Banco Central de Chile
Documentos de Trabajo

Central Bank of Chile
Working Papers

N° 238

Noviembre 2003

CHILE'S REGIONAL ARRANGEMENTS: THE IMPORTANCE OF MARKET ACCESS AND LOWERING THE TARIFF TO SIX PERCENT

Glenn W. Harrison Thomas F. Rutherford David G. Tarr

BANCO CENTRAL DE CHILE

CENTRAL BANK OF CHILE

Documentos de Trabajo del Banco Central de Chile
Working Papers of the Central Bank of Chile
Huérfanos 1175, primer piso.
Teléfono: (56-2) 6702475; Fax: (56-2) 6702231

Documento de Trabajo
N° 238

Working Paper
N° 238

CHILE'S REGIONAL ARRANGEMENTS: THE IMPORTANCE OF MARKET ACCESS AND LOWERING THE TARIFF TO SIX PERCENT

Glenn W. Harrison
University of South Carolina

Thomas F. Rutherford
University of Colorado

David G. Tarr
The World Bank

Resumen

Usando un modelo de equilibrio general computable para múltiples sectores, en este documento se examina la estrategia chilena conocida como "regionalismo aditivo", que aplica el país para negociar tratados bilaterales de libre comercio con todos sus socios comerciales relevantes. Los tratados que ha firmado Chile con sus socios del norte le otorgan suficiente acceso a los mercados como para superar los costos que le significa el desvío de comercio. Al reducir sus aranceles de 11 a 6 por ciento, Chile es capaz de reducir el desvío de comercio de todos sus acuerdos regionales. Con esto, el acuerdo con el MERCOSUR se transforma de negativo a positivo. Gracias al acceso preferencial a los mercados, el regionalismo aditivo probablemente multiplicará las ganancias para Chile varias veces sobre las ganancias estáticas de bienestar del libre comercio unilateral. Nuestro estudio encuentra que al menos un país socio pierde con cada uno de los acuerdos regionales considerados, y los países excluidos en su conjunto pierden siempre. Se estima que lo que ganaría el mundo si existiera el libre comercio global sería muchísimo mayor que con cualquiera de los acuerdos regionales.

Abstract

Using a multi-sector multi-country computable general equilibrium model, we examine Chile's "additive regionalism" strategy of negotiating bilateral free trade agreements with all of its significant trading partners. Chile's agreements with "Northern" partners provide sufficient market access to overcome trade diversion costs for Chile. By lowering its tariff from eleven to six percent, Chile is able to reduce trade diversion from all its regional agreements. This converts MERCOSUR from a negative to a positive agreement. Due to preferential market access, additive regionalism is likely to provide Chile with gains that are many multiples of the static welfare gains from unilateral free trade. We find that at least one partner country loses from each of the regional agreements we consider, and excluded countries as a group always lose. Gains to the world from global free trade are estimated to be vastly larger than any of the regional arrangements.

This paper was prepared for the Central Bank of Chile conference on General Equilibrium Models for the Chilean Economy, Santiago, April 4/5, 2002. We would like to acknowledge the helpful comments of our discussants, Sebastián Claro and Ronald Fischer. We also would like to thank Jerry Haar of the North-South Center; Maurice Schiff, Alberto Valdés, and L. Alan Winters of the World Bank; Dominique Hachette and Juan Coeymans at Pontifica Universidad Católica de Chile; Eugenia Muchnik and Héctor Assael of the United Nations Economic Commission for Latin America and the Caribbean in Santiago; María Wagner of the Chilean Ministry of Finance; M. Marcel of the Chilean Treasury; Andrea Butelmann, Klaus Schmidt-Hebbel, and Ricardo Vicuña, at the Central Bank of Chile; and Liselott Kana of the Chilean Ministry of Foreign Affairs. We thank Isidro Soloaga, Ulrich Reincke, María Kasilag, and Minerva Pateña for excellent research, translation, and logistical support. We are grateful to the North-South Center for research support. The views expressed are not necessarily those of the World Bank or any of its Executive Directors, the North-South Center, any agency of the government of Chile, or those acknowledged.
E-mail: dtarr@worldbank.org.

INTRODUCTION

We define additive regionalism as the process of sequentially negotiating bilateral free trade agreements with all significant trading partners.[1] Chile is the country that has most clearly articulated a strategy of additive regionalism. The government of Chile has successfully concluded a free trade area with the Southern Common Market (MERCOSUR), Canada, and Mexico, and it is reportedly close to a free trade agreement with the United States.[2] Moreover, the government of Chile is attempting to add the European Union, the rest of South America, and several other countries to its network of free trade arrangements.[3] Proponents of the government's strategy point out that if a country were to negotiate free trade agreements with all of its trade partners, it would end up with zero effective tariffs on all imports—or free trade—despite the legal existence of positive most-favored-nation tariffs. In the process, it would also achieve preferential access to its partners' markets. Absent transition dynamics, this strategy may thus produce gains that are considerably larger than unilateral free trade.

Critics of Chile's additive regionalism strategy, such as Donoso and Hachette (1996), argue that agreements with southern countries are unlikely to be beneficial, so it is not worth delaying the benefits of unilateral and multilateral tariff liberalization to pursue these agreements. They argue that only agreements with the European Union, the United States, or Japan offer sufficient access to be worth pursuing. Advocates of the government's strategy, however, believe that agreements with smaller southern countries can also produce substantial gains. They further argue, as in Butelmann and Meller (1995), that additive regionalism will progressively reduce trade diversion costs, lower the effective average tariff in Chile, and provide considerably improved market access. They note that Chile can unilaterally lower its external tariff while simultaneously pursuing additive regionalism to further reduce trade diversion costs.

Does additive regionalism dominate free trade for Chile? If so, by how much? Most results regarding the welfare effects of regional arrangements are typically ambiguous at the theoretical level, and many questions are quantitative rather than qualitative. We therefore employ an eleven-region global computable general equilibrium (CGE) model to quantitatively examine the network of preferential arrangements that Chile is negotiating, as well as unilateral trade policy options in Chile. We also estimate the impact of global free trade as a reference point. Our model includes the Chilean economy, as well as the economies of Argentina, Brazil, Mexico, Central America, the rest of South America, Canada, the European Union, Japan, the United States, and an aggregate rest of the world. Consequently, we are able to estimate the impact on partner and excluded countries from each of the agreements we evaluate.

The analysis of regional trade arrangements is typically conducted in the framework of trade creation versus trade diversion, under which preferential tariff reduction is welfare inferior to nonpreferential tariff reduction. Wonnacott and Wonnacott (1981) show, however, that regional trade

1. Mexico, Singapore, and, to a lesser extent, MERCOSUR, may be following the same strategy.

2. MERCOSUR is a customs union between Argentina, Brazil, Paraguay, and Uruguay. Paraguay and Uruguay are too small to be included as separate countries in the dataset we employ, so our MERCOSUR region excludes them. In a free trade area, partner countries eliminate tariffs and export taxes or subsidies against each other, but retain separate tariffs against third countries. In a customs union, partner regions adopt a common external tariff. Chile has rejected a customs union with MERCOSUR.

3. As of early 2001, Chile had reached preferential trade agreements with at least fifteen countries.

arrangements could produce more gains owing to improved market access to trading partners. That is, preferential tariff reduction results in a shift in demand toward partner countries. The exporters in partner countries receive a terms-of-trade improvement on their exports, which depends on the elasticity of supply of their exports.

This is what we mean by improved market access. Our model endogenously evaluates the impact of improved market access along with the traditional effects considered in theoretical analyses. We find that the results for the North American Free Trade Agreement (NAFTA), MERCOSUR, and the additive regionalism policy point to the crucial importance of improved market access in preferential trading areas. Taken bilaterally, we find that trade diversion costs do indeed dominate the welfare effects of these agreements unless either sufficient market access is obtained in partner countries or third-country tariffs are lowered.

The results support the view that north-south agreements (for example, Chile with the United States or the European Union) are likely to provide sufficient market access to be beneficial, while the results for our south-south agreement (Chile and MERCOSUR) suggest the opposite under the 11 percent tariff regime that Chile employed prior to 1998. The agreements that include a northern partner increase the welfare of the members of the group in aggregate; only the Chile-MERCOSUR agreement results in net losses for the members as a group.

We show that Chile would reduce trade diversion costs, and increase the net gains from all of its regional arrangements, as a result of its policy of unilaterally lowering its tariff to 6 percent. Even the agreement with MERCOSUR would be beneficial with a 6 percent external tariff.[4]

We find that Chile's additive regionalism strategy of combining free trade agreements with four regions—NAFTA, MERCOSUR, the European Union, and rest of South America—produces welfare gains for Chile many times the value of unilateral free trade if it attains tariff-free access to all these markets. This supports the theoretical insight of Wonnacott and Wonnacott (1981). The gains are dramatically reduced, however, if the most highly protected sectors in the European Union and rest of South America are excluded from the agreements. [5]

We estimate that at least one of Chile's potential partners in its additive regionalism strategy loses in all of the options we evaluate. Adding the rest of South America to its network of agreements would substantially improve Chile's preferential access and welfare, but it would significantly reduce the real income of the rest of South America, which would suffer large trade diversion losses with very little improved market access. Theory, intuition, and experience indicate that preferential arrangements are unlikely to be implemented if the partner countries do not also expect to gain. Nonetheless, the gains for Chile remain substantial relative to unilateral free trade, if it could successfully negotiate these agreements with full market access.

Excluded regions are always estimated to lose from any of the preferential arrangements we consider. Thus, when partner countries gain from preferential arrangements, they do so at least partly at the expense of excluded regions.

The gains to the world from global free trade are estimated to be between $199 billion and $456 billion per year. This vastly exceeds the gains from

4. Chile has enacted legislation that will lower its external tariff from 11 to 6 percent in stages, as suggested by our analysis. Our estimates could thus be viewed as an ex post assessment of the policy of lowering the external tariff. In fact, the vice president of the Chilean Central Bank used estimates from an earlier version of our study in his testimony before the Chilean Parliament in favor of lowering the external tariff.

5. The experience of some Mediterranean countries (namely, Morocco, Tunisia, and Turkey) in their preferential trade agreements with the European Union suggests that the highly protected agricultural sectors are likely to be excluded from such an agreement.

any of the regional arrangements. These results emphasize the continuing importance of multilateral liberalization.

We estimate that Chile would gain from the Free Trade Agreement of the Americas (FTAA) if we assume that Chile starts from a status quo of no preferential trade agreements in the Americas. However, given that several agreements in the Americas are already in place, Chile would lose preferential access to markets in the Americas, such as NAFTA and MERCOSUR. As a result the impact on Chile of the FTAA is ambiguous; it depends on how much preferential access Chile has in the markets of the Americas compared with other countries.

Since Chile starts with a relatively efficient uniform tariff of 11 percent, we estimate that it can obtain only small additional gains from improving the efficiency of its resource allocation by its unilateral reduction of its tariffs to 6 percent.[6] The reduction in the tariff to 6 percent will have greater positive impact through the reduction in trade diversion involved in the regional arrangements.

We show that when a country starts with a uniform tariff, as in the case of Chile, the gains from joining a customs union are typically reduced if the country must adopt a nonuniform structure. Conversely, the gains are likely to be augmented if joining a customs union is a movement toward uniformity.[7] In general, this result indicates that the relative uniformity of a country's preexisting tariff structure must be compared with the proposed common external tariff of any customs union on a case-by-case basis to ascertain whether welfare gains will actually be achieved.

