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Computational Analysis of the Accession of Chile to the NAFTA and Western Hemisphere Integration

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Abstract

We present the results based on the Michigan computational general equilibrium model of Western Hemisphere economic integration. It is shown that tariff elimination will have beneficial effects for most countries involved, although the benefits as well as the costs of liberalization are small. However, if a hemispheric treaty were to stimulate an increase in the capital stocks of the major South American economies, the welfare gains would be substantial. Sensitivity tests reveal that the model exaggerates the likely gains from economies of scale due to liberalization. But the error is small in this context because the impact of trade liberalization is small. When econometric estimates of scale economies are incorporated into the model, the welfare gains due to capital flows nevertheless remain robust. A comparison of results for Chile using different databases indicates that the impact of regional liberalization using a 1980 database may overstate the impact on the nonferrous metals sector in particular and manufacturing more generally. Nonetheless, when using a 1990 database, the change in output of the nonferrous metals sector remain larger than for any other sectors in the Chilean economy.

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1. INTRODUCTION[*]

Since the North American Free Trade Agreement (NAFTA) was launched in January 1994, it has generally been acknowledged that, if NAFTA were to be expanded, Chile would be the first South American nation to be granted access. Other South American nations might then follow. Chile's accession has been delayed because of U.S. congressional opposition to granting the President fast-track negotiating authority. However, since it may be only a matter of time before fast-track authority is approved, there is continuing interest in what the economic effects might be if NAFTA were to be expanded.

Our primary purpose in this paper accordingly is to provide an empirical evaluation of the possible accession of Chile to NAFTA as well as broader hemispheric integration. We include in our analysis: tariff elimination between Chile and North America; a broader hemispheric trade treaty involving Argentina, Brazil, and Colombia; liberalization of nontariff barriers (NTBs); and the impact of Chilean accession on foreign direct investment. In doing so, we attempt to elucidate the results that reflect some salient characteristics of the analytical structure of the Michigan Model of World Production and Trade that is used for computational purposes.

It is widely acknowledged that Applied General Equilibrium (AGE) modeling has become the tool of choice for *ex ante* analysis of international trade agreements covering a broad range of products. However, results frequently turn on the theoretical foundation of the model, parametric specification, the precise liberalization scenarios evaluated and, frankly, errors in programming and data construction. In

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Section 2 which follows, we provide some details about the model. Results from trade liberalization scenarios are presented and discussed in Section 3.

We also attempt to address specific criticisms of our previous work on hemispheric economic integration. In particular, Tybout and Westbrook (1996) have criticized AGE analysis of trade liberalization for overstating the gains due to the realization of economies of scale that are likely to emerge with hemispheric integration. Tybout and Westbrook's empirical estimates of available scale economies in Chile, Mexico and Canada suggest that the parametric specification of economies of scale in AGE models generally and the Michigan Model in particular significantly overstate the elasticity of the average total cost curve. The theoretical issues and empirical results are discussed in Section 4.

Additionally, in previous work on hemispheric economic integration (e.g., Brown, Deardorff, and Stern, 1995), our computational results for Chile suggested that the removal of Chile's eleven percent uniform tariffs on all of its manufacturing sectors would result in expansion of the nonferrous metals mining and refining sectors at the expense of all the other major producing sectors. Our results have been criticized by specialists on the Chilean economy who argue that they do not conform to what had already occurred in Chile as the result of the unilateral liberalization that has been achieved since the 1980s. That is, the unilateral liberalization has apparently resulted in the expansion of production and exports of Chilean agricultural products and a variety of manufactured products, and the nonferrous metals mining and refining sectors have apparently diminished in importance. Viewed from this perspective, our previous reliance on a 1980 base year may have led us to misrepresent the likely impact of Chile's accession on the degree of sectoral diversification that now characterizes the Chilean economy. In Section 4, we present a comparison of results using both 1980 and 1990 base years in order to determine how unilateral liberalization has affected the response of the Chilean economy to hemispheric integration. Conclusions are presented in Section 5.

2. THE MICHIGAN MODEL OF WESTERN HEMISPHERIC INTEGRATION

The AGE model used in this study is an extension of the model first constructed by Brown and Stern (1989) to analyze the economic effects of the Canada-U.S. Free Trade Agreement (CUSTA) and later expanded by Brown, Deardorff and Stern (1992,1995) to analyze the NAFTA and a possible Western

Hemispheric Free Trade Area (WHFTA). A fuller exposition of the model, the equations, and their derivation are available from the authors on request.

Currently, we model individually the three NAFTA members (United States, Canada, and Mexico) as well as four of the major South American countries (Argentina, Brazil, Chile, and Colombia) that are presumed to be incorporated into an expanded NAFTA. A group of 27 other major industrialized and developing countries are combined to create an eighth country, and all remaining countries of the world are consigned to a residual rest-of-world to close the model.

The sectoral coverage in each country/region includes 29 tradable product categories covering agriculture, manufacturing, services, and government. With the exception of agriculture, each sector of the model is taken to be monopolistically competitive. Products that are produced and traded are assumed to be differentiated by firm. Each firm undertakes a fixed start-up cost of capital and labor and then faces constant marginal costs of capital, labor, and intermediate inputs. Price is set as an optimal markup over marginal cost but free entry guarantees that profits are zero. The agricultural sector is perfectly competitive which requires that price is set equal to marginal cost.

Each firm faces two sources of demand for its products. A single representative household in each country is assumed to maximize a utility function subject to an income constraint. Income is earned by capital and labor only since firm profits are zero. In addition, each firm's output is used as an intermediate input into the production of other goods.

There are several important assumptions that are either built into the model or are implemented by the model for the present analysis. It is important that they be understood in interpreting the results to be reported below.

Full Employment - The analysis assumes throughout that the aggregate, or economy-wide, level of employment is held constant in each country. The expanded NAFTA is therefore not permitted to change any country's overall rates of employment or unemployment. This assumption is made because overall employment is determined by macroeconomic forces and policies that are not incorporated in the model and are not themselves to be included in a negotiated agreement. The focus instead is on the composition of employment across sectors as determined by the microeconomic interactions of supply and demand with the sectoral trade policies that an expanded NAFTA will alter.

Balanced Trade - The analysis assumes that the trade balance for each country remains unchanged from the base period as trade barriers are changed with an expanded NAFTA. This assumption is intended to reflect the reality of mostly flexible exchange rates among the countries

involved. It also, like the full employment assumption, is appropriate as a way of abstracting from the macroeconomic forces and policies that are the main determinants of trade balances.

Fixed Relative Wages - While the economy-wide wage in each country is permitted to adjust so as to maintain full employment, the wages across sectors are held fixed relative to one another. This permits the analysis to focus on the labor market adjustments that an expanded NAFTA might require, independently of any relative wage change that may facilitate those adjustments.

Fixed Labor Supply - The total labor supply in each country is assumed to be held fixed in the analysis. This is not to say that changes in labor supply will not occur in the course of a phase-in of an expanded NAFTA, but only that such changes are assumed not to be the result of such an agreement.

The reference year for the database of the model is 1990. The input-output relations used in the model refer to different years depending on the availability of national input-output tables.

The policy inputs into the model are tariffs and the NTBs that are currently (as of the mid 1990s) applied to the bilateral trade of the seven countries with respect to each other and to the other two aggregated regions included in the model. As will be noted below, in order to investigate the sectoral employment effects of an expanded NAFTA, it will be assumed that the existing bilateral tariffs for the seven nations will be removed all at one time rather than in stages.

The average tariff rates applying to the major trading partners in the Western Hemisphere are reported in Table 1. As can be seen from the last line of the table, U.S. tariffs on hemispheric trade are already extremely low. On average, U.S. tariffs tend to be about two percent. Chile's tariffs tend to be about five times as high, though still a relatively modest eleven percent.

When the policy changes are introduced into the model, the method of solution yields percentage changes in sectoral employment and other variables of interest for each country/region. Multiplying the percentage changes by the actual levels given in the data base yields the absolute changes, positive or negative, that might result if the bilateral tariffs were removed all at one time.

While the bilateral removal of tariffs (and NTBs) constitutes the main change in trade policies that would occur with an expanded NAFTA, there may be other changes as well. These relate especially to changes in foreign direct investment (FDI) and to the cross-border movement of workers as the result of changes in the rate of return on capital and changes in real wages. In experiments involving capital

flows, it is assumed that capital is installed in the importing country and that interest payments are remitted back to the source country/region each period.

3. COMPUTATIONAL RESULTS - 1990 DATABASE

a. Chile's Accession to NAFTA

The model was first used to analyze the impact of tariff removal on trade between Chile and the NAFTA countries using the 1990 database. NTBs are assumed to remain in place and international factor flows are taken to remain unchanged. A summary of results is presented in Section A of Table 2.

