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Gravity Model Analysis

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In recent years the gravity model has become a workhorse for quantitative studies of international trade and investment policy (Eichengreen and Irwin 1998). Essentially the model uses econometric techniques to evaluate thousands of individual observations on trade and investment between countries over time against the "gravitational mass" of explanatory variables that describe the characteristics of bilateral trade and investment partners. Two familiar explanatory variables are the joint real GDP levels of partners and the distance between them. But numerous other explanatory variables are frequently specified as well, including geographic, political, and institutional factors that either augment or diminish the gravitational forces giving rise to commerce between countries. Most important, recent gravity models incorporate indicators for bilateral and regional free trade agreements (FTAs), enabling the models to assess the FTAs' contribution to international commerce.

The Gravity Model and Dataset

The Peterson Institute gravity model (DeRosa 2007) is based on bilateral merchandise trade flows and inward stocks of foreign direct investment (FDI) among approximately 170 countries from 1976 to 2005 (with numerous gaps, mainly in the observations of bilateral FDI stocks), as compiled

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from the UN COMTRADE database, using the World Integrated Trade Solution software of the World Bank[1] and the United Nations Conference on Trade and Development (UNCTAD) FDISTAT database.[2] The explanatory variables of the model, identified in table 6.1, are taken mainly from an extensive dataset for gravity models compiled by Rose (2004). The model also incorporates indicator variables for over 500 FTAs based on historical notifications of the dates on which the agreements entered into force and their contemporary participants. These indicators are dichotomous (0, 1) variables, often called dummy variables; they take a value of 1 if trade or investment partner countries are FTA members and their mutual trade agreement is in force and a value of 0 otherwise.[3] The FTA indicators are grouped into nine prominent individual FTAs and groups of FTAs worldwide, including the North American Free Trade Agreement (NAFTA) and those of the European Union.[4] Related indicator variables are included in the gravity model to assess the effect of the FTAs on the trade and investment of members with nonmember countries.[5]

Notwithstanding the large number of explanatory variables already specified in most gravity models (including our own), it is common practice to consider any explanatory variables that might be missing or unobservable. This is done in two ways. To account for systemic global influences on trade, we specify year-effect variables that are essentially indicator variables representing episodic global effects on international

1. The World Trade International Statistics database is available at www.worldbank.org (accessed July 7, 2008).

2. The FDISTAT database is available at www.unctad.org (accessed July 7, 2008). The UNCTAD FDI data stock figures are inward FDI stocks, not outward FDI stocks. However, for convenience in our descriptive text and tables, we refer to inward FDI stocks in country B from country A as outward FDI stocks from country A.

3. To illustrate, the NAFTA indicator variable for US-Mexico trade would not take on a value of 1 until 1994.

4. The FTAs and preferential trade agreements are grouped as follows: European Union (EU); European Free Trade Area (EFTA); EU bilateral free trade agreements (EU FTAs); North American Free Trade Agreement (NAFTA); Southern Common Market (Mercosur); Chile, Mexico, Australia, and Singapore (CMAS) FTAs, separately distinguished because these are truly free trade countries; ASEAN Free Trade Area (AFTA); South Asia Free Trade Agreement (SAFTA); and all other customs unions and FTAs.

5. The change in trade or investment between FTA members is most often measured in percentage terms. Given the log-linear specification of the gravity model, the impact of an FTA on bilateral trade or inward FDI stocks can be computed in percentage terms as $100^*[\exp(b_{fta}) - 1.00]$. In this expression, b_{fta} is the estimated coefficient for the dummy variable representing the presence of an FTA and $\exp(b_{fta})$ is the value of the natural number e raised to the exponent b_{fta}. If the coefficient b_{fta} is 0.50, then the value of $\exp(b_{fta})$ is 1.65 and the percentage expansion in bilateral commerce is estimated as $100^*[1.65 - 1.00]$, or 65 percent.

Table 6.1 Gravity model estimates for trade and inward foreign direct investment stocks specifying major customs unions and free trade agreements, 1976–2005

Variable	Merchandise trade	Inward FDI stocks
Distance	–0.91***	–0.50***
Joint GDP	0.03***	–0.10***
Joint GDP per capita	0.04***	0.22***
Common language	–0.03***	0.98***
Common border	0.40***	0.62***
Landlocked	–0.82***	–0.35***
Island	0.48***	0.59***
Land area	0.26***	0.16***
Common colonizer	–0.64***	–0.34***
Current colony	0.42***	–0.37
Ever a colony	1.06***	1.74***
Common country	1.11***	2.09***
GSP	0.37***	0.19***
Joint FDI stocks	0.11***	—
Joint trade with all partners	—	0.54***
EU	0.25***	0.62***
EU FTAs	0.15***	0.17***
NAFTA	0.80***	–0.37***
Mercosur	0.69***	1.25***
CMAS FTAs	0.08***	0.52***
AFTA	0.69***	0.80***
Other FTAs	0.34***	0.07**
Constant	7.67***	–7.94***
R-squared	0.96	0.92
Observations (thousands)	36	36
Clusters (thousands)	4	4

FDI = foreign direct investment; GSP = generalized system of preferences

Notes: Fixed-effects estimates obtained by a multistep method developed by Plumper and Troeger (2007). Dependent variables are bilateral trade and bilateral inward FDI stocks, both measured in log real terms. Distance, joint real GDP, joint real GDP per capita, joint land area, joint real FDI stocks, and joint real trade with all partners are measured in log terms. Estimates for year-effects and indicators of FTA members' trade and investment with nonmember countries are not reported. ** and *** denote statistical significance at the 5 and 1 percent levels, respectively. Trade agreements represented by indicator variables are: European Union (EU), European Free Trade Area (EFTA, not reported), EU bilateral free trade agreements (EU FTAs), North American Free Trade Agreement (NAFTA), Southern Common Market (Mercosur), Chile, Mexico, Australia, and Singapore bilateral free trade agreements (CMAS FTAs), ASEAN Free Trade Area (AFTA), South Asia Free Trade Agreement (SAFTA, not reported), and all other customs unions and free trade agreements (Other FTAs). Clusters are the number of ordered country pairs in the panel dataset.

trade and investment such as oil shocks, fluctuations in the value of the dollar, and the extent of globalization. More important, we specify indicator variables for each ordered country pair in the dataset. This technique minimizes the possible bias in the estimated coefficients of the gravity model that arises from missing or unobservable explanatory variables. Finally we estimate the parameters of our gravity model separately for bilateral trade and inward FDI stocks, using a multistep, fixed-effects method for panel datasets developed recently by Plumper and Troeger (2007). This approach yields reliable coefficient estimates for both time-invariant and time-varying explanatory variables.

Estimation Results

Table 6.1 presents the estimation results for our gravity model, for both bilateral trade flows and inward FDI stocks. A number of regularities are discernible in the results that, broadly speaking, match the findings of other gravity models. Above all, the specified explanatory variables contribute significantly to explaining variations in bilateral trade flows and inward FDI stocks, as indicated by the high R-squared statistics for the two gravity model equations.[6]

As expected, distance between partners reduces bilateral trade and investment, while the joint GDP of partners, expressed in either level or per capita form, expands bilateral commerce in the model, holding other factors constant.[7] The individual influences of the other core explanatory variables are also sensible and generally conform to the results of other gravity model analyses. A common border between countries tends to expand bilateral commerce, as does being an island economy, having had a colonial relationship with a trading partner, or being a beneficiary of the Generalized System of Preferences (GSP).[8] In addition to distance, the

6. Although the R-squared statistic is greater than 0.90 for both equations, the reported value of the statistic may be somewhat inflated by the Plumper and Troeger (2007) multistage estimation, which measures the statistic only in the last stage of the procedure.