We find that the benefits of trade liberalization or regional trade arrangements are considerably reduced if tariff revenue must be replaced by distorting alternative taxes. Similarly, our optimal tariff calculations indicate that unilateral trade liberalization can lead to lower tariff levels if efficient replacement taxes are in place.[8]

When there is an optimal tariff, as in this model, the amount by which a country can reduce its tariff is limited by the distortions of the replacement tax. Consequently, we produce an updated estimate of the collected VAT rates by sector in Chile.[9] This exercise shows that Chile can reduce its legal VAT rates to about 50 percent of present levels and improve its welfare by 0.3 percent of GDP if it were able to eliminate evasion and collect the VAT uniformly.[10] These gains are significant when compared with unilateral trade liberalization options. We find that the optimal tariff in Chile is almost doubled under the current VAT collection rates, compared with a VAT that collects taxes at equal rates across sectors.

We perform systematic sensitivity analysis for the scenario of Chile forming a free trade agreement with NAFTA and imposing a 6 percent tariff. Based on our sample of 3,500 simulations, we conclude that our result is

6. This conclusion ignores dynamic gains from trade liberalization, which could lead to much larger gains.

7. Two other countries with uniform tariffs that may install the nonuniform tariff structure of a customs union are the Kyrgyz Republic and Estonia. The Kyrgyz Republic has a uniform tariff of 10 percent and has, in principle, agreed to join in a customs union with Russia, Belarus, and Kazakhstan. The Kyrgyz have not implemented the common external tariff, however, because of fears of the costs of the nonuniformity of the Russian tariff, which is the present common external tariff. See Michalopoulos and Tarr (1997) for details. Estonia has a uniform tariff of zero and is one of the five transition economies the European Union has designated as candidates for accession. Estonian authorities have considerable concerns, however, about the costs of imposing the European Union's common external tariff, especially in the highly protected sectors.

8. With low elasticities, however, an adverse terms-of-trade effect mitigates the welfare gains from reduced costs of trade diversion.

9. See Harrison, Rutherford, and Tarr (1997c).

10. e also eliminate the output tax that applies primarily to energy and beverages and tobacco.

robust to plausible uncertainty about the key elasticities of the simulation model.

Our analysis focuses on the impact of tariff changes in goods markets, which is the traditional focus of theoretical and applied analysis of regional trade arrangements. Regional arrangements may include other elements that we ignore, such as commitments to foreign investors in services sectors and the dynamic impacts of technology transfer.

The following section describes the model and data. Section 2 then presents and explains the policy results for Chile. Section 3 examines the impact on partner and excluded countries of Chile's agreements, as well as the impact of global free trade. In section 4 we present the results of our systematic sensitivity analysis, and the final section concludes.

1. A Multiregional Trade Model

The quantitative model developed to evaluate the trade policy options facing Chile is multiregional and multisectoral. It explicitly includes eleven regions or countries, with twenty-four sectors in each region or country.[11] The general specification of this model follows our earlier multiregional model of the effects of the Uruguay Round.[12] The most important differences are the inclusion of data for Chile, updated tariff rates for Argentina and Brazil, and more recent data for all other regions. We adopt a multiregion model, rather than a small open economy model, since we need to consider the possible effects on Chile of a reduction in Chile's import tariffs on other MERCOSUR members. Crucially, we also need to account for the market access effects on Chilean exports of a reduction of import tariffs by MERCOSUR, NAFTA, or other regions with which Chile establishes a free trade agreement, either separately or collectively.

The general theory of the welfare effects of preferential trading arrangements allows for the impact of changes in partner country tariffs on the home country's terms-of-trade.[13] Some empirical approaches to evaluating preferential trading arrangements ignore such impacts, however.[14] Our framework allows us to explicitly evaluate the importance to Chile of improved market access to regions such as MERCOSUR and NAFTA, as well as losses Chile may suffer as partner countries raise export prices to Chile.

An important feature of the Chilean economy is that its tariff rate is a uniform 11 percent across all traded sectors. The exception to this is the variable levy system for wheat, sugar, and edible oils. Estimates reveal that the variable levy system has resulted in an average level of protection for

11. The eleven countries or regions are Argentina, Brazil, Chile, the rest of South America, Central America and the Caribbean, Mexico, Canada, the United States, the European Union (an aggregate of fifteen countries), Japan, and the rest of world. The twenty-four sectors are wheat; other grains; nongrain crops; meat products; milk products; other food products; beverages and tobacco; wool and other livestock; textiles, apparel, and leather products; chemicals, rubber, and plastics; fishing; forestry; lumber and wood; pulp and paper; energy products; mineral products; primary ferrous metals; nonferrous metals; fabricated metal products; machinery and equipment; transport industries; trade and transport services; other services; and a savings good.

12. Harrison, Rutherford, and Tarr (1997b). The website DMSWEB.BADM.SC.EDU/GLENN/UR_PUB.HTM provides access to the model and related publications.

13. See Wooton (1986); Harrison, Rutherford, and Wooton (1989, 1993).

14. An example is the approach adopted by Bond (1996). He develops a simple general equilibrium specification of the effects on Chile of these preferential trading arrangements, with an impressive level of detail with respect to tariff data. His results for Chile joining NAFTA, however, differ significantly from ours because his CGE model does not incorporate the impact on Chile of access to NAFTA markets.

these three products in excess of 11 percent.[15] We chose to ignore the variable levy system, as it would slightly bias downward our estimated gains from unilateral trade liberalization. Harrison, Rutherford, and Tarr (1997c) describe the key data that are important in the analysis.

Argentine tariffs are virtually identical to Brazilian tariffs. In the case of the United States, the tariff estimates include the tariff equivalents of the nontariff barriers, which are quite important in sectors with high tariffs. If Chile forms a free trade area with MERCOSUR or NAFTA, Chilean exporters will not face these tariffs, whereas outside exporters to these regions will. These data are thus crucial in assessing the value of the increased access that Chile might obtain from MERCOSUR and NAFTA.

We have also estimated the rates of collected value-added tax in each industry and the tax on gross output. These rates were estimated using procedures explained in Harrison, Rutherford, and Tarr (1997c, appendix A). The different VAT rates across sectors arise mainly because of evasion of the VAT. The two largest sectors in Chile—the trade and transport services sector and the other services sector—together account for 61 percent of value-added, yet they are the sectors with the lowest rate of collected VAT (about 3 percent as opposed to about 17 percent for most of Chilean manufacturing).

1.1 Formal Specification of the Model

The general specification of the model follows our earlier work on the Uruguay Round. We concentrate here on what we call our base model, which is static and assumes constant returns to scale. Except for the fact that imports and exports are distinguished by many regions, the structure of the model within any country is very close to the basic model of de Melo and Tarr (1992); the interested reader may consult their chapter 3 for a detailed explanation of the equations.

Briefly, production entails the use of intermediate inputs and primary factors (labor, capital, and land). Primary factors are mobile across sectors within a region, but they are internationally immobile. We assume constant elasticity of substitution (CES) production functions for value added, and Leontief production functions for intermediates and the value-added composite. Output is differentiated between domestic output and exports, but exports are not differentiated by country of destination.

Each region has a single representative consumer who maximizes utility, as well as a single government agent. In Harrison, Rutherford, and Tarr (1997c, appendix C), we formally characterize the demand structure and elasticities that are critical to the results. Demand is characterized by nested CES utility functions for each agent, which allow multistage budgeting. Demand at the top level, for the composite Armington aggregate of each of the twenty-four goods, is Cobb-Douglas. Consumers first choose how much of each Armington aggregate good to consume, such as wheat, subject to aggregate incomes and composite prices of the aggregate goods. The Armington aggregate good is, in turn, a CES composite of domestic production and aggregate imports. Consumers decide how much to spend on aggregate imports and the domestic good subject to the prior decision of how much income will be spent

15. The variable levy system is applied by examining monthly prices over the previous two and a half years for wheat and fifty months for sugar. The distribution is truncated at the top and the bottom by an equal percentage (about 15 percent). The range of the resulting truncated distribution determines the upper and lower bounds. A tariff surcharge or reduction of the tariff below the 11 percent rate is applied if the price in the present month is below or above the bounds. Since the system is not based on a domestic support price, its impact varies enormously from year to year. Valdés (1996, p. 55) estimates that between 1985 and 1995, the nominal protection rate for sugar ranged from 6 to 98 percent, and the nominal protection rate for wheat ranged from 45 to –10 percent (see also Quiroz and Valdés, 1993).

on this sector, and preferences for aggregate imports and domestic goods are represented by a CES utility function. Finally, consumers decide how to allocate expenditures across imports from the ten other regions based on their CES utility function for imports from different regions and income allocated to consumption on imports from the previous higher level decision.

Data and elasticities

Except for tariff data and the domestic tax data, the data employed to calibrate the model come primarily from the Global Trade Analysis Project (GTAP) database documented in Gehlhar and others (1996). We use the preliminary release of version 3 of this database, current as of May 1996. The eleven-region version of the model retains all regions of the GTAP database that are directly relevant to our policy simulations. The full GTAP database contains thirty-seven sectors.[16]

We generally assume that the lower-level elasticity of substitution between imports from different regions, σ_{MM}, is 30 and that the higher-level elasticity between aggregate imports and domestic production, σ_{DM}, is 15. We refer to these values as our central elasticities. Some econometric studies, such as Reinert and Roland-Holst (1992) and Shiells and Reinert (1993), suggest values that are lower than these. However, Reidel (1988) and Athukorala and Reidel (1994) argue that when the model is properly specified, the demand elasticities are not statistically different from infinity; their point estimates are close to the central elasticity values we have chosen. Moreover, elasticities would be expected to increase over time. This model presumes an adjustment of about ten years, a rather long period in the context of these econometric estimates.

A value of $\sigma_{MM} = 30$ means that if Chile tried to raise its prices by 1 percent on world markets relative to an average of aggregate imports, Chilean imports would decline relative to aggregate imports by 30 percent. Given that some economists may prefer lower elasticity estimates, we also perform most of our important policy simulations with $\sigma_{MM} = 8$ and $\sigma_{DM} = 4$. We refer to these as our low elasticities. A high elasticity scenario for a small open economy such as Chile would be a specification with still less market power for exports, such as would occur within the popular theoretical models of international trade where goods are homogeneous.

The output elasticity for each sector is not specified exogenously, but is determined endogenously from other parameters and data in the model. That is, each firm maximizes profits subject to its production function and input costs under constant returns to scale. An increase in the relative price of its output induces an output expansion, the elasticity of which depends on how fast its costs increase with an expansion of output. Analogous to the Armington assumption on imports, we assume that domestic output and exports are differentiated. The elasticity of transformation between exports and domestic production is assumed to be about four for each sector. Higher transformation elasticities would increase the elasticity of export supply. Elasticities of substitution between primary factors of production are taken from Harrison, Jones, Kimbell, and Wigle (1993) and generally reflect econometric estimates for the United States. These estimates are relatively low for primary goods, around unity for manufacturing goods, and elastic for

16. When we aggregated to twenty-four sectors, we ensured that sectors with significant rates of protection (in the principal trading partners of Chile) were retained as individual sectors. That is, we aggregated sectors that are not important in trade or that have low rates of protection. Aggregation can significantly change the results in applied trade policy analysis, but this type of aggregation results in quite small aggregation bias.

tertiary goods. We assume fixed coefficients between all intermediates and value added.

