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North American Free Trade

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Abstract

The governments of Canada, Mexico, and the United States have recently concluded the negotiations of a North American Free Trade Agreement (NAFTA). This agreement creates a free trade area larger, in terms of both population and GDP, than the European Community. This paper summarizes the results of a number of static applied general equilibrium analyses of the impact of the NAFTA. The impact is expected to be favorable in all three countries but relatively small, particularly in Canada and the U.S., which already have their own free trade agreement. The paper suggests that the dynamic impact of the NAFTA, which takes into account the impact on capital flows and growth rates, will be substantially larger, especially in Mexico.

I. Introduction

In August 1992 representatives of Canada, Mexico, and the United States concluded the negotiations of a North American Free Trade Agreement (NAFTA). Subject to ratification by the legislatures of these three countries, the agreement is scheduled to take effect in January 1994. The NAFTA will create a free trade area with more than 360 million people and a combined

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GDP of roughly 6.5 trillion U.S. dollars.

The NAFTA represents the culmination of a significant policy change by the Mexican government. Up until 1982 Mexico had pursued, with some success, an economic development strategy based on a large degree of government intervention and protectionism. Much of the investment that took place, especially in the late 1970s and early 80s, was financed by foreign borrowing and by oil sales. In 1982, following a rise in international interest rates and a fall in oil prices, Mexico was unable to meet its debt service obligations, causing a financial collapse. The Mexican government sharply cut expenditures and raised taxes. It also initially increased protectionism, making the Mexican economy one of the most closed in the world. In 1986, however, under then President Miguel de la Madrid, the Mexican government changed course, joining the General Agreement on Tariffs and Trade (GATT) and starting the process of opening the economy to foreign trade and investment. This policy of openness, or *apertura*, has continued under current President Carlos Salinas. Its perceived success has resulted in increased popularity for the government and the ruling party within Mexico and in imitation throughout the rest of the less developed world, particularly in Latin America.

Canada and the United States, in contrast, have long followed relatively open trade and investment policies. Indeed, prior to negotiating the NAFTA they had signed their own free trade agreement, which went into effect in January 1989. Yet, even for Canada and the U.S., the NAFTA represents a significant step in helping to integrate Mexico's third world economy into an open trading regime as an equal partner. As such, the NAFTA is being closely monitored throughout the world and could serve as a model for future trade and investment agreements.

This paper summarizes much of the research that has analyzed the potential impact of the NAFTA. Most of this analysis has utilized applied general equilibrium models, which trace their roots to the work of Johansen [1960] and Shoven and Whalley [1972]. They tend to find small, but favorable, overall impacts of the agreement on each of the three economies. Applied general equilibrium models can do a good job in analyzing and, to some extent, predicting the impact of policy changes like trade liberalization on relative prices and resource allocation over a several year time horizon.

Consequently, such models can help us to identify the winners and the losers from trade agreements like the NAFTA.

Most current analyses of the NAFTA utilize static models. In addition to the static effects captured by these models, there are dynamic effects, such as the impact of a NAFTA on capital flows and growth rates, that involve the evolution of the economies involved over time. To adequately capture these dynamic effects, we need to model the intertemporal decision making processes of the agents in the model. We would want to be able to capture, for example, the effect of a NAFTA on savings and investment decisions. To be sure, many of the models of the NAFTA analyze the effect of a higher level of the capital stock in Mexico, but the increase in the capital stock is imposed exogenously on the model rather than being modeled as the result of the treaty.

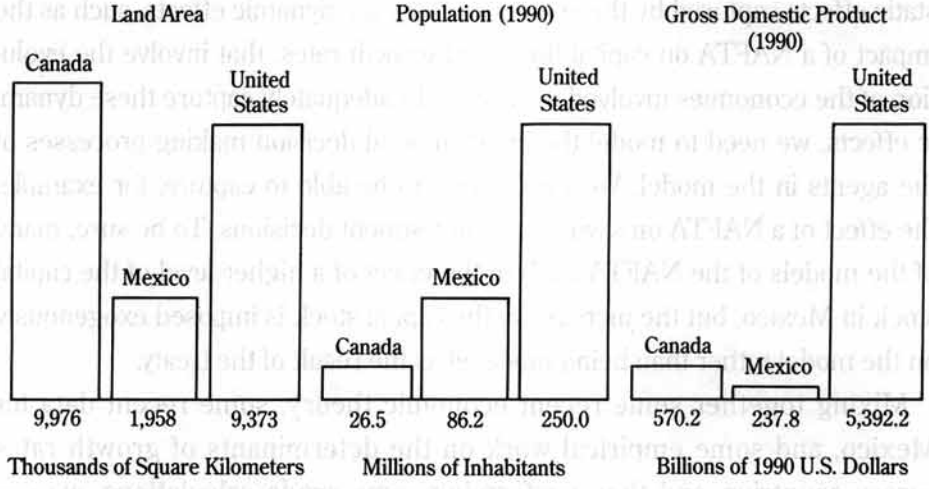
Mixing together some recent economic theory, some recent data for Mexico, and some empirical work on the determinants of growth rates across countries, and then performing some crude calculations, we can develop rough estimates of the capital accumulation and productivity growth in Mexico that could result from the NAFTA. These estimates reveal a favorable impact that dwarfs the static impact found by more conventional analyses. Although a NAFTA would also be expected to have a favorable dynamic impact on Canada and the U.S., we would expect this impact to be smaller given the sizes, levels of economic development, and current degrees of economic openness of these two countries relative to Mexico. In fact, the most significant dynamic impact of a NAFTA on Canada and the U.S. could be the feedback of Mexican growth in providing favorable investment opportunities and markets for exports.

II. The North American Economy

The three North American economies are larger, in terms of both population and GDP, than the European Community (see Table 1). In general, Mexico has a larger population and is poorer than the four poorest members of the E.C., Greece, Ireland, Portugal, and Spain. Figure 1 presents several indicators of the relative sizes of Canada, Mexico, and the U.S. All three countries have large land areas and are rich in natural resources. The U.S. is roughly 9 times as large as Canada both in terms of population and in

Figure 1

Alternative Measures of Relative Size



Sources: World Bank, *World Development Report*, 1992.

terms of GDP. Although the U.S. has less than 3 times as many people as Mexico, in 1990 it had more than 23 times as much national income.

The disparity in this latter set of comparisons is explained by noting that Mexican income per capita, measured in 1990 dollars, was only about one ninth of that in the U.S. This is a figure that must be treated with care, however, because it uses exchange rates to convert an income figure measured in pesos per capita into a dollars per capita figure.[1] The real exchange rate, which measures the value of the peso versus that of the dollar in terms of purchasing power, has had wide swings over the past decade. These swings can unduly influence comparisons of incomes using exchange rate comparisons. In 1991, for example, Mexican income per capita was about $3400, 62 percent higher than it was in 1988. This increase can be decomposed into a 7 percent increase in terms of 1988 pesos, a 12 percent increase due to inflation in the dollar, a 36 percent increase due to a real appreciation in the value of the peso versus the dollar, and a 7 percent increase due to com-

1 In fact, the figure reported here is a three year average intended to mitigate this problem; the per capita income in Mexico converted to dollars using the 1990 exchange rate is larger.