7. The economic theory underlying the gravity model suggests that the estimated coefficient of the joint GDP-level variable should approximate unity when the dependent variable of the estimating equation is bilateral trade. The expected sign of the joint GDP per capita variable is uncertain, but in our estimation results it appears to vie with the joint GDP-level variable for statistical significance in explaining both bilateral trade flows and FDI stocks.

8. Under the GSP, a number of advanced countries extend trade preferences to less developed countries on a nonreciprocal basis. The GSP programs of major industrial and other countries are monitored by UNCTAD, including through a series of manuals describing the individual programs (UNCTAD 2005).

principal resistance factors to trade, according to the gravity model, are being a landlocked country or a member of a country pair with a common colonizer (e.g., India and Kenya, both former UK colonies).

There are also significant interrelationships between trade and foreign investment in the estimation results. The greater is the joint stock of foreign investment in partner countries, the greater is their mutual trade. Analogously, the greater is the joint trade of partner countries with the world, the greater is the level of investment of the two countries in each other's economy, presumably because of both their mutual trade and their general openness to the global economy.

Finally, as a stylistic device in table 6.1, the coefficient estimates for the FTA indicator variables are framed for emphasis. Like the estimates for the other explanatory variables, they are statistically significant in most instances and predominantly bear the anticipated positive sign. The significant negative coefficient estimated for the NAFTA indicator variable in the inward FDI stocks equation is the most important anomaly. It could reflect appreciable tariff-jumping investment between the United States and Canada before NAFTA was established in 1994 as well as some natural unwinding of investment positions between the two NAFTA partners after 1994.[9]

Table 6.2 summarizes the bilateral trade-and-investment impact percentages implied by the FTA coefficients estimates in table 6.1. In some cases, the implied medium- to long-term trade and investment impacts are substantially greater than 100 percent. In general, however, the positive impact effects, measured by an elasticity percentage, range between 15 percent and 100 percent.

The gravity model can simulate the prospective impacts on trade and foreign investment resulting from greater economic integration once we choose appropriate FTA coefficients to apply to the Maghreb scenarios. Reflecting the nature of their underlying trade agreements, the various FTA coefficient estimates in tables 6.1 and 6.2 differ in important ways. The EU and NAFTA coefficients should be regarded as representing the potential impacts of the deepest, most thoroughgoing economic integration schemes, followed by the coefficients for the EU FTAs and Chile,

9. Not reported individually in table 6.1 are estimated year effects representing global influences on trade and investment over the estimation period 1976–2005 and cross-FTA indicators that indicate the influence of the FTAs on trade and investment by member countries with nonmember countries. However, estimated coefficients for cross-FTA indicators in the gravity model equation for bilateral trade are widely positive and significant. In other words, the FTAs appear to stimulate not only intrabloc trade, but also trade with countries outside the trading blocs—an unexpected form of trade diversion. For further discussion, see DeRosa and Hufbauer (2007).

Table 6.2 Gravity model estimates for free trade agreement (FTA) indicator variables and implied impact elasticities

	Merchandise trade		Inward FDI stocks	
Agreement	**Coefficient estimate**	**Impact elasticity** (percent)	**Coefficient estimate**	**Impact elasticity** (percent)
European Union	0.25	29	0.62	85
EU FTAs	0.15	16	0.17	18
North American Free Trade Agreement	0.80	123	–0.37	–31
Mercosur	0.69	98	1.25	247
Chile, Mexico, Australia, and Singapore FTAs	0.08	9	0.52	68
ASEAN Free Trade Agreement	0.69	99	0.80	123
Other FTAs	0.34	41	0.07	7

ASEAN = Association of Southeast Asian Nations
FDI = foreign direct investment

Source: Table 6.1 and author's calculations.

Mexico, Australia, and Singapore (CMAS) FTAs, which represent the recent burgeoning crop of high-standard FTAs established with emerging market countries. At the other end of the FTA spectrum are a large number of early and frequently unsuccessful bilateral and regional FTAs among less developed countries, a description that includes the Arab Maghreb Union (AMU). Notably, however, two prominent developing-country FTAs shown in table 6.2—the Southern Common Market (Mercosur) in Latin America and the Association of Southeast Asian Nations (ASEAN) Free Trade Area (AFTA) in Southeast Asia—post some of the largest trade and investment impact coefficients estimated for the several groups of FTAs identified in the model. These considerations are prominent in our selection of FTA coefficients for application to the Maghreb economic integration scenarios.

Maghreb Integration Scenarios

Established in 1989 by Algeria, Libya, Mauritania, Morocco, and Tunisia, the AMU began with the principal objective of creating a free trade area in goods, services, and factors of production by 1992 and a common market by 2000. To date, however, the free trade area has yet to be fully es-

tablished and economic integration among the Maghreb countries remains weak at best (see chapter 3).[10]

Efforts to advance and strengthen the AMU have been attempted in recent years, including by the World Bank and the International Monetary Fund.[11] Beyond simply reinvigorating the original AMU plan, these proposals have emphasized initiatives to build greater private-sector support in the Maghreb; accelerate and deepen EU plans for widely establishing bilateral FTAs with Maghreb countries, culminating in the envisioned Euro-Mediterranean free trade area; and, more generally, increase integration of the Maghreb countries with the world economy. To this mix of recommendations, we add consideration of the US plan announced by US President George W. Bush in 2003 to establish high-standard US bilateral FTAs with the countries of the Middle East and North Africa (MENA) and eventually to establish a US-MENA free trade area.[12]

Using the Peterson Institute gravity model, we carry out three basic sets of scenarios for achieving greater economic integration of the Maghreb countries that yield estimates of the impacts of the integration schemes on aggregate merchandise trade and inward FDI stocks for the individual Maghreb countries, the European Union, and the United States. The first scenario set covers an AMU free trade area. The second set covers EU and US bilateral FTAs with Algeria, Morocco, and Tunisia.[13] The third scenario involves EU and US regional FTAs with the Maghreb countries.[14]

The first scenario represents a meaningful free trade and investment area among the five AMU countries, largely as envisioned by the current

10. Also see Dennis (2006) and Brenton, Baroncelli, and Malouche (2006). Additionally, it should be noted that as signatories to the Greater Arab Free Trade Area established under the auspices of the League of Arab States (GAFTA), Libya, Morocco, and Tunisia may have eliminated the import tariffs on their mutual trade in 2005. Accordingly, to the extent that their mutual trade meets the 40 percent domestic content requirement of the GAFTA rules of origin and, most importantly, that it is not restricted by nontariff barriers, these three Maghreb countries may already enjoy some of the trade gains from regional integration simulated by the gravity model and presented in the next section.

11. See, e.g., World Bank (2006), Allain and Loko (2007), and Tahiri et al. (2007).

12. To date, the United States has signed FTAs with Israel, Jordan, Morocco, and Bahrain in the MENA region. Additionally, it has begun FTA negotiations with Oman and the United Arab Emirates. See www.ustr.gov for details (accessed July 7, 2008).

