Working Paper Series

NUMBER WP 05-13 OCTOBER 2005

Predicting Trade Expansion under FTAs and Multilateral Agreements

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Abstract

This paper examines the historical record of eight recent free trade agreements (FTAs). It also investigates the predictive power of two popular quantitative world trade models—the single-equation gravity model and the multiequation computable general equilibrium (CGE) model—as applied to three major trade liberalization agreements adopted during the 1990s: Mercosur, NAFTA, and the Uruguay Round Agreement, using the Rose gravity model and the GTAP general equilibrium model. Both models are found accurate in some instances, but intervening influences in the wake of trade liberalization episodes confound the challenge of drawing a strong conclusion in favor of one modeling approach over the other. Between the "naïve" gravity model and "naïve" CGE model predictions, we find that the former tends to overpredict intrabloc trade expansion (especially over horizons of five years and less) while the latter tends to underpredict. CGE models remain favored for ex post analysis of welfare impacts and the direct and indirect linkages between policy reforms and the numerous other economic variables of concern to policymakers and the public at large.

JEL classification: C68, F13, F17

JEL keywords: Gravity models, CGE models, regional trading arrangements

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I. INTRODUCTORY SKETCH

This introductory sketch surveys the record of merchandise trade expansion in the wake of recent free trade agreements (FTAs), with particular focus on the record of the Mercado Comun del Sur (Mercosur) and the North American Free Trade Agreement (NAFTA)—the most prominent FTAs adopted during the 1990s. The principal sections of this paper examine the predictive power of two popular quantitative models of world trade—the single-equation gravity model and the more sophisticated, multiequation computable general equilibrium (CGE) model. The prime objective of this analysis is to assess how well the two economic models fare in predicting the future course of bilateral trade under recent FTAs using "naïve" and more sophisticated variants of the two models. Naïve variants are the sort that trade policy advisers, working under severe time pressures, might have employed at the outset of the two agreements to judge their potential for trade expansion. In this introductory sketch, we report predictions based only on naïve variants. We also leave for the more thoroughgoing analysis of the principal sections of the paper the consideration of the predictive power of sophisticated CGE models for the outcome of the Uruguay Round of multilateral trade negotiations.

What the Record Shows

We adopt a 3-to-10 year horizon to investigate the record of merchandise trade expansion under recent FTAs. Accordingly, we have compiled data on intrabloc trade in US dollars, at intervals of three, five, and 10 years after the establishment of eight selected FTAs, beginning in 1985 with the adoption of the US-Israel FTA (table 1). The other FTAs in table 1 are Mercosur (1991), NAFTA (1994), EU-Turkey Customs Union (1996), Canada-Chile FTA (1997), EU-Mexico FTA (2000), New Zealand–Singapore FTA (2001), and US-Jordan FTA (2001). Long-term trade expansion figures could be compiled only for the FTAs adopted before 2000.

For each agreement, data on intrabloc trade were indexed to the base year immediately preceding implementation. For example, the trade expansion figures in table 1 for the US-Israel FTA indicate the levels of US-Israel trade in 1987, 1989, and 1994 (corresponding to three-, five-, and 10-year intervals, respectively), indexed to levels of export and import trade between the two countries and with the world in 1984 (1984=100, in the US-Israel FTA case). The trade data were also deflated by the US consumer price index to yield trade expansion indices for each FTA in real as well as nominal terms.

The trade expansion statistics in table 1 reveal a wide variety of experience under the recent FTAs considered. However, for nearly all FTAs, intrabloc trade expands substantially both in

nominal and real terms. For instance, after 10 years, Argentina's real exports to its Mercosur partners expanded by just over 170 percent, calculated as the index of 272 after 10 years minus the base year index of 100. Likewise, Mexico's exports to its NAFTA partners expanded by over 160 percent, and those of the European Union to Turkey by about 80 percent. The only case in which real intrabloc trade actually declined after 10 years is Canadian exports to Chile under the Canada-Chile FTA: Canadian exports declined by about 30 percent.

Of greater significance is that intrabloc trade expansion is nearly everywhere greater than expansion of bloc trade with the world, in both nominal and real terms. Neither the simple historical record nor the naïve models can determine to what extent the differential expansion reflects trade diversion and to what extent it reflects trade creation. Nevertheless, the historical record is fascinating. Intrabloc trade under the eight selected FTAs was more dynamic than trade by the FTA members with the rest of the world (and also more dynamic than global trade itself—i.e., world-to-world trade). For instance, whereas Argentina's real exports to its Mercosur partners expanded by 172 percent after 10 years, they expanded to the world at large by 53 percent, and real global trade expanded by just 42 percent. Whether these differences reflect acute trade diversion, or very significant trade creation, the record clearly shows that FTAs foster intrabloc trade by comparison with bloc trade with the world.

What World Trade Models Predict

The historical record reviewed here indicates that the expansion of trade between countries recently forming FTAs has been very impressive. But has the trade expansion induced by the FTAs been more impressive than might have been expected by economists when the agreements were ratified? In this introductory sketch, we investigate this question by examining the predicted expansion of trade under the two most prominent FTAs, Mercosur and NAFTA, given by naïve variants of the gravity trade model and the popular Global Trade Analysis Project (GTAP) model. Trade policy advisers might well have employed these models during the run-up to the two agreements.

The Gravity Model

The gravity model is essentially a single-equation econometric model that relates bilateral real trade flows to a number of explanatory variables through time, including distance between trading partners, their joint GDP and population levels, and whether the partners are members of a bilateral or regional FTA. Here we employ a simple variant of Andrew Rose's (2004) gravity model, one that finds that GDP growth tends to boost bilateral trade between partners by an elasticity factor of 0.87

(i.e., when combined real GDP grows by 10 percent, two-way bilateral trade grows by 8.7 percent). Further, the model finds that formation of an FTA tends to boost bilateral trade between FTA members by 183 percent.[1]

Following common practice of trade policy analysts, this coefficient furnishes the basis for the gravity model predictions of intrabloc trade expansion under Mercosur and NAFTA reported in table 2. In other words, the naïve model predictions are based on the FTA-parameter estimate alone, without any consideration of expected changes in other explanatory variables specified in the underlying gravity model (such as GDP growth). Thus, the predicted expansion of intrabloc trade is everywhere equal to 183 percent.

The computed prediction errors reported in table 2 refer to real exports, real imports, and a simple average of the two. This format is adopted because the underlying gravity model provides estimates for average exports and imports combined, whereas the record of actual trade outcomes (drawn from table 1) refers to exports and imports separately.

The prediction results presented in table 2 indicate that the naïve variant of the gravity model here generally overpredicts trade expansion under Mercosur and NAFTA by wide margins (25 percent or more).[2] This outcome mainly reflects the large magnitude of the estimated FTA-parameter. It is worth noting, however, that the prediction errors are much smaller after 10 years than after three.

The GTAP Model

The GTAP model is a multisector, multicountry applied general equilibrium model of world trade and economic activity. As such, it is more complex than the gravity model. Through a vast number of simultaneous equations, it attempts to represent the main structural elements of interdependent open economies, using modern economic theory as a guide to equation specification. The model is popularly applied to estimating the effect of an FTA by simulating the impact of eliminating tariffs on trade flows between FTA member countries. We consider this application of the GTAP model naïve (analogous to our previous application of the gravity model), because it does not take into account changes in other economic policies and factors that might well accompany the adoption of an FTA.

The "naïve" GTAP model predictions for Mercosur and NAFTA are reported in table 2, alongside those for the naïve variant of the gravity model. The GTAP predictions are based on comparative static results specific to particular three- and five-year intervals beginning somewhat

[1] This and many other coefficients are reported in table 5 of this paper.
[2] When reasonable projections of GDP growth are factored in, the overprediction is even greater.

after the adoption of Mercosur and NAFTA, specifically 1995 to 1997 and 1997 to 2001.[3] The GTAP database dictated the time periods. As such, the predictions are not strictly comparable to the gravity model predictions, nor are they perfectly contemporaneous with the actual record of intrabloc trade expansion reported in table 2. Nonetheless, the naïve GTAP model predictions reported here provide a useful benchmark.

Whereas the gravity model predictions tend to overestimate the expansion of intrabloc trade under both Mercosur and NAFTA, it is apparent from table 2 that the GTAP model predictions tend to underestimate the expansion of same intrabloc trade. In many cases, the absolute error of the GTAP model predictions appears to be somewhat smaller than the gravity model predictions—especially for shorter time horizons. For instance, after five years the GTAP model underestimates Canada's expansion of exports to its NAFTA partners by 33 percent, while the naïve variant of the gravity model overestimates the same expansion of Canada's intrabloc exports by 80 percent.

Concluding Remarks

From the foregoing rough and ready results, we tentatively conclude that the predictions of naive gravity and naïve GTAP models may place wide upper and lower bounds, respectively, on the eventual expansion of intrabloc trade under FTAs. However, more thorough and painstaking analysis of the trade expansion predictions by world economic models is called for in order to confirm this conclusion and also importantly to better understand what qualifications may surround it.

II. TOWARD MORE THOROUGH ANALYSIS

Notwithstanding the remarkable pace of economic integration in the world economy, areas of economic uncertainty still surround initiatives to liberalize international trade. Liberalization initiatives include those both at the multilateral level (Doha Development Agenda) and at the regional and bilateral level, where arguably the greatest concerted activity is found today. Numerous regional and bilateral FTAs have been recently adopted or are under discussion and negotiation (Schott 2004). Differences in the scope, complexity, and openness of these initiatives are one important source of economic uncertainty. With a view to "better practices" in the use of quantitative models for assessing the prospects of trade liberalization initiatives, this paper investigates the predictive power of two popular models as applied to three specific trade liberalization agreements adopted during the 1990s: the 1996 Uruguay Round Agreement among the members of the World

[3] The details are discussed in the main part of this paper.