Distortions

All distortions are represented as ad valorem price wedges. Border protection estimates combine tariff protection and the tariff equivalents of nontariff barriers. For Brazil and Argentina, these data were estimated by Reincke in Harrison, Rutherford, and Tarr (1997c, appendix B). Otherwise these data are taken from the GTAP database. They are presented in Harrison, Rutherford, and Tarr (2001, table 9). Other distortions include factor taxes in production, value-added taxes, export subsidies, voluntary export restraints (represented as ad valorem export tax equivalents). These are also taken from the GTAP database, except for domestic distortion data in Chile. The latter were estimated for this exercise by Soloaga in Harrison, Rutherford, and Tarr (1997c; appendix A). Lump-sum replacement taxes or subsidies ensure that government revenue in each region stays constant at real benchmark levels. For Chile, however, we capture the marginal efficiency cost of the government having to raise extra revenues through a distortionary domestic tax system. For developing countries these costs could be quite significant, since the revenue losses from trade reform could be sizeable.

Solution algorithm

The model is formulated using the GAMS-MPSGE software developed by Rutherford (1999) and solved using the PATH algorithm of Ferris and Munson (2000). Although the model has 11 regions and 24 sectors, and is large by historical standards, it is smaller than our Uruguay Round model. Use of demand elasticities as high as those we employ could pose numerical problems in general, but this model solved without difficulty.

2. Policy Results for Chile

We begin this section with a discussion of how Chile might replace the revenue it will lose from lowering its tariffs and the welfare implications of the different options. We then discuss the results regarding the preferential trade area policy options. Subsequently, we consider how Chile could use unilateral tariff reduction to optimize its trade policy. Finally, we examine the effects of Chile’s strategy of additive regionalism.

2.1 The Role of the Replacement Tax

Chile reduces tariffs in most of our scenarios, which causes a revenue loss to the government. We impose an equal-revenue requirement in all simulations and stipulate explicitly how the additional tax revenue is to be generated. We employ either the existing VAT, a uniform VAT, or a lump-sum tax.

Welfare effects of the replacement tax

Collection of the existing VAT is not uniform in Chile. According to the estimates in Harrison, Rutherford, and Tarr (1997c, table 3), it ranges from 0 to 18 percent across sectors. Raising revenue through the VAT therefore generates distortions: when the VAT is increased, resources move into less highly taxed sectors. This reduces any possible gains from the trade policy

change. Results for welfare using the existing VAT are presented in column 1 of table 1.

[table 1 about here]

We estimated the marginal cost of public funds of the existing VAT in Chile to be equal to 7.6 percent. This implies that consumers and producers have to be taxed 1076 pesos for the government to receive 1000 pesos. The 76 pesos are a welfare loss to the Chilean economy. We also calculated the marginal cost of public funds of the Chilean tariff; it equals 18.5 percent. Despite the fact that the tariff is uniform across sectors—and thus imposes no intersectoral distortion costs—the Chilean tariff imposes a higher distortion cost than the VAT because the tariff favors domestic production over imports.

In column 5 of table 1 we show the results of employing a lump-sum tax as the replacement tax. This tax avoids the distortions of a nonuniform VAT, since consumer income is taxed in a fixed amount independently of consumer choices. Hence, the revenue replacement tax instrument has no resource allocation effects. The results show that the VAT implies an added welfare cost relative to the lump-sum alternative.

Finally, column 3 of table 1 presents the results of using a uniform VAT. In these scenarios we first counterfactually create an equilibrium in which all other domestic taxes and subsidies are zero and the VAT is uniform. The impact we evaluate is then solely due to the trade policy change. Since all sectors are taxed and there is no labor-leisure choice, it is not possible to take an action that lowers the tax. In other words, there are no resource allocation effects and the uniform VAT is essentially equivalent to a lump-sum or distortionless tax in our model. In addition, any second-best interaction effects of distortions between the tariff and the existing VAT are removed if we start with a uniform VAT and no other distortions (for this reason the results for the lump-sum tax and the uniform VAT may differ). In these scenarios we equalize the VAT across sectors and solve for the level of the VAT that is required to compensate for the lost revenues.

Revenue effects

In column 2 of table 1, we present the equiproportional increase in the VAT required to keep government revenue constant. For example, assuming central elasticities, a free trade area with MERCOSUR would require a 45 percent increase in the VAT rate across sectors. If the collected VAT rate is 10 percent in a sector, the collected VAT rate would have to increase to 14.5 percent. With central elasticities, there is a strong substitution away from imports that pay tariffs in favor of imports from partner countries that are tariff free. The revenue requirements for the VAT are quite high in this case to compensate for the lost tariff revenues. With low trade elasticities, the revenue requirement for the VAT is much smaller: increases range from 17 to 26 percent in the three basic preferential trade arrangement scenarios presented in rows 1 through 3.

Columns 4 and 7 show tariff revenues collected in the new equilibrium as a percentage of GDP. In our initial equilibrium, tariff revenues are equal to about 3.6 percent of GDP, but they fall to between 0.9 and 2.7 percent of GDP in the preferential trade area scenarios (rows 1–3). This implies that tariff revenues drop to between 25 and 75 percent of original tariff revenues. The loss of tariff revenue is higher with NAFTA (because NAFTA is a larger share of Chilean imports than MERCOSUR) and higher with central elasticities (because of the greater trade diversion). The VAT revenues initially constitute about 9 percent of GDP. Depending on the preferential trade area and elasticities, the tariff loss is between 0.9 and 2.7 percent of GDP. Hence, if the VAT were employed as the replacement tax, it would be necessary for VAT revenues to increase by about 10 to 30 percent.

Some may question whether the implied increase in the VAT is too high. To provide intuition for the model implications for the VAT, we consider a particular scenario in which the lost tariff revenue is about 2.5 percent of GDP, as in row 6 with central elasticities. It is estimated in table 1 that the VAT rate would have to increase by 45 percent to a legal rate of about 26 percent. In 1994 the legal VAT rate of 18 percent generated VAT revenues of about 9 percent of GDP, so the legal rate was twice the collected rate. If we assume that the rate of VAT evasion does not change, then the VAT must be raised by 5 percent to generate 2.5 percent of GDP (that is, from 18 to 23 percent).

The model, however, predicts a required increase of the legal VAT rate to 26 percent, not 23 percent, because an increase in the tax would induce a shift away from the highly taxed sectors, together with an erosion of the tax base. Given our model parameters, increases in the VAT continue to generate additions in revenue within the range under consideration, but evasion of the VAT could potentially increase. The required legal VAT rate would then increase and the distortion costs of revenue replacement would be still higher than we have estimated—or perhaps it is not feasible to generate considerably more revenue from the VAT without further reform in collection procedures.[17]

The revenue impact estimates depend heavily on σ_{MM}, the elasticity of substitution between imports from different regions.[18] The estimated change in tariff revenue is considerably smaller in the low elasticity case.

Given the uncertainties over rates of evasion of VAT in Chile, these estimates should be taken as indicative of revenue requirements rather than as precise recommendations for the VAT rate. In fact, we emphasize the importance of uniformity of collections below.

2.2 Preferential Trade Area Options

The overall welfare results for the trade policy options are presented in table 1. More detailed results on output, imports, and exports for the main scenarios, with central elasticities, may be found in Harrison, Rutherford, and Tarr (1997c). Welfare impacts are presented as a percent of Chile's GDP. They represent changes on a recurring, annual basis, so a 1 percent welfare gain should be interpreted as a 1 percent increase in real income each year in the future.

In the first row of table 1, we present the results from the scenario in which Chile forms a free trade area with MERCOSUR. We assume that each of the MERCOSUR countries represented in the model (Argentina and Brazil) reduces its tariffs, export subsidies, or taxes on their trade with Chile to zero and that Chile does the same for its trade with MERCOSUR. Chile does not adopt the common external tariff of MERCOSUR in this scenario.

17. To quantify these ideas, we simulated Chile's free trade area with MERCOSUR and NAFTA, where we assume that the collected VAT rates in the services and trade and transportation sectors cannot be increased owing to evasion. These sectors have low rates of VAT collection, and evasion of the VAT may prevent additional collections. Together they produce about 65 percent of Chilean value-added. With central elasticities, the welfare loss in this case from the free trade area with MERCOSUR is increased to –0.60 percent of GDP and the gains from the free trade area with NAFTA are reduced to 0.12 percent of GDP. As expected, the required rate of VAT increase jumps to about 75 percent.

18. The elasticity of substitution between domestic goods and aggregate imports, σ_{DM}, plays a relatively less important role in the revenue impact estimates. The preferential tariff reduction lowers the tariff-ridden composite price of imports and results in an increase in the quantity demanded of composite imports. This would imply additional tariff revenue from additional partner country imports. But the substitution effect between imports of different varieties dominates when we raise both elasticities.

The second scenario, shown in row 2, represents Chile joining MERCOSUR as part of the customs union. In addition to the requirements of the scenario in row 1, Chile adopts the common external tariff of MERCOSUR. Chile has not joined the MERCOSUR customs union and has no plans to do so, but we evaluate this scenario because it is a potential policy option. For simplicity, we assume that the common external tariff that Chile adopts is the import tariff structure that Brazil currently has with the countries that are not in MERCOSUR.[19]

The third scenario, in row 3, is Chile forming a free trade area with NAFTA. In row 4, primarily to help understand the results, we evaluate the consequences of a free trade agreement between Chile and NAFTA in which Chile does not obtain improved access to the NAFTA market. After discussing these scenarios, we introduce further simulations to help explain the results and evaluate modified options.[20]

The effects on welfare are dependent both on how Chile chooses to replace the lost tariff revenues and on assumed elasticities. Chile's preferential trade policy options with MERCOSUR lead to a loss of welfare with our preferred central trade elasticities and negligible gains or losses with low trade elasticities. The trade diversion costs of an agreement with MERCOSUR typically dominate the trade creation effects under central trade elasticities. Moreover, based on the MERCOSUR external tariff, preferential access to the MERCOSUR markets is insufficient to overcome this welfare loss in Chile's markets. Welfare losses are lower with lower assumed elasticities because there is less trade diversion when Chile's consumers are less willing to substitute MERCOSUR's products for those of the rest of the world.[21]

The results indicate that the customs union with MERCOSUR is an inferior outcome for Chile relative to a free trade agreement with MERCOSUR. MERCOSUR's tariff structure is diverse compared with Chile's uniform tariff. Since the welfare costs of trade restrictions tend to increase disproportionately with the height of the tariff, Chile is better off with its own uniform tariff than with the common external tariff of the customs union.[22] That is, part of the costs to Chile of joining a customs union with MERCOSUR derive from the loss of tariff uniformity. One advantage of a free trade agreement for Chile as opposed to a customs union is that only the customs union requires the adoption of a common external tariff.

---

19. This tariff structure is slightly different than the tariff structure shown for Argentina, for two reasons. First, there are exceptions to the common external tariff for Argentina and Brazil, as both countries continue to adapt their tariff schedules over time to the agreed common external tariff. Second, Argentina and Brazil could well have adopted exactly the same common external tariff at a detailed tariff-line level, but have different trade shares across these tariff lines. With the different trade weights, the rates that appear in the GTAP database at the twenty-four sector level reflect differences in these trade patterns, and need not reflect differences in the common external tariff at the detailed tariff-line level. For ease of comparison, we also assume in our "Chile customs union with MERCOSUR" scenario that Argentina adopts the tariff of Brazil as its common external tariff. This provides a clean representation of the MERCOSUR customs union for our purposes.

20. Higher elasticities result in higher gains for the free trade agreement with NAFTA, but lower elasticities are better for the free trade agreement with MERCOSUR. The reason is that there is a welfare tradeoff with higher elasticities: they result in greater trade diversion costs in both agreements, and they result in increased gains from improved market access. The NAFTA market is much larger, however, and the value of improved market access is worth more in the NAFTA case than the increased trade diversion costs. The opposite is true for MERCOSUR.

21. These results are consistent with Donoso and Hachette (1996) and Muchnik, Errázuriz, and Domínguez (1996). Based on the results of Muchnik, Errázuriz, and Domínguez (1996), who focus on agriculture, Donoso and Hachette (1996) estimate that access to the MERCOSUR market would not offer significant gains to Chile. See also Valdés (1995) and Schiff and Sapelli (1996) for other views.