13. Specifically, this includes the EU-Algeria FTA, EU-Morocco FTA, EU-Tunisia FTA, EU-Algeria+ FTA, EU-Morocco+ FTA, EU-Tunisia+ FTA, US-Algeria FTA, US-Morocco FTA, US-Tunisia FTA, US-Algeria+ FTA, US-Morocco+ FTA, and US-Tunisia+ FTA. See below for explanation of "plus" scenarios.

14. Specifically, this includes an EU-Maghreb free trade area, a US-Maghreb free trade area, and an EU-US-Maghreb free trade area.

AMU plan for regional economic integration. In the second set, the integration scenarios depict perhaps less ambitious but potentially more outward-oriented bilateral FTAs by the European Union and United States with the three major Maghreb countries—Algeria, Morocco, and Tunisia—individually. These scenarios are regarded as the most politically feasible approaches to establishing and deepening Maghreb integration in the near future. They are also regarded as potential instruments for encouraging the Maghreb countries to reach out gradually to one another and liberalize intraregional economic relations, in part to offset the distortions in foreign trade, especially in investment, that can emerge from the hub-and-spoke structure of a network of EU and US bilateral FTAs (Wonnacott 1996). The implications of such regional outreach are illustrated by our hypothesized "plus" scenarios for EU and US bilateral FTAs with the three major Maghreb countries. In these scenarios, the European Union and United States strike bilateral FTAs with the three individual Maghreb countries as before, but the three countries also simultaneously eliminate barriers to trade and investment with their AMU partners, widening the liberalization of their markets within the Maghreb.

The third set of scenarios depicts the establishment of full-fledged EU and US regional free trade areas with the Maghreb countries, both individually by the European Union and the United States and on a combined basis. These scenarios envision the widest possible liberalization of the Maghreb countries with one another and the global economy, through their integration with either the European Union or the United States.

The final element of the scenarios is to select the appropriate gravity model FTA coefficients for the simulation analysis. Our choice of coefficient estimates for the AMU scenario and EU-Maghreb FTA scenarios is straightforward. We assume that the trade and investment impacts of the hypothesized AMU free trade area will be governed by the gravity model coefficient estimates for the group of other FTAs (tables 6.1 and 6.2), whereas those of the hypothesized EU bilateral and regional FTAs will be governed by the coefficient estimates for the group of EU FTAs. Choosing estimates for the US bilateral and regional FTA scenarios is more difficult, as we hesitate to specify the NAFTA coefficients estimated by our gravity model because of the aforementioned anomaly of the negative coefficient estimated for NAFTA in the gravity model for inward FDI stocks. Additionally, the estimated coefficient for NAFTA in the gravity model for merchandise trade is the largest estimated FTA coefficient in our gravity model, implying a trade impact elasticity of 123 percent in table 6.2. To avoid these extremes and the uncertainties that underlie them, we represent the trade and investment impacts of the bilateral and regional FTAs between the United States and Maghreb countries by the average of the estimated coefficients for the CMAS FTAs and AFTA. The assumption essentially balances the experience of recent high-standard FTAs between the United States and advanced countries, such as Australia and Singa-

pore, against the experience of the relatively dynamic ASEAN developing countries with regional free trade. This implies an average impact of US-Maghreb FTAs of about 55 percent on bilateral trade and about 85 percent on bilateral inward FDI stocks.

In the enhanced EU and US FTA scenarios, we assume that by extending some preferences to Libya and Mauritania and among themselves, the three major Maghreb countries of Algeria, Morocco, and Tunisia will achieve only half the percentage gains in trade and investment that the European Union and United States achieve in expanding their economic relations with the three major Maghreb countries. This assumption recognizes the reality of current intra-Maghreb relations, which, since the adoption of the AMU, have been slow in opening Maghreb borders to greater regional trade and investment.

Simulation Results

The gravity model simulation results for merchandise trade and inward stocks of FDI for the Maghreb countries, the European Union, and the United States under the three sets of Maghreb integration scenarios are reported in tables 6.3 and 6.4, respectively. To facilitate comparison, the two tables also report the base levels of Maghreb, EU, and US trade and FDI stocks in the gravity model as well as the simulated trade and investment impacts of the integration scenarios, expressed as percentages of the base level of trade and investment with the world for each of the countries.

The impacts of the integration scenarios were obtained by first predicting trade and investment outcomes in the gravity model over the period 2001–05, assuming that the relevant FTA indicator—for example, the EU FTA variable in the case of the EU bilateral and regional FTAs—was zero. Then we replaced the FTA variable with an FTA indicator tailored specifically to the individual scenario and re-solved the model to predict the new trade and investment outcomes over the same period. We then averaged the difference between the second and the first values predicted by the gravity model over the five-year period (at 2005 prices) to determine the average annual impacts for trade and investment under each scenario reported in tables 6.3 and 6.4.

Through this methodology, the gravity model provides estimates of the bilateral impacts of the different Maghreb integration scenarios even when no underlying trade or investment is reported. In other words, impacts are computed on the basis of the predictions of the gravity model assuming that the trade or investment levels of the partner countries conform to the norms that the model estimates for other country pairs with similar characteristics. When no trade or investment is reported, the estimated impacts are underestimated substantially, as they ascribe base

Table 6.3 Average impacts on merchandise trade of Maghreb economic integration scenarios, 2001–05
(millions of US dollars at 2005 prices; percent in parentheses)

Country	Base: Trade with the world	Arab Maghreb Union	EU and US bilateral FTAs				EU and US regional FTAs		
			EU-Alg EU-Mor EU-Tun	EU-Alg+ EU-Mor+ EU-Tun+	US-Alg US-Mor US-Tun	US-Alg+ US-Mor+ US-Tun+	EU-Maghreb	US-Maghreb	EU-US-Maghreb
Total trade									
Maghreb	115,130	893	2,654	2,793	3,110	3,534	3,604	5,216	8,820
		(0.8)	(2.3)	(2.4)	(2.7)	(3.1)	(3.1)	(4.5)	(7.7)
Algeria	42,410	254	469	518	1,734	1,885	620	2,258	2,878
		(0.6)	(1.1)	(1.2)	(4.1)	(4.4)	(1.5)	(5.3)	(6.8)
Libya	24,073	242	0	32	0	95	429	703	1,133
		(1.0)	(0.0)	(0.1)	(0.0)	(0.4)	(1.8)	(2.9)	(4.7)
Mauritania	1,406	122	0	9	0	26	217	340	558
		(8.7)	(0.0)	(0.6)	(0.0)	(1.9)	(15.5)	(24.2)	(39.7)
Morocco	26,738	138	1,770	1,792	793	862	1,846	1,061	2,907
		(0.5)	(6.6)	(6.7)	(3.0)	(3.2)	(6.9)	(4.0)	(10.9)
Tunisia	20,504	136	415	442	583	665	492	853	1,345
		(0.7)	(2.0)	(2.2)	(2.8)	(3.2)	(2.4)	(4.2)	(6.6)
European Union	6,182,919	0	2,654	2,654	0	0	3,086	0	3,086
		(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)
United States	2,285,789	0	0	0	3,110	3,110	0	3,411	3,411
		(0.0)	(0.0)	(0.0)	(0.1)	(0.1)	(0.0)	(0.1)	(0.1)
World	16,407,561	893	5,308	5,447	6,219	6,643	6,691	8,627	15,318
		(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.1)	(0.1)
Exports									
Maghreb	66,296	446	461	531	198	410	934	1,194	2,128
		(0.7)	(0.7)	(0.8)	(0.3)	(0.6)	(1.4)	(1.8)	(3.2)
Algeria	26,952	136	170	186	32	81	251	313	564
		(0.5)	(0.6)	(0.7)	(0.1)	(0.3)	(0.9)	(1.2)	(2.1)
Libya	18,506	120	0	32	0	95	213	271	485
		(0.6)	(0.0)	(0.2)	(0.0)	(0.5)	(1.2)	(1.5)	(2.6)