Perhaps the most striking result is the remarkably small impact that trade liberalization has on any of the countries of the model. For example, notice that real GNP in the United States rises by a mere 0.09%, as can be seen from column (5) of Table 2. In view of the fact that an agreement would be phased in over a period of a decade or more, one would expect little noticeable impact on the U.S. economy. Nor is the impact on Chile very large. Real income rises by 0.37%. Negative consequences for excluded countries are negligible as well.

The welfare results are also notable in that the lion's share of the welfare gain from trade liberalization accrues to the United States. U.S. welfare rises under Scenario A by $4.6 billion while Chile's welfare rises by $101.5 million. Furthermore, the welfare gain for Chile, whether measured by dollar amount, fraction of GNP or share of total gains accrued, is much smaller than has been obtained by Canada or Mexico as a result of the formation of the NAFTA. For example, Brown, Deardorff and Stern (1992) estimate that Mexico's entrance into the NAFTA could be expected to increase Mexican welfare by 1.4%, and Mexico's welfare gain ($1.8 billion) was more than half as large as that for the United States ($3.3 billion).

The small impact of trade liberalization is partly a result of the fact that, as a fraction of GNP, most countries do not trade very much and the tariffs applying to trade are not very intrusive. For example, Chile's exports to the Northern Hemisphere ($1.7 billion) account for only six percent of Chilean GNP ($27.3 billion). Tariffs against the imports from Chile's North American trade partners range from an average of 11.1% against Canada up to 14.4% against Mexico.

The second-best nature of preferential trade liberalization may also be playing a role particularly for Chile. Concern with trade diversion for the original three members of the NAFTA was relatively small for the simple reason that there was little trade to divert. For Canada, 80-90% of its trade prior to the CUSTA was already with the United States. However, countries in South America have a far more diverse portfolio of trade partners. For example, Chile's exports to North America account for only 19% of Chile's total exports.

It should also be noted that there are several avenues through which trade liberalization might be expected to increase welfare. The standard textbook arguments concerning exchange and specialization gains are captured by the BDS model. In addition, the pro-competitive effect of trade liberalization and the consequent realization of economies of scale have also been modeled. However, some more complex mechanics that are usually cast under the rubric of *dynamic effects* are not incorporated. As a consequence, the results presented here may somewhat understate the potential gains to Chile of reciprocal tariff removal

Small overall effects on real GNP are mirrored in the impact on factor returns. Note that for the United States, neither factor of production loses. Both the real wage and the real return to capital are virtually unchanged, as can be seen from columns (7) and (8) of Table 2, Scenario A. A similar result obtains for Chile, though with a rise in the return to capital (0.57%) relative to labor (0.36%).

The impact on factor returns runs somewhat contrary to our expectations based on a standard Heckscher-Ohlin model. As a consequence of the Stolper-Samuelson Theorem, trade liberalization should lower the return to the scarce factor. However, when returns to scale are present, the Stolper-Samuelson Theorem must be generalized. BDS (1993) have shown that an increase in output-per-firm in a sector raises the return to the factor used intensively it its production. That is, if economies of scale are realized in nonferrous metals and capital is the factor used intensively in the production of nonferrous metals, then the return to capital will rise economy-wide and the return to labor will fall. However, if returns to scale are realized across both labor-intensive and capital-intensive sectors, then the returns to both factors may rise. It appears to be the case that scale effects on real returns have swamped the more familiar Stolper-Samuelson mechanics. As a consequence, Chilean accession to NAFTA is unlikely to have any important

distributional consequences in the United States or Chile. Both capital and labor should expect to gain, albeit by a small amount.

(i) Sectoral Results

Sectoral results are reported in Table 3 for the United States and Table 4 for Chile. In each table we report percent changes in exports and imports in columns (2) and (3), respectively. Imports are then disaggregated by trade partner in columns (4)-(9). The percent changes in sectoral output and the number of firms are reported in columns (10) and (11) of each table. For the United States and, to a lesser degree, for Chile, the percent change in sectoral output also equals the percent change in employment. This is the case because there is little or no change in the wage-rent ratio.

Tariff removal has the expected effect of increasing trade between the Northern Hemisphere and Chile. U.S. imports from Chile rise in every sector except financial services as can be seen from column (7) of Table 3. The largest increases are agriculture (12.0%), leather products (15.5%) and glass products (17.3%). In fact, virtually all sectors show significant increases in trade with Chile, with the exception of the service sectors in which trade and tariff protection are quite small. However, the impact on total U.S. imports is negligible, as can be seen from column (3) of Table 3. In no sector, do imports change by more than six-tenths of one percent. Similarly, output is virtually unaffected, as can be seen from column (10).

Chile's imports from North America increase on the order of 25% in most product categories, as can be seen from columns (6), (8), and (9) of Table 4. The only exceptions are textiles (10%), clothing (3.6%), and footwear (5.7%) owing to the presence of NTBs in these sectors. The largest increase in imports occurs in transportation equipment (37%), again reflecting Chile's high level of protection in this sector. The impact on output across sectors is somewhat less, ranging from a low of -9.3% in nonelectrical machinery to a high of 4.2% in nonferrous metals.

(ii) Economies of Scale

The impact of trade liberalization on economies of scale can be seen by comparing the columns (10) and (11) of Table 3 (for the United States) and Table 4 (for Chile). In each table, column (10) reports the percent change in industry output and column (11) reports percent change in the number of firms.

The difference is the percent change in output-per-firm. The calculation is performed for Chile and reported in column (12) of Table 4.

First, note that output per firm increases in virtually every sector in both countries. The only exceptions are the service sectors in Chile. While the realization of economies of scale is not inevitable, it is the expected result from models with monopolistic competition. Trade liberalization intensifies the competition from foreign suppliers. Domestic firms must reduce price in order to remain competitive. This can be done while still satisfying the zero-profits condition only if firms expand the scale of production, thereby lowering average total cost. Nevertheless, the scale gains, while positive, are very small. There are only two sectors in which output-per-firm rises by more than one percent. These are the transportation equipment (2.0%) and miscellaneous manufacturers (1.1%) industries in Chile.

The comparatively strong gain in economies of scale in the transportation equipment sector in Chile provides an excellent example of the pro-competitive effects of trade liberalization. Chile adopts a fairly uniform 11% tariff rate across all product categories. The most import exception is the transport equipment sector, which shows tariff protection that averages 19.3%. Removal of this tariff would thus have a significant impact on firm behavior. The uniformly positive scale gains also help to explain the rise in both the return to capital and labor in Chile following accession, as discussed above. Scale gains across all sectors raise the return to both factors. However, the impact on the return to capital is slightly larger owing to the relative capital intensity of the transportation equipment sector.

b. A Western Hemispheric Free Trade Area (WHFTA)

In Section B of Table 2, we report a summary of results allowing for the accession of Argentina, Brazil, Chile and Colombia into NAFTA. The impact of the formation of a free trade area that encompasses these Western Hemisphere nations is broadly similar to Chilean accession. Colombia enjoys a welfare gain of 0.5% of GNP and Brazil's welfare rises by 0.1%.

The most important difference is that Argentina experiences a welfare loss of about 0.17% of GNP. There are several possible causes of this result. First, Argentina suffers a deterioration in its terms of trade of -0.9%, as can be seen in column (4), Section B of Table 2. The deterioration in the terms of trade follows from the fact that Argentina currently has relatively high tariffs. In order to pay for the

relative rise in the price of imports, exports must rise relative to imports. Exports increase by $36.6 billion while imports rise by only $22.7 billion. The fall in absorption will contribute to a decline in welfare.

Argentina may also be suffering from the loss of preferential access to the Brazilian market. Argentina and Brazil already have removed tariffs on one another under MERCOSUR. When Brazil enters a broader free trade area, Argentina's preferences are eroded. Notice also that Brazil sustains a steep deterioration in its terms of trade of -1.9%, although, Brazilian welfare still rises due to the other beneficial effects of trade liberalization.

(i) Sectoral results

Sectoral results for the formation of a WHFTA, which are not included here but are available from the authors on request, suggest a distinct pattern of specialization, which is as expected given standard trade theory. Argentina, Chile, and Colombia increase output in a fairly small range of products which are either natural-resource-based or involve a low level of processing. For example, sectoral output in Argentina rises in agriculture (0.7%), food (0.6%), clothing (0.25%), leather products (3.2%), footwear (1.4%), wood products (0.13%), petroleum products (2.8%), nonferrous metals (0.75%), and mining and quarrying (0.74%). Industrial performance by Brazil, Chile and Colombia is very similar. The only exception is that Chile also shows an increase in miscellaneous manufacturing (2.6%).