Table 1
North American/European Community Comparisons

	Population[1]	GDP[2]	GDP/Capita[3]	GDP/Capita (PPP)[4]	GDP/Worker (PPP)[5]
Canada	26.5	570.2	21.5	19.7	39.2
Mexico	86.2	237.8	2.8	6.0	17.5
United States	250.0	5,392.2	21.6	21.4	43.8
North America	362.7	6,200.2	17.1	17.6	38.7
Belgium	10.0	192.4	19.2	13.0	31.0
Denmark	5.1	131.0	25.7	15.4	27.9
France	56.4	1,190.8	21.1	15.2	33.4
Germany (FRG)	61.0	1,488.2	24.4	16.3	33.8
Greece	10.1	57.9	5.7	7.3	19.3
Ireland	3.5	42.5	12.1	9.1	22.7
Italy	57.7	1,090.8	18.9	14.6	36.2
Luxembourg	0.4	10.9	28.7	16.0[6]	38.2[6]
Netherlands	14.9	279.2	18.7	14.6	35.7
Portugal	10.4	56.8	5.5	8.0	16.0
Spain	39.0	491.2	12.6	10.8	29.9
United Kingdom	57.4	975.2	17.0	15.0	30.9
European Community	325.9	6,006.9	18.4	14.1	31.9
Greece, Ireland, Portugal & Spain	63.0	648.4	10.3	9.7	24.9

Note: 1. 1990 Millions
2. Million 1990 U.S. Dollars
3. Thousand 1990 U.S. Dollars
4. Purchasing Power Parity – Thousand 1990 U.S. Dollars
5. Calculated using 1988 worker/capita ratio
6. Estimated using 1988 figure

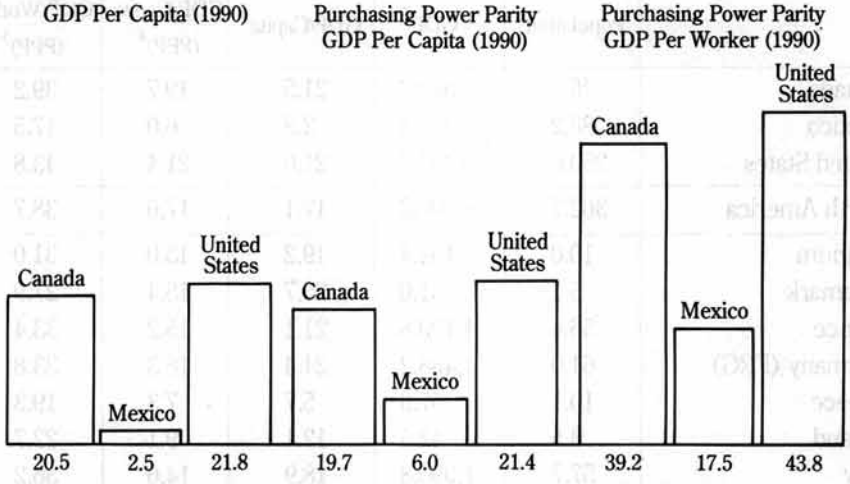
Sources: World Bank, *World Development Report* [1992] and Heston and Summers [1991].

pounding these various effects. Looked at another way, the U.S. dollar appreciated far less against the peso in nominal terms than would have been justified by the differences in the rates of inflation in Mexico and the U.S. In another illustration of the perils of using comparisons based on exchange rate conversions, we can calculate that real U.S. income per capita fell by

Figure 2

Alternative Measures of Income per Capita

(Thousands of 1990 U.S. Dollars)



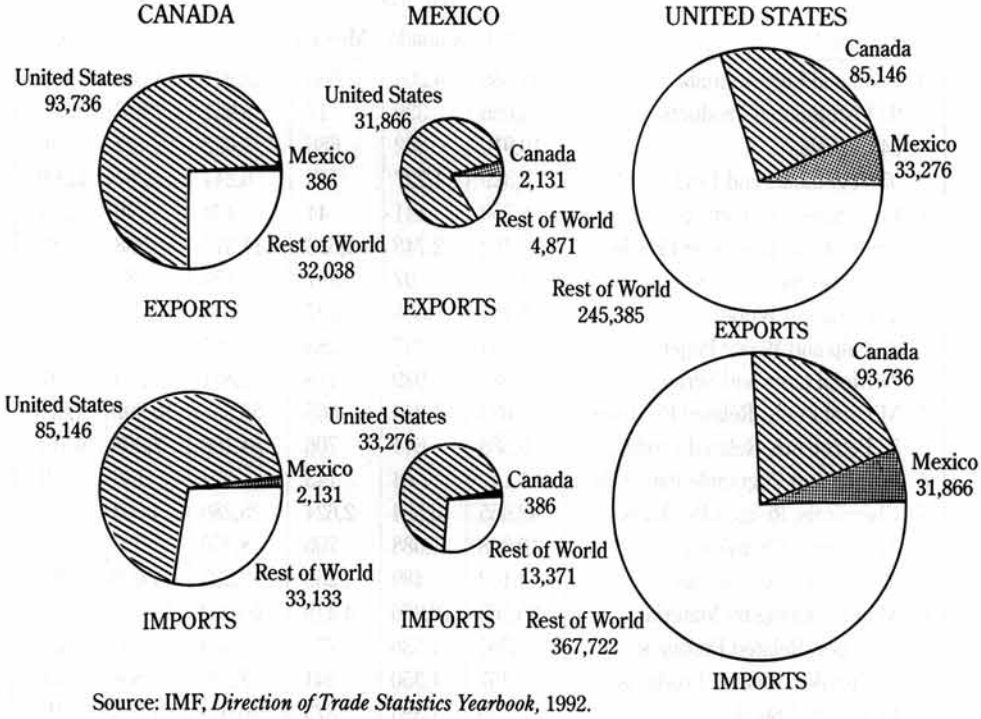
Sources: World Bank, *World Development Report*, 1992 and Summers and Heston (1991).

more than 19 percent between 1985 and 1988 when measured in 1985 British pounds, while it rose by almost 8 percent over the same period when measured in terms of 1985 dollars.

Measuring different countries' incomes in terms of one country's currency can be useful for thinking about some trade issues. It is misleading for making comparisons of standards of living. For this purpose, we would want to make comparisons based on real incomes in terms of a common basket of goods, comparisons that assume purchasing power parity in exchange rates. The United Nations' International Comparison Program has constructed such numbers. As shown in Figure 2, the levels of income per capita in the U.S. and Mexico that take into account purchasing power differentials differ by a factor of less than 4, rather than by one of 9.

Even these purchasing power parity incomes per capita are misleading if we are interested in comparing productivity levels across countries. Because of a higher rate of population growth, Mexico has a larger fraction of its population that is very young, and consequently that is not in the labor force, than does the U.S.. When we calculate purchasing power parity outputs per worker, we see that those in the U.S. and Mexico differ by a factor of less than 3.

Figure 3
Direction of Trade 1991
(Millions of 1991 U.S. Dollars)



Source: IMF, *Direction of Trade Statistics Yearbook*, 1992.

The statistics reported above portray Mexico and Canada as economies much smaller than the U.S. and Mexico as much poorer than its two neighbors. This suggests that a NAFTA would have much larger impacts on Canada and, particularly, on Mexico than it would on the U.S. Another set of statistics that suggest the same conclusion are the direction of trade data reported in Figure 3. Although Canada is the number one trading partner of the U.S. and Mexico is number three after Japan, the U.S. conducts only about one quarter of its trade with its two North American neighbors. In contrast, more than two thirds of foreign trade in both Canada and Mexico is with the U.S. They have little direct trade with each other. Put bluntly, and somewhat simplistically, foreign trade in Canada and in Mexico means trade with the U.S.