Trade Organization (WTO) and two prominent regional FTAs, the 1991 Mercosur (among Argentina, Brazil, Paraguay, and Uruguay) and the 1994 NAFTA (among Canada, Mexico, and the United States).

The first quantitative approach utilized here is the gravity model, an *empirical* methodology that predicts the level of trade between countries using a single, econometric estimating equation and a limited number of explanatory variables. The second approach is the CGE model, an *applied* methodology that simulates rather than predicts the level of consumption, production, and trade, among other variables, for one or more trading countries using a (typically large) system of simultaneous equations. These equations describe the economy and international trade of each country in the model and entail a priori specifications of the mathematical form and parameter values of the model.[4]

In the analysis here, we employ the gravity model developed by Andrew Rose (2004), covering aggregate merchandise trade between 178 countries during the period 1948–99, to represent the gravity model approach. To represent the CGE model approach, on the other hand, we employ the widely utilized GTAP model, which incorporates as many as 87 regions and 57 sectors and is constructed around base data for the years 1992, 1995, 1997, and 2001. Broadly speaking, these two quantitative models are applied to assess the economic impacts of trade liberalization agreements in the same manner. Both models are employed here to make medium- and long-term predictions of the impacts of trade agreements based on available information near the beginning of the agreements. The GTAP model is applied to the Uruguay Round Agreement and the two regional trade agreements. However, the gravity model is applied solely to Mercosur and NAFTA because the gravity model is not easily able to predict the outcome of multilateral trade liberalization agreements.[5] Moreover, the end point of the GTAP model analysis is 2001 (based on the newly released GTAP 6 beta database) and that of the gravity model analysis is 1999 (the end point of the database underlying the Rose gravity model).

Finally, it should be emphasized that the analysis here considers only the impacts of liberalizing merchandise trade between countries under the three trade liberalization agreements and then mainly in a highly stylized manner. Important broader aspects of the three trade liberalization agreements, covering, for instance, trade in services and trade-related investment measures (and their possible feedback effects on merchandise trade), are not explicitly considered. Thus, the prediction errors reported here for the two quantitative models reflect in part the merchandise trade focus of the analysis, particularly in the case of the GTAP model because of its more specific (and hence more narrow) representation of the three trade liberalization agreements.

[4] For empirical versus applied methodologies in economy analysis, see, for instance, Mayes (1978).
[5] See Rose (2004) for the significance of WTO membership for bilateral trade.

III. EMPIRICAL ANALYSIS USING A GRAVITY MODEL

The gravity model is among the most robust empirical approaches to forecasting bilateral trade flows.[6] The traditional gravity model is estimated using ordinary least squares (OLS) and sometimes more sophisticated methods of fitting a regression equation pitting bilateral trade flows in a common currency (adjusted for inflation) against the gravitational "mass" of explanatory variables describing the bilateral trading partners. The explanatory variables include the proximity, combined population, and combined GDP of the two countries. Most gravity models find that trade between countries is significantly greater, the greater the combined population and GDP of the trading partners and the shorter the distance between the countries. Additional explanatory variables are frequently found to be significant as well, and these variables are often of greatest interest. For instance, trading partners that share a common border or a common language are frequently found to enjoy significantly greater mutual trade (Rose 2004).

The Rose Gravity Model and Database

Gravity models have been applied to preferential trading arrangements such as Mercosur and NAFTA. This is accomplished by including a dichotomous (0, 1) explanatory variable in the regression equation for each preferential arrangement among two or more trading partners. The econometric results have been impressive, widely supporting the hypothesis that preferential trading arrangements lead to significant expansion of trade between FTA member countries.[7]

This is reflected in the Rose gravity model estimation results presented in table 3, covering the entire Rose database for bilateral merchandise trade between 178 countries from 1948 to 1999 (with gaps and excluding Taiwan and some centrally planned economies), as compiled from IMF's *Direction of Trade Statistics*. The bilateral trade data are averages of FOB export and CIF import data in US dollars, deflated by the US consumer price index. In table 3, the "core" explanatory variables include distance between trading partners, joint real GDP, and joint real GDP per capita. They also include a number of country-specific variables, such as landlocked and island status, language, colonizers and dates of independence, and an explanatory variable representing the generalized system of preferences (GSP) under which a number of advanced countries extend preferences to less

[6] The theoretical basis of the gravity model, on the other hand, has not been appreciated until relatively recently. An extensive, critical review of the gravity model in theory and practice is provided by Anderson and van Wincoop (2004).

[7] See, for instance, Frankel (1997) and Greenaway and Milner (2002).

developed countries on a nonreciprocal basis.[8] And finally, the core explanatory variables include groups of countries that have formally established currency unions (Glick and Rose 2002).[9]

Our analytical attention focuses principally on the dichotomous explanatory variables representing Mercosur, NAFTA, and "other FTAs combined." These variables take on unitary values for trade between the FTA members after establishment of their mutual trade agreement. The variable representing the "other FTAs combined" includes eight preferential trade agreements around the world, the most prominent of which are the European Union, the Association of Southeast Asian Nations, and the Australia–New Zealand Closer Economic Relations Trade Agreement.[10] Combined treatment of these FTAs enables the gravity model to estimate a single, aggregate (or average) coefficient for the impact of preferential trade agreements based on the experience of FTAs that preceded the establishment of Mercosur and NAFTA.

Estimation of gravity models using panel data presents some problems in econometric methods (Egger 2002, Wooldridge 2002, Hsiao 2003). Without special consideration, OLS regression does not admit possible unobserved effects related to the bilateral pairs of trading countries (country pair-effects). Following Rose (2004), this problem is dealt with by clustering the regression observations by country pairs and computing so-called robust standard errors of the resulting OLS coefficient estimates, thereby enforcing the assumption of independence of observations across but not necessarily within the clusters and producing correct standard errors of the estimates when the observations may be correlated.[11]

Additionally, following Rose (2004) and other investigators, we emphasize so-called fixed-effects and random-effects variants of the gravity model, which are inherently country-pair specific. These are more sophisticated and potentially more discerning variants of the gravity model. In these variants, the unexplained error component of the regression equation is assumed to incorporate either fixed or random unobservable elements, necessitating use of the generalized least squares technique in the case of the random-effects variant. Tables 3 through 5 report the estimation results for the Rose gravity model using ordinary least squares (robust standard errors variant) and

[8] The GSP programs of major industrial and other countries are monitored by the UN Conference on Trade and Development (UNCTAD), including through a series of manuals describing the individual programs. See UNCTAD (2005).

[9] In addition to IMF's *Direction of Trade Statistics*, observations on core and country-specific variables in the Rose database are drawn from several standard sources, including the CIA *World Factbook*, IMF's *International Financial Statistics*, Penn World Table, and World Bank's *World Development Indicators*. In all, the Rose dataset entails nearly 235,000 observations, covering recorded bilateral trade for about 12,000 pairs of countries.

[10] The eight FTAs are the Association of Southeast Asian Nations (ASEAN), European Union (EU), US-Israel FTA, Caribbean Community (CARICOM), Agreement on Trade and Commercial Relations between the Government of Australia and the Government of Papua New Guinea (PATCRA), Australia–New Zealand Closer Economic Relations Trade Agreement (ANZCERTA), Central American Common Market (CACM), and South Pacific Regional Trade and Economic Cooperation Agreement (SPARTECA).

[11] For clustering of regression data and obtaining robust variance estimates for OLS coefficient estimates, see StataCorp (2003).

generalized least squares (random-effects variant), for the entire sample period 1948–99 and for ten sequential intervals ending during the 1990s: 1948–90 through 1948–99. Though not reported in these tables, each of the regression results also incorporates year-specific effects to account for possible year-to-year changes in the global macroeconomic environment surrounding international trade (Rose 2004).[12]

Estimation Results

1948–99

The estimation results presented in table 3 for the Rose gravity model correspond to the entire sample period 1948–99. They mirror the widely reported empirical robustness of the gravity model. The observed explanatory variables of the model explain 60 to 65 percent of the variation in trade flows between countries worldwide, with the robust standard errors variant of the gravity model yielding a slightly better overall goodness of fit (R-squared equal to 0.65 for the robust standard errors variant versus 0.61 for the random-effects variant). Notably however, by taking into account the influence of unobserved country-pair effects, the random-effects variant of the Rose gravity model yields an appreciably smaller average in-sample prediction error than the robust standard errors variant (the root mean squared error is equal to 1.32 for the random-effects variant versus 1.98 for the robust standard errors variant).

The core explanatory variables, led by trade distance, joint real GDP, and joint real GDP per capita, predominantly bear the anticipated signs and are generally significant at high levels of probability (with the exception of joint real GDP per capita in the random-effects variant). Thus, for instance, bilateral trade is often significantly positively related to joint GDP in partner countries and significantly negatively related to distance between partner countries. Similarly, countries sharing a common border tend to trade significantly more with one another, whereas landlocked countries tend to trade significantly less than nonlandlocked countries. Currency unions and nonreciprocal GSP programs are among the core variables that are found by both variants of the gravity model to add significantly to the bilateral trade of countries.