By contrast, U.S. output rises in most of the industrial sectors. Output declines in sectors with a relatively low level of processing, e.g., agriculture (-0.2%), leather products (-0.6%), footwear (-0.6%), and mining and quarrying (-0.2). A similar production pattern emerges for Mexico. It is also worth noting that the resource reallocation required in the United States is trivial. Sectoral output and employment fluctuations are all smaller than one percent. Such a change is smaller than normal fluctuations that are experienced each *month* due to cyclical fluctuations. In view of the fact that a treaty would be phased in over several years, it is highly unlikely that employment and production fluctuations due to an expanded NAFTA would be destabilizing or even observable.

The only sizable production changes occur in Chile and Colombia. Colombia could be expected to experience output and employment changes that exceed ten percent in some sectors. In Chile, output is

shown to fall in nonelectrical machinery (-9.0%), electrical machinery (-6.0%) and transportation equipment (-8.0%). Even larger changes occur in Colombia. Some examples are nonelectrical machinery (-12.6%), electrical machinery (-5.9%), and transportation equipment (-6.2%). Not surprisingly, in all cases the large declines in output occur in the sectors which involve higher levels of processing.

(ii) Economies of scale

As already noted, the extent to which trade liberalization leads to the realization of economies of scale can be seen by comparing the percent change in sectoral output and the percent change in the number of firms. The results, which are not reported here but are available on request, indicate that most countries in the model realize economies of scale in most sectors. For example, in Argentina, output/firm rises in 21 of the 29 sectors. In Chile, scale economies are realized in all of the manufacturing sectors. For Canada and the United States, output per firm rises in every single sector of the economy. Colombia is an exception. Economies of scale are realized in only seven sectors. Even in theses cases, output per firm, though rising, changes by less than 0.1%. The biggest gain occurs in petroleum products, but is still less than one percent. By contrast, the loss in scale in the declining industries in Colombia is quite substantial. For example, output per firm in paper products, metal products, nonelectrical machinery, electrical machinery and transportation equipment falls by 2-2.5%. The loss in scale of production across the entire economy helps explain why the return to both capital and labor declines in Colombia as a consequence of accession. Wages fall by 0.57% and the return to capital falls by 0.16%.

c. Liberalization of nontariff barriers

Chile's trade policy is distinguished by the largely uniform tariff rate applied across all product categories. Nontariff barrier protection is similarly nondiscriminatory. The more important NTBs affecting Chilean imports are discussed below.

(i) Tariff surcharges

A system of tariff surcharges was implemented in 1983. The surcharge system, according to Corbo (1991), appears to have been established *in lieu* of an anti-dumping law. According to the law passed in 1986, a National Commission may impose a surcharge if it is found that due to "special

circumstances in international markets, their import prices could result in lower than their normal prices and whose import in such circumstances could cause great actual or potential damage to the domestic producer." During the 1990s, products such as wheat flour, rice, powdered milk and maize have been subject to surcharges ranging from one to twelve percent. However, since 1995, no surcharges have been applied. (WTO, 1997).

(ii) Variable levies

Chile applies a system of variable levies and subsidies to establish and stabilize internal prices of edible oils, sugar, wheat and wheat flour. But, in recent years the levies have, on balance, been close to zero. For example, in 1995 and 1996 no specific duties were applied to sugar and wheat. The price of edible oils has been more volatile. As a consequence, in 1995 the *ad valorem* import duty was actually eliminated due to a negative variable levy whereas in 1996 a specific duty was applied. (WTO, 1997).

(iii) Minimum customs valuation

The President of Chile may establish minimum customs values when the normal price of a good is temporarily reduced and is causing serious actual damage to national production. A National Commission is responsible for establishing minimum values only after an investigation has been conducted and damage to national production has been established. Beginning in 1985, minimum customs valuations were established for 20 products. This increased to 21 in 1986, 30 in 1987, 45 in 1989 and 46 in 1990. However, since 1994, no minimum customs valuations have been applied (WTO, 1997).

(iv) Computational results

Of course, the NTBs that Chilean exporters face entering the United States are more formidable. Most notable are the quantitative restrictions placed on textiles, clothing, and footwear. Consequently, trade liberalization by the United States will be far more meaningful if NTBs are included in a trade treaty. Thus, it is expected that relaxing NTBs as a part of Chile's accession into NAFTA will diminish the terms-of-trade loss for Chile.

The model was rerun eliminating tariffs. However, unlike in Scenario A, NTBs are assumed not to be binding on trade. A summary of results is presented in Section C of Table 2 and sectoral results for

the United States and Chile are available on request. As noted in Table 2, adding NTB removal to liberalization Scenario A has the expected effect of reducing Chile's terms-of-trade loss from –0.80% to –0.72%. However, quite surprisingly, Chile's welfare gain is *reduced* when NTB constraints are eliminated. In the tariff elimination experiment when NTBs are assumed not to bind trade between Chile and North America, Chile gains $90.2 million which is 0.32% of GNP. By contrast, in the experiment where tariffs are removed but NTBs remain in place, Chile gains 0.37% of GNP. The impact of accession on factor returns is also reduced. The difference is small, but nonetheless, interesting.

Sectoral results show a distinctly different pattern, as well. U.S. NTBs against Chilean exports are primarily focused on textiles, clothing, footwear, and iron and steel. Once these NTBs are relaxed, tariff liberalization has a somewhat different impact on the pattern of production in Chile. The results indicate that most industries in Chile expand less when NTBs are relaxed. The important exceptions are clothing, leather products, and footwear for which Chilean output is approximately 1.5 percentage points higher in the absence of NTB constraints. Furthermore, the biggest negative impact of NTB removal falls on the transportation equipment sector in Chile. Output of transportation equipment is a full two percentage points lower when NTBs are relaxed. These results suggest that the presence of NTBs in the United States is playing a minor role in stimulating economic diversification in Chile.

However, there is a more interesting consequence of NTB removal. For every single sector, scale gains are *smaller* when tariff removal is accompanied by the relaxation of NTBs. Reduced scale gains largely explain the weaker welfare gains when NTBs are relaxed. There appear to be two factors at work that are reducing scale gains, operating both on the firm's perceived elasticity of demand and on the cost structure.

Output per firm depends on the perceived elasticity of demand. However, changes in the cost structure of the firm play the critical role. Monopolistically competitive firms set an optimal markup of price over marginal cost (MC) but free entry guarantees that price is also equal to average total cost (ATC). Equilibrium for an individual firm is depicted in Figure 1. Each firm maximizes profits by setting quantity where marginal revenue (MR) is equal to marginal cost. But the zero-profits condition requires that the corresponding price (P), also equals ATC. Equilibrium, then, requires a particular gap

between MC and ATC that depends on the elasticity of demand. A change in the relationship between the MC and ATC curves can alter equilibrium output for the firm even if there is no change in the elasticity of the firm's demand curve.

Under the assumptions of the model, each firm has fixed inputs of capital and labor that determine fixed cost. Variable inputs of capital and labor are also required along with intermediate inputs. Total cost is made up of both fixed and variable inputs. Note that the assumption that intermediate inputs are not included in fixed cost has important implications for the relationship between total cost and variable cost. *It is logically the case that intermediate inputs account for a larger share of variable than of total cost. Concomitantly, it is also the case that primary factors account for a smaller share of variable than of total cost.*

A rise in the price of intermediate inputs will raise MC relative to ATC. For example, MC may shift up in Figure 1 relative to ATC. With MC now closer to ATC, the gap between MC and ATC at the current level of firm output no longer satisfies the optimal markup and zero-profits conditions. These two conditions can only be restored at a lower level of output. Therefore, firm output must fall when the price of intermediate inputs rises.

Now, return to the issue of NTB liberalization. As discussed above, NTBs in North America are much more important than in Chile. When tariff removal is accompanied by NTB reform, the degree of liberalization by the North American partners is comparatively deeper than if tariff removal alone is considered. The net impact of including NTB liberalization is to shift world demand toward Chilean goods, thereby raising their relative price. Concomitantly, the price of North American goods falls on the world market. That is, Chile's terms of trade improve.

The rise in the price of Chilean produced goods, however, also raises the price of domestically produced intermediate inputs. While it is true that the price of imported intermediate inputs falls, the net impact is to raise MC in Chile while lowering MC for North American firms. This conclusion follows from the fact that firms tend to purchase a disproportionate share of domestically produced varieties. Chilean firms primarily purchase Chilean produced varieties of each intermediate input. Since the

relative price of Chilean varieties has risen, MC rises for Chilean firms, as compared to North American firms.

The rise in the price of intermediate inputs pushes MC up relative to ATC in Chile. The new equilibrium is found at a lower level of firm output and, thus, diminished economies of scale. Consequently, welfare gains for Chile are also smaller.

d. Trade liberalization and foreign direct investment

The results presented in the first three liberalization scenarios would appear to provide little incentive to pursue hemispheric integration. Tariff liberalization, itself, even combined with the relaxation of NTBs has positive but very small static welfare implications. However, trade liberalization can affect economic welfare in ways other than the standard textbook analysis of distortions of consumer and producer choice. In particular, trade liberalization is likely to stimulate international capital flows, as well.

