countries was assumed to be similar to those of Algeria and Tunisia, respectively.

Figure 7.1 Protection of services by country and sector, 2006



Source: Centre d'Etudes Prospectives et d'Informations Internationales.

exportation), and Article X (publication and administration of trade regulations), with a view to further expediting the movement, release, and clearance of goods, including goods in transit. In other words, trade facilitation aims to reduce the cost of transacting trade.

In the Mirage model, trade facilitation costs are modeled as iceberg costs: For every 100 units of a product exported, only x percent arrive at the destination. This loss is the result of cumbersome administrative requirements and procedural delays in processing goods through customs. According to studies cited in Berisha-Krasniqi, Bouët, and Mevel (2006), the potential losses from cumbersome customs requirements and delays can amount to between 1 and 15 percent of the value of international trade. Developing countries usually adopt less efficient trade facilitation measures than do developed countries, and consequently exports to developing countries face higher trade facilitation costs. In addition, trade facilitation costs are higher in agricultural and food sectors than in industrial sectors, mainly due to sanitary and phytosanitary controls and the expiration of perishable products (Berisha-Krasniqi, Bouët, and Mevel 2006). To reflect these considerations, the model estimates trade facilitation costs at 2 percent and 3 percent of the value of international trade for industry and agro-food sectors, respectively, in developed countries, and 5 and 7.5 percent, respectively, in developing countries. The dynamic analysis accounts for increased trade facilitation by reducing trade costs

in the Maghreb countries by 50 percent in conjunction with the adoption of an EU-US-Maghreb FTA. Finally, given the current highly inefficient indirect trade route of energy products between Algeria and Morocco, we reduce the trade costs of oil and gas exports from Algeria to Morocco by an additional 15 percent of the value of bilateral exports.

Increased Domestic Investment. Finally, to assess the potential positive impact of trade liberalization on domestic investment, we follow the example of the steady-state variant of the Harrison, Rutherford, and Tarr (1996) model, in which trade and other economic reforms call for an expansion of physical capital sufficient to bring the real rate of return of capital back to its preliberalization rate. Over the long run, firms react to the new economic environment and accompanying business opportunities by increasing their investment until the returns to capital revert to their initial equilibrium. Because the Mirage model is a neoclassical savings-driven model, we represent this idea by assuming a 5 percent increase in the propensity to save in each Maghreb country in the EU-US-Maghreb FTA.

Table 7.8 summarizes the results of the dynamic analysis. The base scenario is the stylized EU-US-Maghreb FTA considered previously, but now simulated by the dynamic Mirage model. The model incorporates imperfect competition in selected sectors and the elimination of bilateral tariffs on agricultural and industrial goods, implemented linearly over a period of 10 years for the Maghreb countries and 5 years for the United States and European Union. The cumulative impacts of sequentially adding liberalization of trade in services, trade facilitation, and an increase in domestic investment are reported in table 7.8 for the five Maghreb countries individually, the European Union, and the United States.

Impact on Total Exports

In the long run, total exports increase for all countries under the EU-US-Maghreb FTA and the complementary policies contribute positively to the base scenario trade gains. Morocco and Tunisia enjoy the largest export gains overall, around 38 and 43 percent, respectively (table 7.8). This is due to the relatively high rates of protection for specialized agricultural exports (e.g. olive oil exports) and labor-intensive manufactures in both the European Union and the United States. Morocco and Tunisia also expand their exports to the rest of the Maghreb, where their exports face higher tariffs than the two countries apply to imports from the region. Regarding the benefits of complementary policies, liberalizing services offers the largest stimulus to Algerian, Mauritanian, and Moroccan exports; trade facilitation initiatives contribute most to Tunisian exports; and induced increases in domestic investment result in the largest export gains for Libya.