The estimation results for the FTA variables, including not only the aggregate Mercosur and NAFTA variables but also the "other FTAs combined" variable, provide strong support for the trade expansion effects of FTAs. When the aggregate Mercosur and NAFTA variables are decomposed by bilateral trading partners under the two agreements, the estimation results for the bilateral FTA

[12] For the methodological details of estimating the robust standard errors variant and random-effects variant of the gravity model, and similar single equation models based on panel data, see StataCorp (2003).

variables are somewhat more discriminating. Although the overall goodness of fit statistics (R-squared values) of the regression equations are not appreciably affected, the bilateral FTA variables suggest a variety of impacts across pairs of trading partners when the random-effects variant of the gravity model is assumed. Indeed, whereas the robust standard errors variant finds positive and highly significant impacts for all partners under the two regional trade agreements (except for US-Mexico under NAFTA),[13] the more sophisticated random-effects variant finds positive and highly significant bilateral trade impacts for only Argentina-Brazil, Argentina-Uruguay, and Brazil-Paraguay under Mercosur and only US-Mexico under NAFTA. Since the random-effects estimates for the FTA variables are more discriminating than the robust standard errors estimates for the FTA variables, the implication is that unaccounted for country-pair effects matter importantly. This is especially true for Mercosur, where the estimated aggregate FTA coefficient (1.01) is about half the magnitude of both the estimated Argentina-Uruguay FTA coefficient (1.98) and the estimated Brazil-Paraguay FTA coefficient (2.19).

Finally, with regard to the magnitude of the trade expansion effects implied by the highly significant FTA coefficient estimates, ceteris paribus, the gravity model suggests that the expansion of trade between FTA member countries ranges between 60 percent (Canada-Mexico) and 1,200 percent (Brazil-Paraguay) based on the robust standard errors variant of the gravity model. The range is between 200 percent (Argentina-Brazil and US-Mexico) and 800 percent (Brazil-Paraguay) based on the random-effects variant of the gravity model.[14]

1948–90 Through 1948–99

Tables 4 and 5 provide results analogous to those in table 3 but for ten sequential periods ending annually during the 1990s: 1948–90 through 1948–99. The estimation results for the ten sequential periods are very similar in character to those for the entire sample, including the greater discrimination in the significance found for the FTA variables using the random-effects variant of the Rose gravity model (table 3). Interestingly, the sequential estimation results using the random-effects variant indicate that the magnitude and significance of the estimated coefficients for some FTA variables do increase with time after an FTA is established, especially in the case of NAFTA.

More important for the analysis here, the sequential annual estimation results provide a basis for predicting the bilateral trade impacts of Mercosur and NAFTA at different points in time

[13] The estimated coefficient on the bilateral FTA variable is significantly different from zero at the 95 percent level of confidence or higher.

[14] Given the log-linear specification of the gravity model regression equation, the impact of an FTA on bilateral trade is computed in percentage terms as $100*[EXP(b_{fta}) - 1]$, where b_{fta} is the estimated coefficient for the dichotomous explanatory FTA variable and EXP is the natural exponential function operator.

beginning with the establishment of the two FTAs. Given the gravity model predictions at different points in time during the 1990s, the predictions may then be compared with the actual outturn of trade flows in 1999 (the end point of the Rose database) to assess their accuracy. The comparison is especially useful for the model predictions at the outset of the two agreements—the vantage that best mirrors the situation that policymakers face today in considering the prospects of newly proposed FTAs.

Prediction Results

The actual versus predicted values of bilateral trade found using the annual estimates for both variants of the Rose gravity model are reported in tables 6 and 7, for trade between the Mercosur partners and between the NAFTA partners, respectively. For the Mercosur trade partners (table 6), the 1948–90 estimation results are used to predict long-term bilateral trade outcomes in 1999. For NAFTA partners (table 7), the 1948–93 estimation results are used to predict long-term bilateral trade outcomes in 1999.[15]

The long-term gravity model predictions in tables 6 and 7 are based on the coefficient estimates for the "other FTAs combined" variable, which is uniformly positive and highly significant in all the gravity model estimation results reported in tables 4 and 5. This coefficient is what could have been known when Mercosur and NAFTA were negotiated. Based on these prior FTAs, a prediction might have been made that Mercosur and NAFTA would increase trade between partners by between about 185 and about 250 percent. The higher of these two predictions is based on the coefficient estimates for the "other FTAs combined" variable found by the robust standard errors variant of the gravity model.[16] As seen in table 4, the coefficient estimates for this variable are equal to 1.26 for both 1948–90 and 1948–93, the estimation intervals ending just prior to the establishment of Mercosur and NAFTA, respectively. In table 5, on the other hand, the coefficient estimates for the "other FTAs combined" variable found by the random-effects variant of the gravity model are somewhat lower—about 1.05 for both 1948–90 and 1948–93—but, holding other explanatory variables constant, still imply expanded trade of about 185 percent for partners under the two FTAs.

[15] The discussion here focuses on the long-term predictions reported in tables 6 and 7 for bilateral trade outcomes in 1999. However, for the interested reader, the two tables also report near-term (or medium-term) prediction results for 1999, based on the 1948–95 estimation results for both variants of the gravity model.
[16] See footnote 14 for an explanation of how these ceteris paribus predictions of the gravity model are derived from the estimated coefficients of the "other FTAs combined" variable. Of course, the overall mutatis mutandis predictions of the two variants of the gravity model that are presented in tables 6 and 7 incorporate the effects of not only freer trade under Mercosur and NAFTA but also changes over time in the other explanatory variables of both variants of the model.

The long-term gravity model predictions in tables 6 and 7 also reflect the coefficient estimates for the core explanatory variables, including the core time-series explanatory variables.[17] Finally, also included in the trade flow predictions are the average estimated year-effects and the country-pair effects corresponding to the two variants of the Rose gravity model. Of these last explanatory variables, the estimated year-effects are possibly the weakest element, because they cannot represent the future (i.e., out-of-sample) developments in the global economy. In the robust standard errors variant of the gravity model, the year-effects variable applied to the future is a single estimated value that reflects the average influence of past developments in the global economy. In the random-effects variant, the year-effect variable applied to the future is the regression constant term, which represents the influence of developments in the global economy during the last year of the estimation period.

Some of the gravity model predictions are truly impressive. The robust standard errors variant, for instance, provides a long-term estimate for Canada-Mexico trade under NAFTA that is less than 1 percent off the mark. And in several instances, the random-effects variant provides long-term estimates of the expanded bilateral trade under Mercosur that are off the mark by only about 5 to 10 percent (Argentina-Paraguay [5.5 percent], Argentina-Brazil [11.2 percent], and Paraguay-Uruguay [11.4 percent]).

Overall, however, the gravity model predictions in tables 6 and 7 are far from impressive. In absolute terms, as summarized in table 8, the long-term prediction errors average about 47 percent for Mercosur, about 54 percent for NAFTA and nearly 50 percent for the two FTAs combined. Even the more sophisticated random-effects variant for NAFTA misses the long-term bilateral trade outcome in 1999 by nearly 60 percent. The average long-term prediction errors of the robust standard errors variant are 60 percent for Mercosur and 50 percent for NAFTA. These results do not inspire a great confidence in gravity model predictions. Our next task is to evaluate the comparative power of the CGE model approach to forecast the trade impacts not only of Mercosur and NAFTA but also the Uruguay Round Agreement.

IV. APPLIED ANALYSIS USING THE GTAP MODEL

Applied general equilibrium is an analytical technique that uses large-scale numerical simulation models to make predictions regarding the likely economic implications of changes in trade policies or other economic variables. The defining feature of this technique, also known as computable general

[17] The Rose gravity model predictions in tables 6 and 7 employ actual, not predicted, out-of-sample values for the core time-series explanatory variables, such as average population and average GDP of bilateral trading partners.

equilibrium or CGE analysis, is that the models represent complete economic systems, constructed at the national, regional, or global level. Maximizing behavior is explicitly built into the system through the assumptions of welfare maximization by individuals and profit maximization by firms. Economy-wide constraints, such as the investment-saving relationship and factor endowment restrictions, are rigorously enforced. At a practical level, an applied general equilibrium model is a large series of simultaneous equations representing the economic system and the behavior of the agents within the system. The system is calibrated to an equilibrium dataset representing the economy, or an interrelated set of economies, at a particular point in time and is solved using numerical algorithms.[18]

The applied general equilibrium approach has significant advantages but also has important limitations. In particular, the data requirements of applied general equilibrium models are substantial. As a consequence, the predictions of an applied general equilibrium model are generally based on a single observation on an economic system (although the model's behavioral parameters may be econometrically estimated from outside sources, using a large number of observations). Balanced against this and other limitations, however, are theoretical consistency and the ability to predict values for many economic variables in the system. Thus, applied general equilibrium analysis is most useful when the contemplated changes in trade policy are large, when they involve multiple sectors and/or countries, when they involve complex interactions between a wide range of economic variables, or when they lie well outside the range of empirically observed outcomes.

Applied general equilibrium techniques have been widely used in the study of regional trading arrangements. They are regarded as particularly well-suited to the analysis of multisectoral reforms being undertaken in two or more economies simultaneously, and to the analysis of preferential trade arrangements, which inevitably entail some discrimination against outsiders (Panagariya 2000). With respect to the episodes of regional and multilateral trade liberalization considered here, Burfisher, Robinson, and Thierfelder (2001) provide a background survey of results for NAFTA, while Francois, McDonald, and Nordstrom (1996) provide a comprehensive survey of the Uruguay Round literature. Analyses of Mercosur are somewhat fewer in number, but recent efforts include Diao and Somwaru (1999, 2000), and Filho and Bento de Souza (1999).

The GTAP Model and Database

The CGE model simulations presented in this study were undertaken using the GTAP model. This is a publicly available model that is widely used, and that has a structure typical of many CGE models

[18] For a brief overview of the basic structure of applied general equilibrium models, see Gilbert and Wahl (2002). More detailed explanations of the structure of typical CGE models are provided by de Melo and Tarr (1992) and Dervis et al. (1982).