As can be seen from column (6) of Table 2, the return to capital in Chile rises relative to the return in all other countries in the world when Chile accedes to NAFTA. This premium in itself has the potential to attract international capital. In addition, a trade treaty with North America could lower the risk premium on Chilean investments, thereby further attracting capital. Therefore, in Scenario D, we assume that tariff removal on trade between Chile and North America is accompanied by foreign direct investment from the rest of the world that increases Chile's capital stock by five percent. Chile is assumed to pay foreign owners the marginal value product of the newly installed capital each period.

A summary of results is reported in Section D of Table 2. First note, by comparing imports in column (2) and exports in column (3), that Chile experiences a substantial increase in its trade surplus of $25.9 billion. There are two reasons for such a large trade imbalance. First, Chile has to remunerate foreign capital owners. Funds are generated by running a trade surplus. In addition, the increase in exports tends to depress prices of Chilean goods on the world market. Thus, a –1.92% terms-of-trade loss (reported in column 4) emerges. The fall in the price of Chilean goods requires yet even larger exports to pay for the now-more-expensive imports. More importantly, the welfare impact on Chile of accession is now a quite robust 5.15%, as can be seen from column 5, Section D of Table 2. Both factors of production

show a rise in their respective returns, with the lion's share of the gain accruing to labor (4.8%) as compared to capital (1.4%). The rise in the wage-rent ratio is as expected, given that the capital inflow will uniformly raise the capital-labor ratio.

(i) Sectoral results

The sectoral effects for Chile, which are not reported here, show that the impact of the capital inflows on production is positive in every single sector of the Chilean economy. The largest increases occur in nonferrous metals (10.8%), footwear (5.2%), and miscellaneous manufacturers (5.2%). In fact, the only sectors of the economy that fail to increase substantially are nonelectrical machinery (0.5%), electrical machinery (1.8%) and transportation equipment (0.6%).

(ii) Economies of scale

Scale gains are also quite pronounced. Output per firm rises in every sector. The smallest scale gain emerges in wood products (1.7%), whereas most sectors experience a rise in output per firm between two and six percent. The uniformly positive scale gains across all sectors tends to benefit both factors of production, as would be expected given our generalization of the Stolper-Samuelson Theorem. The source of the positive scale gains as the Chilean economy grows is not immediately obvious from the structure of the model. One might expect, based on the intuition from a one-sector, one-factor model, that the economy might just reproduce itself simply by adding five percent more firms each producing at the same level that prevailed before the capital inflow. However, if this were the case, the increase in the number of firms would intensify competition, thereby raising each firm's perceived elasticity of demand. Firms would respond by increasing the scale of production, as we observe. So simple reproduction of the economy is unlikely to be an equilibrium outcome.

Nevertheless, the fact of the matter is that the demand elasticity changes very little in Scenario C. No single firm experiences a change in elasticity that even approaches one percent and, in most cases, demand elasticity changes on the order of one-tenth of one percent. Therefore, elasticity of demand is playing only a minor role in determining changes in firm output. Once again, we must turn to the cost

structure and the relationship between MC and ATC to understand the scale gains that emerge in Scenario D.

As discussed above, Chile generates the income necessary to pay foreign capital owners for the newly installed capital by running a merchandise trade surplus. The consequent increase in supply of Chilean goods tends to depress their prices on world markets. That is, Chile suffers a deterioration in its terms of trade of −1.9%. Returning to Figure 1, the decline in the price of domestically produced intermediate inputs falls disproportionately on MC as compared to ATC, as noted earlier. Therefore, firms are no longer at a point where ATC is at an optimal markup over MC. This time, firm output is too small. A new equilibrium emerges with significantly higher firm output.

(iii) Magnification effect

It is worth noting that a fall in MC actually has a magnification effect on firm output. As we see, Chile's terms of trade deteriorate by −1.9% in Scenario D. This change in the price of domestically produced inputs translates into a proportionately smaller change in the cost of intermediate inputs, since the price of imported intermediate inputs has risen. Yet, output per firm in Scenario D rises generally from 1.6% up to six percent. The source of the very large output changes can be understood by considering the interaction between the optimal markup equation, the zero-profits condition, and the definition of ATC. The details are given in the Appendix.

4. SENSITIVITY ANALYSIS

a. Returns to Scale

The specification of the elasticity of returns to scale in Applied General Equilibrium models has been criticized by Tybout and Westbrook (1996). It is implicit in the specification of the Michigan Model that firm output rises by 1.5% for each one percent increase in inputs. However, regression analysis undertaken by Tybout and Westbrook suggests that returns to scale gains are far smaller. Consequently, our results may overstate the gains from trade liberalization, to the extent that they turn on the realization of economies of scale.

The elasticity of returns to scale for the Michigan Model database and estimates obtained by Tybout and Westbrook are reported in Table 5. Figures in this table can be interpreted as the percent change in output for a one-percent increase in all inputs. Entries greater than one indicate the presence of increasing returns to scale. Note that the estimates of economies of scale by Tybout and Westbrook are uniformly smaller than the specification adopted in the Michigan Model database.

For our purposes here, it is useful to consider the connection between returns to scale and the cost function. A concept analogous to the elasticity of returns to scale is the elasticity of total cost with respect to firm output. If returns to scale exist, then the elasticity of total cost with respect to output should be smaller than one. As noted in the Appendix, it can be shown that the cost elasticity is simply the inverse of the scale elasticity.

b. Tybout-Westbrook estimates of the elasticity of scale

Rather than deriving the elasticity of scale within the model, an alternative starting point is to use measures of the elasticity of scale as estimated by Tybout and Westbrook. MC's total cost share would then be set equal to the inverse of the elasticity of scale. From there, the firm's perceived elasticity of demand can be determined according to equation (5') in the Appendix.

c. Formation of a WHFTA

We have followed this latter approach and rerun the experiment in which the NAFTA is expanded to include Argentina, Brazil, Chile and Colombia. A summary of results is presented in Section A of Table 3. Individual country results for Argentina, Brazil, Chile, Colombia, and Mexico are available on request.

Not surprisingly, the change in output per firm when using the Tybout-Westbrook estimates of the elasticity of scale is equal to or less than the case where the Michigan Model database is used. This is the case for virtually every single sector for all countries. The only exception is Colombia.

The smaller scale gains are reflected in factor returns reported in the last two columns of Section A of Table 6. For example, in Section B, Table 2, using the Michigan Model database we find that a WHFTA would raise the return to labor in Chile by 0.35% and the return to capital by 0.57%. However,

the same scenario in Section A, Table 6, using the Tybout-Westbrook scale estimates produces an increase in the return to labor of 0.22% and increase in the return to capital of 0.44%. Similar results emerge for factors in Argentina, Brazil, and Mexico. In fact, both labor and capital in Brazil are found to be made worse off by the formation of a WHFTA using the Tybout-Westbrook scale estimates. The only exception is Colombia for which both factors fare better if Tybout-Westbrook scale estimates are used. Apparently, on balance, scale gains are larger in Colombia when the Tybout-Westbrook scale estimates are used, which is reflected in higher factor returns.

We can draw two conclusions from this analysis. On the one hand, it is clear that for most countries, the Michigan Model probably overstates the scale gains due to trade liberalization. On the other hand, the error appears to have only minor implications for our conclusions. The scale gains are very small using either set of scale parameters. The difference in output per firm from the two different experimental results runs on the order of five one-hundredths of a percentage point for Argentina to a quarter of a percentage point for Chile. Also, the qualitative results are largely unchanged. Most countries show a small positive gain from liberalization. The only exception is Brazil for which the factors of production could lose or gain from the formation of a WHFTA depending on the scale parameters used.

d. Chile's accession to NAFTA, tariffs, and foreign direct investment

It is more interesting to evaluate the role of the scale elasticity in an experiment in which scale gains actually play a significant role. We found above that, when capital flows accompany tariff liberalization, the welfare consequences are large and scale gains play an important role. Therefore, liberalization Scenario D was rerun using the Tybout-Westbrook scale estimates. A summary of results is presented in section B of Table 6 and a comparison of results from the Michigan Model database and the Tybout-Westbrook scale estimates is presented in Table 7.

Once again, we see that scale gains are smaller when we assume a smaller elasticity of scale. A comparison of columns (4) and (7) of Table 7 reveals that the gain in output per firm in Chile is smaller in every single sector when the Tybout-Westbrook scale estimates are incorporated. The difference ranges up to 1.67 percentage points for miscellaneous manufactures.