Table 7.8 Dynamic analysis: Macroeconomic impacts of the EU-US-Maghreb regional FTA sequentially adding complementary economic reforms (percent)

Category	Base: EU-US- Maghreb FTA	Plus		
		Liberalization of services	Trade facilitation	Increased domestic investment
Algeria				
Real exports	12.3	17.7	19.8	24.5
Real GDP	0.9	2.1	2.7	6.3
Real exchange rate	-1.1	-0.1	-0.5	-1.5
Return to capital	-2.1	-1.9	-1.8	-3.5
Return to land	11.2	10.0	10.1	12.6
Return to natural resources	-3.4	-5.9	-5.3	-2.9
Skilled wages	0.0	4.6	6.2	12.3
Unskilled wages	2.8	4.4	5.1	9.3
Agriculture	6.2	6.9	7.4	11.2
Nonagriculture	1.2	3.2	4.0	8.4
Real national income	-0.1	1.1	1.9	3.3
Allocation efficiency	0.3	0.9	1.0	1.2
Terms of trade	-0.3	-0.4	0.0	-0.4
Capital accumulation	0.8	1.3	1.7	5.2
Other	-0.9	-0.6	-0.7	-2.7
Libya				
Real exports	15.3	15.7	18.3	30.4
Real GDP	2.9	2.8	3.5	10.3
Real exchange rate	-5.6	-5.9	-6.8	-7.4
Return to capital	-3.3	-2.9	-3.1	-10.0
Return to land	-1.2	-0.8	-1.1	3.1
Return to natural resources	10.3	10.9	13.5	21.4
Skilled wages	1.2	0.6	1.9	12.0
Unskilled wages	-0.9	-0.9	-0.5	6.0
Agriculture	-1.4	-1.3	-1.2	4.8
Nonagriculture	-0.5	-0.6	0.0	6.8
Real national income	1.7	1.8	2.9	7.7
Allocation efficiency	0.3	0.2	0.3	0.4
Terms of trade	-0.6	-0.4	-0.1	-0.7
Capital accumulation	2.6	2.6	3.3	9.7
Other	-0.6	-0.6	-0.6	-1.8
Mauritania				
Real exports	5.8	9.5	11.8	16.4
Real GDP	-0.1	0.4	1.1	4.2

(table continues next page)

Table 7.8 Dynamic analysis: Macroeconomic impacts of the EU-US-Maghreb regional FTA sequentially adding complementary economic reforms (percent) (continued)

Category	Base: EU-US- Maghreb FTA	Plus		
		Liberalization of services	Trade facilitation	Increased domestic investment
Mauritania				
Real exchange rate	-1.7	-2.0	-2.5	-3.3
Return to capital	-0.2	0.7	1.4	-0.9
Return to land	-5.7	-4.3	-4.9	-3.7
Return to natural resources	-2.9	-0.8	1.0	4.3
Skilled wages	-2.1	-1.3	0.7	3.7
Unskilled wages	-2.9	-1.6	-0.7	1.5
Agriculture	-4.2	-2.8	-2.5	-0.6
Nonagriculture	-2.0	-0.8	0.5	2.8
Real national income	-0.8	0.3	1.7	2.3
Allocation efficiency	0.0	0.2	0.2	0.4
Terms of trade	-0.9	-0.4	0.3	-0.2
Capital accumulation	0.1	0.2	0.6	2.8
Other	0.0	0.3	0.6	-0.6
Morocco				
Real exports	37.8	42.6	47.9	50.5
Real GDP	0.9	1.4	2.0	3.9
Real exchange rate	-5.7	-5.1	-5.4	-5.6
Return to capital	1.5	1.6	1.9	-1.8
Return to land	-13.6	-14.6	-14.8	-13.8
Return to natural resources	-1.5	-2.7	-1.6	0.3
Skilled wages	3.4	4.9	6.8	10.8
Unskilled wages	-2.3	-1.9	-0.9	1.4
Agriculture	-7.5	-7.7	-7.2	-5.3
Nonagriculture	-0.2	0.3	1.4	3.9
Real national income	-0.2	0.2	1.2	1.6
Allocation efficiency	2.0	2.5	2.8	2.9
Terms of trade	-2.5	-2.6	-2.1	-2.2
Capital accumulation	-0.6	-0.5	-0.4	1.2
Other	0.9	0.9	1.0	-0.2
Tunisia				
Real exports	42.7	46.1	53.5	59.4
Real GDP	2.8	3.5	5.0	7.8
Real exchange rate	0.1	0.6	0.9	0.9
Return to capital	0.9	1.2	1.6	-1.8