Table 2 reports the composition of that trade by sector. Although all three

Table 2
United States Merchandise Trade by Commodity 1991
(Millions of 1991 U.S. Dollars)

SITC Code*	Exports			Imports		
	World	Canada	Mexico	World	Canada	Mexico
0 Food and Live Animals	29,555	4,204	2,086	23,924	4,023	2,666
03 Fish Related Products	3,056	329	17	5,951	1,248	297
04 Cereals	10,916	362	686	1,092	423	40
05 Vegetables and Fruit	5,329	1,727	153	6,244	287	1,509
1 Beverages and Tobacco	6,750	141	44	5,132	746	267
2 Crude Materials Except Fuels	25,462	2,748	1,626	14,317	6,888	782
22 Oil Seeds	4,324	97	391	150	83	27
24 Cork and Wood	5,103	665	227	3,342	2,970	145
25 Pulp and Waste Paper	3,604	227	285	2,301	1,983	2
28 Metal Ores and Scrap	3,989	929	178	3,881	994	213
3 Mineral Fuels, Related Products	12,033	1,240	865	58,557	10,992	4,876
33 Petroleum, Related Products	6,586	644	706	54,150	7,308	4,751
4 Animal and Vegetable Fats, Oils	1,147	64	143	927	138	31
5 Chemicals, Related Products	42,965	6,554	2,624	25,289	4,603	748
51 Organic Chemicals	10,928	1,088	705	8,450	797	257
52 Inorganic Chemicals	4,102	489	259	3,533	1,078	193
6 Manufacturing by Material	35,566	10,266	4,419	60,362	15,762	2,364
64 Paper, Related Products	5,961	1,536	775	8,435	6,352	124
65 Textiles, Related Products	5,457	1,350	541	7,339	506	330
67 Iron and Steel	4,365	1,393	873	10,073	1,579	314
68 Nonferrous Metals	5,713	1,210	425	8,621	3,687	356
7 Machinery, Transport Equipment	187,360	42,489	15,059	215,950	41,030	15,040
71 Power Generating Machinery	16,968	4,097	1,070	14,487	2,344	1,140
72 Specialized Machinery	16,565	2,658	1,222	11,244	1,122	142
74 General Industrial Machinery	17,107	4,654	1,548	14,891	1,812	837
75 Office Machines, Computers	25,954	3,680	1,002	30,703	2,324	729
76 Telecommunications	9,966	1,486	1,506	23,915	1,013	2,965
77 Electrical Machinery	29,935	6,175	4,211	35,822	3,686	4,875
78 Road Vehicles	31,805	17,396	3,590	72,732	25,945	4,312
79 Other Transport Equipment	36,355	1,739	671	8,414	2,550	33
8 Miscellaneous Manufacturing	43,162	8,122	3,694	87,375	3,689	3,658
82 Furniture	2,113	895	638	5,286	1,081	751
84 Apparel, Clothing	3,212	244	533	27,699	319	921
87 Scientific Instruments	13,488	1,883	999	6,908	585	648
9 Not Classified Elsewhere	13,447	2,654	1,612	15,423	4,635	1,401
TOTAL	**397,448**	**78,282**	**32,172**	**507,255**	**92,505**	**31,834**

*Standard International Trade Classification (Revision 3), one-digit and selected two-digit.

Source: OECD, *Foreign Trade by Commodities*, Series C.

countries are large agricultural producers, there was relatively little North American trade in agricultural goods in 1991. Canada exports significant amounts of wood, paper products, and nonferrous metals to the U.S. This pattern reveals Canada's comparative advantage in raw materials compared to the U.S., which itself exports large amounts of these sorts of goods to the rest of the world. Both Canada and Mexico have large exports of petroleum to the U.S. By far the biggest category of trade among North America, however, is machinery and transport equipment: The largest category of Canadian exports to the U.S., at the two-digit SITC level, is road vehicles and parts; this is also the largest category of exports from the U.S. to Canada. The largest two categories of U.S. exports to Mexico are electrical machinery and road vehicles and parts; these are also the largest and third largest categories of exports from Mexico to the U.S., the second largest being petroleum and petrochemicals.

The North American Free Trade Agreement eliminates tariffs on trade among the three countries over a fifteen year period; it substantially reduces nontariff barriers to trade (NTBs); and it ensures the free flow of capital throughout the region. Unlike the European Community, the North American Free Trade Area ensures neither common trade barriers against the rest of the world nor the free flow of labor. Although it establishes a dispute resolution mechanism, there are no plans for a central North American government like the European Parliament and the EC bureaucracy. Neither is there currently serious talk about a common currency system in the NAFTA as there is in the EC, although both Canadian and Mexican monetary authorities carefully manage their currencies' exchange rates with the U.S. dollar.

III. Static Applied General Equilibrium Analyses of a NAFTA

In 1991, Mexican tariffs on imports from the U.S. averaged about 11 percent when weighted by value imported; U.S. tariffs on imports from Mexico averaged about 4 percent. The U.S. and Canada have no tariffs on most of the trade between themselves as a result of their own free trade agreement. Nontariff barriers are expected to be reduced substantially by the NAFTA, although they will not be completely eliminated. Currently, there are signifi-

cant NTBs on agricultural imports in all three countries. There are on NTBs on imports of processed foods, particularly meat, dairy products, and sugar in the U.S. and Canada. The U.S. has significant NTBs on imports of textiles and apparel. Mexico has NTBs on imports of chemicals. All there countries have very significant NTBs on imports of automobiles and parts.[2] These NTBs usually take the form of import quotas, phyto-sanitary regulations, and licensing regulations. Currently, there are few restrictions to capital flows in North America; the obvious exceptions are in Mexico and are laws prohibiting private ownership, foreign or domestic, in the petroleum and parts of the petrochemical industry, laws restricting foreign ownership of banks and laws institutionalizing communal ownership of much of agricultural land, the *ejido* system.

There are a large number of applied general equilibrium analyses of the impacts of eliminating these barriers to trade. Although all employ multisectoral general equilibrium models, the emphasis differs across models: Brown, Deardorff, and Stern [1991] model the general impact on all three countries. Bachrach and Mizrahi [1992], who constructed their model for KPMG Peat Marwick, concentrate on liberalizing Mexico-U.S. trade. Cox and Harris [1992] focus on the impact of the NAFTA on Canada; Sobarzo [1992] focuses on Mexico. Roland-Holst, Reinert, and Shiells [1992] pay special attention to modeling the reduction of NTBs; Hinojosa and Robinson [1991] pay attention to modeling labor markets and migration from the rural sector to the urban sector in Mexico and migration from Mexico to the U.S. Hunter, Markusen, and Rutherford [1992] concentrate on the impact on the automobile industry; Trela and Whalley [1992] on textiles, apparel, and steel; and Levy and van Wijnbergen [1992] and Robinson, Burfisher, Hinojosa-Ojeda, and Thierfelder [1992] on agriculture. McCleery [1992] and Young and Romero [1992] analyze some of the dynamic impacts of the NAFTA, although neither of their models explicitly models intertemporal savings and investment decisions.

It is worth noting that all of these models are calibrated to data from before 1989. In general, the policy simulations include the trade liberalization that was part of the Canada-U.S. FTA and at least some of the liberali-

2 See U.S. International Trade Commission 1991 for a summary of these barriers.

Figure 4
U.S. Exports to Mexico

Source: IMF, *Direction of Trade Statistics,* March 1993.

zation that has occurred in Mexico since 1986. In 1985 Mexico was one of the most closed economies in the world with tariffs as high as 100 percent, licenses required to import all goods, and laws that prohibited foreigners from investing in the stock market or, with a few exceptions, from owning more than 49 percent of any business or private property. The drastic impact of the liberalization that has already occurred in Mexico can be partially seen in Figure 4, which depicts the increase in imports from the U.S. Between 1986 and 1992 these imports increased by 226 percent when measured in current U.S. dollars and by 185 percent when measured in 1987 U.S. dollars.