The overall welfare gain for Chile is also smaller. When the Michigan Model database is used, Chile's overall welfare rises by 5.15%, the return to labor rises by 4.76% and the return to capital rises by 1.37%. However, when the Tybout-Westbrook scale parameters are employed, Chile's overall welfare rises by 4.82%, the return to labor rises by 4.41% and the return to capital rises by 1.05%. Once again, these results clearly suggest that scale gains are overstated in the Michigan Model.

However, we can draw a more important lesson from these results. There are many channels through which trade liberalization can affect an economy such as removing distortions in consumer and producer decisions, the realization of economies of scale, and dynamic gains. Nevertheless, the empirical results presented here and confirmed in other research efforts, is that the most important consequence of trade liberalization may be the stimulus to international capital flows.

Given the current level of tariff (and even nontariff) barriers to trade, the welfare and production consequences of liberalization are likely to be virtually unobservable and swamped by other ongoing macro events. This is the case, independent of the presence or lack thereof of realizable economies of scale. Nevertheless, when capital flows that are likely to accompany a trade treaty are incorporated into the analysis, the welfare consequences are quite pronounced, once again, largely independent of the scale gains available. We conclude, then, that the Michigan Model overstates the scale gains that are likely to emerge with trade liberalization. However, the error appears to be fairly small, at least in the context of Western Hemispheric integration.

e. Comparison of 1990 database to 1980 database

Over the past two decades, economic policy in Chile has placed great emphasis on industrial diversification, particularly away from the long-standing reliance on the nonferrous metals sector. The change in economic orientation is clearly reflected in Chile's export pattern. In Table 8, we report Chile's nominal exports by sector for 1980 and 1990. The percent changes over the period have also been calculated and reported in column (4) of the table.

It is immediately clear that trade in many sectors of the Chilean economy has grown quite dramatically. There are two important exceptions. Exports from the nonmetal mineral products and the associated glass products sector have actually declined in nominal terms. Nominal export growth in

nonferrous metals has been quite small in comparison to other sectors of the economy and the associated metal products and mining and quarrying sectors have actually declined. Nevertheless, it should be noted that nonferrous metals is still by far Chile's most important export sector. The next largest export sector, food, is less than one-third as large. Furthermore, the nonferrous metals sector comprised 43% of total Chilean exports as recently as 1990.

It is interesting to consider the implications of a program of economic diversification for the consequences of trade liberalization. We are also motivated to undertake a comparison of the 1980 and 1990 databases in light of criticisms leveled by Chilean specialists at Brown, et al. (1995). In previous work using 1980 data we found that hemispheric integration would possibly have a powerful expansionary impact on the nonferrous mining and refining sectors at the expense of all the major manufacturing sectors in the Chilean economy. Country experts have argued that our results do not conform to Chile's experience with unilateral liberalization that had been achieved during the 1980s. That is, unilateral liberalization has apparently resulted in the expansion of production and exports of Chilean agricultural products and a variety of manufactured products, and the nonferrous mining and refining sectors have apparently diminished in importance.

Accordingly, we have rerun Scenario A in which Chile enters NAFTA (tariff removal only) using 1980 production and employment data. A summary of results is presented in Section C of Table 6. Detailed sectoral results are available on request. There are a couple of aspects of the 1980 data set results that are as expected when compared to the same experiment using 1990 data. For example, consider the degree of economic specialization that tariff removal triggers. It is generally the case that a highly specialized economy will become even more specialized when trading with comparatively diverse economies such as the United States and Canada. Such a pattern is clearly apparent from the sectoral results. Using the 1990 database, we find that Chilean output rises in eight sectors with the largest changes occurring in nonferrous metals (4.2%), miscellaneous manufactures (2.1%), and mining and quarrying (1.5%). By comparison, using the 1980 database we find Chile specializing in a smaller range of products, with output increasing in only five sectors. Furthermore, the increases in output in the nonferrous metals (6.2%) and mining and quarrying (3.4%) sectors are about 50% larger.

These results point us to the now quite obvious conclusion that our previous reliance on 1980 data did indeed lead us to overstate the impact of Chilean accession to NAFTA on the nonferrous metals sector in particular and manufacturing, more generally. However, it should be noted that the sectoral response to *reciprocated* trade liberalization may not be the same as the response to a *unilateral* tariff reduction, as was undertaken during the 1980s. Note in particular that we do not observe a strong response by the agricultural and food sectors even using the 1990 data set. In fact, the response of these two sectors is independent of the base year employed. Furthermore, the change in output by the nonferrous metals sector is larger than for any other segment of the economy whether the 1980 or 1990 data set is used.

It is also the case that highly specialized economies gain more from international trade than diversified economies. Using 1980 data, the welfare gain for Chile's accesstion to NAFTA is 1.4%, as compared to a gain of 0.37% based on 1990 data. This is the case even though Chile also would have experienced a deeper deterioration in its terms of trade. However, the greater degree of specialization in Chile in 1980 is also reflected in relative factor returns. In Scenario A using the 1990 data, Chilean capital gained relative to labor, but the difference was small and both factors show some rise in real compensation. But, when 1980 data are used, the allocation of gains is quite lopsided. The rise in the real return to capital is 0.77% compared to a rise of 0.05% in real wages. Thus, the more specialized an economy becomes in a trading environment, the greater the relative gains that accrue to its abundant factor. Given Chile's relative capital abundance, the Stolper-Samuelson Theorem leads us to expect a rise in the real return to capital. The more specialized Chile becomes as a consequence of trading, the greater the relative rise in the rental rate.

5. CONCLUSIONS

We have presented results from an applied general equilibrium model of Western Hemispheric economic integration. The results of the model clearly support the view that tariff elimination will have beneficial effects for most countries involved. However, the benefits as well as the costs of liberalization, while positive, will be quite small, with gains for each country generally less than one percent of GNP.

Nevertheless, there are other channels through which tariff elimination on intra-hemispheric trade might have secondary effects that would produce strongly positive welfare gains. For example, as an historical matter, it appears that trade treaties that demonstrate a commitment to a liberal trading regime have provided an impetus to international investment. We find that, if a hemispheric treaty were to stimulate even a small increase in the capital stock of countries in South America, the welfare gains would be quite substantial. For example, a five percent increase in the capital stock in Chile produces a welfare gain exceeding five percent of GNP, even after allowing for the fact that Chile will have to make dividend payments on the newly installed capital. In addition, the augmented capital stock raises wages, thereby easing the adjustment to freer markets.

The model was then subjected to sensitivity analysis in order to address criticisms leveled at previous analysis of hemispheric integration by country and data experts. First, the realization of economies of scale has played an important role in the discussion of the gains from hemispheric integration. However, the availability of unrealized economies of scale is an empirical matter. Estimates of the elasticity of scale using regression analysis by Tybout and Westbrook suggest that the specification of AGE models overstates the likely economies not yet realized. We found that the current specification of the Michigan Model does result in an exaggeration of the likely scale gains to emerge from liberalization. However, the error, at least in this context, is small, largely due to the fact that the impact of trade liberalization itself is small. The Tybout and Westbrook scale estimates were also incorporated into the liberalization scenario in which capital flows were allowed to occur in order to test the model's sensitivity to the specification of the elasticity of scale in a context in which the economic effects are more pronounced. Again we found that the Michigan Model database led to an overstatement of the scale gains as compared to the Tybout-Westbrook specification. However, the welfare gains due to capital flows remained quite robust even if the scale gains were reduced. We conclude then that the Michigan Model can be fine tuned by substituting the Tybout-Westbrook scale estimates, but that the results are not likely to be materially altered.

Further, previous work with the Michigan Model has been criticized for the choice of the base year. Chile, in particular, passed through a period of deep unilateral liberalization and economic

diversification during the 1980s. Results using a 1980 database, then, may misrepresent the impact of additional liberalization particularly on the nonferrous metals sector relative to manufacturing and agriculture. After updating to a 1990 data base we found that our previous reliance on 1980 data did indeed lead us to overstate the impact of Chilean accession on the nonferrous metals sector in particular and manufacturing more generally. However, it should be noted that the sectoral response to reciprocated trade liberalization might not be the same as the response to a unilateral tariff reduction. We note especially that a strong response by the agricultural and food sectors was not observed even using the 1990 data set. In fact, the response of these two sectors is independent of the base year employed. Furthermore, the change in output by the nonferrous metals sector is larger than for any other segment of the economy whether the 1980 or 1990 data set is used.

Finally, we conclude that hemispheric economic integration should be viewed positively. The consequences appear to be uniformly welfare-improving for nearly all countries involved and all factors of production and the adjustment costs will be small. Furthermore, to the extent that trade liberalization is accompanied by the transfer of technology either embodied or otherwise, welfare gains particularly to South America may be strongly positive.