22. Ramsey-optimal tariffs vary inversely with the elasticity of demand. Typically, however, departures from uniformity do not conform with Ramsey-optimal rules, but rather with political economy considerations (see Panagariya and Rodrik, 1993).

In comparing our results in rows 1 through 3 regarding Chile's preferential trade area options, the most important result is that the free trade area with NAFTA is beneficial to Chile while the other options are likely to present problems.[23] In order to ascertain the source of the gain to Chile from a free trade area with NAFTA, we performed the simulation in row 4 in which Chile lowers its tariffs against imports from NAFTA countries but does not obtain improved access in NAFTA markets. Although this is not a policy option that Chile would adopt, the results of row 4 show that Chile loses from preferential reduction of its tariffs against NAFTA countries without reciprocal access to NAFTA markets, since the trade diversion dominates the trade creation.[24] Chilean access to the United States market in nongrain crops (for which the tariff rate is 20 percent) is especially important.[25]

These results demonstrate the importance of improved access emphasized by Wonnacott and Wonnacott (1981). Our results show that Chile can gain more from a free trade agreement with NAFTA than it can from global free trade. Chile can expect to lose, however, from any of the preferential trade agreements we consider if access to partner country markets does not improve.

The importance of low, uniform tariffs

These results differ from several earlier numerical evaluations of preferential trading areas (for example, see Rutherford, Rutström, and Tarr, 1997; Harrison, Rutherford, and Tarr, 1997a). We speculate that part of the reason that trade diversion dominates trade creation in these estimates is that Chile has a low, uniform tariff. That is, the implementation of a preferential trade agreement in a country that starts with a dispersed tariff structure may result in a reduction in the dispersion of the tariff structure. Potential benefits from a reduction in tariff dispersion, however, are ignored in more aggregated analyses of preferential trade arrangements.[26]

---

23. Coeymans and Larraín (1994), Reinert and Roland-Holst (1996), and Hinojosa-Ojeda, Lewis, and Robinson (1995) also find that Chile would gain from a free trade area with NAFTA.

24. We performed an analysis with MERCOSUR similar to the simulation in row 4 for NAFTA. The impact with lump-sum tax replacement is also 0.83 percent of GDP. The trade creation and trade diversion effects are thus about the same for the agreement between MERCOSUR and NAFTA.

25. Although the GTAP database indicates that the U.S. tariff on nongrain crops is 47 percent, we lowered this to 20 percent in our benchmark equilibrium for two reasons. First, we prefer updated estimates where possible. The most important nongrain crop products for Chile are fruits and vegetables, and post–Uruguay Round tariff rates for these products in the U.S. market are the relatively modest figures cited below. The higher protection estimates for these products in the GTAP database, averaging 56 percent, were derived from an average of protection estimates in the 1989–1994 period. Second, the U.S. protection on these products varies with the season. We have assumed that Chilean fruits and vegetables would typically face U.S. tariffs that are in the low range of the seasonal tariffs applied by the United States, when they are ready for harvest and export to the United States. Products included in the nongrain crops category of the GTAP database, along with the estimated tariff and tariff equivalent of the nontariff barrier in the United States, are as follows: sugar, 67 percent; oilseeds, including peanuts, 25 percent; coffee, cocoa, and tea, 0 percent; cotton, 31 percent; vegetables (fresh, 0–25 percent; frozen, 17.5–25.0 percent; dried, 25–35 percent; prepared and preserved, 13.6–14.7 percent); fruits (fresh, 0–20 percent; dehydrated, 0.6–2.2 percent; frozen, 0.7–14.0 percent; juices, 0–31.3 percent; jams and pastes, 7.0–35.0 percent; canned, 1.9–20.0 percent); and other nonfood crops (tobacco, jute, and so forth), 19 percent. The reduced estimates are closer to the estimates of Butelmann and Meller (1995, p. 376), who report that Chilean fresh, frozen, and canned vegetables face most-favored-nation tariff rates in the United States ranging from 9.5 to 17.5 percent, with a reduction of a few percentage points for the former two categories where GSP treatment applies, and that Chilean fruits face U.S. most-favored-nation tariffs from 1 to 10 percent.

Since U.S. protection in milk products is also high, we examined the impact of denial of improved access in NAFTA markets for Chilean products on both nongrain crops and milk products. Chile exports very few milk products, however, so the welfare result was only slightly more adverse for Chile (–0.60 percent of GDP with central elasticities and existing VAT replacement) relative to denial of Chilean access in nongrain crops alone.

26. Further theoretical work into the generality of the impact of preferential arrangements on uniformity would be valuable. In our model elasticities are equal across sectors, so the

To verify this intuition, we counterfactually created an initial equilibrium in which Chile applies a 22 percent tariff on one-half of its imports and a zero tariff on all others; it then implements the policy scenarios in rows 1 through 4 of table 1, with existing VAT replacement and central elasticities. The sectors with the high tariffs were selected at random, and the experiment was repeated 206 times. The means of the distributions for welfare as a percent of GDP are as follows: free trade area with MERCOSUR, –0.56 percent; customs union with MERCOSUR, –0.44 percent; free trade area with NAFTA, 1.47 percent; and free trade area with NAFTA but without improved access, –0.52 percent.

The gains from the free trade area with NAFTA are significantly larger when based on the hypothetical nonuniform initial tariff structure. Similarly, the losses from the free trade area with MERCOSUR are slightly smaller, reflecting a movement toward uniformity. Losses from a preferential reduction of tariffs toward the NAFTA markets remain, however, if not accompanied by improved access to the NAFTA market. These numerical results are consistent with the theoretical results of Hatta (1977), who finds that countries benefit from moving toward uniformity by simultaneously lowering the highest tariff and raising the lowest tariff.

In this hypothetical experiment, the ranking of the customs union with MERCOSUR versus the free trade area with MERCOSUR is reversed compared with the actual situation represented by table 1. Although Chile still loses from both preferential trade agreements with MERCOSUR, the customs union produces smaller losses than the free trade area because the common external tariff of MERCOSUR is more uniform than the hypothetical Chilean tariff. In the actual situation of table 1, the customs union with MERCOSUR represents a movement away from uniformity.

2.3 Optimizing Chile’s Trade Policy Options

We know from theory that Chile can reduce the trade diversion costs of preferential trade areas if it lowers its external tariff. A number of economists thus recommend that Chile reduce its external tariff in conjunction with establishing free trade agreements.[27] In rows 5 and 6, we evaluate the two free trade area options with a simultaneous reduction of the tariff to 6 percent. In rows 7 and 8, we examine the impact of lowering the external tariff to 8 percent and 6 percent, respectively, on a multilateral basis. We consider global free trade in row 9.

Chile may have a low optimal tariff despite being a small country, for the following reason. If Chilean exports are differentiated from the products of other countries so that Chile in aggregate faces a downward sloping demand curve for a product, even if individual Chilean producers do not perceive a downward sloping demand curve, then there is an optimal export tax that maximizes Chilean export profits. The height of the optimal export tax is inversely related to the elasticity of demand faced by Chile in its export markets, which is in turn determined by how substitutable Chile’s products are with those of other countries.[28] In the limit, when Chilean products are perfect substitutes for products from all other countries in all its export

---

Ramsey-optimal tariff is uniform. A useful exercise would be to evaluate the impact of a preferential trade arrangement, in which we start from randomly selected elasticities across sectors and see how often Chile gains from preferential trade agreements as we use a large number of distinct sets of elasticities.

27. For example, Schiff (1996); Corbo (1996); Leipziger and Winters (1996).

28. Individual competitive firms price at their marginal costs, but since the country as a whole must accept a lower price to sell more, there is an optimal export tax that equates the marginal revenue received from exports with the marginal costs. The more elastic the demand, the lower the optimal export tax.

markets, Chile has no ability to obtain a higher price by restricting its exports. In this case, the optimal export tax is zero.

Chile imposes virtually no export taxes, but the Lerner symmetry theorem shows that equilibrium import tariffs are generally equivalent to export taxes. The import tariff taxes all export sectors roughly uniformly. Market power on exports differs across sectors and destination markets, however, when the economy is characterized by many export sectors and product differentiation. Consequently, the import tariff is not as efficient an instrument as export taxes varied by sector and destination. Nonetheless, if export taxes are ruled out, there is a positive optimal import tariff. Given the existence of an 11 percent uniform tariff, we investigate both theoretically and numerically whether the optimal tariff is above or below the existing 11 percent tariff.

In our central elasticity scenarios, we assume that all countries have an elasticity of substitution between imports from different countries (σ_{MM}) equal to 30. We show in Harrison, Rutherford, and Tarr (1997c, appendix C) that the optimal tariff t^* is bounded below by

$$t^* = \left(\frac{\sigma_{MM}}{\sigma_{MM} - 1} \right) - 1 .$$

Thus, even with σ_{MM} = 30, the optimal tariff is over 3 percent, whereas it is over 14 percent in our low elasticity scenarios, with σ_{MM} = 8.

The preferential trade options in rows 5 and 6 generate the expected increase in the estimated welfare gains relative to rows 1 and 3, respectively. With central elasticities, welfare improves significantly compared with an 11 percent external tariff. With low elasticities, the adverse terms-of-trade effect of reducing tariffs mitigates the welfare gain from reducing the trade diversion costs. These results show that as long as Chile limits itself to a free trade area, it can profit from the increased access it obtains in its partner countries without excessive trade diversion costs, provided it lowers its external tariff sufficiently. In particular, the results in row 5 show that the free trade agreement with MERCOSUR can be expected to yield benefits when the external tariff is lowered to 6 percent. On the other hand, a comparison of rows 5 and 6 shows that an agreement with NAFTA is worth a lot more than one with MERCOSUR, largely as a result of the superior market access of NAFTA.[29]

Rows 7 and 8 present our estimates of the welfare and replacement tax implications for Chile of unilaterally lowering its external tariff to 8 percent and 6 percent, respectively. With central elasticities and distortionless domestic taxes (either a lump-sum tax or a uniform VAT), unilateral reduction of the tariff to 8 percent increases welfare, and further gains are achieved from reducing tariffs from 8 percent to 6 percent. With the existing VAT as the replacement tax, reducing the tariff to 8 percent increases welfare. However, the distortion costs of the VAT are sufficiently high that, when combined with the small adverse terms-of-trade effects, no further gains are generated by reducing the tariff below 8 percent. With a distortionless replacement tax, reduction of the external tariff to zero produces positive welfare gains compared with the 11 percent tariff (row 9). The gains are less than in the case of reduction to 6 percent

29. These additional gains to Chile with a 6 percent tariff from a free trade agreement with either MERCOSUR or NAFTA derive primarily from the reduction in trade diversion costs, rather than from moving the tariff closer to an optimal tariff. This follows because the unilateral gains are only about 0.1 percent of GDP, whereas the preferential trading arrangements are worth about 0.8 percent of GDP more with the lowered external tariff.

(row 8), which indicates that the optimal tariff is between 0 percent and 6 percent.[30]

There is thus some limited scope for beneficial tariff reduction under existing VAT replacement and central elasticities. With higher elasticities, the optimal tariff is lower and the gains from tariff reduction greater.