(Hertel 1997). Briefly, the GTAP model is a multiregion, multisector, computable general equilibrium model that features perfect competition and constant returns to scale. Bilateral demand for trade is handled via the so-called Armington (1969) assumption, which treats similar traded goods produced by different countries as imperfect substitutes. The assumption of imperfect substitution better fits observed patterns of bilateral trade data than the textbook assumption that similar goods from different countries are perfect substitutes. Production is modeled using "nested" constant elasticity of substitution (CES) functions; in these functions, intermediate goods are used in fixed proportions. Household demand for goods and services is specified to take into account changes in the structure of demand as incomes rise. Finally, the GTAP model is a static general equilibrium model, meaning that its structure represents the global economy at a point in time. Experiments with GTAP—in which several parameters and variables are changed to represent "before" and "after" conditions—are therefore comparative static in nature. They involve comparing the static equilibria that arise under alternative hypotheses for the underlying parameters and policy variables.[19]

The latest version of the GTAP database is version 6 (presently in beta form), which represents the global economy in 2001. Previous versions represented the global economy in 1997 (versions 5 and 5.4), 1995 (version 4), and 1992 (version 3), with incremental improvements in the coverage and quality of the data at each successive stage. The main sources of the data used in constructing the GTAP database include the UNCTAD Trade Analysis and Information System (TRAINS) database, the multilateral cooperative Agricultural Market Access Database (AMAD) database of agricultural protection, and the social accounting matrices and production input-output data submitted by researchers in the countries covered by the dataset. The current version of the GTAP database is documented in Dimaranan and McDougall (2005).

Applications of the GTAP model to regional trading arrangements abound. For a recent application of the GTAP model to the issue of US bilateral FTAs, see DeRosa and Gilbert (2004).

Experimental Design

As with the gravity model analysis in section III, the objective of this section is to explore the extent to which the predictions of a CGE model like GTAP are likely to match observed outcomes with respect to trade flows and other variables. To this end we utilize two or more equilibrium datasets. We have chosen to use the GTAP 6 (beta) dataset representing the world economy at 2001, the GTAP 5.4 dataset representing the world economy at 1997, and the GTAP 4 dataset representing the world economy at 1995. The GTAP 3 dataset is not used because of its limitations in regional

[19] For further details, see Hertel (1997) and the GTAP website at www.gtap.org.

coverage and because skilled and unskilled categories of labor were not distinguished in GTAP datasets until GTAP 4.

We take a sequential approach in five stages to generate GTAP model predictions of the outcome of trade liberalization episodes. The process is one that gives insights into what sort of information is most useful when predicting changes in trade flows and other variables and the degree to which simulations using less information are likely to alter the predicted outcomes.

We begin with simulations that are typical of the comparative static approach often found in the literature—what might be termed naïve simulations. For NAFTA and Mercosur, we first simulate the agreement under the assumption that all tariffs are eliminated in the FTA partner countries, holding all other conditions in the model unchanged. That is, tariffs and other distortions in nonmember countries are left in place, and no other changes to member or nonmember countries are considered. For the Uruguay Round simulation, the post-Uruguay Round database of Francois and Strutt (1999) is used, along with adjustments to agricultural domestic support and the elimination of the Multi-Fiber Arrangement.

In all cases we start from both the 1995 equilibrium as represented by the GTAP 4 database and from the 1997 equilibrium as represented by GTAP 5.4 database. The results of this type of simulation are often interpreted as representing how the economic system under consideration would have looked had the new policies been in place in the base year, after all relevant economic adjustments had taken place. The factor market closure is medium run, with both capital and labor assumed mobile between economic activities.

In the second set of simulations we attempt to describe the change that would occur with knowledge of the *actual* liberalization. While a simulation undertaken at the beginning of NAFTA might assume elimination of all tariffs, the actual tariff reductions could be quite different. Hence we consider the actual trade reforms that take place in the FTA partner countries, using the actual barriers still in place in the GTAP 5.4 (simulating from 1995) and the GTAP 6 (simulating from 1997) databases, respectively. The rationale for this approach is that the equilibrium at 1997 represents new information that can be incorporated into the simulation procedure.

In the final three sets of simulations we relax the ceteris paribus conditions that underlie the typical comparative static analysis. In the third simulation we begin by making the necessary changes to the remaining policy variables measured in GTAP—particularly the import tariffs, export subsidies, and domestic tax policies for *all* countries. Because domestic policies and trade policies often interact in their effects, changes in domestic policies in the countries undertaking trade reforms may significantly alter the predicted outcomes of the trade reforms. Similarly, if nonmember countries are simultaneously undertaking economic reforms, this could also alter model outcomes, especially with respect to trade flows. If the object were solely to assess the effect of the trade reform

in the FTA member countries ceteris paribus, then these other reforms might not be an issue. However, our objective is to understand how the economy is actually likely to look in the future, and therefore trade and other economic reforms within the entire system should be taken into account.

In the fourth simulation, we add growth in productive factors, notably labor and capital, to the simulation, using information from the World Bank's *World Development Indicators* (2004) and the GTAP database itself. Again, the objective is to see how the predicted variables are affected by relaxing the assumption of constant factor endowments in the naive comparative static simulation using the GTAP model. Because GTAP is constructed in the spirit of Heckscher-Ohlin trade theory, changes in endowments over time will possibly have significant implications for trade flows and other variables.

Finally, in the fifth simulation we take into account changes over time in aggregate factor productivity. This is accomplished using information from the GTAP model itself. We take the predicted outcome from the fourth simulation, and the actual level of aggregate output in the GTAP 5.4 and GTAP 6 databases, respectively. We can then "back out" an approximate rate of factor productivity growth over the period under consideration. The productivity growth determined in this way is then exogenously imposed in GTAP, and the predicted levels of trade and other variables observed. This gives us the final predicted outturn of the model variables. Also, it provides a measure (in the form of predicted total factor productivity) of the extent to which the simulations are reasonable. As previously, the fourth and fifth simulations using GTAP are undertaken for both 1995 and 1997.

Simulation Results for Trade

The results of GTAP analysis for trade flows are presented in tables 9 through 13. Our focus on trade impacts is prompted by an interest in comparing the CGE results with those found previously from the gravity model. The results of the GTAP analysis for output at the sectoral level are considered further below.

NAFTA

We begin with the long-term results predicted by GTAP for NAFTA (table 9). This table presents actual trade flows in 1995, 1997, and 2001, as recorded in the GTAP 4, GTAP 5.4, and GTAP 6

databases, respectively. In order to make the figures comparable, we have deflated the results to common units where necessary.[20]

The long-term GTAP simulation results, covering the period 1997–2001, are reported under the heading simulation 2. The actual initial and final levels of trade flows for the three NAFTA countries are presented in the first two rows (a and b), deflated to constant dollars. The actual percentage change in the value of these trade flows over the four-year period is given in the third row (c), in constant dollars. It is against these values that we check the GTAP simulation predictions for their accuracy.

Line (d) gives the predicted percentage changes in the value of trade resulting from complete removal of the barriers to trade that were in place between the NAFTA members in 1997 but not changing any other variables or parameters (the naïve ceteris paribus assumption). In all cases, the estimated changes differ significantly from the actual changes, with much lower predicted values than actual. The situation is not improved by considering the actual trade reform that took place over the period (line e) or by considering other domestic tax reforms and the trade reforms that simultaneously took place in other countries (line f).

However, once factor accumulation (line g) is added to the simulation, the results begin to look much closer to the actual changes in line (c). And, when factor productivity is included (line h), the results look even more in line with the actual changes in line (c). In particular, the GTAP model does a relatively good job of predicting changes in the overall trade pattern of Mexico and Canada, although it does less well in the case of the United States. Indeed, the prediction for the changes in the trade flows for Mexico and Canada are startlingly close to the actual outcomes (for Mexico in particular). Overall, the direction of change is correctly predicted in seven out of nine cases.[21]

What should be made of these simulation outcomes? Clearly, the results of naïve simulations are unlikely to match the actual trade flows very well. It is questionable, however, whether this represents a failure of the model. The usual purpose of the comparative static simulation is to isolate the effect of the trade policy changes alone. If instead the objective is to understand how the economy will in fact look at some future point in time—for example, to help understand the actual adjustments that may take place over the transition period with the new trade policy in place—then the ceteris paribus calculations are inappropriate.

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[20] As in the case of the gravity model results, near-term (or medium-term) simulation results, namely for 1975–97, are reported in the tables accompanying this section. The interested reader will find that the GTAP model does a better job predicting the trade flow changes from 1997 to 2001 than from 1995 to 1997, despite the longer time period and the accompanying uncertainties. This improvement may importantly reflect enhancements made to the GTAP database over the years, as better quality equilibrium data should result in a model that more closely matches reality.

[21] Predictions with incorrect signs are highlighted in the tables accompanying this section (tables 9 to 12).

To answer the question, How will actual trade flows likely change?, the ceteris paribus conditions must clearly be adjusted. It is thus of interest to consider what additional information is most significant. The results indicate that, while collateral reforms in the home country, or simultaneous changes in trade instruments in other countries, do affect the results, these forces are dwarfed by the impact of factor accumulation and factor productivity changes. Factor accumulation is particularly important. Hence, the growth path of countries plays a huge role in predicting actual trade outcomes, as one might expect from economic theory. Of course, the growth path is not independent of trade policy reform, especially since induced changes in sectoral price incentives will determine where the expanded endowments are allocated in each country.

It is interesting that the GTAP model does a better job of predicting the trade flows of Mexico and Canada than those of the United States. It seems that the answer lies in the magnitude of the changes. Within NAFTA, the most significant changes in trade flows are those between Canada and Mexico, and in Mexico's overall level of trade, precisely the flows that are best predicted by GTAP. The changes in the US trade in total and with Canada are fairly small and not well predicted by the model. The one US result that does yield the correct sign and approximate order of magnitude is US-Mexico exports. This is the largest proportional change in the US trade pattern. The results suggest that CGE models are likely to be better at highlighting major trade shifts than smaller ones.

Mercosur and Uruguay Round Agreement

The results of the GTAP model simulations for Mercosur are presented in table 10, following the same format as table 9. Overall, the GTAP simulations do not perform particularly well for the Mercosur countries. This may reflect the relatively small trade flows of these countries relative to the global trading system and also the very modest proportion of intraregional trade in the trade profiles of the individual Mercosur countries.