APPENDIX

a. Magnification effect

The optimal markup of price over marginal cost is given by

$$(1) \quad P = \frac{MC}{1 + 1/\eta}$$

where P is the price charged by the firm, MC is marginal cost and η<-1 is the firm's perceived elasticity of demand. Proportionately differentiated, equation (1) becomes

$$(1') \quad \hat{P} = \hat{MC} + \frac{\hat{\eta}}{1+\eta}$$

where the circumflex indicates percent change. The zero-profits condition requires that price equal average total cost, so that we can rewrite equation (1′) as

$$(1'') \quad A\hat{T}C = \hat{M}C + \frac{\hat{\eta}}{1+\eta}.$$

Now, ATC is a just the sum of MC and average fixed cost. That is

$$(2) \quad ATC = MC + \frac{P_V}{q}$$

where P_V is the cost of the fixed inputs of capital and labor and q is firm output. Proportionately differentiating equation (2), we have

$$(2') \quad A\hat{T}C = \theta_{MC}\hat{M}C + \theta_{FC}(\hat{P}_V - \hat{q})$$

where θ_{MC} is marginal cost's share of total cost and θ_{FC} is fixed cost's share of total cost.

Combining equations (1″) and (2′), noting that firm perceived elasticity of demand was virtually unchanged in Scenario D, we have

(3) $\hat{q} = \hat{P}_V - \hat{MC}.$

That is, absent any changes in the cost of the primary inputs, P_V, the percent change in firm output should exactly equal the percent change in marginal cost. However, as the results from Scenario C show, output per firm grew by more than the percent fall in the price of domestically produced intermediate inputs.

The reason for the magnification on firm output is the following. As the scale of production rises across all sectors the gains accrue to both factors of production. Capital and labor enjoy the benefits of increased economies of scale. Thus, P_V is rising as q falls. The rise in the cost of primary inputs again affects the cost structure of the firm. This time, since primary inputs account for a greater share of total cost than marginal cost, ATC rises as compared to MC. Firms are no longer located at the equilibrium markup of ATC over MC. The gap is too large. In order to restore the equilibrium gap between ATC and MC, firm output must rise further, pulling firms down the ATC curve, closer to MC.

b. Returns to scale in the Michigan model

Consider first the determination of the returns to scale in the Michigan Model. As discussed in Section II above, we assume that the cost function is characterized by a fixed input of capital and labor plus variable inputs that are proportional to output. That is, total cost is given by

(4) $TC = FC + q\,MC$

where TC is total cost, FC is fixed cost, MC is marginal cost and q is firm output. Differentiating TC with respect to q and then converting to an elasticity we find that the elasticity of total cost with respect to output is

(4′) $\frac{q}{TC}\frac{dTC}{dq} = \frac{q\,MC}{TC} = \frac{MC}{ATC} = \theta_{MC}.$

The elasticity of scale, then, reported in Table 5, is simply $1/\theta_{MC}$.

The economic intuition of this measure is that firms that are at a very small level of output are also at a point on the ATC curve where there is a large gap between ATC and MC. Therefore, MC's cost

share is small. However, further down the ATC curve where MC's share of ATC share is large, most scale gains have already been achieved.

It remains only to determine a value for MC's ATC share. MC's share of ATC in the Michigan Model is determined by the profit maximization and zero-profits conditions. We have already seen from the discussion of equation (1) that these two conditions together imply that

$$(5) \qquad ATC = \frac{MC}{1 + 1/\eta}.$$

Rearranging equation (5) we can see that MC's cost share depends only on the firm's perceived elasticity of demand, η:

$$(5') \qquad \theta_{MC} = \frac{MC}{ATC} = 1 + \frac{1}{\eta}.$$

The firm's perceived elasticity of demand can be readily calculated depending on the value set for the elasticity of substitution among varieties of each good.

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TABLE 1
Average Tariff Rates for the Mid-1990s among
Major Western Hemisphere Trading Countries

Importer	Exporter						
	Argentina	Brazil	Canada	Chile	Colombia	Mexico	U.S.
Argentina		0	9.9	10.3	6	8.6	11.4
Brazil	0		10.4	7.2	10.7	9.1	16.9
Canada	8.7	5.6		3.6	5.5	2.8	4.5
Chile	11.3	13.1	11.1		11	14.4	12.5
Colombia	13.1	10.1	7.7	12.8		10.1	10.5
Mexico	5.5	9.1	7.5	2.9	7.7		11.4
U.S.	2.1	2	1.1	2.5	1.5	1.2	

TABLE 2

Summary Results of the Expansion of NAFTA
Change in Country Imports, Exports, Terms of Trade, Welfare
and Return to Labor and Capital
(Trade in Millions of U.S. Dollars)

	Imports	Exports	Terms of Trade Percent Change	Equivalent Variation		Wage Percent Change	Return to Capital Percent Change
				Percent	Millions		
	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A. EXPANSION OF NAFTA TO INCLUDE CHILE							
Argentina	-661.20	258.90	-0.06	-0.02	-19.83	-0.01	-0.01
Brazil	-1426.54	-532.39	-0.02	-0.01	-30.86	0.00	0.00
Canada	3483.76	1457.42	0.01	0.01	53.57	0.01	0.00
Chile	27358.50	34612.40	-0.80	0.37	101.48	0.36	0.57
Colombia	-79.69	-33.02	-0.01	0.00	-1.69	0.00	0.00
Mexico	1711.69	1525.14	0.01	0.10	232.99	0.01	0.01
United States	37469.60	28566.90	0.02	0.09	4591.88	0.00	0.00
Other	-1522.89	370.99	0.00	-0.04	-4871.28	0.00	0.00
B. EXPANSION OF NAFTA TO INCLUDE ARGENTINA, BRAZIL, CHILE AND COLOMBIA							
Argentina	22723.80	36562.30	-0.90	-0.17	-175.36	-0.05	0.02
Brazil	127055.00	190591.00	-1.89	0.11	510.85	0.02	0.03
Canada	21855.30	14016.30	0.05	0.11	625.95	0.03	0.02
Chile	28918.40	36090.10	-0.76	0.39	107.74	0.35	0.57
Colombia	39026.90	53970.60	-2.11	0.50	205.34	-0.57	-0.16
Mexico	12711.10	13880.20	0.00	0.26	607.85	0.03	0.04
United States	296569.00	219012.00	0.18	0.09	4592.67	0.03	0.03
Other	44782.00	31049.80	0.02	0.02	2700.59	0.01	0.01
C. EXPANSION OF NAFTA TO INCLUDE CHILE: TARIFFS AND NONTARIFF BARRIERS							
Argentina	-769.51	212.58	-0.07	-0.02	-20.59	-0.01	-0.01
Brazil	-1525.96	-606.54	-0.02	-0.01	-29.21	0.00	0.00
Canada	3411.59	1399.92	0.01	0.01	55.59	0.00	0.00
Chile	27891.00	34381.10	-0.72	0.32	90.17	0.25	0.45
Colombia	-139.47	-66.39	-0.01	-0.01	-2.34	0.00	0.00
Mexico	1724.24	1524.29	0.01	0.10	227.95	0.00	0.01
United States	38423.40	29649.70	0.02	0.01	684.33	0.00	0.00
Other	-2370.11	-268.58	0.00	0.00	-70.03	0.00	0.00
D. EXPANSION OF NAFTA TO INCLUDE CHILE: TARIFFS AND CAPITAL FLOWS							
Argentina	-76.17	568.80	-0.02	-0.01	-6.36	-0.01	0.00
Brazil	403.13	974.52	-0.01	0.00	-17.04	0.00	0.00
Canada	3607.29	1479.85	0.01	0.01	58.82	0.01	0.00
Chile	46310.00	72169.40	-1.92	5.15	1430.72	4.76	1.37
Colombia	222.25	203.22	0.01	0.00	1.94	0.00	0.00
Mexico	1837.88	1590.09	0.01	0.10	239.44	0.01	0.01
United States	41442.80	31044.00	0.02	0.09	4659.51	0.00	0.00
Other	20473.40	7281.55	0.01	-0.05	-6007.61	-0.01	0.00

TABLE 3

Sectoral Effects on the United States
Expansion of NAFTA to Include Chile
Tariffs Only
Percent Change