Mauritania	755	46	0	9	0	26	100	166	265
		(6.1)	(0.0)	(1.2)	(0.0)	(3.5)	(13.2)	(21.9)	(35.2)
Morocco	11,031	73	172	177	105	121	211	245	456
		(0.7)	(1.6)	(1.6)	(1.0)	(1.1)	(1.9)	(2.2)	(4.1)
Tunisia	9,053	70	119	128	61	88	158	199	357
		(0.8)	(1.3)	(1.4)	(0.7)	(1.0)	(1.7)	(2.2)	(3.9)
European Union	3,025,399	0	2,192	2,192	0	0	2,412	0	2,412
		(0.0)	(0.1)	(0.1)	(0.0)	(0.0)	(0.1)	(0.0)	(0.1)
United States	842,357	0	0	0	2,911	2,911	0	3,120	3,120
		(0.0)	(0.0)	(0.0)	(0.3)	(0.3)	(0.0)	(0.4)	(0.4)
World	8,203,780	446	2,654	2,724	3,110	3,322	3,345	4,313	7,659
		(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.1)	(0.1)
Imports									
Maghreb	48,834	446	2,192	2,262	2,911	3,123	2,671	4,022	6,692
		(0.9)	(4.5)	(4.6)	(6.0)	(6.4)	(5.5)	(8.2)	(13.7)
Algeria	15,458	118	298	332	1,701	1,804	368	1,945	2,314
		(0.8)	(1.9)	(2.1)	(11.0)	(11.7)	(2.4)	(12.6)	(15.0)
Libya	5,567	122	0	0	0	0	216	432	648
		(2.2)	(0.0)	(0.0)	(0.0)	(0.0)	(3.9)	(7.8)	(11.6)
Mauritania	651	75	0	0	0	0	118	175	292
		(11.6)	(0.0)	(0.0)	(0.0)	(0.0)	(18.1)	(26.8)	(44.9)
Morocco	15,707	65	1,598	1,616	688	742	1,635	816	2,451
		(0.4)	(10.2)	(10.3)	(4.4)	(4.7)	(10.4)	(5.2)	(15.6)
Tunisia	11,451	66	296	314	522	577	334	654	988
		(0.6)	(2.6)	(2.7)	(4.6)	(5.0)	(2.9)	(5.7)	(8.6)
European Union	3,157,520	0	461	461	0	0	675	0	675
		(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)
United States	1,443,433	0	0	0	198	198	0	292	292
		(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)
World	8,203,780	446	2,654	2,724	3,110	3,322	3,345	4,313	7,659
		(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.1)	(0.1)

Source: Peterson Institute gravity model.

Table 6.4 Average impacts on inward foreign direct investment stocks of Maghreb economic integration scenarios, 2001–05 (millions of US dollars at 2005 prices; percent in parentheses)

Country	Base: Inward FDI stocks	Arab Maghreb Union	EU and US bilateral FTAs				EU and US regional FTAs		
			EU-Alg EU-Mor EU-Tun	EU-Alg+ EU-Mor+ EU-Tun+	US-Alg US-Mor US-Tun	US-Alg+ US-Mor+ US-Tun+	EU-Maghreb	US-Maghreb	EU-US-Maghreb
Total inward FDI stocks									
Maghreb	8,096	156	3,719	3,859	1,366	1,996	5,376	4,356	9,732
		(1.9)	(45.9)	(47.7)	(16.9)	(24.6)	(66.4)	(53.8)	(120.2)
Algeria	4,827	54	1,370	1,423	779	1,013	1,524	1,563	3,087
		(1.1)	(28.4)	(29.5)	(16.1)	(21.0)	(31.6)	(32.4)	(64.0)
Libya	458	50	0	33	0	155	1,197	1,436	2,633
		(11.0)	(0.0)	(7.2)	(0.0)	(33.8)	(261.2)	(313.6)	(574.7)
Mauritania	35	2	0	1	0	5	161	50	212
		(6.3)	(0.0)	(3.2)	(0.0)	(15.2)	(455.8)	(142.1)	(597.9)
Morocco	2,286	20	1,506	1,528	268	367	1,563	555	2,118
		(0.9)	(65.9)	(66.8)	(11.7)	(16.0)	(68.4)	(24.3)	(92.6)
Tunisia	489	30	842	874	318	455	931	751	1,682
		(6.1)	(172.2)	(178.6)	(65.1)	(93.1)	(190.2)	(153.6)	(343.8)
European Union	7,478,118	0	3,719	3,719	0	0	4,926	0	4,926
		(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.1)	(0.0)	(0.1)
United States	3,286,223	0	0	0	1,366	1,366	0	2,081	2,081
		(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.1)	(0.1)
World	14,881,710	156	7,437	7,578	2,731	3,361	10,301	6,437	16,738
		(0.0)	(0.0)	(0.1)	(0.0)	(0.0)	(0.1)	(0.0)	(0.1)
Inward FDI stocks "exported"									
Maghreb	397	78	1,393	1,463	254	569	2,190	1,736	3,926
		(19.7)	(351.2)	(368.9)	(64.0)	(143.4)	(552.0)	(437.5)	(989.5)
Algeria	0	30	643	662	169	255	726	595	1,321
		(6,584.4)	(>999.9)	(>999.9)	(>999.9)	(>999.9)	(>999.9)	(>999.9)	(>999.9)
Libya	71	27	0	33	0	155	566	709	1,275
		(37.9)	(0.0)	(46.4)	(0.0)	(218.9)	(801.2)	(>999.9)	(>999.9)