Finally, tables 11 and 12 present the results of the GTAP model simulations for the Uruguay Round Agreement. The overall trade flows of each WTO member are considered, with headings corresponding to the simulation stages in tables 9 and 10. Table 11 contains the medium-term simulation results over 1995–97 and table 12 the long-term simulation results over 1997–2001. Once again, we observe that the results of naïve simulations have little resemblance to actual outcomes. More importantly, even simulations that take advantage of additional information can perform poorly.

The overall fit of the predictions is summarized in table 13. In the first column, we have the simple average percentage deviation of the predicted change from the actual change, for total trade (26 data items), total bilateral trade (676 data items), and trade by sector and region (15,548 data

items). In effect, this statistic indicates whether there is a bias in the predictions (the average deviation would be zero if the model results were unbiased). It is apparent that the predictions are slightly biased for all variables. However, the model tends to perform much better, by the average deviation criterion, over the longer period 1997–2001 than over the shorter period 1995–97.

One well-known problem with GTAP and similar CGE models is that they tend to perform very poorly when the initial trade flows or other variables are very small.[22] It is common for CGE models to predict very large percentage changes in trade when initial trade volumes are virtually nonexistent.[23] In any event, we can correct the possible measure of bias by weighting the average deviations of predicted trade flows by their trade shares (thereby applying a lower weight to very small initial values). These results are shown in the second column of table 13, where it is apparent that the degree of bias in the model is significantly lower, suggesting that the model does a much better job of predicting changes, on average, in large trade flows than in small ones.

To say that the predictions are reasonably consistent, in particular with the more recent 2001 database and when deviations are weighted by trade flows, is not the same as saying that we can have confidence in any individual result. The latter requires consideration of the dispersion of the results around the mean. In column 3 of table 13 we have calculated the standard deviation of the mean over/under prediction, a statistic analogous to the root mean squared error statistic used previously to evaluate the gravity model predictions. The numbers are quite large and increasingly so as the level of trade considered becomes finer. The underlying simulation results indicate that approximately a quarter of the total trade predictions between 1997 and 2001 lie within plus or minus 15 percent of the mean prediction, and about a half of the total trade predictions between 1997 and 2001 lie within plus or minus 30 percent of the mean prediction. At the bilateral trade level, the results are considerably less predictable and more so at the bilateral/sectoral level.

The fourth column of table 13 reports the percentage of trade changes with the correctly predicted sign. The model correctly predicts the direction of change in approximately two-thirds of the bilateral trade flows but only for about half of the total trade and bilateral/sectoral trade flows. This measure should be interpreted in conjunction with other information. Predicting –3 percent when the actual value is +3 percent is probably a less serious error than predicting +3 percent when the actual value is +100 percent, although +3 percent correctly predicts the direction of change.

Overall, like the gravity model predictions discussed in section II, the results of the simulations do not inspire great confidence in the use of applied general equilibrium models as a tool for predicting trade flows in the wake of either regional or multilateral agreements. However, the

[22] See, for instance, Scollay and Gilbert (2001).

[23] The CGE model would be a poor choice to study a very small sector; a partial equilibrium approach is likely to be better-suited.

GTAP model predictions of trade flows, particularly using more recent versions of the model, are not significantly biased up or down, once full account is taken of the underlying growth of the economies in addition to liberalization. Significant underestimates of trade changes using CGE models reflect naïve assumptions in the liberalization scenario—that is, considering the effect of trade policy liberalization in isolation from the changes in the economic system.

Simulation Results for Output

As mentioned previously, a major advantage of CGE models is that they are able to predict changes in the entire economic system. Thus, the GTAP model predictions for sectoral variables in addition to trade flows are likely to interest policymakers when they evaluate the prospects of concerted regional or multilateral trade liberalization. Because the GTAP predictions at the sectoral level are extensive, they are only briefly discussed here, based on the simulation results for the value of output by sector tabulated in the appendix.

The sectoral results are presented in tables A.1 and A.2 for the NAFTA countries, tables A.3 and A.4 for the Mercosur countries, and tables A.5 through A.12 for prominent countries in connection with the Uruguay Round Agreement. Again because of space limitations, we present only a comparison of the results of the final stage simulation (described above) with the actual change in the value of output by sector from the GTAP databases. As before, the tables provide a rough measure of the predictive capacity of the GTAP model by noting the proportion of output effects for which the model correctly predicts the direction of change.

The NAFTA results in tables A.1 and A.2 indicate that the final simulation correctly predicts the direction of change in output approximately 70 percent of the time over the long-term period 1997–2001, with better results found for Mexico than Canada or the United States. The long-term Mercosur predictions are somewhat better, with 84 percent of the cases correctly predicted (particularly for Argentina and Brazil). Finally, with respect to the final simulation results for the remaining countries under the Uruguay Round Agreement in tables A.5 through A.12, the directions of sectoral change are predicted correctly in 79 percent of the cases over the period 1997–2001.

We have constructed summary measures of the performance of the model with respect to sectoral output, and the results are reported in table 13. Again, we have measured the simple average percentage deviation of the predicted change from the actual change, the weighted average deviations of predicted changes, with weights provided by GDP shares (thereby applying a lower weight to very small initial values), the standard deviation of the mean over/underprediction, and the proportion of results with the direction of change correctly predicted.

Out of the 598 predicted values for sectoral output changes by region, 79 percent have the correct sign for the period 1997–2001, better than found for the trade flow changes. On other criteria also, the sectoral results perform somewhat better than the trade results. They are relatively unbiased (and not so dramatically affected by small initial values, probably because fewer small values occur in output statistics than trade statistics), and the degree of dispersion is relatively small. This suggests that CGE results regarding the sectoral impact of trade reform and other changes in the global economy may be more reliable than the trade predictions. This in turn suggests that more work is required in modeling the trade pattern and in determining appropriate values for Armington elasticities, since these are the most important parameters in the trade component of a CGE model like GTAP.

V. CONCLUSION

Traditionally, a major vein of trade policy analysis has been the estimation of the economic gains from trade liberalization. In fact, estimates of the gains from the Uruguay Round Agreement and the two prominent regional FTAs considered here, Mercosur and NAFTA, abound, derived from a number of empirical and applied economic models. Nonetheless, considerable uncertainty surrounds the reliability of these estimates, prompting economists to draw on a variety of other quantitative methods to evaluate trade benefits.[24] While critics of freer trade frequently find fault with quantitative estimates of trade gains and with the models from which the estimates are derived, champions of freer trade frequently find no less fault with the same estimates and models, albeit with the opposite view—namely, that trade and welfare gains are actually much larger than estimated by existing economic models.

The stand-alone impacts of regional and multilateral trade liberalization are, in fact, often swamped by other influences on international trade and economic growth in the real world. Hence, the present analysis has endeavored to examine how well popular applied economic models fare in predicting observed trade and output levels in the aftermath of three major FTAs and multilateral trade agreements established during the 1990s. Using both the Rose gravity trade model and the popular GTAP general equilibrium model to predict outcomes after the establishment of Mercosur, NAFTA, and the Uruguay Round Agreement, the ex post analysis presented here does not inspire great confidence in the forecasts. What can be said is that naïve versions of the gravity model may overpredict while naïve versions of the CGE model may underpredict. Adding factor expansion and

[24] See, for instance, Bradford, Grieco, and Hufbauer (2005).

productivity growth to the CGE model improves its record. At the moment, neither model has a stellar forecasting record. Better models remain to be constructed.

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Table 1 Expansion of intrabloc trade under selected free trade agreements, at 3-year, 5-year, and 10-year intervals

		Nominal trade flows				Real trade flows			
Free trade agreement	Year	Intrabloc exports	Intrabloc imports	Exports to world	Imports from world	Intrabloc exports	Intrabloc imports	Exports to world	Imports from world
US-Israel FTA (1985)									
Israel	3	150.6	109.2	153.5	146.4	137.7	99.9	140.4	133.9
United States	3	109.2	150.6	114.7	124.3	99.9	137.7	104.9	113.7
World	3				130.7				119.5
Israel	5	183.8	133.0	195.3	144.4	154.0	111.5	163.7	121.0
United States	5	133.0	183.8	160.8	144.6	111.5	154.0	134.8	121.2
World	5				161.9				135.7
Israel	10	294.9	240.4	303.6	242.1	206.8	168.6	212.8	169.8
United States	10	240.4	294.9	239.3	202.1	168.6	206.8	167.8	141.7
World	10				224.8				157.6
Mercosur (1991)									
Argentina	3	180.3	388.0	102.0	411.3	163.1	350.9	92.3	372.0
Brazil	3	291.1	113.9	108.7	124.1	263.3	103.1	98.4	112.2
Paraguay	3	101.1	173.8	74.0	124.7	91.4	157.2	66.9	112.8
Uruguay	3	261.2	157.9	104.4	177.3	236.2	142.8	94.4	160.4
World	3				107.9				97.6
Argentina	5	322.4	337.2	161.2	471.3	276.5	289.2	138.2	404.2
Brazil	5	368.2	215.1	135.7	217.6	315.7	184.5	116.4	186.7
Paraguay	5	160.1	339.7	113.0	229.4	137.3	291.4	96.9	196.8
Uruguay	5	240.5	199.1	106.4	217.7	206.2	170.7	91.3	186.7
World	5				146.1				125.3
Argentina	10	358.9	659.1	201.7	619.9	272.4	500.3	153.1	470.5
Brazil	10	455.0	219.4	166.7	247.7	345.3	166.5	126.5	188.0
Paraguay	10	305.1	458.2	91.2	168.2	231.6	347.8	69.2	127.7
Uruguay	10	451.0	233.2	122.4	263.1	342.3	177.0	92.9	199.7
World	10				187.5				142.3
NAFTA (1994)									
Canada	3	145.2	145.6	141.7	126.0	133.8	134.1	130.5	116.1
Mexico	3	171.3	147.6	182.3	136.9	157.7	135.9	167.9	126.1
United States	3	138.0	161.2	140.3	135.6	127.1	148.5	129.2	124.9
World	3				141.9				130.7
Canada	5	176.9	171.5	152.2	147.7	156.8	152.0	134.9	130.9
Mexico	5	212.2	198.7	228.0	191.5	188.1	176.1	202.1	169.8
United States	5	177.4	196.3	151.6	156.7	157.2	174.0	134.4	138.9
World	5				145.6				129.0
Canada	10	277.3	245.8	190.0	177.4	217.8	193.0	149.2	139.3
Mexico	10	334.5	290.3	327.9	260.9	262.7	228.0	257.5	204.9
United States	10	195.9	271.6	157.4	216.5	153.8	213.3	123.6	170.0
World	10				205.0				161.0