2.4 Sectoral Impacts

In Harrison, Rutherford, and Tarr (1997c, tables 6 and 7), we present the impacts on output, exports, and imports at the twenty-four-sector level of three of the principal trade policy options: the free trade area with MERCOSUR, the free trade area with NAFTA, and unilateral reduction of the tariff to 8 percent. Here we focus on the percentage change in output under central elasticities. The sectors that expand significantly under the free trade agreement with MERCOSUR are transportation equipment (dramatically), machinery and equipment, iron and steel, and milk.[31] In the case of the free trade agreement with NAFTA, the sectors that expand more than 10 percent are iron and steel, transportation equipment, milk, nongrain crops, and textiles. With unilateral tariff reduction, the expanding sectors are transportation equipment, iron and steel, and, to a lesser extent, nonferrous metals and mining.

Iron and steel and transportation equipment expand under all three trade policy options, but the other expanding sectors differ. Iron and steel and transportation equipment are both small sectors in Chile; each sector produces less than 1 percent of Chilean value added. However, these are the two sectors that export the most intensively: both export over 90 percent of their output. Preferential or multilateral tariff reduction induces a depreciation of the real exchange rate, which makes exporting more profitable and gives a boost to sectors that export intensively.

With unilateral tariff reduction, the other sectors that expand (nonferrous metals and mining) also export a high percentage of their output. The real exchange rate impact and export intensity thus explain well the pattern of expanding and contracting sectors with unilateral nondiscriminatory tariff reduction.

Under a free trade agreement with NAFTA, textiles, milk, and nongrain crops expand, in addition to the two or three most export intensive sectors, because the former three sectors obtain a substantial improvement in their terms-of-trade in the U.S. market. As discussed earlier, improved access to nongrain crops and milk is crucial to an improvement in Chilean welfare from NAFTA, and these sectoral results are consistent with those welfare results.

Finally, the free trade agreement with MERCOSUR triggers an expansion of machinery and equipment and milk, in addition to transportation and iron and steel. Our data indicate that the former two sectors are among the most highly protected in MERCOSUR. These sectors obtain relatively greater improvement in their terms-of-trade after implementation of a free trade agreement with MERCOSUR, which induces their expansion.

30. These are the results that the vice president of the Central Bank of Chile employed in his presentation before the lower house committee of the Chilean Parliament when he argued for a reduction of the tariff to 6 percent. In fact, we have separately calculated the optimum tariff with central elasticities at between 3 and 4 percent, and with the low elasticities about 14 percent, assuming lump-sum replacement of tariff revenues in each case.

31. Although the expansion of transportation equipment is dramatic in percentage terms, it is starting from a very small base. Thus the absolute increase is plausible.

2.5 Additive Regionalism

Butelmann and Meller (1995) articulate the Chilean government's strategy: to negotiate bilateral free trade agreements with MERCOSUR, NAFTA, and all of its significant and willing trading partners, including the European Union and the rest of South America.[32] They argue that this strategy progressively lowers the effective average tariff, successively reduce trade diversion costs, and, crucially, help to ensure stability of access to the markets of partner countries. The free trade agreement between Chile and Canada in late 1996, in which both countries agreed to eschew antidumping actions against each other, is regarded as a notable example of the advantages that the bilateral approach offers. An opposing view within Chile is offered by Donoso and Hachette (1996). They argue that the limited market access of bilateral agreements with southern countries (for example, MERCOSUR) is not worth delaying the benefits of opening up unilaterally, although agreements with the large markets of the United States, the European Union, or Japan would be worthwhile. Moreover, they fear that the MERCOSUR arrangement may restrict broader liberalization.

In table 2, we present estimates of the gains to Chile of progressively adding free trade agreements, where we use our central elasticities and a lump-sum tax as the replacement tax. Columns 1 and 2 are reproduced from the estimates in table 1. Column 3 shows that although the MERCOSUR agreement independently results in losses to Chile, it has a positive rather than negative impact when combined with an agreement with NAFTA. The reason is that competition from NAFTA producers greatly reduces the extent and impact of trade diversion.[33] Column 4 of row 1 shows that combining agreements with NAFTA and MERCOSUR with an agreement with the European Union results in a large increase in the gains to over 5 percent of GDP. Finally, adding a free trade agreement with the rest of South America results in gains of 8.4 percent of GDP. These are enormous estimated gains for a constant-returns-to-scale model. In the last column of row 1, we exclude the United States from the agreement. This has only a small negative impact on Chile since the country obtains such substantial preferential access in the other markets.

[table 2 about here]

Critics of the government's strategy argue that it is unrealistic to assume that the European Union would grant tariff-free access in its highly protected agricultural products as part of a free trade agreement with Chile. The European Union has steadfastly refused to do so in its association agreements with the Central and Eastern European countries and in its free trade and customs union agreements with Mediterranean countries such as

32. The percentage share of Chile's aggregate exports (imports) for its most significant trading partners are: the European Union, 32 percent (23 percent); Japan, 17 percent (10 percent); the United States, 14 percent (25 percent); Brazil, 5 percent (7 percent); Argentina, 5 percent (6 percent); and the rest of South America, 5 percent (5 percent).

33. NAFTA and MERCOSUR combined produce gains of 1.48 percent of GDP, whereas the gains would be only 0.61 percent of GDP if the results of the NAFTA and MERCOSUR agreements were merely additive (columns 1 plus 2). That is, we find that reduced trade diversion from the combined agreements accounts for 0.87 percent of GDP. Since this may appear to be too large a saving from reduced trade diversion, we use three additional simulations to verify our explanation: (1) Chile unilaterally eliminates tariffs on NAFTA imports without improved access to NAFTA; (2) Chile unilaterally eliminates tariffs on MERCOSUR imports without improved access to MERCOSUR; and (3) Chile unilaterally eliminates tariffs on NAFTA and MERCOSUR without improved access to NAFTA or MERCOSUR markets. If our explanation is correct, simulation 3 should result in reduced trade diversion costs of at least 0.87 percent of GDP, compared to additive losses from the first two simulations. The welfare impacts from these three simulations are as follows: (1) –0.83 percent of GDP; (2) –0.82 percent of GDP; and (3) –0.77 percent of GDP. If the losses of the preferential tariff reduction were additive, the total losses would be –1.65 (that is, –0.83 – 0.82). Since preferential tariff reduction against the two regions combined results in losses of only –0.77 percent of GDP, trade diversion costs are reduced by 0.88 percent of GDP by combining tariff reductions for the two regions.

Morocco, Tunisia, and Turkey. It is unlikely to offer concessions to Chile that it has refused to offer other countries from which it has more to gain geopolitically. Similarly, although more speculatively, tariff-free access in the most highly protected products is unlikely to be provided by the rest of South America, since (following Grossman and Helpman, 1995) the political economy interests that obtained such high protection would resist regional competition as well.

Row 2 of table 2 presents results that more realistically reflect possible outcomes by excluding highly protected agricultural products from the agreement with the European Union and products with tariffs above 25 percent in the rest of South America from that agreement. The results show, as expected, that the gains would be dramatically reduced without preferential access to these highly protected markets. The last column shows that the United States is crucial to the whole story. If the United States is not included in the additive agreements, the gains drop dramatically to 0.44 percent of GDP. The drop in welfare for Chile exceeds the gains from NAFTA alone, showing that competition from (and in) the United States is important if Chile is to avoid the trade diversion costs of these agreements. Conversely, if Chile can get a free trade agreement with the United States as part of NAFTA, then free trade agreements with MERCOSUR, the European Union, and the rest of South America each add about 0.5 percent to Chilean GDP. These gains accrue even when the European Union and the rest of South America exclude their most highly protected items from the agreements.

Proponents of the government's strategy maintain that the trade diversion costs of the free trade agreements would be diminished if Chile adopted a 6 percent external tariff. Moreover, while they concede that access to the European Union in highly protected agricultural products is unlikely, they maintain that Chile could possibly receive full access to the markets of the rest of South America, in view of the sustained trend toward open economies in Latin America. In row 3 of table 2, we evaluate the impact of a 6 percent external tariff with the same products excluded from the agreements with the European Union and the rest of South America as in row 2. There are slightly larger gains to Chile from lowering the external tariff, but the United States remains important for substantial gains. In rows 4 and 5, we evaluate additive regionalism excluding only European Union agricultural products, so that full access to the rest of South America is obtained. Columns 5 and 6 show that obtaining tariff-free access to the highly protected markets of the rest of South America generates very substantial gains for Chile, with either a 6 percent or 11 percent external tariff.[34]

If Chile succeeds in including a wide net of countries in its additive regionalism strategy, the estimates of the welfare gains range from 0.44 percent to 8.4 percent of Chilean GDP. In contrast, table 1 indicated that the gains to Chile from unilateral trade liberalization are only about 0.11 percent of GDP. The estimated gains to Chile from additive regionalism are thus between four and seventy-six times the gains from unilateral trade liberalization. On balance, it appears that Chile has little to lose by pursuing additive regionalism, especially given that additive regionalism is being combined with lowering the external tariff to about 6 to 8 percent.[35]

34. These results support the view that preferential access to highly protected markets provides the greatest benefits to Chile, especially if the markets are large.

35. Some critics of Chile's additive regionalism strategy argue that Chile will be unable to negotiate effective agreements with good partner countries if Chile's tariff is low. We are skeptical of this argument, since Chile has reached a tentative agreement with the United States despite lowering its tariff to 6 percent. Singapore has negotiated free trade agreements in recent years, despite having a free trade regime. Critics would maintain, however, that dispute resolution in free trade agreements, for policies such as nontariff barriers, would be difficult for a country with a low tariff, so the value of the agreements would not be great.

3. The Impact of Additive Regionalism on Other Countries and a Comparison with Global Free Trade

Experience with regional trade arrangements has shown that if the agreement is not mutually beneficial to all parties, then it is unlikely to be effectively implemented or sustained (World Bank, 2000). Agreements may exist de facto, but they are not implemented effectively. The impact on Chile's partner countries in the trade agreements is thus relevant to the likely success of the strategy in the long run. Moreover, even if the agreements are beneficial to Chile and its partners, if the benefits are derived from losses to countries that are excluded from the agreements, then the agreements would be unattractive from the perspective of the multilateral trading system. This section estimates the impact of Chile's additive regionalism strategy on partner and excluded countries and assesses the impact on the world in general. As a point of comparison, we also estimate the impact of global free trade on the countries and regions of our model.

Our estimates are presented in tables 3 and 4. Table 3 reports welfare gains as a percentage of own-country GDP, for both our central and low elasticity cases. Table 4 then gives the estimated welfare gains in millions of 1995 U.S. dollars, to facilitate a comparison of gains and losses across countries. The first five columns of the first row of table 4 reproduce the results for Chile's additive regionalism strategy that we presented in the first five columns of table 2. The remaining rows present results for the other ten countries or regions in our model. Column 6 presents results for the global free trade scenario.

[tables 3 and 4 about here]

3.1 Impact on Individual Countries and Regions

The first five columns of table 3 demonstrate that Chile is too small, or its trade pattern sufficiently different, for its regional agreements to have more than a trivial impact on about half of the countries and regions in the model.[36] This group includes Japan and the rest of the world (which are excluded from all the agreements evaluated in table 2), as well as the European Union and the United States (which are excluded in some of the arrangements in table 2 and included in others). Canada is also essentially unaffected by Chile's trade policy options.

The rest of South America and Central America, on the other hand, lose from all the agreements from which they are excluded, although the welfare loss is only about five one-hundredths of a percent of their GDP. These regions compete with Chile for the markets in MERCOSUR and NAFTA, and they compete with producers from MERCOSUR and NAFTA for the Chilean market. In both cases, they lose access to markets since the demand for their exports declines owing to preferential access arrangements between Chile and its partners; this adversely affects their terms of trade and welfare.[37]

While the rest of South America loses from being excluded by Chile, the biggest loss for this region by far occurs when the rest of South America is included with Chile in a free trade agreement (along with the European Union, NAFTA, and MERCOSUR, as shown in column 5). The rest of South America has high protection on the products mentioned in the notes to table 2. To the

36. When we round welfare to the nearest one-hundredth of a percent of GDP, the impact is either zero or one one-hundredth of a percent.