Mauritania	2	1	0	1	0	5	78	32	110
		(72.3)	(0.0)	(70.6)	(0.0)	(331.9)	(>999.9)	(>999.9)	(>999.9)
Morocco	323	7	388	394	23	44	410	123	533
		(2.1)	(120.1)	(121.8)	(7.0)	(13.7)	(127.0)	(38.0)	(164.9)
Tunisia	1	14	362	374	62	109	410	278	687
		(1,801.8)	(>999.9)	(>999.9)	(>999.9)	(>999.9)	(>999.9)	(>999.9)	(>999.9)
European Union	3,875,859	0	2,325	2,325	0	0	2,961	0	2,961
		(0.0)	(0.1)	(0.1)	(0.0)	(0.0)	(0.1)	(0.0)	(0.1)
United States	1,781,483	0	0	0	1,112	1,112	0	1,483	1,483
		(0.0)	(0.0)	(0.0)	(0.1)	(0.1)	(0.0)	(0.1)	(0.1)
World	7,440,855	78	3,719	3,789	1,366	1,681	5,151	3,219	8,369
		(0.0)	(0.0)	(0.1)	(0.0)	(0.0)	(0.1)	(0.0)	(0.1)
Inward FDI stocks "imported"									
Maghreb	7,699	78	2,325	2,396	1,112	1,427	3,186	2,621	5,806
		(1.0)	(30.2)	(31.1)	(14.4)	(18.5)	(41.4)	(34.0)	(75.4)
Algeria	4,826	24	727	761	610	758	798	968	1,766
		(0.5)	(15.1)	(15.8)	(12.6)	(15.7)	(16.5)	(20.1)	(36.6)
Libya	387	23	0	0	0	0	630	728	1,358
		(6.0)	(0.0)	(0.0)	(0.0)	(0.0)	(162.7)	(187.9)	(350.5)
Mauritania	34	1	0	0	0	0	83	19	102
		(3.2)	(0.0)	(0.0)	(0.0)	(0.0)	(247.1)	(55.2)	(302.3)
Morocco	1,963	14	1,118	1,135	246	323	1,153	432	1,585
		(0.7)	(56.9)	(57.8)	(12.5)	(16.4)	(58.7)	(22.0)	(80.7)
Tunisia	488	16	481	500	256	346	521	474	995
		(3.3)	(98.4)	(102.4)	(52.5)	(70.9)	(106.7)	(97.0)	(203.7)
European Union	3,602,259	0	1,393	1,393	0	0	1,965	0	1,965
		(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.1)	(0.0)	(0.1)
United States	1,504,740	0	0	0	254	254	0	598	598
		(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)
World	7,440,855	78	3,719	3,789	1,366	1,681	5,151	3,219	8,369
		(0.0)	(0.0)	(0.1)	(0.0)	(0.0)	(0.1)	(0.0)	(0.1)

Source: Peterson Institute gravity model.

levels of trade or investment as predicted by the gravity model when in fact no trade or investment may have actually occurred.[15]

Trade Impacts

We first consider the trade impacts of the three sets of Maghreb integration scenarios summarized in table 6.3. All the calculations refer to merchandise trade; at this time, the gravity model data set does not cover service trade flows.

Given the small economic size of the AMU and the limited diversity of endowments among its members, a full-fledged free trade area among the Maghreb countries yields a gain in total trade (merchandise exports plus imports) of only about $1 billion, or about 1 percent of base total trade. Notwithstanding this modest impact for the AMU bloc as a whole, the impacts on the total trade of Mauritania ($122 million, or 8.7 percent) and the total imports of Libya ($122 million, or 2.2 percent) are significant and would improve general welfare substantially in both countries.

As emphasized previously, fully establishing the AMU has not proven politically feasible owing to deep-seated rivalries. More feasible may be the establishment of FTAs between the European Union or the United States on one hand and the major Maghreb countries (Algeria, Morocco, and Tunisia) on the other. The simulation results in table 6.3 support this view, although the economic benefits are clearly concentrated in the combined imports of the three Maghreb partner countries, at $2 billion to $3 billion or about 5 to 6 percent of the combined base imports of those countries. Although the European Union trades more extensively than the United States with the Maghreb countries, the US FTA impacts on AMU trade are somewhat greater than the impacts of the EU FTA because the assumed gravity model coefficients for US FTAs are larger in value.

The "plus" integration scenarios—in which Algeria, Morocco, and Tunisia extend the trade and investment preferences under the EU and US FTAs to one another and to Libya and Mauritania—yield only modest trade gains to the latter two countries, Libya and Mauritania. Yet such an approach to leveraging wider liberalization in the Maghreb might still be the most feasible path to spread globalization more widely and quickly in the region.[16]

While the bilateral EU and US FTAs with the three major Maghreb countries are probably the most politically feasible route in the near term and

15. These instances arise in the simulation results mainly for inward FDI stocks (table 6.4), where the percentage impacts are reported to be greater than 999 percent.

16. The macroeconomic benefits to EU and US economies are clearly not appreciable in percentage terms from the simulation results presented in table 6.3. EU and US trade with the Maghreb countries does expand, however, and to the individual EU and US exporters and importers involved in the expansion of trade, the gains from trade may well be substantial and significant.

would yield substantial economic benefits to the Maghreb partners, still of interest are the potential economic gains from true globalization of the AMU countries. That scenario is represented by the hypothesized EU and US regional FTAs in the third set of Maghreb integration calculations in table 6.3. As expected, the simulated trade gains under the regional FTA scenarios are the largest of all, for the Maghreb countries considered individually and as a bloc. Total Maghreb trade expands by $4 billion to $5 billion, or 3 to 4.5 percent, when the European Union and the United States separately establish free trade areas with the Maghreb countries. The same trade expands by nearly $9 billion, nearly 8 percent, when both the European Union and the United States establish regional FTAs with the AMU countries (table 6.3).

The estimated impacts on Maghreb imports are especially strong. Under a combined EU-US-Maghreb FTA, total Maghreb imports expand by $6.7 billion or nearly 14 percent. Moreover, the stimulus to the imports of the individual Maghreb countries ranges between about 10 percent (Tunisia) and 45 percent (Mauritania). Total Maghreb exports expand substantially less, by $2.1 billion or 3.2 percent. Yet the export gains are significant in percentage terms for Mauritania (35 percent) and for Morocco and Tunisia (4 percent). Also, if Maghreb imports expanded as much as the simulation results suggest, it seems likely that greater efficiencies would stimulate exports in ways not covered, such as by larger service exports. Furthermore, the potential trade gains could create considerable incentives for the Maghreb countries to build on the foundations of either EU or US FTAs, through a process of competitive liberalization to embrace a wide range of economic reforms.[17]

FDI Impacts

In recent years it has become widely accepted that trade and FDI are closely linked (see box 6.1), with worldwide investment by multinational firms motivating trade flows and guiding their directions in important ways. The limited inward stocks of FDI in the Maghreb, which are especially small outside its energy sector, reflects the region's failure to keep pace with the world economy.

The FDI impacts of the three sets of Maghreb integration scenarios represented in table 6.4 indicate the extent to which greater openness might boost foreign investment in the Maghreb. Broadly speaking, the FDI impacts are similar to the trade impacts, suggesting that inward FDI stocks increase substantially more when closer economic ties are pursued with either the European Union or the United States, rather than simply on an AMU basis.[18] Closer Maghreb economic ties with the European Union and

17. On the notion of competitive liberalization, see Bergsten (1996).

18. EU and US bilateral and regional FTAs with the Maghreb imply very little change in inward FDI for either the European Union or the United States.

Box 6.1 Trade and FDI linkages in the gravity model

The impacts on Maghreb trade and investment of the proposed EU and US bilateral and regional FTAs with the countries of the region should be determined simultaneously in the Peterson Institute gravity model. This is because the separate gravity model equations for bilateral trade and inward FDI stocks are interrelated by including the joint FDI variable and the joint trade variable, respectively, as explanatory variables in the two equations. Thus, an initial expansion of either bilateral trade or FDI under an EU or US FTA with one or more Maghreb countries should lead to additional rounds of increases in bilateral trade and stocks of FDI for the FTA partners until a final equilibrium is reached at levels greater than those reported in tables 6.3 and 6.4.