SECTOR	EXPORTS	IMPORTS	BILATERAL IMPORTS						Output	No. Firms
			ARG	BRZ	CND	CHL	COL	MEX		
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Agriculture	-0.01	0.56	0.26	0.15	-0.06	12.03	0.06	-0.06	-0.04	0.00
Food	-0.01	0.13	0.30	0.18	-0.02	8.07	0.09	-0.02	0.00	-0.01
Textiles	0.06	0.03	0.05	0.03	0.00	1.52	0.01	0.00	0.01	0.00
Clothing	-0.01	0.03	0.03	0.02	0.00	1.87	0.01	0.00	0.00	-0.01
Leather Products	-0.02	0.12	0.37	0.20	-0.05	15.53	0.10	-0.03	-0.02	-0.02
Footwear	-0.04	0.06	0.18	0.10	-0.03	6.11	0.04	-0.03	-0.04	-0.04
Wood Products	-0.03	0.03	0.32	0.20	-0.04	5.28	0.11	-0.03	0.00	0.00
Furniture	0.07	0.08	0.30	0.20	-0.03	6.09	0.10	-0.03	0.00	0.00
Paper Products	0.03	0.00	0.31	0.20	-0.03	8.32	0.11	0.01	0.00	0.00
Printing, Publishing	0.02	0.07	0.31	0.21	0.00	1.75	0.12	0.02	0.00	0.00
Chemicals	0.11	0.07	0.27	0.19	-0.02	4.26	0.05	0.02	0.01	0.00
Petroleum Products	0.03	0.08	0.35	0.20	-0.01	2.42	0.10	0.00	0.00	0.00
Rubber Products	0.21	0.05	0.25	0.16	-0.02	1.55	0.09	0.01	0.02	0.01
Nonmetal Min. Products	0.13	0.07	0.28	0.19	-0.02	4.30	0.10	-0.02	0.00	0.00
Glass Products	0.07	0.06	0.29	0.20	-0.03	17.26	0.10	0.00	0.00	0.00
Iron, Steel	0.08	0.02	0.05	0.03	0.00	1.05	0.02	0.00	0.01	0.01
Nonferrous Metals	-0.07	0.35	0.17	0.14	-0.06	8.76	-0.02	-0.04	-0.05	-0.05
Metal Products	0.14	0.07	0.26	0.16	-0.01	6.57	0.09	0.00	0.01	0.00
Nonelec. Machinery	0.16	0.06	0.22	0.15	0.08	0.16	0.10	-0.04	0.02	0.01
Electrical Machinery	0.02	0.06	0.26	0.16	0.01	5.74	0.09	-0.01	0.00	-0.01
Transport Equipment	0.16	0.04	0.21	0.11	-0.02	5.20	0.09	0.07	0.03	0.02
Misc. Mfrs.	0.02	0.08	0.26	0.19	-0.04	7.76	0.09	0.01	0.00	-0.01
Mining, Quarrying	0.01	0.05	0.31	0.21	-0.02	3.10	0.10	-0.07	-0.01	-0.01
Utilities	0.00	-0.02	0.31	0.20	-0.03	1.16	0.11	-0.01	0.00	0.00
Construction	-0.06	0.09	0.30	0.20	-0.01	1.32	0.11	0.00	0.00	0.00
Wholesale Trade	-0.07	0.07	0.31	0.21	-0.01	0.11	0.12	-0.01	0.00	0.00
Transportation	-0.08	0.08	0.32	0.20	-0.02	1.32	0.11	0.00	0.00	0.00
Financial Services	-0.05	0.05	0.32	0.21	-0.01	-0.34	0.11	-0.02	0.00	0.00
Personal Services	-0.07	0.07	0.32	0.21	-0.02	0.71	0.11	-0.01	0.00	0.00
Total	0.07	0.07	0.27	0.14	-0.02	8.78	0.08	-0.02	0.00	0.00

TABLE 4
Sectoral Effects on Chile
Expansion of NAFTA to Include Chile
Tariffs Only
Percent Change

SECTOR	EXPORTS	IMPORTS	BILATERAL IMPORTS						Output	No. Firms	Output per firm
			ARG	BRZ	CND	COL	MEX	US			
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Agriculture	6.21	5.83	-1.49	-1.61	27.31	-1.71	27.30	27.33	1.35	0.00	
Food	2.38	2.20	-1.76	-1.89	26.43	-1.98	26.43	26.46	0.11	-0.18	0.30
Textiles	1.85	1.44	-0.78	-0.82	10.10	-0.86	10.10	10.11	-0.89	-1.30	0.41
Clothing	2.14	0.01	-0.21	-0.23	3.60	-0.24	3.61	3.61	-0.37	-0.62	0.25
Leather Products	2.82	3.86	-1.63	-1.80	27.67	-1.91	27.69	27.71	-0.13	-0.58	0.44
Footwear	5.59	0.50	-0.47	-0.50	5.69	-0.53	5.69	5.69	0.54	0.14	0.40
Wood Products	1.48	9.79	-2.79	-2.90	26.59	-3.00	26.59	26.63	0.71	0.53	0.18
Furniture	5.44	5.38	-3.83	-3.93	25.57	-4.03	25.57	25.60	0.08	-0.42	0.50
Paper Products	1.05	4.73	-2.27	-2.38	27.11	-2.47	27.15	27.14	-0.38	-0.72	0.34
Printing, Publishing	1.26	7.19	-1.85	-1.95	27.57	-2.04	27.60	27.57	-0.85	-1.13	0.28
Chemicals	1.84	5.94	-4.59	-4.68	24.54	-4.81	24.58	24.56	-2.84	-3.44	0.60
Petroleum Products	1.69	5.29	-1.96	-2.10	26.23	-2.20	26.25	26.25	-0.22	-0.79	0.57
Rubber Products	0.48	2.91	-3.34	-3.44	24.32	-3.51	24.35	24.34	-1.72	-2.37	0.65
Nonmetal Min. Products	2.95	5.04	-2.02	-2.13	27.38	-2.22	27.38	27.40	-0.55	-1.05	0.50
Glass Products	2.10	2.23	-2.08	-2.16	26.45	-2.26	26.48	26.48	-1.71	-1.95	0.25
Iron, Steel	1.06	0.46	-3.11	-3.20	26.32	-3.28	26.35	26.34	-1.90	-2.30	0.40
Nonferrous Metals	4.80	2.71	-3.16	-3.19	26.31	-3.37	26.34	26.34	4.25	3.39	0.86
Metal Products	3.42	4.50	-2.09	-2.21	27.32	-2.29	27.33	27.33	-1.01	-1.38	0.37
Nonelec. Machinery	0.71	4.19	-7.08	-7.15	22.50	-7.21	22.37	22.41	-9.30	-9.87	0.57
Electrical Machinery	0.66	2.65	-5.94	-6.06	23.51	-6.13	23.48	23.49	-6.14	-6.84	0.70
Transport Equipment	3.07	5.88	-11.16	-11.28	37.09	-11.31	37.20	37.13	-7.64	-9.67	2.03
Misc. Mfrs.	3.75	2.68	-10.48	-10.56	18.94	-10.65	18.99	18.97	2.07	0.99	1.08
Mining, Quarrying	2.65	0.56	-1.22	-1.32	26.99	-1.42	26.94	27.00	1.52	0.93	0.59
Utilities	0.93	-1.06	-0.90	-1.01	-1.24	-1.11	-1.22	-1.21	-0.05	0.01	-0.05
Construction	1.14	-1.90	-1.69	-1.80	-2.01	-1.88	-2.00	-1.99	-0.67	0.00	-0.67
Wholesale Trade	0.01	-0.71	-0.48	-0.58	-0.80	-0.67	-0.80	-0.78	-0.68	0.00	-0.68
Transportation	1.21	-1.67	-1.42	-1.54	-1.76	-1.63	-1.74	-1.74	-0.42	0.00	-0.42
Financial Services	-0.41	-0.54	-0.30	-0.42	-0.64	-0.52	-0.64	-0.63	-0.97	0.00	-0.97
Personal Services	0.58	-1.57	-1.33	-1.45	-1.67	-1.55	-1.66	-1.65	-0.94	0.00	-0.94
Total	3.83	3.60	-3.28	-6.26	23.91	-2.22	28.20	25.22	0.07	0.25	