Table 7.8 Dynamic analysis: Macroeconomic impacts of the EU-US-Maghreb regional FTA sequentially adding complementary economic reforms (percent) (continued)

Category	Base: EU-US- Maghreb FTA	Plus		
		Liberalization of services	Trade facilitation	Increased domestic investment
Tunisia				
Return to land	-1.7	-2.4	-1.2	0.7
Return to natural resources	-15.9	-16.7	-16.6	-14.8
Skilled wages	0.1	1.0	3.6	7.4
Unskilled wages	1.4	1.9	4.0	7.3
Agriculture	1.6	1.7	3.7	6.7
Nonagriculture	1.3	2.0	4.2	7.6
Real national income	1.6	2.2	3.9	4.6
Allocation efficiency	3.8	4.2	5.1	6.2
Terms of trade	-1.6	-1.6	-0.6	-0.7
Capital accumulation	0.6	0.8	1.3	3.4
Other	-1.3	-1.2	-1.9	-4.5
European Union				
Real exports	3.9	7.3	7.7	7.9
Real GDP	0.0	0.2	0.2	0.3
Real exchange rate	0.6	0.7	0.8	0.9
Return to capital	0.1	0.2	0.2	0.3
Return to land	-0.5	-0.5	-0.4	-0.2
Return to natural resources	-1.7	-1.8	-2.0	-3.2
Skilled wages	0.2	0.2	0.3	0.4
Unskilled wages	0.2	0.3	0.3	0.5
Agriculture	-0.1	-0.1	0.1	0.3
Nonagriculture	0.2	0.3	0.4	0.5
Real national income	0.1	0.2	0.2	0.3
Allocation efficiency	0.0	0.2	0.2	0.1
Terms of trade	0.1	0.0	0.0	0.1
Capital accumulation	0.0	0.0	0.0	0.0
Other	0.0	0.0	0.0	0.1
United States				
Real exports	2.6	6.3	6.3	6.4
Real GDP	0.0	0.1	0.1	0.1
Real exchange rate	0.3	0.3	0.3	0.4
Return to capital	0.0	0.1	0.1	0.1
Return to land	1.0	1.1	1.1	1.1
Return to natural resources	-2.5	-2.5	-2.8	-4.6

(table continues next page)

Table 7.8 Dynamic analysis: Macroeconomic impacts of the EU-US-Maghreb regional FTA sequentially adding complementary economic reforms (percent) (continued)

Category	Base: EU-US- Maghreb FTA	Plus		
		Liberalization of services	Trade facilitation	Increased domestic investment
		United States		
Skilled wages	0.0	0.2	0.2	0.2
Unskilled wages	0.1	0.2	0.2	0.2
Agriculture	1.1	1.3	1.3	1.3
Nonagriculture	0.1	0.2	0.2	0.2
Real national income	0.1	0.2	0.2	0.2
Allocation efficiency	0.0	0.0	0.0	0.0
Terms of trade	0.0	0.1	0.1	0.1
Capital accumulation	0.0	0.0	0.0	0.0
Other	0.0	0.0	0.0	0.0

FTA = free trade agreement

Source: Dynamic MIRAGE model results.

Impact on Real Income

In table 7.8 not all Maghreb countries realize real income gains from the EU-US-Maghreb FTA. However, when the impacts of the complementary policies are included, no Maghreb country loses from the combination of the EU-US-Maghreb FTA and the supporting economic reform initiatives. Increased domestic investment promotes real income most in Algeria and Libya, while the trade facilitation initiative yields the largest real income gains for Morocco and Tunisia. These income gains represent the net effect of greater import discipline over domestic competitive conditions, terms of trade changes, the efficiency of domestic resource allocation, and domestic capital accumulation. All the Maghreb countries experience terms of trade losses owing to trade diversion effects, but these are offset by allocation efficiency gains generated by reallocating factors of production to more efficient sectors as imports increase market competition in some sectors and trade facilitation initiatives reduce trade costs within the Maghreb. Increased competition in the services sectors also contributes to substantial gains in resource allocation efficiency in the Maghreb countries. These efficiency gains are positive for all Maghreb countries; they are particularly sizable for Morocco and Tunisia. Finally the gains from capital accumulation contribute significantly to net gains in real income across the Maghreb countries.