Algebraically determining the appropriate adjustment of the two right-hand side variables—joint trade with the world and joint total inward FDI stocks—to changes in the two left-hand side (or predicted) variables in the gravity model—bilateral trade and bilateral FDI stocks—reveals that the relationships involve calculations of changes in two-way trade and FDI stock holdings weighted by baseline shares of both FTA partners and non-FTA partners that are too extensive to be computed readily in successive simulations of the Peterson gravity model.

Nonetheless, the initial bilateral impacts of FTAs on bilateral trade and inward FDI stocks in the gravity model are highly symmetric when measured in proportional changes. This allows us to approximate the adjustment in the two right-hand side variables with a simple linear relationship. Based on baseline shares of country pairs in their joint trade with the world and their joint inward FDI stocks in the gravity model, we assume that the proportional change in the joint trade variable equals 0.10 times the corresponding proportional change in the predicted level of bilateral exports. We also assume that the proportional change in the joint inward FDI stocks variable equals 0.15 times the corresponding proportional change in the predicted bilateral level of outward FDI stocks.

Table 6.5 presents the results of incorporating these linkages in the gravity model and then applying the model to the case—chosen for illustration—of the enhanced ("plus") EU FTAs with Algeria, Morocco, and Tunisia. These results are placed alongside the results for the same Maghreb integration scenario without linking the trade and FDI first reported in tables 6.3 and 6.4. In the simultaneous gravity model, general equilibrium is effectively reached after five successive iterations of the model after the establishment of the enhanced EU FTAs with the three major Maghreb countries.

In table 6.5, the results of incorporating the trade-FDI linkages are fairly straightforward. The simulated trade impacts of the enhanced EU FTAs are greater than

(box continues next page)

Box 6.1 Trade and FDI linkages in the gravity model *(continued)*

those found without the trade-FDI linkages, but only marginally so (about 2 percent across the board). Thus, total Maghreb trade expands by nearly $2.9 billion when the trade-FDI linkages are built into the model, compared with $2.8 billion without the linkages.

The general equilibrium impacts on FDI stocks, however, are substantially greater than those found without the trade-FDI linkages: They are over 5 percent greater across the board. Total outward and inward Maghreb FDI stocks expand by nearly $4.1 billion, compared with $3.9 billion without accounting for the linkages. The impacts on FDI stocks when the trade-FDI linkages are included in the model are substantially greater because of the relatively large estimated coefficient (0.54) in table 6.1 for the joint trade explanatory variable in the gravity model equation for FDI stocks.

the United States tend to result in greater impacts on inward FDI stocks than outward FDI stocks. The FDI impacts for EU bilateral and regional FTAs are larger than those for US FTAs because the gravity model predicts substantially greater base-period investment between the Maghreb and the European Union than between the Maghreb and the United States.

In the most ambitious hypothesized EU-US-Maghreb free trade area, total Maghreb inward FDI stocks increase by $5.8 billion (75 percent) compared with the simulated increase in total Maghreb outward FDI stocks amounting to $3.9 billion. These potential impacts of Maghreb integration scenarios on FDI reinforce the conclusions of the previous discussion of trade flows. In their own right, the FDI calculations add significantly to the potential gains that the Maghreb countries might enjoy by forging closer economic relations with the European Union and the United States, through competitive liberalization and other strategies to engage the Maghreb with the world economy.

Impacts on Output, Employment, and Growth

The gravity model's predicted impacts of Maghreb economic integration on merchandise trade and FDI for the AMU countries are expected to materialize over a horizon of two to five years. However, as Maghreb consumers and producers adapt during this period to the opportunities provided by greater openness—and the likely accompanying domestic economic reforms to facilitate the bilateral or regional FTAs—adjustments in other economic variables may take place with additional impacts on trade and investment. Greater openness, particularly added domestic and for-

eign investment in the Maghreb, should be expected to result in greater employment and higher growth in the region in the long run.

The apparent imbalance between the impacts of greater economic integration on Maghreb exports and imports in table 6.3 point to the most immediate adjustment of other economic variables in the aftermath of the several Maghreb integration scenarios involving the European Union and the United States. The greater expansion of imports than exports for the Maghreb countries implies a deterioration in the balance of payments positions of these countries, requiring exchange rate depreciation and further adjustments in Maghreb trade to maintain the countries' external payments positions.[19] This deterioration is accounted for in the final estimates of the impacts of greater economic integration on Maghreb trade (table 6.5). The final trade impacts assume that exchange rate adjustments in the five Maghreb countries moderate the initial expansion of Maghreb imports by 25 percent and expand Maghreb exports until each country's balance of payments returns to equilibrium.[20] Comparing the initial trade impacts to the final impacts for the Maghreb countries in tables 6.3 and 6.5, respectively, one observes a modest reduction in final imports and the very remarkable increase in final exports of the Maghreb countries under each of the several integration scenarios except the scenario depicting the AMU plan. The combined exports of the Maghreb countries more than double in the scenarios depicting the prospective EU and US FTAs with the AMU countries when the gravity model simulations account for balance of payment constraints.

Table 6.5 also provides estimates of the medium- to long-term impacts of the final levels of trade under the Maghreb integration scenarios on the Maghreb countries' levels of aggregate output (GDP). The GDP impacts are based on the findings of Cline (2004), whose survey of empirical studies on the relationship between openness and per capita output in mainly developing countries finds an average elasticity of 0.5 when the changes in the two variables are measured over periods of 5 to 10 years. When translated into the dimensions of the present analysis, this average elasticity implies that for every percentage point that total trade expands in a

19. The initial decline in the balance of payments positions of the Maghreb countries might be ameliorated in part by the changes in long-term net foreign asset holdings of the AMU countries implied by the FDI impacts reported in table 6.4. However, the changes in net foreign asset holdings are one-time adjustments in FDI stocks, whereas the trade impacts reported in table 6.3 represent perpetual changes in international payment flows that must be factored into the balance of payments constraint of the individual Maghreb countries. For expository ease, we do not consider here the possible secondary impacts of the integration scenarios on EU and US trade to maintain equilibrium in the international payments positions of the European Union and the United States, though the secondary impacts should be expected to be small relative to overall levels of EU and US trade.

20. In effect, this methodology assumes that, not unlike in most other small trading countries, the demand for imports in the Maghreb countries is less price elastic than is the supply of exports.

Maghreb country, the aggregate output of the country should be expected to increase by 0.33 percentage points in the long run.[21]

In table 6.5, the GDP impacts for the three major Maghreb countries under the combined EU and US free trade areas with the AMU countries range between about 2.5 percent (Algeria and Tunisia) and 4.5 percent (Morocco). For Libya and Mauritania, the GDP impacts are below and above this range, at 1.3 percent and 10.3 percent, respectively. In comparison, the average GDP impact for the three major Maghreb countries under the EU and US bilateral FTAs ranges between about 1.0 percent and 1.5 percent. The average for all the Maghreb countries under the AMU plan is only 0.3 percent. These results suggest that the prospective EU and US FTAs with the Maghreb countries would add appreciably to output in the region if they were to be pursued to the widest possible extent, namely, as a unified free trade area with the two external trading partners.

The gravity model can also derive the long-term employment and growth effects of the prospective EU and US FTAs on the Maghreb countries. These effects are best and most fundamentally related to the FDI impacts in table 6.4. This is because increased FDI in the Maghreb countries from EU and US multinational firms implies the addition to the Maghreb economies of particularly productive, world-class resources, accompanied often by the considerable technological and managerial knowhow of these generally internationally competitive, outward-oriented firms.