(table continues next page)

Table 1 Expansion of intrabloc trade under selected free trade agreements, at 3-year, 5-year, and 10-year intervals *(continued)*

		Nominal trade flows				Real trade flows			
Free trade agreement	**Year**	**Intrabloc exports**	**Intrabloc imports**	**Exports to world**	**Imports from world**	**Intrabloc exports**	**Intrabloc imports**	**Exports to world**	**Imports from world**
EU-Turkey Customs Union (1996)									
European Union	3	126.6	127.1	108.0	109.8	118.3	118.9	101.0	102.7
Turkey	3	127.1	144.5	122.5	128.4	118.9	135.1	114.5	120.1
World	3				107.5				100.5
European Union	5	158.6	138.5	117.1	121.7	140.4	122.5	103.7	107.7
Turkey	5	138.5	158.6	129.4	152.4	122.5	140.4	114.5	134.9
World	5				128.4				113.6
European Union	10	223.0	317.6	181.0	182.5	179.9	256.3	146.0	147.2
Turkey	10	317.6	263.1	313.3	272.2	256.3	212.2	252.8	219.6
World	10				185.2				149.4
Canada-Chile FTA (1997)									
Canada	3	99.4	112.8	117.3	125.9	93.6	106.2	110.5	118.6
Chile	3	112.8	99.4	98.1	82.2	106.2	93.6	92.3	77.5
World	3				108.1				101.8
Canada	5	104.3	165.2	129.3	130.3	92.4	146.3	114.6	115.4
Chile	5	165.2	104.3	115.1	91.3	146.3	92.4	102.0	80.9
World	5				118.6				105.1
Canada	10	84.1	403.3	152.8	159.9	69.8	335.0	126.9	132.8
Chile	10	403.3	84.1	195.1	126.9	335.0	69.8	162.1	105.4
World	10				176.7				146.7
EU-Mexico FTA (2000)									
European Union	3	129.6	119.4	110.0	109.5	120.0	110.5	101.9	101.4
Mexico	3	119.4	129.6	122.8	118.8	110.5	120.0	113.7	110.0
World	3				114.0				105.6
European Union	5	143.9	160.6	160.8	159.7	126.9	141.7	141.8	140.8
Mexico	5	160.6	143.9	145.5	120.9	141.7	126.9	128.3	106.7
World	5				163.5				144.2
NZ-Singapore FTA (2001)									
New Zealand (NZ)	3	114.8	152.7	120.3	132.4	107.4	142.9	112.6	123.9
Singapore	3	152.7	114.8	105.3	95.1	142.9	107.4	98.5	89.0
World	3				118.0				110.4
US-Jordan FTA (2001)									
Jordan	3	473.3	138.2	192.8	166.9	443.7	129.6	180.8	156.4
United States	3	138.2	473.3	112.0	129.3	129.6	443.7	105.0	121.2
World	3				148.9				139.6

Sources: IMF's *Direction of Trade Statistics* CD-ROM (July 2005), and authors' calculations.

Notes: FTA commencement year is in parentheses. Intrabloc trade expansion figures are relative to base year prior to FTA = 100. Figures for Mercosur and NAFTA are mean values for bilateral intrabloc trade. Real trade flows are computed using US consumer price index.

Table 2 Predicted versus actual expansion of intrabloc trade under Mercosur and NAFTA, at 3-year, 5-year, and 10-year intervals

(real terms, relative to year prior to FTA commencement) [1]

		Naïve gravity model prediction	Naïve GTAP model prediction			Actual intrabloc trade expansion			Prediction error (percent)					
									Naïve gravity model			Naïve GTAP model		
	Year	Bilateral trade	Exports	Imports	Simple avg.	Exports	Imports	Simple avg.	Exports	Imports	Simple avg.	Exports	Imports	Simple avg.
Mercosur (1991)														
Argentina	3	282.9	161.0	187.1	174.0	163.1	350.9	257.0	73.5	-19.4	10.1	-1.3	-46.7	-32.3
Brazil	3	282.9	167.4	181.6	174.5	263.3	103.1	183.2	7.5	174.5	54.5	-36.4	76.2	-4.8
Paraguay	3	282.9	…	…	…	91.4	157.2	124.3	209.5	79.9	127.6	…	…	…
Uruguay	3	282.9	172.9	132.5	152.7	236.2	142.8	189.5	19.8	98.1	49.3	-26.8	-7.2	-19.4
Argentina	5	282.9	141.7	166.2	153.9	276.5	289.2	282.8	2.3	-2.2	0.0	-48.8	-42.5	-45.6
Brazil	5	282.9	154.9	165.9	160.4	315.7	184.5	250.1	-10.4	53.4	13.1	-51.0	-10.1	-35.9
Paraguay	5	282.9	…	…	…	137.3	291.4	214.3	106.1	-2.9	32.0	…	…	…
Uruguay	5	282.9	180.6	145.0	162.8	206.2	170.7	188.5	37.2	65.7	50.1	-12.5	-15.1	-13.7
Argentina	10	282.9	…	…	…	272.4	500.3	386.4	3.9	-43.4	-26.8	…	…	…
Brazil	10	282.9	…	…	…	345.3	166.5	255.9	-18.1	69.9	10.6	…	…	…
Paraguay	10	282.9	…	…	…	231.6	347.8	289.7	22.2	-18.6	-2.3	…	…	…
Uruguay	10	282.9	…	…	…	342.3	177.0	259.7	-17.3	59.8	9.0	…	…	…
NAFTA (1994) [2]														
Canada	3	282.9	92.8	96.5	94.6	133.8	134.1	133.9	111.5	111.0	111.2	-30.7	-28.1	-29.4
Mexico	3	282.9	96.2	92.5	94.3	157.7	135.9	146.8	79.4	108.1	92.7	-39.0	-32.0	-35.8
United States	3	282.9	96.6	96.6	96.6	127.1	148.5	137.8	122.7	90.5	105.3	-24.0	-35.0	-29.9
Canada	5	282.9	105.4	95.9	100.6	156.8	152.0	154.4	80.4	86.1	83.2	-32.8	-36.9	-34.8
Mexico	5	282.9	95.9	106.5	101.2	188.1	176.1	182.1	50.4	60.6	55.4	-49.0	-39.6	-44.5
United States	5	282.9	96.5	95.4	95.9	157.2	174.0	165.6	79.9	62.6	70.8	-38.6	-45.2	-42.1
Canada	10	282.9	…	…	…	217.8	193.0	205.4	29.9	46.6	37.8	…	…	…
Mexico	10	282.9	…	…	…	262.7	228.0	245.3	7.7	24.1	15.3	…	…	…
United States	10	282.9	…	…	…	153.8	213.3	183.6	83.9	32.6	54.1	…	…	…

Sources: IMF *Direction of Trade Statistics* on CD-ROM (July 2005) and authors' calculations based on gravity model estimation results in table 5.

Notes: FTA commencement dates are in parentheses. Intrabloc trade expansion numbers are mean values for bilateral intrabloc trade, relative to year prior to FTA = 100. The naïve gravity model applies a FTA-coefficient estimate of 1.04. The naïve plus gravity model additionally accounts for expected GDP growth by trading partners, based on 5-year average growth by the partners and a gravity model GDP growth-coefficient of 0.87. The naive GTAP model simulates only the impacts of only eliminating tariffs on trade between FTA members.

1. Trade values in US dollars are converted to real terms using the US consumer price index.

2. US-Canada FTA commencement date is 1989.

Table 3 Rose gravity model estimation results, 1948-99

	Robust standard errors variant (OLS)		Random-effects variant (GLS)	
Core explanatory variables				
Constant	-27.79 ***	-27.79 ***	-20.59 ***	-20.58 ***
Distance	-1.12 ***	-1.12 ***	-1.32 ***	-1.32 ***
Product GDP	0.92 ***	0.92 ***	0.88 ***	0.88 ***
Product GDP per capita	0.32 ***	0.32 ***	0.00	0.00
Common language	0.32 ***	0.32 ***	0.27 ***	0.27 ***
Land border	0.53 ***	0.53 ***	0.66 ***	0.66 ***
Number landlocked	-0.27 ***	-0.27 ***	-0.53 ***	-0.53 ***
Number islands	0.04	0.04	0.18 ***	0.18 ***
Product land area	-0.10 ***	-0.10 ***	-0.06 ***	-0.06 ***
Common colonizer	0.58 ***	0.58 ***	0.16 **	0.16 **
Currently colonized	1.08 ***	1.08 ***	0.32 ***	0.32 ***
Ever colony	1.16 ***	1.16 ***	2.15 ***	2.15 ***
Common country	-0.02	-0.02	1.20	1.20
Currency union	1.12 ***	1.12 ***	0.60 ***	0.60 ***
GSP	0.86 ***	0.86 ***	0.30 ***	0.30 ***
Free trade agreements				
Mercosur	1.60 ***	…	1.01 ***	…
Arg-Brz		2.07 ***		1.09 **
Arg-Par		2.19 ***		0.62
Arg-Urg		0.89 ***		1.98 ***
Brz-Par		2.57 ***		2.19 ***
Brz-Urg		0.97 ***		0.92 *
Par-Urg		2.19 ***		0.38
NAFTA	0.94 **	…	0.85 ***	…
US-Can		1.62 ***		0.57
US-Mex		0.16		1.17 **
Can-Mex		0.45 ***		1.01 *
Other FTAs	1.19 ***	1.19 ***	0.89 ***	0.89 ***
Summary statistics				
R-squared	0.65	0.65	0.61	0.61
RMSE	1.98	1.98	1.32	1.32
Observations (Th.)	235	235	235	235
Country pairs (Th.)	12	12	12	12

GSP = generalized system of preferences

RMSE = root mean squared error

Source: Ordinary least squares (OLS) and generalized least squares (GLS) estimation with year effects (intercepts not reported), using Stata software and Rose (2004) database.