37. This is consistent with the evidence of Winters and Chang (2000); who find that the price of imports from the United States and Korea in Brazil fell after the formation of MERCOSUR.

extent that Chilean imports displace imports from other countries in the rest of South America, the rest of South America loses tariff revenue on imports. Although some trade creation results from tariff free access to Chilean imports in the rest of South America, the tariff loss dominates the trade creation owing to the high level of the tariffs.[38] Moreover, a comparison of columns 4 and 5 illustrates that the addition of the rest of South America to the coalition of Chile, the European Union, MERCOSUR, and NAFTA results in an aggregate reduction in welfare for the partner countries. The gains to the other partners to this agreement are less than the losses to the rest of South America. The benefits are thus insufficient to allow the gainers to compensate the rest of South America for its losses.

For Mexico, competition from Chile for preferred access in the U.S. market results in a very small negative impact of including Chile in NAFTA. Chile, however is too small to make a significant difference to Mexico in the U.S. market. When Chile combines an agreement with NAFTA with an agreement with MERCOSUR, the diversification of Chilean exports results in still less displacement of Mexican exports in the United States, which reduces the negative impact on Mexico of Chile in NAFTA. When Chile adds the European Union to its group of free trade agreements, the diversification of Chilean exports reduces the small negative impact on Mexico of Chile's preferential access to the United States to virtually zero. Mexican losses are substantial in our global free trade scenario discussed below, given the erosion of preferential access in U.S. markets from the whole world.

Brazil and Argentina both lose from Chile joining NAFTA as a result of the erosion of preference margins in both Chile and NAFTA markets. Both countries gain small amounts from a MERCOSUR free trade agreement with Chile. The latter fact is partly explained by improved access to the Chilean market for MERCOSUR producers. This result is probably also partially explained by the fact that Brazil and Argentina reduce the trade diversion costs of MERCOSUR when they add new partners. That is, Chile would compete with Brazilian producers in Argentine markets, which reduces Argentina's trade diversion costs from importing Brazilian products under the MERCOSUR agreement. Of course, Chile could displace imports from the rest of the world in Argentine markets, which could increase Argentine trade diversion costs. As more countries are added to a network of preferential trading arrangements, however, the trade diversion costs associated with earlier partners is reduced, especially if these are large countries that interject significant competition.[39] Brazil and Argentina both lose from Chile negotiating a free trade agreement with the rest of South America (see columns 4 and 5). This is likely due to a terms-of-trade loss in the markets of the rest of South America.

3.2 Aggregate Impact of Chile's Additive Regionalism Strategy

Even if Chile gains from an agreement or set of agreements, the question remains of whether Chile gains only because other countries lose. Table 4 converts the percentage gains and losses of table 3 into gains and losses in millions of 1995 U.S. dollars. This allows us to compare gains and losses across countries and arrive at a total for the world. At the bottom of the table, we sum the welfare effects, first, for countries that are included in the agreement. For example, Chile-MERCOSUR (column 1) includes Chile, Argentina, and Brazil in our model. We then sum the welfare effect for all

38. If the high tariff products mentioned above are excluded from the free trade agreement with Chile, the losses are reduced to about one-third of their level (to –0.36 percent).

39. It is possible, however, that a new partner could divert imports from an excluded country and add to the trade diversion costs on balance.

countries that are not part of the agreement (for example, all countries other than Chile, Argentina, and Brazil in the case of Chile-MERCOSUR). The final row presents the sum of all countries.

The sum for included countries shows that the Chile-MERCOSUR agreement is dominated by trade diversion, to the extent that even the members of the agreement lose in aggregate. This is, however, the only agreement we consider that results in losses for the member countries. All the north-south agreements in table 4 (which all include the United States) result in aggregate net benefits for the member countries, even though at least one member loses in all of them. The inclusion of the United States means that significant competition is injected into the markets of participating members, which reduces the likelihood of trade diversion dominating.

The sum for excluded countries indicates that all of the preferential arrangements considered result in losses for the excluded countries or regions. These results are consistent with Winters and Chang (2000), who find, based on ex post data, that regional arrangements can have a very significant negative welfare effect on excluded countries (through negative terms-of-trade effects). In particular, they estimate that MERCOSUR induced losses for Chile, Germany, Japan, Korea, and the United States of about $800 million per year, which was about 9 percent of the value of their exports to MERCOSUR.[40]

For the world as a whole, assuming central elasticities, the agreement with MERCOSUR leads to losses for the world of $183 million, primarily owing to the trade diversion costs for Chile and the terms-of-trade loss for the European Union. Independent of elasticities, the agreements in the first three columns result in essentially a zero impact for the world or for the three excluded regions outside of the Western Hemisphere (rounded to the nearest one-hundredth of a percent of their own GDP). Chile gains significantly when NAFTA is involved, but the terms-of-trade loss for the excluded countries is almost as much as the gains to Chile, so the impact on the world in small.

The gains for the world become significant when either the European Union or the European Union and the rest of South America are added to Chile’s network of agreements (see columns and 5). The main reason behind these larger gains to the world is that the gains to Chile become very large when it obtains preferential access to the markets of the European Union and the rest of South America. Given the high protection on selected products in the rest of South America, however, the trade diversion costs in this region significantly reduce the gains to the world from including this region in Chile’s network of free trade agreements.

3.3 Impact of Global Free Trade

The results for global free trade are presented in column 6 of tables 3 and 4. As expected the gains to the world vastly exceed the gains from any regional arrangement. Even the included countries to any agreement gain more from multilateral global free trade than any individual regional arrangement (although the impact on Chile of an agreement with NAFTA is close).These results emphasize the importance of moving toward lower trade barriers in the multilateral context.

Mexico is an exception (as is Canada in the low elasticity case). Mexico sees losses from global free trade owing to the erosion of favored access to the U.S. market.

40. We estimate a very small negative effect for Central America as a result of Chile forming a free trade area with NAFTA.

3.4 Impact of the Free Trade Agreement of the Americas

We estimate that Chile would gain from a Free Trade Agreement of the Americas (FTAA) if we assume that Chile starts from a status quo of no preferential trade agreements in the Americas. The estimated gains are 1.25 percent of GDP under central elasticities and 0.53 percent under low elasticities.

Given that Chile already has several agreements in the Americas in place, Chile would lose preferential access to these markets, including NAFTA and MERCOSUR. The FTAA's impact on Chile is therefore ambiguous; it depends on how much preferential access Chile has in the markets of the Americas compared to other countries.

4. Systematic Sensitivity Analysis

To calibrate the model, estimates of elasticities must be assembled for primary factor substitution, import demand, import source, and domestic demand. In the base model, all elasticity values are assigned a priori to values that we believe are plausible central tendency estimates. Since elasticity estimates are subject to a margin of error, our remedy for this problem, which is endemic to any large-scale model of this kind, is to undertake systematic sensitivity analyses of our major results with respect to plausible bounds on these elasticities. Even if we are unable to specify a point estimate with any precision, our prior assumptions over the likely bounds that these elasticities could take are quite strong. To the extent that our major conclusions are robust to perturbations over these bounds, we do not see our uncertainty over specific values of these elasticities as a weakness of the model.[41]

Our sensitivity analysis employs the procedures developed by Harrison and Vinod (1992). These procedures essentially amount to a Monte Carlo simulation exercise in which a wide range of elasticities are independently and simultaneously perturbed from their benchmark values. These perturbations follow prescribed distributions, such as a *t* distribution with a specified standard deviation and degrees of freedom, or a uniform distribution over a specified range. For each Monte Carlo run, we solve the counter-factual policy with the selected set of elasticities. This process is repeated until we arrive at the desired sample size, which in our case is 3,500. The results are then tabulated as a distribution, with equal weight being given (by construction) to each Monte Carlo run. The upshot is a probability distribution defined over the endogenous variables of interest.

We focus solely on the welfare impacts of the scenario in which Chile joins NAFTA and unilaterally imposes a 6 percent tariff on imports, using lump-sum taxes to replace any lost revenue. The point estimate of the welfare change for Chile from this scenario is 1.70 percent of GDP (see table 1). The issue for our sensitivity analysis is whether that result is robust to uncertainty over the elasticities.

The sensitivity analysis we undertake reflects a diffuse set of prior assumptions over the plausible elasticity values. Specifically, it assumes that elasticities are drawn from a probability distribution, typically

41. These remarks should not be interpreted as denying the value of any new empirical work on generating such elasticities. On the contrary, any effort that could generate better bounds on these point estimates would be useful in generating policy conclusions that carry greater credibility, even if those conclusions are still probabilistic in nature. Moreover, we do not consider sensitivity analysis with respect to more general functional forms, even though we share concerns with the restrictiveness of some of the popular forms we employ.

uniform, over a specified interval. For the elasticity of substitution between primary factors in each sector, we assume a univariate normal distribution in each sector using the point estimate and standard errors from Harrison, Jones, Kimbell, and Wigle (1993) (the base model assumes the point estimates).[42] For the elasticity of substitution between intermediate inputs and the value added composite in each sector, we assume a uniform distribution between 0 and 0.5 (the base model assumes 0). For the elasticity of substitution between domestic products and imported products, we assume a uniform distribution between 10 and 20 (the base model assumes 15). For the elasticity of substitution between imported products by source, we assume a uniform distribution between 20 and 40 (the base model assumes 30). For the elasticity of transformation between domestic and export markets, we generally assume a uniform distribution between 2 and 6 (the base model generally assumes 4).[43] Finally, for the elasticities of substitution between products in government demand and consumption demand for each household, we assume an interval between 0.5 and 1.5 (the base model assumes 1).

The results are reported in figure 1 in the form of a histogram of the solutions obtained. We also display a vertical line at the 1.70 percent point estimate, for comparison. The main welfare results for the base model are relatively robust to the range of elasticity perturbations considered here, although the point estimate of 1.70 percent is a slight overestimate of the true distribution of likely welfare impacts. The distribution of welfare impacts estimated with the sensitivity analysis has a mean of 1.54 percent, a standard error of 0.15 of a percentage point, a 90 percent confidence interval between 1.31 percent and 1.81 percent, and no values lower than 1.14 percent or higher than 2.05 percent. The point estimate is at the eighty-fifth percentile of the distribution of results, so 15 percent of the solutions generated welfare changes that were greater than 1.70 percent.

[figure 1 about here]

Our sensitivity analysis is local in the sense that we perturb trade elasticities around what we believe are plausible values. Since we already know that the effects of the scenario are sensitive to the use of significantly lower short-run trade elasticities, there is little point including that in our formal sensitivity analysis. In other words, it is more informative to present results conditional on either short-run or long-run assumptions, and then undertake local sensitivity analysis around the precise numbers used to make either of those assumptions operational. Our primary conclusion, of significant welfare improvements for Chile from the policy of joining NAFTA and setting a 6 percent import tariff, is thus robust to plausible uncertainty about the key elasticities of the simulation model.

5. CONCLUSIONS

Our results for Chile point to some general themes regarding regional trading arrangements. One clear theme is that improved market access in preferential trading areas is important. In the case of Chile, trade diversion costs dominate the welfare effects of bilateral agreements unless either sufficient market access is obtained in partner countries or third-country tariffs are lowered. The north-south agreements generally provide sufficient access to make them beneficial, but the south-south agreement we examined (namely, MERCOSUR) did not. Chile can reduce trade diversion costs

42. The distribution is truncated from below at 0 if need be.

43. The base model assumes a higher elasticity of transformation of 5 for three agricultural sectors (namely, wheat, other grains, and Nongrain crops). The uniform distribution varies the elasticity for these sectors between 3 and 7.

and increase the net benefits of all agreements, however, by lowering its tariff to 6 percent. In the case of MERCOSUR, this agreement becomes beneficial with the reduction in the external tariff to 6 percent.