TABLE 5

Elasticity of Returns to Scale

Michigan Model Data Base and Tybout-Westbrook Scale Estimates

for

Canada, Chile and Mexico

SECTOR	Michigan Model Database			Tybout-Westbrook Scale Estimates		
	Canada	Chile	Mexico	Canada	Chile	Mexico
	(2)	(3)	(4)	(5)	(6)	(7)
Agriculture	1.00	1.00	1.00	n.a.	n.a.	n.a.
Food	1.50	1.52	1.50	1.27	1.35	1.07
Textiles	1.51	1.51	1.51	1.10	1.10	1.09
Clothing	1.50	1.51	1.50	1.04	1.12	1.08
Leather Products	1.50	1.53	1.50	1.10	1.14	1.07
Footwear	1.50	1.52	1.51	1.10	1.14	1.07
Wood Products	1.51	1.57	1.51	1.26	1.06	1.09
Furniture	1.50	1.52	1.50	1.26	1.06	1.09
Paper Products	1.51	1.56	1.50	1.22	1.02	1.04
Printing, Publishing	1.50	1.51	1.52	1.22	1.02	1.04
Chemicals	1.51	1.52	1.51	1.02	1.11	1.05
Petroleum Products	1.08	1.15	1.52	1.10	1.08	1.09
Rubber Products	1.50	1.60	1.51	1.10	1.08	1.09
Nonmetal Min. Products	1.50	1.52	1.51	1.30	1.07	1.05
Glass Products	1.50	1.55	1.52	1.30	1.07	1.05
Iron, Steel	1.18	1.15	1.51	1.14	1.17	1.09
Nonferrous Metals	1.51	1.53	1.52	1.14	1.17	1.09
Metal Products	1.50	1.19	1.50	1.14	1.17	1.09
Nonelec. Machinery	1.52	1.52	1.51	1.07	1.08	1.18
Electrical Machinery	1.51	1.15	1.51	1.13	1.05	1.10
Transport Equipment	1.50	1.51	1.50	1.12	1.11	1.06
Misc. Mfrs.	1.51	1.70	1.51	1.04	1.06	1.11
Mining, Quarrying	1.51	1.50	1.52	n.a.	n.a.	n.a.
Utilities	3.30	1.38	1.59	n.a.	n.a.	n.a.
Construction	1.44	1.34	1.34	n.a.	n.a.	n.a.
Wholesale Trade	1.62	1.52	1.75	n.a.	n.a.	n.a.
Transportation	1.42	1.38	1.56	n.a.	n.a.	n.a.
Financial Services	1.64	1.45	1.82	n.a.	n.a.	n.a.
Personal Services	1.88	1.60	1.64	n.a.	n.a.	n.a.

Sources: Michigan Model Data Base and Tybout and Westbrook (1996).

TABLE 6

Summary Results of the Expansion of NAFTA
Change in Country Imports, Exports, Terms of Trade, Welfare
and Return to Labor and Capital
Sensitivity Analysis
(Trade in Millions of U.S. Dollars)

	Imports	Exports	Terms of Trade	Equivalent Variation		Wage	Return to Capital
			Percent Change	Percent	Millions	Percent Change	Percent Change
	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A. EXPANSION OF NAFTA TO INCLUDE ARG., BRZ., CHL. AND COL.: TYBOUT AND WESTBROOK SCALE ESTIMATES							
Argentina	22680.20	36656.40	-0.92	-0.14	-149.27	-0.07	0.00
Brazil	126769.00	190182.00	-1.89	0.14	670.31	-0.02	-0.01
Canada	20027.20	12204.70	0.05	0.12	663.87	0.02	0.02
Chile	27779.00	34512.00	-0.71	0.52	143.74	0.22	0.44
Colombia	37281.40	51577.00	-2.02	0.37	152.78	-0.33	0.05
Mexico	12483.70	13749.10	-0.01	0.26	623.61	0.02	0.03
United States	292229.00	214622.00	0.19	0.09	4823.13	0.03	0.02
Other	43198.30	28902.20	0.02	0.02	2740.40	0.00	0.01
B. EXPANSION OF NAFTA TO INCLUDE CHILE: TARIFFS AND CAPITAL FLOWS -TYBOUT AND WESTBROOK SCALE ESTIMATES							
Argentina	-300.14	489.23	-0.04	-0.01	-10.55	-0.01	0.00
Brazil	293.40	868.15	-0.01	0.00	-15.59	0.00	0.00
Canada	3386.70	1241.47	0.01	0.01	55.05	0.00	0.00
Chile	43275.90	67524.40	-1.74	4.82	1340.79	4.41	1.05
Colombia	79.43	111.88	0.00	0.00	0.33	0.00	0.00
Mexico	1845.60	1584.70	0.01	0.10	235.31	0.00	0.01
United States	41057.30	30599.90	0.03	0.09	4633.84	0.00	0.00
Other	18974.40	6737.70	0.01	-0.05	-5862.83	-0.01	0.00
C. EXPANSION OF NAFTA TO INCLUDE CHILE: TARIFFS - 1980 DATA BASE							
Argentina	-326.61	-249.20	-0.01	-0.01	-10.66	0.00	0.00
Brazil	390.54	308.40	0.00	-0.01	-20.52	0.00	0.01
Canada	1714.19	1027.40	0.01	0.01	24.83	0.01	0.00
Chile	24332.30	30812.70	-1.22	1.39	389.63	0.05	0.77
Colombia	7.01	0.67	0.00	0.00	1.29	0.00	0.00
Mexico	563.80	555.51	0.00	0.01	24.70	0.00	0.00
United States	31388.10	21722.40	0.04	0.01	257.04	0.01	0.00
Other	-2425.44	-672.27	0.00	0.00	-76.66	0.00	0.00

TABLE 7

Scale Effects on Chile

Comparison of Michigan Model Database to Tybout-Westbrook Returns to Scale Estimates

Expansion of NAFTA to Include Chile

Tariffs Plus Capital Flows

Percent Change

SECTOR	Michigan Model Database			Tybout-Westbrook Scale Estimates		
	Output	No. Firms	Output per firm	Output	No. Firms	Output per firm
	(2)	(3)	(4)	(5)	(6)	(7)
Agriculture	3.84	0.00	3.84	4.09	0.00	4.09
Food	4.38	2.36	2.02	4.18	2.60	1.58
Textiles	4.80	2.38	2.41	3.45	2.02	1.43
Clothing	4.66	1.96	2.70	3.47	1.88	1.59
Leather Products	4.87	1.80	3.06	3.51	1.47	2.04
Footwear	5.17	1.96	3.21	3.91	1.91	2.00
Wood Products	3.65	1.97	1.68	3.71	2.63	1.09
Furniture	4.41	1.98	2.43	3.18	1.53	1.65
Paper Products	4.62	2.33	2.28	3.53	1.75	1.78
Printing, Publishing	4.50	0.93	3.57	3.12	0.83	2.29
Chemicals	3.08	0.04	3.04	1.31	-0.57	1.88
Petroleum Products	4.98	2.51	2.47	4.72	2.26	2.45
Rubber Products	3.84	1.00	2.84	2.48	0.73	1.76
Nonmetal Min. Products	4.72	2.05	2.67	4.30	2.40	1.89
Glass Products	3.60	1.82	1.78	2.89	1.34	1.55
Iron, Steel	4.96	1.91	3.05	4.74	1.91	2.84
Nonferrous Metals	10.78	7.64	3.15	9.44	7.27	2.17
Metal Products	4.91	1.92	3.00	4.58	1.97	2.61
Nonelec. Machinery	0.49	-2.58	3.07	-1.91	-3.85	1.94
Electrical Machinery	1.82	-2.56	4.37	0.75	-2.85	3.60
Transport Equipment	0.60	-3.65	4.25	-3.23	-5.92	2.68
Misc. Mfrs.	5.19	1.76	3.43	2.59	0.83	1.76
Mining, Quarrying	7.03	4.55	2.48	6.88	4.64	2.24
Utilities	5.68	0.05	5.62	5.51	0.07	5.43
Construction	4.76	0.00	4.76	4.75	0.00	4.75
Wholesale Trade	5.07	0.00	5.07	4.67	0.00	4.67
Transportation	4.95	0.00	4.95	4.80	0.00	4.79
Financial Services	4.61	0.00	4.61	4.44	0.00	4.44
Personal Services	2.75	0.00	2.75	2.36	0.00	2.36
Total	5.30	3.67		4.85	3.68	

TABLE 8

Chile Exports: 1980-1990
Millions U.S. Dollars

SECTOR	1980 (2)	1990 (3)	Percent Change (4)
Agriculture	435.27	1063.43	144.32
Food	330.73	1162.80	251.59
Textiles	16.26	39.63	143.73
Clothing	1.81	40.76	2151.93
Leather Products	1.26	2.05	62.70
Footwear	0.68	38.20	5517.65
Wood Products	93.65	448.08	378.46
Furniture	1.26	26.04	1966.67
Paper Products	216.49	397.35	83.54
Printing, Publishing	1.85	21.57	1065.95
Chemicals	104.41	282.92	170.97
Petroleum Products	10.45	45.68	337.13
Rubber Products	5.42	28.36	423.25
Nonmetal Min. Products	22.20	15.64	-29.55
Glass Products	10.13	3.22	-68.21
Iron, Steel	28.20	71.40	153.19
Nonferrous Metals	2920.30	3866.36	32.40
Metal Products	33.31	29.88	-10.30
Nonelec. Machinery	11.03	17.85	61.83
Electrical Machinery	11.58	11.97	3.37
Transport Equipment	7.58	66.44	776.52
Misc. Mfrs.	26.38	393.33	1391.02
Mining, Quarrying	989.95	951.48	-3.89
Utilities	n.a.	0.08	
Construction	n.a.	0.14	
Wholesale Trade	n.a.	0.48	
Transportation	n.a.	1.04	
Financial Services	n.a.	0.20	
Personal Services	n.a.	0.15	
TOTAL	5280.20	9026.53	

Sources: Michigan Model Data Base.

FIGURE 1

Equilibrium under Monopolistic Competition