Table 3 summarizes the overall effects of a NAFTA on welfare in the Brown, Deardorff, and Stern [1991] model. These results are fairly typical of those found in these models: The impact of a NAFTA as a percentage of GDP is largest in Mexico and smallest in the U.S., with Canada in between, even though the absolute gain may be largest in the U.S. It makes little difference to Canada whether or not Mexico joins the Canadian free trade association with the U.S. What these results also have in common with those of many of the other models is that the biggest impact of the NAFTA occurs if capital is allowed to flow to Mexico from the U.S. or from the rest

Table 3
Applied General Equilibrium Estimates of the Impact of NAFTA
(Changes in Economic Welfare)

Scenario	Canada		Mexico		United States	
	Total[1]	Percent GDP	Total[1]	Percent GDP	Total[1]	Percent GDP
NAFTA Tariffs, NTBs	3.51	0.7	1.98	1.6	6.45	0.1
NAFTA Tariffs, NTBs, Foreign Investment	3.66	0.7	6.30	5.0	13.23	0.3
U.S.-Mexico Tariffs, NTBs	0.08	0.0	1.93	1.5	3.66	0.1
U.S.-Mexico Tariffs, NTBs Foreign Investment	0.23	0.0	6.26	4.9	10.65	0.2
U.S.-Canada	3.36	0.6	0.04	0.0	2.87	0.1

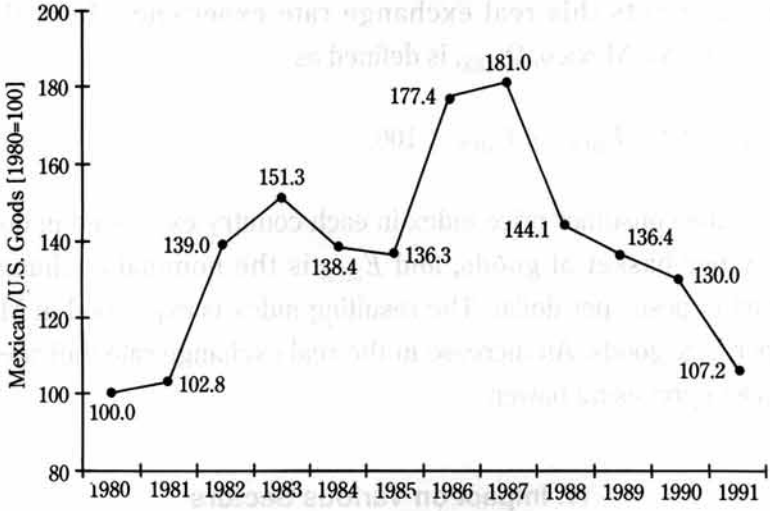
Note: 1. Billions of U.S. Dollars.
Source: Brown, Deardorff, and Stern [1991]

of the world. In all of these models, such capital flows are exogenously imposed, however, either to increase Mexican capital by a fixed amount or to lower the marginal product of capital to a fixed level.

The overall size of the impact depends on modeling assumptions. Brown [1992] presents an excellent summary and evaluation of the different results. In models with constant returns to scale and perfect competition, such as that of Bachrach and Mizrahi [1992], the effects tend to be small, since they only pick up the traditional gains due to countries expanding the production of goods in which they have comparative advantage and thereby increasing efficiency within North America.

Other models, such as those of Brown, Deardorff, and Stern [1991], Cox and Harris [1992], Roland-Holst, Reinert, and Shiells [1992], and Sobarzo [1992] find larger gains because they model some industries as operating

Figure 5
Real Exchange Rate Index (Mexico/United States)



Sources: Banco de Mexico and USDC, Bureau of Economic Analysis

under conditions of increasing returns to scale and imperfect competition. In the Cox and Harris and Sobarzo models, where domestic producers collude to set prices as high as possible, lowering trade barriers has the maximum possible pro-competitive effects, forcing producers to lower prices and produce at a more efficient scale. Here there are relatively large gains. Furthermore, in the Cox and Harris model, Canada benefits significantly from a NAFTA, over and beyond the benefits that it reaps from the Canada-U.S. FTA, because the threat of competition from Mexico forces Canadian producers to operate more efficiently, even though there are few Mexican exports to Canada after the NAFTA. The Brown, Deardorff, and Stern model treats producers as monopolistically competitive and obtains a lesser pro-competitive effect than do Cox and Harris and Sobarzo. Roland-Holst, Reinert, and Shiells model markets as contestable, which is the closest possible assumption to perfect competition in models with increasing returns. Here the pro-competitive effects are even smaller and the results are similar to those with perfect competition.

One major difficulty involved in using static applied general equilibrium models to analyze changes in trade policy is that they do not do a good job in explaining fluctuations in exchange rate. It is worth pointing out that fluc-

tuations in the real exchange rate between Mexico and the U.S. over the past decade have dwarfed the changes in tariffs included in the NAFTA. Figure 5 presents this real exchange rate experience; here the real exchange rate for Mexico, Q_{MEX}, is defined as

$$Q_{MEX} = (P_{US}/P_{MEX}) \times E_{MEX} \times 100.$$

Here P_i is the consumer price index in each country expressed in domestic currency per basket of goods, and E_{MEX} is the nominal exchange rate expressed in pesos per dollar. The resulting index is expressed in Mexican goods per U.S. goods. An increase in the real exchange rate indicates a fall in Mexican purchasing power.

IV. Impact on Various Sectors

The comparative advantage of static applied general equilibrium models is the analysis of the impact of policy change on various sectors of the economy. Kehoe, Polo, and Sancho [1991], for example, have found that such a model did an excellent job in predicting the impact of Spain's 1986 integration into the European Community on relative prices and resource allocation, at least when some of the other major exogenous shocks that occurred in Spain in 1986 were taken into account. The small overall impact of the NAFTA on the U.S. economy predicted by the model summarized in the previous section is easy to understand given the large size of the U.S. relative to its two neighbors and the low level of trade barriers currently in place. There are, however, significant impacts expected in several sectors of the economy. A summary of the analyses of some of these is provided below.

***Automobiles and Parts*:** As Table 2 indicates, automobiles and parts are by far the largest components of North American trade at the two digit S.I.T.C. level. The North American automobile industry is dominated by U.S. owned companies, with some German or Japanese owned companies operating in each country. The Canadian and U.S. industries have been highly integrated for some time, partly as a result of the 1965 Auto Pact between the two countries. Currently Mexican automotive products can enter Canada and the U.S. either duty free or at low tariff rates. Mexico,

however, charges significant tariffs on imports and imposes a variety of non-tariff barriers. They will be gradually eliminated. The NAFTA will gradually increase the regional value content rule from 50 to 62.5 percent; in other words, to be a North American vehicle when shipped from one NAFTA member to another, an automobile must have 62.5 percent of its value generated in North America.

The U.S.I.T.C. [1993] expects NAFTA to initially cause an increase in automobile output in the U.S. resulting from increased exports to Mexico. As investment and modernization take place in Mexico, however, these exports will fall, and eventually output and employment in the U.S. may even fall slightly below its initial level. Both output and employment in the U.S. automobile parts industry are expected to rise significantly, however. It is worth pointing out that a number of models, among them those of Brown, Deardorff, and Stern [1991] and of Roland-Holst, Reinert, and Shiells [1992] predict significant expansion of all three North American countries.