Notes: Regressand is log real trade. Distance, product GDP, product GDP per capita, and product land area are in log terms. ***, **, * indicate that the coefficients are statistically significant at the 99, 95, and 90 percent levels, respectively.

Table 4 Rose gravity model estimation results: Robust standard errors variant, 1948-90 through 1948-99

		Mercosur (from 1991)								
					NAFTA (from 1994)					
	1948-90	1948-91	1948-92	1948-93	1948-94	1948-95	1948-96	1948-97	1948-98	1948-99
Core explanatory variables										
Constant	-27.73 ***	-28.00 ***	-28.27 ***	-28.44 ***	-28.53 ***	-28.68 ***	-28.72 ***	-28.72 ***	-28.19 ***	-27.79 ***
Distance	-1.08 ***	-1.08 ***	-1.09 ***	-1.09 ***	-1.10 ***	-1.11 ***	-1.12 ***	-1.13 ***	-1.12 ***	-1.12 ***
Product GDP	0.89 ***	0.90 ***	0.90 ***	0.91 ***	0.91 ***	0.91 ***	0.91 ***	0.91 ***	0.91 ***	0.92 ***
Product GDP per capita	0.38 ***	0.38 ***	0.38 ***	0.38 ***	0.38 ***	0.39 ***	0.39 ***	0.38 ***	0.35 ***	0.32 ***
Common language	0.30 ***	0.30 ***	0.31 ***	0.31 ***	0.31 ***	0.31 ***	0.31 ***	0.31 ***	0.32 ***	0.32 ***
Land border	0.45 ***	0.45 ***	0.46 ***	0.47 ***	0.48 ***	0.49 ***	0.49 ***	0.50 ***	0.51 ***	0.53 ***
Number landlocked	-0.20 ***	-0.20 ***	-0.21 ***	-0.22 ***	-0.23 ***	-0.22 ***	-0.23 ***	-0.23 ***	-0.25 ***	-0.27 ***
Number islands	0.07 *	0.06	0.06	0.05	0.05	0.05	0.04	0.04	0.04	0.04
Product land area	-0.09 ***	-0.10 ***	-0.10 ***	-0.10 ***	-0.10 ***	-0.10 ***	-0.10 ***	-0.10 ***	-0.10 ***	-0.10 ***
Common colonizer	0.59 ***	0.60 ***	0.60 ***	0.60 ***	0.59 ***	0.59 ***	0.58 ***	0.58 ***	0.58 ***	0.58 ***
Currently colonized	1.05 ***	1.05 ***	1.04 ***	1.04 ***	1.04 ***	1.03 ***	1.04 ***	1.04 ***	1.06 ***	1.08 ***
Ever colony	1.17 ***	1.16 ***	1.16 ***	1.16 ***	1.15 ***	1.15 ***	1.15 ***	1.15 ***	1.16 ***	1.16 ***
Common country	0.04	0.02	0.00	-0.02	-0.04	-0.06	-0.08	-0.08	-0.04	-0.02
Currency union	1.13 ***	1.14 ***	1.15 ***	1.17 ***	1.17 ***	1.17 ***	1.17 ***	1.16 ***	1.13 ***	1.12 ***
GSP	0.92 ***	0.92 ***	0.92 ***	0.92 ***	0.91 ***	0.90 ***	0.89 ***	0.87 ***	0.87 ***	0.86 ***
Free trade agreements										
Mercosur										
Arg-Brz	...	2.00 ***	2.12 ***	2.21 ***	2.21 ***	2.23 ***	2.26 ***	2.27 ***	2.17 ***	2.07 ***
Arg-Par	...	2.06 ***	2.13 ***	2.17 ***	2.20 ***	2.24 ***	2.26 ***	2.27 ***	2.22 ***	2.19 ***
Arg-Urg	...	1.20 ***	1.22 ***	1.30 ***	1.32 ***	1.25 ***	1.19 ***	1.12 ***	0.99 ***	0.89 ***
Brz-Par	...	2.56 ***	2.52 ***	2.62 ***	2.66 ***	2.68 ***	2.70 ***	2.71 ***	2.66 ***	2.57 ***
Brz-Urg	...	1.28 ***	1.22 ***	1.27 ***	1.24 ***	1.24 ***	1.22 ***	1.19 ***	1.08 ***	0.97 ***
Par-Urg	...	1.98 ***	1.89 ***	1.90 ***	1.92 ***	1.99 ***	2.10 ***	2.14 ***	2.16 ***	2.19 ***
NAFTA										
US-Can	2.09 ***	2.01 ***	1.93 ***	1.89 ***	1.85 ***	1.80 ***	1.76 ***	1.72 ***	1.66 ***	1.62 ***
US-Mex	...	...	...	...	0.13	0.13	0.13	0.12	0.13	0.16
Can-Mex	...	...	...	...	0.26 ***	0.32 ***	0.33 ***	0.32 ***	0.37 ***	0.45 ***
Other FTAs	1.26 ***	1.26 ***	1.26 ***	1.26 ***	1.25 ***	1.24 ***	1.25 ***	1.25 ***	1.21 ***	1.19 ***
Summary statistics										
R-squared	0.63	0.64	0.64	0.64	0.64	0.64	0.65	0.65	0.65	0.65
RMSE	1.95	1.96	1.97	1.98	1.98	1.99	1.99	1.99	1.98	1.98
Observations (Th.)	168	175	181	189	196	204	212	220	227	235
Pairs (Th.)	9	9	9	10	10	11	11	11	12	12

GSP = generalized system of preferences; RMSE = root mean squared error

Source: Ordinary least squares estimation with year effects (intercepts not reported) using Rose (2004) database.

Notes: Regressand is log real trade. Distance, product GDP, product GDP per capita, and product land area are in log terms. Pre-1994 results for NAFTA reflect US-Canada FTA. ***, **, * indicate that the coefficients are statistically significant at the 99, 95, and 90 percent levels, respectively.

Table 5 Rose gravity model estimation results: Random-effects variant, 1948-90 through 1948-99

		Mercosur (from 1991)								
					NAFTA (from 1994)					
	1948-90	1948-91	1948-92	1948-93	1948-94	1948-95	1948-96	1948-97	1948-98	1948-99
Core explanatory variables										
Constant	-25.99 ***	-26.00 ***	-26.55 ***	-26.47 ***	-25.80 ***	-25.63 ***	-25.17 ***	-24.72 ***	-21.99 ***	-20.58 ***
Distance	-1.33 ***	-1.36 ***	-1.34 ***	-1.36 ***	-1.38 ***	-1.39 ***	-1.39 ***	-1.38 ***	-1.34 ***	-1.32 ***
Product GDP	0.86 ***	0.86 ***	0.87 ***	0.87 ***	0.87 ***	0.87 ***	0.87 ***	0.87 ***	0.88 ***	0.88 ***
Product GDP per capita	0.35 ***	0.36 ***	0.36 ***	0.35 ***	0.33 ***	0.32 ***	0.30 ***	0.28 ***	0.10 ***	0.00
Common language	0.33 ***	0.34 ***	0.35 ***	0.34 ***	0.29 ***	0.28 ***	0.28 ***	0.28 ***	0.26 ***	0.27 ***
Land border	0.36 **	0.32 *	0.39 **	0.40 **	0.43 ***	0.46 ***	0.46 ***	0.47 ***	0.64 ***	0.66 ***
Number landlocked	-0.38 ***	-0.43 ***	-0.41 ***	-0.48 ***	-0.40 ***	-0.38 ***	-0.39 ***	-0.38 ***	-0.47 ***	-0.53 ***
Number islands	0.19 ***	0.19 ***	0.21 ***	0.17 ***	0.17 ***	0.16 ***	0.16 ***	0.12 ***	0.17 ***	0.18 ***
Product land area	-0.04 ***	-0.04 ***	-0.04 ***	-0.04 ***	-0.04 ***	-0.04 ***	-0.05 ***	-0.06 ***	-0.06 ***	-0.06 ***
Common colonizer	0.23 ***	0.28 ***	0.26 ***	0.24 ***	0.24 ***	0.26 ***	0.24 ***	0.21 ***	0.22 ***	0.16 **
Currently colonized	0.24 ***	0.25 ***	0.25 ***	0.25 ***	0.26 ***	0.27 ***	0.27 ***	0.28 ***	0.30 ***	0.32 ***
Ever colony	2.00 ***	2.00 ***	1.99 ***	1.97 ***	2.00 ***	2.00 ***	2.01 ***	2.00 ***	2.09 ***	2.15 ***
Common country	0.95	0.97	0.96	0.99	1.02	1.01	0.99	0.99	1.15	1.20
Currency union	0.56 ***	0.55 ***	0.55 ***	0.56 ***	0.56 ***	0.56 ***	0.57 ***	0.57 ***	0.59 ***	0.60 ***
GSP	0.36 ***	0.36 ***	0.35 ***	0.35 ***	0.34 ***	0.33 ***	0.32 ***	0.31 ***	0.31 ***	0.30 ***
Free trade agreements										
Mercosur										
Arg-Brz	...	0.74	0.89	1.02	1.07	1.13 *	1.18 **	1.23 **	1.16 **	1.09 **
Arg-Par	...	0.33	0.41	0.48	0.54	0.61	0.66	0.71	0.65	0.62
Arg-Urg	...	2.08 *	2.15 **	2.26 ***	2.32 ***	2.29 ***	2.26 ***	2.23 ***	2.07 ***	1.98 ***
Brz-Par	...	1.92	1.89 **	2.01 ***	2.09 ***	2.15 ***	2.20 ***	2.25 ***	2.24 ***	2.19 ***
Brz-Urg	...	0.97	0.92	1.00	1.02	1.04 *	1.06 *	1.06 **	1.00 *	0.92 *
Par-Urg	...	0.09	0.00	0.00	0.06	0.14	0.27	0.34	0.35	0.38
NAFTA										
US-Can	0.63	0.64	0.64	0.66	0.67	0.68	0.68	0.69	0.61	0.57
US-Mex	...	...	...	...	1.02	1.06	1.10	1.14 *	1.13 *	1.17 **
Can-Mex	...	...	...	...	0.78	0.85	0.89	0.91	0.94	1.01 *
Other FTAs	1.05 ***	1.04 ***	1.05 ***	1.03 ***	1.01 ***	0.98 ***	0.98 ***	0.96 ***	0.92 ***	0.89 ***
Summary statistics										
R-squared	0.62	0.62	0.62	0.62	0.62	0.63	0.63	0.63	0.62	0.61
RMSE	...	...	...	...	...	...	...	...	...	...
Observations (Th.)	168	175	181	189	196	204	212	220	227	235
Pairs (Th.)	9	9	9	10	10	11	11	11	12	12