The long-term employment gains presented in table 6.6 assume that increased foreign investment in the Maghreb economies employs surplus (or underemployed) labor. The magnitudes of the estimated employment gains in table 6.6 are based on the recent level of employment supported by US FDI in a representative Central American economy, Nicaragua (Hufbauer and Adler 2008). These data indicate that each full-time job in US foreign-affiliate firms in the representative economy is supported by $90,000 in US FDI.[22] Applying this rule of thumb to the FDI impacts in the gravity model's Maghreb integration scenarios reveals that, while the

21. Cline's (2004) average elasticity estimate of 0.5 for per capita output levels (GDP/N) in relation to trade openness (X + M/GDP) may be expressed as (GDP/N)* = 0.5 ([X + M]/GDP)*, where asterisks (*) denote percentage change. Solving for the change in aggregate output in terms of changes in total trade (X + M) and population (N) yields GDP* = 0.33 (X + M)* + 0.5 N*, which is the relation used to derive the GDP impacts for unchanged population levels in the Maghreb countries reported in table 6.5.

22. US Department of Commerce, Bureau of Economic Analysis, interactive tables, available at www.bea.gov (accessed July 7, 2008). The data for US foreign investment in the Maghreb countries in this dataset were viewed as too sparse for some countries and too heavily concentrated in the capital-intensive oil sector for other countries to be relied on for the present analysis. By contrast, the data for Nicaragua were viewed as a more appropriate and conservative norm for representing the proximate employment impacts in the Maghreb of greater FDI from the European Union, United States, and other countries under fully liberalized trade and investment regimes in the region.

Table 6.5 Average impacts on merchandise trade and gross domestic output of Maghreb economic integration scenarios assuming trade flows adjust to maintain balance-of-payments equilibrium, 2001–05
(millions of US dollars at 2005 prices; percent in parentheses)

Country	Base: Trade with the world; 2005 GDP	Arab Maghreb Union	EU and US bilateral FTAs				EU and US regional FTAs		
			EU-Alg EU-Mor EU-Tun	EU-Alg+ EU-Mor+ EU-Tun+	US-Alg US-Mor US-Tun	US-Alg+ US-Mor+ US-Tun+	EU-Maghreb	US-Maghreb	EU-US-Maghreb
Total trade									
Maghreb	115,130	918	3,289	3,393	4,367	4,685	4,006	6,033	10,038
		(0.8)	(2.9)	(2.9)	(3.8)	(4.1)	(3.5)	(5.2)	(8.7)
Algeria	42,410	296	448	498	2,552	2,706	553	2,918	3,470
		(0.7)	(1.1)	(1.2)	(6.0)	(6.4)	(1.3)	(6.9)	(8.2)
Libya	24,073	183	0	0	0	0	324	648	972
		(0.8)	(0.0)	(0.0)	(0.0)	(0.0)	(1.3)	(2.7)	(4.0)
Mauritania	1,406	113	0	0	0	0	176	262	438
		(8.1)	(0.0)	(0.0)	(0.0)	(0.0)	(12.5)	(18.6)	(31.2)
Morocco	26,738	162	2,397	2,424	1,032	1,113	2,452	1,224	3,676
		(0.6)	(9.0)	(9.1)	(3.9)	(4.2)	(9.2)	(4.6)	(13.7)
Tunisia	20,504	164	444	471	783	866	501	981	1,481
		(0.8)	(2.2)	(2.3)	(3.8)	(4.2)	(2.4)	(4.8)	(7.2)
Exports									
Maghreb	66,296	459	1,644	1,697	2,183	2,342	2,003	3,016	5,019
		(0.7)	(2.5)	(2.6)	(3.3)	(3.5)	(3.0)	(4.5)	(7.6)
Algeria	26,952	148	224	249	1,276	1,353	276	1,459	1,735
		(0.5)	(0.8)	(0.9)	(4.7)	(5.0)	(1.0)	(5.4)	(6.4)
Libya	18,506	91	0	0	0	0	162	324	486
		(0.5)	(0.0)	(0.0)	(0.0)	(0.0)	(0.9)	(1.8)	(2.6)
Mauritania	755	57	0	0	0	0	88	131	219
		(7.5)	(0.0)	(0.0)	(0.0)	(0.0)	(11.7)	(17.4)	(29.0)
Morocco	11,031	81	1,199	1,212	516	556	1,226	612	1,838
		(0.7)	(10.9)	(11.0)	(4.7)	(5.0)	(11.1)	(5.5)	(16.7)
Tunisia	9,053	82	222	236	391	433	250	490	741
		(0.9)	(2.5)	(2.6)	(4.3)	(4.8)	(2.8)	(5.4)	(8.2)

Imports									
Maghreb	48,834	459	1,644	1,697	2,183	2,342	2,003	3,016	5,019
		(0.9)	(3.4)	(3.5)	(4.5)	(4.8)	(4.1)	(6.2)	(10.3)
Algeria	15,458	148	224	249	1,276	1,353	276	1,459	1,735
		(1.0)	(1.4)	(1.6)	(8.3)	(8.8)	(1.8)	(9.4)	(11.2)
Libya	5,567	91	0	0	0	0	162	324	486
		(1.6)	(0.0)	(0.0)	(0.0)	(0.0)	(2.9)	(5.8)	(8.7)
Mauritania	651	57	0	0	0	0	88	131	219
		(8.7)	(0.0)	(0.0)	(0.0)	(0.0)	(13.5)	(20.1)	(33.7)
Morocco	15,707	81	1,199	1,212	516	556	1,226	612	1,838
		(0.5)	(7.6)	(7.7)	(3.3)	(3.5)	(7.8)	(3.9)	(11.7)
Tunisia	11,451	82	222	236	391	433	250	490	741
		(0.7)	(1.9)	(2.1)	(3.4)	(3.8)	(2.2)	(4.3)	(6.5)
GDP									
Maghreb	225,593	567	2,087	2,156	3,040	3,252	2,492	4,027	6,519
		(0.3)	(0.9)	(1.0)	(1.3)	(1.4)	(1.1)	(1.8)	(2.9)
Algeria	101,786	234	354	395	2,021	2,143	438	2,311	2,749
		(0.2)	(0.3)	(0.4)	(2.0)	(2.1)	(0.4)	(2.3)	(2.7)
Libya	41,667	104	0	0	0	0	185	370	555
		(0.3)	(0.0)	(0.0)	(0.0)	(0.0)	(0.4)	(0.9)	(1.3)
Mauritania	1,837	49	0	0	0	0	76	113	189
		(2.7)	(0.0)	(0.0)	(0.0)	(0.0)	(4.1)	(6.2)	(10.3)
Morocco	51,621	103	1,527	1,544	657	709	1,562	780	2,342
		(0.2)	(3.0)	(3.0)	(1.3)	(1.4)	(3.0)	(1.5)	(4.5)
Tunisia	28,683	76	205	218	361	400	231	453	684
		(0.3)	(0.7)	(0.8)	(1.3)	(1.4)	(0.8)	(1.6)	(2.4)

Source: Author's calculations based on the initial impacts on merchandise trade of Maghreb integration scenarios in table 6.3 and Cline's (2004) finding that the long-term elasticity of output per head with respect to openness, as measured by total trade relative to GDP, tends to equal 0.5 across a wide variety of empirical studies.