***Electronic Products*:** Electrical machinery, telecommunications equipment, and computers rank as the second largest commodity group in North American trade in general, after automobiles and parts, and as the largest in Mexico-U.S., trade. The Mexican electronic products industry is small relative to those of its two neighbors. Relative to Canadian and U.S. industries, it is also technologically unsophisticated, having been one of the most heavily protected industries in Mexico. Mexican exports of electronic products are dominated by U.S. owned companies who ship components tariff-free to Mexico, do assembly there, and then re-export the product to the U.S. under the *maquiladora* program, paying tariffs only on Mexican value added.

The U.S.I.T.C. [1993] expects the NAFTA to substantially lead to increases both in production and trade in electronic products in North America. On one hand Mexico will provide U.S. producers with a growing market for electronic products. On the other, doing labor intensive parts of the production process, such as assembly in Mexico will increase the competitiveness of North American products relative to those from East Asian countries. This sort of production sharing between high-wage countries and low-wage countries is common there, with producers in Japan, Hong Kong, Taiwan, and Singapore carrying out assembly in China, Thailand, the Philippines, and Malaysia. The NAFTA will most likely result in diverting U.S. trade and

investment in electronic products from East Asia and Mexico. The NAFTA will also provide U.S. producers with increased protection of their intellectual property rights in Mexico, particularly on computer software and on designs of integrated circuits.

***Textiles and Apparel*:** Like trade in electronic products, Mexico-U.S. trade in textiles and apparel has been dominated since 1960's by production-sharing operations as part of the *maquiladora* program. The NAFTA imposes strict rules of origin for textiles and apparel to qualify as North American. The rule of origin, in general, is what is called the *yarn forward* rule: Fibers may be imported, but from the yarn stage forward all operations must be carried out in North America. All tariffs and quotas on North American trade will be eliminated in stages over 10 years.

According to the U.S.I.T.C. [1993], the NAFTA should lead to a significant expansion of U.S. textile industry, an industry that is capital intensive. The NAFTA is also expected to lead to a substantial contraction of the apparel industry, an industry that is labor intensive. This contraction will be the result of expansion of the textile industry in Mexico. Much of the benefits of the NAFTA for the Mexican apparel industry could be lost, however, if current proposals in the Uruguay Round of Negotiations of the General Agreement of Tariffs and Trade (GATT) are approved. These proposals would eliminate the stringent quotas embodied in the Multifiber Agreement, and allow imports of apparel into the U.S. from all over the world.

***Industrial Machinery*:** U.S. exports of industrial machinery to Mexico have expanded rapidly since 1988. The impact of the NAFTA on trade in industrial machinery in an applied general equilibrium model depends crucially on assumptions made on capital flows. In Sobarzo's [1992] model, for example, in scenarios where no investment flows accompany the NAFTA, there is only a modest expansion in Mexican imports of industrial machinery from the U.S. In scenarios where there are increased flows of investment into Mexico, however, industrial machinery is the sector where Mexican imports from the U.S. grow the most. To the extent to which the analysis in the next section, which indicates that the NAFTA will result in increased investment in Mexico, is valid, industrial machinery should continue to be one of the fastest growing sectors for U.S. exports to Mexico.

***Agriculture*:** The NAFTA is expected to result in substantial increases in

exports of grains and oilseeds from the U.S. to Mexico and substantial increases in exports of frozen citrus products and winter vegetables from Mexico to the U.S.

The impact of NAFTA on Mexico will be hard to disentangle from that of a major agricultural reform that was enacted in January 1992. This reform amended the Mexican Constitution of 1917, which institutionalized a system of communal land ownership, the *ejido* system, that in some areas dated back to pre-Hispanic years. Under the reform, which is phased in over a 10 year period, individual farmers are given the right to sell or lease their land. This reform will probably result in a significant increase in economic efficiency in the Mexican agricultural sector. It is also likely to result in a substantial movement of workers out of agriculture, particularly from rain fed, corn producing areas in central and southern Mexico. These displaced workers will have to be absorbed into industry and services. Otherwise, many would seek to migrate, legally or illegally, to the U.S. Robinson, Burfisher, Hinojoso-Ojeda, and Thierfelder [1992] analyze these issues using a static applied general equilibrium model.

***Financial Services*:** The NAFTA will liberalize trade and investment in services as well as that in commodities. The major impact is expected to be in financial services, that is, banking and insurance. Mexican banks were nationalized during the financial crisis of 1982. Starting in 1989 these banks have been privatized. The NAFTA will extend the process of liberalizing Mexican laws governing investment in banking that started in 1991. Entry of foreign banks into the banking sector will be phased in over a ten year period. Competition from U.S. owned banks should have a significant impact on the Mexican banking industry, which is typically characterized as highly concern-treated and inefficient.[3] The benefits to the U.S. banking industry of opportunities for exports and investment in Mexico are limited by the relatively small size of the Mexican economy. The potential benefits to the Mexican economy as a whole of liberalization of the banking industry are expected to be significant to the extent that it promotes greater efficiency in financial intermediation and in investment. The same analysis, in a somewhat smaller scale, applies to the Mexican insurance industry.

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3 See, for example, Garber and Weisbrod [1991].

V. Capital Flows and Demographics

As summarized in the previous two sections, the overall impact of the NAFTA in the first few years after its enactment should be favorable for all three countries but relatively small, particularly for Canada and the U.S. Over a longer time horizon, the NAFTA can be expected to have a larger impact. The major source of this impact would be growth in Mexico induced by inflows of investment and by increases in productivity. This growth in Mexico could have favorable effects on Canada and the U.S. through increased Mexican demand for imports from these countries.

Analyzing the demand impact of the NAFTA requires a fully specified dynamic general equilibrium model of the North American economy. Constructing such a model remains an important challenge for future research. In this and the subsequent section, we discuss the essential ingredients for such a model.

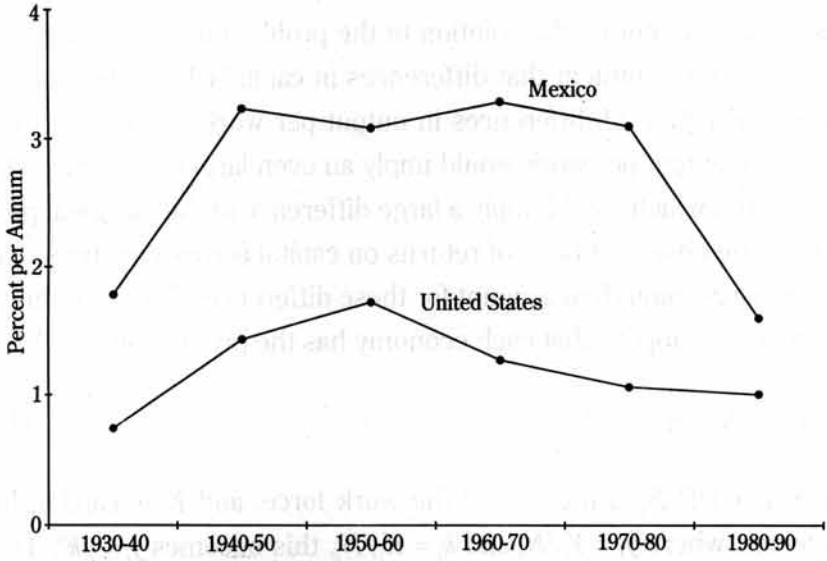
One of the most significant differences between Mexico and its two northern neighbors is its demographic structure. This difference is crucial for an economic researcher interested in analyzing the dynamic impact of the NAFTA. As Figure 6 indicates, Mexico has had, until very recently, substantially higher rates of population growth than the U.S. This has resulted

Table 4
Population by Age Groups (1990)

Age	Mexico		United States	
	Percent	Cumulative	Percent	Cumulative
0- 5	12.6	12.6	7.6	7.6
5-15	28.7	41.3	15.5	23.1
15-19	9.2	50.5	5.6	28.7
20-24	9.6	60.1	7.4	36.1
25-44	24.5	84.6	32.6	68.7
45-64	11.2	95.8	18.7	87.4
65 & over	4.2	100.0	12.6	100.0

Sources: Instituto Nacional de Estadística, Geografía e Información, Mexico and Department of Commerce, Bureau of the Census, United States.