Absent its regional arrangements, unilateral reduction of the tariff to 6 percent conveys very small gains to Chile, whereas the regional arrangements are considerably more beneficial with the 6 percent tariff. Moreover, efficient replacement taxes are important with either regional or unilateral trade policy changes, and they provide greater scope for trade policy action. Finally, our range of estimates for the gains from additive regionalism indicate that Chile has little to lose by pursuing this strategy, and it may potentially gain many multiples of the gains from unilateral trade liberalization.

We find that the excluded countries lose from all of the regional arrangements that we examine. Partners to the preferential arrangements sometimes also lose. Chile’s additive regional arrangements have an almost imperceptible impact on world welfare. In contrast, we estimate that global free trade generates gains to the world that are enormous in comparison, emphasizing the importance of moving toward lower trade barriers in the multilateral context.

REFERENCES

Athukorala, P., and J. Reidel. 1994. "Demand and Supply Factors in the Determination of NIE Exports: A Simultaneous Error-Correction Model for Hong Kong. A Comment." *Economic Journal* 104 (November): 1411–14.

Bond, E. 1996. "Using Tariff Indices to Evaluate Preferential Trading Arrangements: An Application to Chile." Pennsylvania State University, Department of Economics.

Butelmann, A., and P. Meller. 1995. "Evaluation of a Chile-U.S. Free Trade Agreement." In *Trade Liberalization in the Western Hemisphere.* Santiago: Economic Commission for Latin America and the Caribbean.

Coeymans, J. E., and F. B. Larraín. 1994. "Efectos de un acuerdo de libre comercio entre Chile y Estados Unidos: un enfoque de equilibrio general." *Cuadernos de Economía* 31(94): 357–99.

Corbo, V. 1996. "Comentario a 'La integración de Chile al NAFTA: temas elegidos.'" In *Chile en el NAFTA: acuerdos de libre comercio versus liberalización unilateral*, edited by M. Schiff and C. Sapelli. Santiago: Centro Internacional para el Desarrollo Económico.

De Melo, J., and D. Tarr. 1992. *General Equilibrium Analysis of U.S. Foreign Trade Policy.* Cambridge, Mass.: MIT Press.

Donoso, B., and D. Hachette. 1996, "MERCOSUR y la apertura comercial chilena." Pontificia Universidad Católica de Chile, Department of Economics.

Ferris, M. C., and T. S. Munson. 2000. "Complementarity Problems in GAMS and the PATH Solver." *Journal of Economic Dynamics and Control* 24(2): 165–88.

Gehlhar, M., and others. 1996. "Overview of the GTAP Data Base." In *Global Trade Analysis: Modeling and Applications*, edited by T. W. Hertel. New York: Cambridge University Press.

Grossman, G., and E. Helpman. 1995. "The Politics of Free Trade Agreements." *American Economic Review* 85(4): 667–90.

Harrison, G. W., R. Jones, L. J. Kimbell, and R. Wigle. 1993. "How Robust Is Applied General Equilibrium Analysis?" *Journal of Policy Modeling* 15(1): 99–115.

Harrison, G. W., T. F. Rutherford, and D. G. Tarr. 1997a. "Economic Implications for Turkey of a Customs Union with the European Union." *European Economic Review*, 41(3-5): April 1997a, 861-870.

———. 1997b. "Quantifying the Uruguay Round." *Economic Journal* 107(444): 1405–30.

———. 1997c. "Trade Policy Options for Chile: A Quantitative Evaluation." Policy research working paper 1783. Washington: World Bank.

———. 2001. "Chile's Regional Arrangements and the Free Trade Agreement of the Americas: The Importance of Market Access." Policy research working paper 2634. Washington: World Bank.

Harrison, G. W., T. F. Rutherford, and I. Wooton. 1989. "The Economic Impact of the European Community." *American Economic Review* 79 (May, *Papers and Proceedings*): 288–94.

———. 1993. "An Alternative Welfare Decomposition for Customs Unions." *Canadian Journal of Economics* 26(4): 961–68.

Harrison, G. W., and H. D. Vinod. 1992. "The Sensitivity Analysis of Applied General Equilibrium Models: Completely Randomized Factorial Sampling Designs." *Review of Economics and Statistics* 74 (May): 357–62.

Hatta, T. 1977. "A Theory of Piecemeal Policy Recommendations." *Review of Economic Studies* 44(1): 1–21.

Hinojosa-Ojeda, R., J. Lewis, and S. Robinson. 1995. "Convergence and Divergence between NAFTA, Chile and MERCOSUR: Overcoming Dilemmas of North

and South American Economic Integration." University of California—Los Angeles, Department of Economics.
Leipziger, D., and L. A. Winters. 1996. "Chile y el NAFTA: lecciones y orientaciones futuras." In *Chile en el NAFTA: acuerdos de libre comercio versus liberalización unilateral*, edited by M. Schiff and C. Sapelli. Santiago: Centro Internacional para el Desarrollo Económico.
Michalopoulos, C., and D. Tarr. 1997. "The Economics of Customs Unions in the Commonwealth of Independent States." *Post-Soviet Geography and Economics* 38(3): 125–43.
Muchnik, E., L. F. Errázuriz, and J. I. Domínguez. 1996. "Efectos de la asociación de Chile al Mercosur en el sector agrícola y agroindustrial." *Estudios Públicos* 63: 113–64.
Panagariya, A., and D. Rodrik. 1993. "Political Economy Arguments for a Uniform Tariff." *International Economic Review* 34(3): 685–703.
Quiroz, J., and A. Valdés. 1993. "Price Bands for Agricultural Stabilization: The Chilean Experience." Washington: World Bank.
Reidel, J. 1988. "The Demand for LDC Exports of Manufactures: Estimates from Hong Kong." *Economic Journal* 98 (March): 138–48.
Reinert, K. A., and D. W. Roland-Holst. 1992. "Armington Elasticities for United States Manufacturing Sectors." *Journal of Policy Modeling* 14(5): 631–39.
———. 1996. "Chilean Accession to the NAFTA: General Equilibrium Estimates." In *Western Hemispheric Economies in the 21st Century*, edited by K. Fatemi. Laredo, TX: Texas A&M University, Graduate School of Business.
Rutherford, T. F. 1999. "Applied General Equilibrium Modeling with MPSGE as a GAMS Subsystem: An Overview of the Modeling Framework and Syntax." *Computational Economics* 14(1–2): 1–46.
Rutherford, T. F., E. E. Rutström, and D. G. Tarr. 1997. "Morocco's Free Trade Agreement with the European Community." *Economic Modelling* 14(2): 237–69.
Schiff, M. 1996. "La integración de Chile al NAFTA: temas elegidos." In *Chile en el NAFTA: acuerdos de libre comercio versus liberalización unilateral*, edited by M. Schiff, and C. Sapelli. Santiago: Centro Internacional para el Desarrollo Económico.
Schiff, M., and C. Sapelli, eds. 1996. *Chile en el NAFTA: acuerdos de libre comercio versus liberalización unilateral.* Santiago: Centro Internacional para el Desarrollo Económico.
Shiells, C. R., and K. A. Reinert. 1993. "Armington Models and Terms-of-Trade Effects: Some Econometric Evidence for North America." *Canadian Journal of Economics* 26(2): 299–316.
Valdés, A. 1995. "Joining an Existing Regional Trading Agreement from the Perspective of a Small Open Economy: Chile's Accession to NAFTA and MERCOSUR." *American Journal of Agricultural Economics* 77: 1292–97.
———. 1996. "Surveillance of Agricultural Price and Trade Policy in Latin America during Major Policy Reforms." Discussion paper 349. Washington: World Bank.
Winters, L. A., and W. Chang. 2000. "Regional Integration and Import Prices: An Empirical Investigation." *Journal of International Economics* 51(2): 363–77.
Wonnacott, P., and R. Wonnacott. 1981. "Is Unilateral Tariff Reduction Preferable to a Customs Union? The Curious Case of the Missing Foreign Tariffs." *American Economic Review* 71(4): 704–14.
Wooton, I. 1986. "Preferential Trading Agreements: An Investigation." *Journal of International Economics* 21: 81–97.
World Bank. 2000. *Trade Blocs.* Oxford and New York: Oxford University Press.

Figure 1. Sensitivity Analysis of Welfare Change for Chile When Chile Joins NAFTA and Imposes a 6 Percent Tariff
Fraction of solutions (N = 3500)

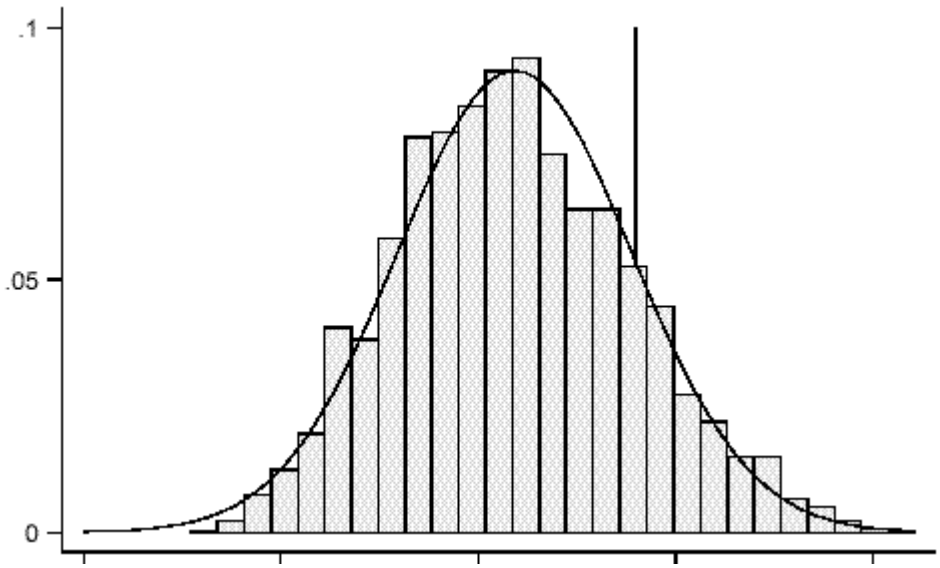

Table 1: Welfare and Government Revenue Results for Chile's Trade Policy Options
In percent of GDP

		Replacement tax					*Combined effect of uniform VAT and trade policy*[b]	
		Existing VAT		*Uniform VAT*[a]		*Lump-sum*		
Policy simulation	*Elasticity*	*Change in welfare*[c] *(1)*	*Change in VAT*[d] *(2)*	*Change in welfare*[c] *(3)*	*Tariff revenue (4)*	*Change in welfare*[c] *(5)*	*Change in welfare*[c] *(6)*	*Tariff revenue (7)*
1. Free trade agreement with MERCOSUR	Central	−0.62	45	−0.40	1.7	−0.43	−0.19	1.8
	Low	0.04	17	0.07	2.7	0.08	0.19	2.7
2. Customs union with MERCOSUR	Central	−0.95	52	−0.74	1.3	−0.73	−0.62	1.2
	Low	−0.20	21	−0.22	2.5	−0.17	−0.14	2.5
3. Free trade agreement with NAFTA	Central	0.82	48	1.03	0.9	1.04	1.23	0.9
	Low	0.30	26	0.31	2.1	0.38	0.43	2.1
4. Zero tariffs on NAFTA imports; no improved access	Central	−1.11	62	−0.92	0.7	−0.83	−0.64	0.7
	Low	−0.47	30	−0.45	2.0	−0.41	−0.33	2.0
5. Free trade agreement with MERCOSUR; 6% external tariff	Central	0.12	49	0.44	1.7	0.35	0.61	1.7
	Low	0.06	38	0.11	1.7	0.13	0.21	1.7
6. Free trade agreement with NAFTA; 6% external tariff	Central	1.46	45	1.72	1.1	1.70	1.89	1.1
	Low	0.41	41	0.45	1.4	0.49	0.55	1.4
7. External tariff reduced to 8%	Central	0.02	16	0.12	2.9	0.10	0.41	2.9
	Low	−0.11	17	−0.08	2.7	−0.06	0.03	2.7
8. External tariff reduced to 6%	Central	0.01	28	0.16	2.3	0.11	0.43	2.3
	Low	−0.18	30	−0.14	2.1	−0.14	−0.04	2.1
9. External tariff reduced to zero	Central	−0.26	76	0.02	0	0.09	0.21	0
	Low	−0.54	72	−0.45	0	−0.42	−0.37	0

Source: Authors' estimates.
a. In these scenarios, we first create an equilibrium with a uniform VAT with no other domestic taxes, then evaluate the pure effects of the trade policy.
b. These scenarios combine the impacts of the trade policy simulation with the move to a uniform VAT and the elimination of the domestic output tax; government revenues are held constant.
c. Change in Hicksian equivalent variation, as a percentage of GDP.
d. Required equiproportional increase in the VAT rate across all sectors to keep government revenues unchanged, as a percentage of GDP.