Table 6.6 Employment and growth impacts of increased foreign direct investment under Maghreb economic integration scenarios

Country	Arab Maghreb Union	EU and US bilateral FTAs: EU-Alg EU-Mor EU-Tun	EU and US bilateral FTAs: EU-Alg+ EU-Mor+ EU-Tun+	EU and US bilateral FTAs: US-Alg US-Mor US-Tun	EU and US bilateral FTAs: US-Alg+ US-Mor+ US-Tun+	EU and US regional FTAs: EU-Maghreb	EU and US regional FTAs: US-Maghreb	EU and US regional FTAs: EU-US-Maghreb
Average increase in foreign direct investment, 2001–05 (millions of US dollars at 2005 prices)								
Maghreb	78	2,325	2,396	1,112	1,427	3,186	2,621	5,806
Algeria	24	727	761	610	758	798	968	1,766
Libya	23	0	0	0	0	630	728	1,358
Mauritania	1	0	0	0	0	83	19	102
Morocco	14	1,118	1,135	246	323	1,153	432	1,585
Tunisia	16	481	500	256	346	521	474	995
Average increase in foreign direct investment, 2001–05 (percent of GDP)								
Maghreb	0.0	1.0	1.1	0.5	0.6	1.4	1.2	2.6
Algeria	0.0	0.7	0.7	0.6	0.7	0.8	1.0	1.7
Libya	0.1	0.0	0.0	0.0	0.0	1.5	1.7	3.3
Mauritania	0.1	0.0	0.0	0.0	0.0	4.5	1.0	5.6
Morocco	0.0	2.2	2.2	0.5	0.6	2.2	0.8	3.1
Tunisia	0.1	1.7	1.7	0.9	1.2	1.8	1.7	3.5
Employment gain (number of workers)								
Maghreb	869	25,837	26,618	12,354	15,854	35,397	29,117	64,513
Algeria	270	8,075	8,454	6,779	8,423	8,866	10,757	19,623
Libya	260	0	0	0	0	7,003	8,087	15,091
Mauritania	12	0	0	0	0	928	207	1,135
Morocco	151	12,420	12,608	2,728	3,584	12,811	4,800	17,612
Tunisia	177	5,342	5,556	2,847	3,846	5,788	5,265	11,053
GDP growth (percentage points)								
Maghreb	0.0	0.5	0.5	0.2	0.3	0.7	0.6	1.3
Algeria	0.0	0.4	0.4	0.3	0.4	0.4	0.5	0.9
Libya	0.0	0.0	0.0	0.0	0.0	0.8	0.9	1.6
Mauritania	0.0	0.0	0.0	0.0	0.0	2.3	0.5	2.8
Morocco	0.0	1.1	1.1	0.2	0.3	1.1	0.4	1.5
Tunisia	0.0	0.8	0.9	0.4	0.6	0.9	0.8	1.7

Source: Tables 6.4 and 6.5 and author's calculations assuming that $90,000 in new foreign direct investment (FDI) supports each additional job and that increasing the inflow rate of FDI by 2 percent of GDP will increase the growth rate by 1 percentage point.

AMU plan results in total increased Maghreb employment of just under 875 workers, the EU and US FTAs result in vastly higher employment growth in the Maghreb. Bilateral EU and US FTAs with the major Maghreb countries could create total gains of 12,000 to 27,000 jobs, while the EU and US regional FTAs involving all five AMU countries result in total employment gains more than two times greater: 29,000 to 65,000 workers added to the Maghreb's formal employment rolls.

Finally, table 6.6 considers the impacts on growth in the Maghreb economies resulting from the increases in inward FDI stocks under the Maghreb integration scenarios. The growth impacts are based on recent review by Hufbauer and Adler (2008) of an extensive body of empirical studies on the benefits of inward FDI, especially for host developing countries. These studies suggest that increasing FDI inflows by 2 percent of aggregate output (GDP) tends to increase the growth rate of the economy by 1 percentage point. In table 6.6 it is apparent on applying this norm that the AMU plan does not contribute appreciably to growth in the region because it does not increase foreign investment perceptibly among the member countries. However, the story is different when the major Maghreb countries pursue bilateral FTAs with the United States and especially the European Union: Average growth rates in the region increase by between 0.2 percentage points (US bilateral FTAs) and 0.5 percentage points (EU bilateral FTAs). When the AMU purses regional FTAs with the two external trading partners, average growth in the Maghreb increases by between 0.7 percentage points (EU or US) and 1.3 percentage points (EU and US combined).

References

Allain, Laurence, and Boileau Loko. 2007. Fresh Impetus toward Maghreb Integration. *IMF Survey* 36, no. 12: 188–89.

Bergsten, C. Fred. 1996. *Competitive Liberalization and Global Free Trade: A Vision for the Early 21st Century*. Working Paper 96-15. Washington: Institute for International Economics.

Brenton, Paul, Eugenia Baroncelli, and Mariem Malouche. 2006. *Trade and Investment Integration of the Maghreb*. Middle East and North Africa Working Paper Series 44. Washington: World Bank.

Cline, William A. 2004. *Trade Policy and Global Poverty*. Washington: Center for Global Development and Peterson Institute for International Economics.

Dennis, Allen. 2006. *The Impact of Regional Trade Agreements and Trade Facilitation in the Middle East and North Africa Region*. Policy Research Working Paper WPS 3837. Washington: World Bank.

DeRosa, Dean A. 2007. *International Trade and Investment Data Set by 1-Digit SITC, 1976–2005*. Washington: Peterson Institute for International Economics.

DeRosa, Dean A., and Gary Clyde Hufbauer. 2007. "What Do Gravity Models Tell Us about PTAs' Impacts on Trade Flows: More Creation or More Diversion?" Available at voxeu.org (accessed July 8, 2008).

Eichengreen, Barry, and Douglas A. Irwin. 1998. The Role of History in Bilateral Trade Flows. In *The Regionalization of the World Economy*, ed. Jeffrey A. Frankel. Chicago: University of Chicago Press.

Hufbauer, Gary C., and Matthew Adler. 2008. FDI Promotion in Nicaragua. Peterson Institute for International Economics, Washington. Photocopy (May 23, 2008).
Plumper, Thomas, and Vera E. Troeger. 2007. Efficient Estimation of Time-Invariant and Rarely Changing Variables in Finite Sample Panel Analyses with Unit Fixed Effects. *Political Analysis* 15, no. 2: 124–39.
Rose, Andrew K. 2004. Do We Really Know That the WTO Increases Trade? *American Economic Review* 94, no. 1: 98–114.
Tahiri, Amor, Patricia Brenner, Erik DeVrijer, Marina Moretti, Abdelhak Senhadji Semlali, Gabrial Sensenbrenner, and Juan Sole. 2007. *Financial-Sector Reforms and Prospects for Financial Integration in Maghreb Countries*. Working Paper 07/125. Washington: International Monetary Fund.
UNCTAD (UN Conference on Trade and Development). 2005. Generalized System of Preferences. Available at www.unctad.org (accessed July 4, 2008).
Wonnacott, Richard J. 1996. Trade and Investment in a Hub-and-Spoke System vs. a Free Trade Area. *The World Economy* 19, no. 3: 237–52.
World Bank. 2006. *Is There a New Vision for Maghreb Economic Integration?* World Bank Report 38359. Washington.