Figure 6
Growth Rate of Population



Sources: NAFINSA and USDC, Bureau of the Census.

in a Mexican population that is significantly younger than that of the U.S. Currently, half of the population of Mexico is age 19 years or under; in the U.S. the comparable age is 34; Table 4 presents a comparison of age structures. This table indicates a certain complementarity between the two countries in terms of population: The bulk of the U.S. labor force is middle aged while the Mexican one is young. Mexico presents U.S. workers saving for retirement with investment opportunities in a dynamic and growing economy.

The starkly different demographic structures of Mexico and the U.S. prompt the question, "Where will the new workers who will enter the Mexican workforce over the next twenty years get the capital, both physical and human, necessary to increase, or even just to maintain, levels of output per worker?" One of the expected results of the NAFTA is increased investment flows in North American, with investment flowing from relatively capital rich Canada and the U.S. to relatively capital poor Mexico. Indeed, it is by exogenously imposing a substantial capital flow of this sort that many of the static applied general equilibrium models are able to show a significant welfare gain to Mexico, as discussed in Section III. It is worth stressing, howev-

er, that differences in capital-labor ratios between Mexico and its northern neighbors cannot be the sole explanation of the large differences in output per worker between these countries.[4] Consequently, simply equalizing capital-labor ratios cannot be the solution to the problem of eliminating income differences. The argument that differences in capital-labor ratios cannot be the sole explanation of differences in output per worker is simple: A large difference in output per work would imply an even larger difference in capital per worker, which would imply a large difference in the marginal product of capital. The observed rates of returns on capital across countries, however, are not large enough to account for these differences. To make this argument concrete, suppose that each economy has the production function.

$$Y_j = \gamma N_j^{1-\alpha} K_j^{\alpha} \tag{1}$$

where Y_j is GDP, N_i is the size of the work force, and K_j is capital, In per capita terms, where $y_j = Y_j/N_j$ and $k_j = K_j/N_j$, this becomes $y_j = \gamma k_j^{\alpha}$. The net return of capital is

$$r_j = \alpha\gamma k_j^{\alpha-1} - \delta$$

where δ is the depreciation rate. Using the World Bank's [1992] estimates of real GDP per capital and Summers and Heston's data for workers per capita, we can calculate real output per worker in Mexico in 1990 as $17,500 and that in the U.S. $43,800. Suppose that $\alpha = 0.3$, which is roughly the capital share of income in the U.S. Then to explain this difference in output per worker, we need capital per worker to be larger than that in Mexico by a factor of 21.3,

$$\frac{k_{us}}{k_{mex}} = \left[\frac{y_{us}}{y_{mex}}\right]^{1/\alpha} = \left[\frac{43,800}{17,500}\right]^{1/0.3} = (2.5)^{1/0.3} = 21.3 \tag{2}$$

Supposes that $\delta = 0.05$ and $r_{us} = 0.05$, which are roughly the numbers obtained from calibration. Then the net interest rate in Mexico should be 16

4 See Lucas [1990] for a discussion and calculations similar to those below.

times that in the U.S.,

$$r_{mex} = (r_{us} + \delta)\left[\frac{k_{us}}{k_{mex}}\right]^{1-\alpha} - \delta = 0.10\ (21.3)^{0.7} - 0.05 = 0.80. \qquad (3)$$

During the period 1988-90 the real return on bank equity in Mexico (and banks are the major source of private capital in Mexico) averaged 28.2 percent per year, as compared to 4.7 percent in the U.S.[5] Since 28 percent is far less than the 80 percent that we would expect if the difference in capital-labor ratios were the principal determinant of the difference in output per worker between Mexico and its neighbors, we must look elsewhere for this determinant.

There are at least two objections that can be raised to the above calculations. First, a comparison based on per capita GDP in U.S. dollars using the exchange rate to convert pesos into dollars would suggest that y_{us}/y_{mex} is much larger, than 2.5, about 5.4. Second, calibrating the capital share parameter α using Mexican GDP data would yield a larger value, about 0.5. These two objections work in opposite directions, however, and our calculations can be defended as being in a sensible middle ground: Income comparisons based on exchange rate conversions neglect purchasing power parity differentials; much of what is classified as net business income in Mexico is actually returns to labor; per capita comparisons rather than per worker comparisons neglect demographic differences; and so on.

Moreover, that differences in capital per worker cannot be the sole explanation of differences in output per worker across countries is a more general point. It is supported both by historical evidence, such as that of Clark [1987], and by even more extreme examples of differences in output per worker: Real GDP per worker in Haiti in 1990, for example, was 4.6 percent of that in the U.S. The same sort of calculations as those above would suggest that interest rates in Haiti should be over 13,000 percent per year if differences in the capital-labor ratio were the sole explanation of the differences in output per worker. Furthermore, historical evidence does not indicate that Mexico has always been starved of funds for investment. The prob-

5 See Garber and Weisbrod [1991].

lem has often been that investments abroad, particularly in the U.S., have been more attractive. Indeed, during the previous period with large amounts of capital inflows into Mexico, 1977-82, $17.8 billion of private investment flowed into Mexico while $18.7 billion flowed out.[6]

Although capital flows cannot provide all of the answers to Mexico's problems, they are important. If capital flows could lower the net interest rate in Mexico from 28 percent per year to 5 percent, we would estimate that the capital labor ratio in Mexico would increase by a factor of about 5.5

$$\frac{k'_{mex}}{k_{mex}} = \left[\frac{0.28+\delta}{0.05+\delta}\right]^{1/(1-\alpha)} = 5.5. \qquad (4)$$

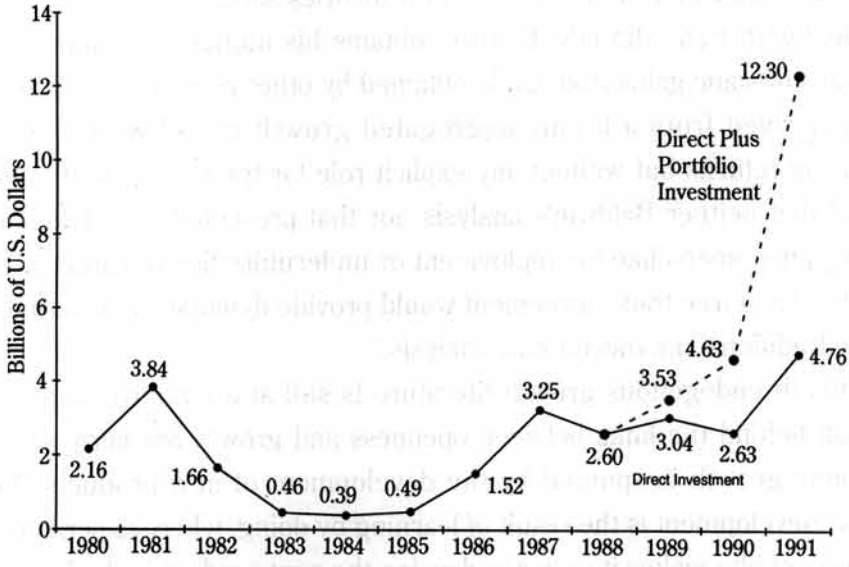
This would increase Mexican output per worker to about $29,200, which would close the current gap with the U.S. level by about 44 percent.