GDP and Distributional Effects

The long-run impacts on GDP of the EU-US-Maghreb FTA and complementary economic policy reforms are positive across the Maghreb countries. Libya enjoys the greatest gain in aggregate output (10 percent), followed by Tunisia (8 percent) and Algeria (6 percent). GDP gains are positive but smaller for Morocco and Mauritania.

The primary factors of production do not benefit equally from output gains. GDP gains are associated principally with increased returns to landowners in Algeria and natural-resource owners in Libya. The gains to labor favor skilled workers in all countries, but they do not benefit unskilled workers in Libya, Mauritania, or Morocco.

Our Mirage model cannot measure the potential impacts of an EU-US-Maghreb FTA and policy reforms on poverty in the Maghreb countries. Some insights, however, can be drawn from the effects of the FTA and policy reforms on the various classes of labor. Given that the poor in developing countries are mostly unskilled workers and often found in rural households, the negative impacts on real returns to unskilled labor in agriculture in Morocco, Libya, and Mauritania suggest that the gains from regional integration under the EU-US-Maghreb FTA are not especially pro-poor. Only in Algeria do the results suggest a win-win outcome, as unskilled workers in agriculture enjoy higher returns than unskilled workers outside of agriculture.

Eliminating the Wedge on Oil and Gas Shipments from Algeria to Morocco

As part of the trade facilitation initiatives, opening the border between Algeria and Morocco under the EU-US-Maghreb FTA allows energy products to be shipped directly between the two countries. Thus the cost of shipping oil and gas from Algeria to Morocco is reduced by an additional 15 percent. This cost saving further increases energy exports from Algeria to Morocco, from 37.6 percent (the increase without eliminating the price wedge) to 53.6 percent (the increase after eliminating the price wedge). No other appreciable changes in the Mirage model variables result from eliminating the energy import price wedge that Morocco bears.

Conclusion

Using a Mirage model of the world economy, the MAcMap protection dataset, and an augmented version of the GTAP 6.2 database, our static analysis of the prospective impacts of various Maghreb integration schemes and complementary economic policy reforms leads us to several conclusions. South-south integration in the region leads to little trade creation. North-south integration with either the European Union or the

United States leads to trade creation but also diverts some Maghreb trade from customary channels. Full trade liberalization stimulates much more trade but also exposes net food-importing Maghreb countries to higher agricultural prices and lost trade preferences.

That said, our findings are subject to important caveats related to the circumstances of the Maghreb countries and the limitations of our static model. The Mirage model does not account for the benefits of greater competition and possible increasing returns to scale under regional or wider economic integration. It also does not account for FDI and trade in services, two important forces that would likely be stimulated by greater openness and complementary economic reforms in the Maghreb.

To partially overcome these limitations, we apply a dynamic version of the Mirage model that includes imperfect competition and augments Maghreb economic integration with complementary policies that liberalize trade in services, advance trade facilitation, and increase domestic investment. In the dynamic analysis, the prospective impacts of a comprehensive EU-US-Maghreb FTA and supporting policy reforms in the Maghreb countries are substantial in terms of increased real income and GDP. Export gains are relatively modest for the oil-exporting Maghreb countries without the complementary reforms. Tunisia and Morocco are the big winners in terms of expanded exports, mainly to the European Union and United States. Still, the oil-exporting Maghreb countries also gain significantly from the complementary policy reforms, especially in terms of their GDP and real income. Finally, although adverse terms-of-trade effects occur with greater Maghreb regional and global integration, they are offset by allocation efficiency gains stimulated by the procompetitive effects of greater import competition, complementary policy reforms, and increased domestic investment.

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