Table 2. Welfare Results for Chile of Additive Free Trade Agreements[a]

In percent of Chilean GDP

External tariff rate and product coverage	*Partner countries or regions*					
	MERCOSUR (1)	*NAFTA (2)*	*NAFTA and MERCOSUR (3)*	*NAFTA, MERCOSUR, and the European Union (4)*	*NAFTA, MERCOSUR, the European Union, and the rest of South America[b] (5)*	*Canada, Mexico, MERCOSUR, the European Union, and the rest of South America[b] (6)*
11% tariff; all products included	-0.43	1.04	1.48	5.24	8.40	8.16
11% tariff; excluded products[c]	—	—	—	2.02	2.48	0.44
6% tariff; excluded products[c]	0.35	1.70	2.01	2.29	2.66	0.87
11% tariff; EU agricultural products excluded[d]	—	—	—	2.02	5.48	3.90
6% tariff; EU agricultural products excluded[d]	—	—	—	2.29	5.71	4.44

Source: Authors' estimates.

a. Chilean gains with central elasticities and lump-sum tax replacement.

b. The rest of South America includes all countries in the region except Argentina, Brazil, and Chile.

c. Excluded products in the agreement with the European Union (and their tariffs plus nontariff equivalents in the European Union) are wheat (57 percent), grains (74 percent), nongrain crops (51 percent), fishing (14 percent), meat (63 percent), and milk (129 percent). Excluded products in the agreement with the rest of South America (and their tariffs) are nongrain crops (29 percent), meat (51 percent), milk (27 percent), food (34 percent), beverages and tobacco (55 percent), textiles and apparel (46 percent), chemicals, rubber, and plastics (31 percent), fabricated metal products (43 percent), and machinery (52 percent). All products are included in the NAFTA and MERCOSUR agreements in row 3.

d. Excluded agricultural products in the European Union are the same as in line 3. The other agreements include all products.

Table 3. The Welfare Impact of Chile's Additive Free Trade Agreements and Global Free Trade[a]
In percent of each country's GDP

		Partner countries or regions					
Country	*Elasticity*	*MERCOSUR* (1)	*NAFTA* (2)	*NAFTA and MERCOSUR* (3)	*NAFTA, MERCOSUR, and the European Union* (4)	*NAFTA, MERCOSUR, the European Union, and the rest of South America* (5)	*Global free trade* (6)
Chile	Central	−0.40	1.04	1.48	5.24	8.40	1.26
	Low	0.00	0.37	0.60	2.55	3.31	0.68
Argentina	Central	0.06	0.00	0.10	0.12	0.07	0.82
	Low	0.00	−0.01	0.02	0.02	0.01	0.60
Brazil	Central	0.02	−0.01	−0.04	−0.04	−0.02	0.94
	Low	0.00	−0.01	0.00	0.00	−0.01	0.24
Canada	Central	0.00	0.00	0.00	0.00	0.01	0.42
	Low	0.00	0.00	0.00	0.00	0.00	−0.36
Central America	Central	0.00	−0.06	−0.05	−0.04	−0.06	9.70
	Low	0.00	−0.03	−0.03	−0.05	−0.06	4.42
European Union	Central	0.00	0.00	0.00	0.00	0.00	2.74
	Low	0.00	0.00	0.00	0.00	0.00	1.17
Japan	Central	0.00	0.00	0.00	0.00	0.00	3.43
	Low	0.00	0.00	0.00	0.00	0.00	1.98
Mexico	Central	0.00	−0.02	−0.01	0.00	0.00	−1.38
	Low	0.00	−0.01	−0.01	0.00	0.00	−1.02
United States	Central	0.00	0.00	0.00	0.00	0.00	0.34
	Low	0.00	0.01	0.00	0.00	0.00	0.18
Rest of South America	Central	0.00	−0.03	−0.06	−0.04	−1.19	4.40
	Low	0.00	−0.02	−0.04	−0.05	−0.22	1.25
Rest of the world	Central	0.00	0.00	0.00	0.00	0.00	1.97
	Low	0.00	0.00	0.00	0.01	0.01	0.54

Source: Authors' estimates.
a. Lump-sum tax replacement and all products included in the agreements. The rest of South America includes all countries in the region except Argentina, Brazil, and Chile.

Table 4. The Welfare Impact of Chile's Additive Free Trade Agreements and Global Free Trade[a]
In millions of 1995 U.S. dollars.

		Partner countries or regions					
Country	*Elasticity*	*MERCOSUR (1)*	*NAFTA (2)*	*NAFTA and MERCOSUR (3)*	*NAFTA, MERCOSUR, and the European Union (4)*	*NAFTA, MERCOSUR, the European Union, and the rest of South America (5)*	*Global free trade (6)*
Chile	Central	−291	414	590	2,090	3,350	504
	Low	−67	149	239	1,013	1,318	270
Argentina	Central	63	−1	222	264	147	1,832
	Low	44	−18	54	54	28	1,327
Brazil	Central	214	−42	−171	−161	−70	3,912
	Low	108	−36	15	−11	−21	1,004
Canada	Central	5	−20	−22	23	49	243
	Low	4	−15	−13	14	19	−2,058
Central America	Central	4	−37	−32	−23	−38	6,112
	Low	3	−21	−21	−29	−36	2,680
European Union	Central	−184	−156	−336	−88	−200	207,413
	Low	−28	−241	−317	156	86	88,720
Japan	Central	−58	−19	−30	81	−2	127,664
	Low	−30	−48	−69	−76	−91	73,711
Mexico	Central	13	−58	−44	−11	15	−4,539
	Low	1	−35	−35	−3	0	−3,315
United States	Central	−7	51	−29	138	60	19,972
	Low	−24	306	231	59	−11	10,833
Rest of South America	Central	−34	−56	−95	−73	−2,024	7,456
	Low	−28	−39	−75	−90	−376	2,110
Rest of the world	Central	92	−73	−50	−115	6	85,111
	Low	29	−89	−100	−229	−232	23,348
Sum for included countries	Central	−14	387	546	2,255	1,327	
	Low	85	405	491	1,282	1,043	
Sum for excluded countries	Central	−169	−384	−543	−130	−34	
	Low	−73	−492	−582	−424	−359	
Sum for all countries	Central	−183	3	3	2,125	1,293	455,680
	Low	12	−87	−91	858	684	198,626

Source: Authors' estimates. a. Lump-sum tax replacement and all products included in the agreements. The rest of South America includes all countries in the region except Argentina, Brazil, and Chile.

Documentos de Trabajo
Banco Central de Chile

Working Papers
Central Bank of Chile

NÚMEROS ANTERIORES

PAST ISSUES

La serie de Documentos de Trabajo en versión PDF puede obtenerse gratis en la dirección electrónica: www.bcentral.cl/esp/estpub/estudios/dtbc. Existe la posibilidad de solicitar una copia impresa con un costo de $500 si es dentro de Chile y US$12 si es para fuera de Chile. Las solicitudes se pueden hacer por fax: (56-2) 6702231 o a través de correo electrónico: bcch@bcentral.cl.

Working Papers in PDF format can be downloaded free of charge from: www.bcentral.cl/eng/stdpub/studies/workingpaper. Printed versions can be ordered individually for US$12 per copy (for orders inside Chile the charge is Ch$500.) Orders can be placed by fax: (56-2) 6702231 or e-mail: bcch@bcentral.cl.

DTBC-237 Noviembre 2003
The Role of Credibility in the Cyclical Properties of Macroeconomic Policies in Emerging Economies
César Calderón, Roberto Duncan y Klaus Schmidt-Hebbel

DTBC-236 Noviembre 2003
Commodity Currencies and the Real Exchange Rate
Paul Cashin, Luis Felipe Céspedes y Ratna Sahay

DTBC-235 Octubre 2003
Heterogeneidad de la Transmisión Monetaria: Efectos Sectoriales y Regionales
Héctor F. Bravo, Carlos J. García, Verónica Mies y Matías Tapia

DTBC-234 Octubre 2003
Must Original Sin Cause Macroeconomic Damnation?
Luis Felipe Céspedes, Roberto Chang y Andrés Velasco

DTBC-233 Octubre 2003
Stock de Capital de la Economía Chilena y su Distribución Sectorial
Josué Pérez Toledo

DTBC-232 Octubre 2003
Pricing Policies and Inflation Inertia
Luis Céspedes, Michael Kumhof y Eric Parrado

DTBC-231 Octubre 2003
Banking Concentration: Implications for Systemic Risk and Safety Net Design
Rodrigo Cifuentes

DTBC-230 Octubre 2003
The Effect of Cross-Industry Ownership on Pricing: Evidence from Bank-Pension Fund Common Ownership in Chile
Luis Antonio Ahumada y Nicola Cetorelli

DTBC-229 Octubre 2003
Foreign Bank Entry and Business Volatility: Evidence from U.S. States and Other Countries
Donald P. Morgan y Philip E. Strahan

DTBC-228 Octubre 2003
Financial Markets and Financial Leverage in a Two-Country World-Economy
Simon Gilchrist

DTBC-227 Octubre 2003
Deposit Insurance: Handle with Care
Asli Demirgüç-Kunt y Edward J. Kane

DTBC-226 Octubre 2003
Concentration, Hold-Up and Information Revelation in Bank Lending: Evidence from Chilean Firms
Álvaro García, Andrea Repetto, Sergio Rodríguez y Rodrigo Valdés

DTBC-225 Octubre 2003
Alternative Approaches to Taxing the Financial Sector: Which is Best and Where does Chile Stand?
Patrick Honohan

DTBC-224 Septiembre 2003
Efectos de Cambios en Impuestos Indirectos en la Inflación
Carlos García, Pablo García, M. Carolina Grünwald, Felipe Liendo, I. Igal Magendzo y Enrique Orellana

DTBC-223 Agosto 2003
Bank Lending Channel and the Monetary Transmission Mechanism: The Case of Chile
Rodrigo Alfaro, Helmut Franken, Carlos García y Alejandro Jara

DTBC-221 Agosto 2003
Retail Bank Interest Rate Pass-Through: Is Chile Atypical?
Marco A. Espinosa-Vega y Alessandro Rebucci