Some of the current high return on capital in Mexico can be accounted for by an inefficient and oligopolistic financial services sector. A NAFTA might increase the efficiency of this sector. An even more significant impact of a NAFTA would be to create a stable economic environment that would encourage private investment in Mexico. It would do this in at least two ways: First, it would lock the Mexican government into the free trade policy and the liberal policy towards foreign investment that it is currently pursuing unilaterally. Second, it would protect Mexican producers from protectionist tendencies in the U.S., which fluctuate with the business cycle and are sensitive to a variety of special interest groups. Foreign investment in Mexico has increased dramatically in recent years, as seen in Figure 7. Some of this increase had been due to the liberalization of Mexican laws regarding such investments, and some has undoubtedly been due to improvements in expectations about Mexico's economic future.

One point to be stressed about capital flows into Mexico is that they are now, and probably will be in the future, tiny in comparison with capital flows into the U.S. over the past decade: in 1989, for example, the U.S. absorbed $71.9 billion of foreign direct investment, $59.2 billion of investment in equities, $35.0 billion of investment in corporate bond purchases; and $128.3 bil-

6 See Garcia-Alba and Serra-Puche [1983] p. 45.

Figure 7
Foreign Investment in Mexico



Sources: Banco de Mexico

lion in government bond purchases. (*Economic Report of the President,* [1992]).

VI. Productivity Growth

As we have seen, a low capital ratio cannot be the only factor in explaining the low level of output per worker in Mexico compared to that in a country like the United States. We must look elsewhere for explanations for the differences in levels of output per worker. It is here that the new, endogenous growth literature, which follows Romer [1987] and Lucas [1988] and focuses on endogenous technical change, is able to provide potential answers. This literature is still at a tentative, mostly theoretical level. In this section we use preliminary empirical work at an aggregate level to estimate the impact of free trade on growth rates in Mexico.

Although our calculations are fairly crude, they suggest that the dynamic impact of a NAFTA could dwarf the static effects found by more conventional applied general equilibrium models. Similar kinds of suggestive calcula-

tions are done to estimate the dynamic gains from the European Community's 1992 Program by Baldwin [1992]. Unlike Baldwin's analysis, however, the results presented here are based on theories sand empirical estimates that deal with trade directly. Baldwin obtains his numbers by multiplying estimates of static gains from trade obtained by other researchers by a multiplier derived from a highly aggregated growth model with dynamic increasing returns but without any explicit role for trade. It is worth pointing out that neither Baldwin's analysis nor that presented here takes into account phenomena like unemployment or underutilization of capacity. It is possible that a free trade agreement would provide dynamic gains based on a more traditional microeconomic analysis.[7]

Although endogenous growth literature is still at a tentative stage, the intuition behind the links between openness and growth are fairly simple: Economic growth is spurred by the development of new products. New product development is the result of learning by doing, where experience in one product like makes it easier to develop the next product in the line, and of direct research and development. On the final product side, increased openness allows a country to specialize more, achieving a larger scale of operations in those industries in which it has a comparative advantage. On the input side, increased openness allows a country to import many technologically specialized inputs to the production process without needing to develop them itself.

The potential of learning by doing to account for productivity growth has been recognized since the pioneering work of Arrow [1962]. The micro evidence has a long history going back to Wright [1936], who found that productivity in airframe manufacturing increased with cumulative output at the firm level. Later studies have confirmed this relationship at the firm level and industry level. Recent research that incorporate learning by doing into models of trade and growth include Stokey [1988] and Young [1991].

Consider the following simple framework, as presented by Backus, Kehoe, and Kehoe [1992]: Output in an industry in some country depends on inputs of labor and capital, country and industry specific factors, and an experience factor that depends, in turn, on previous experience and output

7 See Fischer [1992] for some suggestive results in this direction.

of that industry in the previous period. Keeping constant the rates of growth of inputs, the crucial factor in determining the rate of growth output per worker is the rate of growth of the experience factor. Output per worker grows faster in industries in which this experience factor is higher. The level of growth of output per worker nationwide is a weighted average of the rates of growth across industries. One way increased openness promotes growth is that it allows a country to specialize in certain product lines and attain more experience in these industries.

Modeling dynamic increasing returns as the result of learning by doing is a reduced form specification for a very complex microeconomic process. It captures the effects of the learning curve documented by industrial engineers. It also captures, to some extent, the adoption of more efficient production techniques from abroad and from other domestic industries. The learning that takes place is not solely related to physical production techniques, but also to the development of complex financial and economic arrangements between producers of primary and intermediate goods and producers of final goods. The ability of a country to benefit from learning by doing depends on the educational level of the work force. It also depends on whether a country is at the frontier of development of new products and production techniques or if it can import these from abroad: It is easier to play catch-up than to be the technological leader.

Increased openness also allows a country to import more specialized inputs to the production process. Stokey [1988] and Young [1991] have proposed models in which new product development is still the result of learning by doing, but where the primary impact of learning by doing is in the development of new, more specialized inputs. Trade allows a country to import these inputs without developing them itself. Aghion and Howitt [1989], and others have proposed similar models where it is research and development that leads to the development of new products.[8]

The most interesting aspect of the theory that emphasizes development of new inputs is the perspective it gives us on trade and growth. The natural

8 Here, of course, the relationship of trade and growth is more complicated if one country can reap the benefits of technological progress in another country by importing the technology itself without importing the products that embody it.

interpretation of the theory that emphasizes specialization in final products is that technology is embodied in people and is not tradeable. Trade may influence the pattern of production, including both the scale of production and the pattern of specialization, and in this way affect growth. In the model with specialized inputs, technology is embodied in product variety, and there is a more subtle interaction between trade and growth. Increases in the number of varieties of intermediate goods raise output. If these varieties are freely traded, a country can either produce them itself or purchase them from other countries. By importing these products a small country can grow as fast as a large one. When there is less than perfectly free trade in differentiated products, we might expect to find that both scale and trade in differentiated products are positively related to growth.

A commonly used measure of the extent to which a country engages in trade of specialized products is the Grubel-Lloyd [1975] index. The Grubel-Lloyd index for country j is

$$GL^j = \frac{\sum_{i=1}^{I}\left(X_i^j + M_i^j - \left|X_i^j - M_i^j\right|\right)}{X^j + M^j} \tag{5}$$

Here X_i^j is exports of industry i; M_i^j is imports of industry i; M^j is total exports; and M^j is total imports. Backus, Kehoe, and Kehoe [1992] find a strong positive relation between the Grubel-Lloyd index for all products at the three-digit S.I.T.C. level and growth in GDP per capita for a large sample of countries. They also find a strong positive relationship between the Grubel-Lloyd index for manufactured products and growth in manufacturing output per worker. Trade in category 711, nonelectrical machinery, might consist of imports of steam engines (7113) and exports of domestically produced jet engines (7114). Simultaneous imports and exports of these goods provide the country with both, and leads to more efficient production.

Using cross-country data from a large number of countries over the period 1970 to 1985, Backus, Kehoe, and Kehoe [1992] analyze the determinants of growth. Various other researchers have used similar cross-country data sets to estimate the parameters of endogenous growth models.[9] Typi-

9 See Levine and Renelt [1992] for a survey.

cally, researchers in this area find that their results are very sensitive to the exact specification of the model and the inclusion or exclusion of seemingly irrelevant variables. Backus, Kehoe, and Kehoe find, however, that, in explaining rates of growth of output per worker in manufacturing, results related to the theory sketched out in this section are remarkably robust. Using their methodology we can estimate some parameters for a model in which both specialization in final output and the ability to import specialized inputs foster growth. Details concerning the data sources and methodology can be found in Backus, Kehoe, and Kehoe.

Consider a relationship of the form

$$g(\bar{y}^j) = \alpha + \beta_1 \log \bar{Y}^j + \beta_2 \log \sum_{i=1}^{I} (\bar{X}_i^j / \bar{Y}^j)^2 + \beta_3 \log \overline{GL}^j + \beta_4 \log y^j + \beta_5 PRIM^j + \varepsilon^j. \tag{6}$$

Here $g(\bar{y}^j)$ is average yearly growth of manufacturing output per worker in percent form from 1970-85; $\bar{Y}^j$ is 1970 manufacturing output; $\sum_{i=1}^{I} (\bar{X}_i^j / \bar{Y}^j)^2$ is a specialization index for exports at the three digit S.I.T.C. level; $\overline{GL}^j$ is the 1970 Grubel-Lloyd index of intra-industry trade; y^j is 1970 per capita income; and $PRIM^j$ is 1970 primary schools enrollment rate. Bars above the variables indicate that the variable deals with the manufacturing sector only; the specialization index and the Grubel-Lloyd index, for example, and computed for manufacturing industries only.

We include total manufacturing output and the specialization index to account for the impact of specialization in production of final goods. One motivation for using export data is that specialization is most important in the export sector. Another motivation is purely practical: The trade data permit a more detailed breakdown of commodities, and the export specialization index can be thought of as a proxy for the total production specialization index: if exports are proportional to outputs; then $\bar{X}_i^j = \varepsilon \bar{Y}_i^j$ and $\sum_{i=1}^{I} (\bar{X}_i^j / \bar{Y}^j)^2 = \varepsilon^2 \sum_{i=1}^{I} (\bar{Y}_i^j / \bar{Y}^j)^2$ and the two indices are proportional. The Grubel-Lloyd index is included, as we have explained, because it captures, in a loose way, the ability of a country to trade in finely differentiated products, which our theory implies is important for growth. We include initial per capita income and the primary enrollment rate partly because they are widely used by other researchers in this area, such as Barro [1991], and

partly because they may be relevant to out theory: The inclusion of per capita income allows for less developed countries, which are playing catch-up, to face different technological constraints. The inclusion of the enrollment rate allows for differences in countries' ability to profit from learning by doing because of differences in levels of basic education.

A regression of the above relationship yields

$$g(\bar{y}^j) = \underset{(5.686)}{2.602} + \underset{(0.259)}{0.743} \log \bar{Y}^j + \underset{(0.113)}{0.309} \log \sum_{i=1}^{I} (\bar{X}_i^j / \bar{Y}^j)^2 \qquad (7)^{10}$$

$$+ \underset{(0.410)}{0.890} \log \overline{GL}^j - \underset{(0.799)}{0.172} \log y^j + \underset{(2.271)}{2.421} PRIM^j$$

$$\text{NOBS} = 49 \qquad R^2 = 0.479$$

Notice that in this regression the coefficients all have the expected signs, and that the first three variables, total manufacturing output, the specialization index, and the Grubel-Lloyd index, are all statistically significant.

To illustrate the dramatic impact of trade liberalization possible in a dynamic model that contains the endogenous growth features discussed in this section, let us suppose that NAFTA allowed Mexico to increase its level of specialization in production of final manufactured goods and imports of specialized inputs. The average values over 1970-85 of the specialization indices and Grubel-Lloyd indices for the three North American countries and listed below. The values of the same indices for South Korea, a country with about the same output per worker as Mexico, are also included for comparison.

	$\sum_{i=1}^{I} (\bar{X}_i^j / \bar{Y}^j)^2$	$\overline{GL}^j$
Canada	7.10×10^{-2}	0.638
Mexico	5.93×10^{-4}	0.321
U.S.	1.92×10^{-3}	0.597
Korea	5.43×10^{-2}	0.362

10 The numbers in parentheses are heteroskedasticity-consistent standard errors.

Suppose that free trade allows Mexico to increase its specialization index to 1.0×1.0^{-2} and it Grubel-Lloyd index to 0.6. Dramatic increases of this sort are possible: In 1970, for example, Ireland had a Grubel-Lloyd index for manufactured goods of 0.150; in 1980, after having joined the European Economic Community in 1973, this index was 0.642. Over the same 1970-1980 period earnings per worker in Ireland grew at a 4.1 percent annual rate.

Using the above regression results, we would estimate the increase in the growth rate of manufacturing output per worker of 1.43 percent per year

$$1.430 = 0.309 \log\left(\frac{1.00\times10^{-2}}{5.93\times10^{-4}}\right) + 0.890 \log\left(\frac{0.600}{0.321}\right) = 0.873 + 0.557 \quad (8)$$

It is clear that much is at stake in the issues discussed here. Suppose that Mexico is able to increase its growth rate of output per worker by an additional 1.43 percent per year by taking advantage of both specialization and increased imports of specialized intermediate and capital goods. Then after 30 years, its level of output worker would be more than 50 percent higher than it would otherwise have been. By way of comparison, if Mexico's output per worker were 50 percent higher in 1988 than it was, then output per worker in Mexico would be about the same as that in Spain.[11] Our earlier calculations suggested that Mexico could increase its output per worker by about 66 percent by increasing its capital per worker until the rate of return on capital is equal to that in the U.S. Admittedly, these calculations are very crude, but they suggest that there is a significant impact of increased openness on growth through dynamic increasing returns. Furthermore, the dynamic benefits of increased openness dwarf the static benefits found by more conventional applied general equilibrium models.

Obviously, this is an area that requires more research, and even a crude disaggregated dynamic general equilibrium model of North American economic integration would make a substantial contribution. More empirical work also needs to be done. Notice, for example, that the Grubel-Loyd indices reported above fail to capture the observation that Korea is fairly closed in final goods markets but open to imports of intermediate and capi-

11 Again, this comparison uses Summers and Heston's [1991] data.

tal goods.

Our analysis suggests that Mexico has more to gain from free trade than do Canada or the U.S. Both are already fairly open economies, and the U.S. is big enough to exploit its dynamic scale economies. Mexico, however, has a smaller internal market. To follow an export-lead growth strategy, Mexico must look to the U.S., as the trade statistics in Figure 3 indicate.

Endogenous growth theories can be used to support industrial policies that target investment towards certain industries and trade polices that protect some final goods industries. At the level of aggregation used here, our results have little to say directly about such policies. Two warnings about such policies are worth making, however: First, with regard to industrial policies, the learning by doing process discussed in this paper, and innovation in general, is something that needs to be modeled at a more micro level. Whether the government can do a better job than market forces in directing investment in the presence of this kind of external effect is an important question that is left open by our analysis. Second, with regard to trade policies, open access to U.S. markets for Mexico mean open access to Mexican markets for the U.S. in the context of the NAFTA. It would be difficult, if not impossible, politically for Mexico to pursue selective protectionist policies like those of Korea.

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