GSP = generalized system of preferences; RMSE = root mean squared error

Source: Generalized least squares estimation with random effects and year effects (intercepts not reported) using Rose (2004) database.

Notes: Regressand is log real trade. Distance, product GDP, product GDP per capita, and product land area are in log terms. Pre-1994 results for NAFTA reflect US-Canada FTA. ***, **, * indicate that the coefficients are statistically significant at the 99, 95, and 90 percent levels, respectively.

Table 6 Actual versus predicted trade between Mercosur countries using the Rose gravity model, 1990-99
(millions of US dollars, at 1982-84 prices)

Partner countries by model variant, estimation period	Actual/ predicted value	1990	%error	Mercosur (from 1991) 1993	%error	1995	%error	1999	%error	
Argentina-Brazil	A	851	...	2,271	...	3,205	...	3,450	...	
RSE, 1948-90	P	126	-85.2	619	-72.8	719	-77.6	1,252	-63.7	
RSE, 1948-93	P			1,778	-21.7	2,072	-35.4	3,640	5.5	
RSE, 1948-95	P					2,601	-18.8	4,587	33.0	
RSE, 1948-99	P							7,633	121.3	
RE, 1948-90	P	501	-41.2	1,958	-13.8	2,260	-29.5	3,837	11.2	##
RE, 1948-93	P			1,810	-20.3	2,093	-34.7	3,574	3.6	
RE, 1948-95	P					2,623	-18.2	4,433	28.5	#
RE, 1948-99	P							5,440	57.7	
Argentina-Paraguay	A	76	...	122	...	204	...	260	...	
RSE, 1948-90	P	8	-90.0	41	-66.7	46	-77.7	56	-78.5	
RSE, 1948-93	P			107	-12.1	121	-41.0	148	-43.0	
RSE, 1948-95	P					155	-24.0	191	-26.5	#
RSE, 1948-99	P							359	38.0	
RE, 1948-90	P	47	-37.2	202	65.7	226	10.5	275	5.5	##
RE, 1948-93	P			109	-10.6	122	-40.3	149	-42.9	
RE, 1948-95	P					157	-23.3	191	-26.6	
RE, 1948-99	P							279	7.3	
Argentina-Uruguay	A	131	...	325	...	283	...	354	...	
RSE, 1948-90	P	38	-70.7	221	-31.8	241	-14.8	461	30.1	##
RSE, 1948-93	P			257	-21.0	280	-1.2	540	52.6	
RSE, 1948-95	P					326	15.2	633	78.7	
RSE, 1948-99	P							852	140.5	
RE, 1948-90	P	18	-86.3	82	-74.9	89	-68.7	164	-53.6	
RE, 1948-93	P			261	-19.7	283	-0.1	529	49.3	
RE, 1948-95	P					330	16.4	608	71.6	#
RE, 1948-99	P							597	68.7	

Notes: RSE denotes the robust standard errors variant, and RE the random-effects variant. Ex ante forecasts are highlighted. ## denotes best pre-Mercosur (1990) forecast for 1999, # best near-term (1995) forecast for 1999.

Table 6 Actual versus predicted trade between Mercosur countries using the Rose gravity model, 1990-99
(millions of US dollars, at 1982-84 prices) *(continued)*

Partner countries by model variant, estimation period	Actual/ predicted value	1990	%diff	Mercosur (from 1991) 1993	%diff	1995	%diff	1999	%diff	
Brazil-Paraguay	A	243	...	315	...	479	...	316	...	
RSE, 1948-90	P	15	-94.0	60	-80.8	73	-84.7	63	-80.2	
RSE, 1948-93	P			247	-21.4	301	-37.1	257	-18.9	
RSE, 1948-95	P					388	-19.0	330	4.4	#
RSE, 1948-99	P							605	91.1	
RE, 1948-90	P	30	-87.4	101	-68.0	121	-74.7	105	-67.0	##
RE, 1948-93	P			252	-19.8	304	-36.5	262	-17.2	
RE, 1948-95	P					391	-18.4	339	7.1	
RE, 1948-99	P							503	59.0	
Brazil-Uruguay	A	336	...	392	...	496	...	389	...	
RSE, 1948-90	P	70	-79.2	310	-20.8	366	-26.2	487	25.2	##
RSE, 1948-93	P			334	-14.7	395	-20.3	528	35.9	
RSE, 1948-95	P					462	-6.8	618	59.1	
RSE, 1948-99	P							941	142.2	
RE, 1948-90	P	106	-68.6	374	-4.4	438	-11.6	576	48.1	
RE, 1948-93	P			340	-13.1	399	-19.4	526	35.4	
RE, 1948-95	P					465	-6.1	610	57.0	#
RE, 1948-99	P							707	81.8	
Paraguay-Uruguay	A	8	...	9	...	17	...	31	...	
RSE, 1948-90	P	1	-88.5	4	-48.0	5	-71.1	5	-84.6	
RSE, 1948-93	P			8	-1.3	10	-44.9	9	-70.8	
RSE, 1948-95	P					12	-28.7	12	-62.2	
RSE, 1948-99	P							27	-11.6	
RE, 1948-90	P	7	-16.9	26	200.0	29	66.1	27	-11.4	##
RE, 1948-93	P			9	0.5	10	-44.3	9	-70.3	
RE, 1948-95	P					13	-28.0	12	-61.4	#
RE, 1948-99	P							22	-27.6	

Notes: RSE denotes the robust standard errors variant, and RE the random-effects variant. Ex ante forecasts are highlighted. ## denotes best pre-Mercosur (1990) forecast for 1999, # best near-term (1995) forecast for 1999.

Table 7 Actual versus predicted trade between NAFTA countries using the Rose gravity model, 1990-99
(millions of US dollars, at 1982-84 prices)

Partner countries by model variant, estimation period	Actual/ predicted value	1990	%error	1993	%error	NAFTA (from 1994) 1995	%error	1999	%error	
US-Canada	A	66,420	...	71,946	...	87,904	...	109,197	...	
RSE, 1948-90	P	66,176	-0.4	68,012	-5.5	78,073	-11.2	210,828	93.1	
RSE, 1948-93	P			67,413	-6.3	77,566	-11.8	213,135	95.2	
RSE, 1948-95	P					88,536	0.7	244,754	124.1	
RSE, 1948-99	P							338,808	210.3	
RE, 1948-90	P	67,002	0.9	68,810	-4.4	78,509	-10.7	202,570	85.5	
RE, 1948-93	P			67,438	-6.3	77,059	-12.3	201,000	84.1	##
RE, 1948-95	P					87,545	-0.4	223,561	104.7	#
RE, 1948-99	P							210,224	92.5	
US-Mexico	A	18,710	...	29,753	...	37,629	...	64,840	...	
RSE, 1948-90	P	17,580	-6.0	21,011	-29.4	76,378	103.0	83,826	29.3	
RSE, 1948-93	P			24,809	-16.6	90,260	139.9	99,195	53.0	
RSE, 1948-95	P					36,027	-4.3	39,622	-38.9	
RSE, 1948-99	P							72,448	11.7	
RE, 1948-90	P	9,398	-49.8	11,147	-62.5	32,747	-13.0	35,816	-44.8	
RE, 1948-93	P			11,271	-62.1	32,509	-13.6	35,592	-45.1	##
RE, 1948-95	P					37,012	-1.6	40,552	-37.5	#
RE, 1948-99	P							60,353	-6.9	
Canada-Mexico	A	495	...	1,032	...	1,297	...	2,033	...	
RSE, 1948-90	P	581	17.4	661	-36.0	2,391	84.3	1,868	-8.1	
RSE, 1948-93	P			725	-29.8	2,626	102.5	2,042	0.4	##
RSE, 1948-95	P					1,209	-6.8	939	-53.8	
RSE, 1948-99	P							1,837	-9.7	
RE, 1948-90	P	416	-15.9	471	-54.4	1,378	6.2	1,089	-46.4	
RE, 1948-93	P			469	-54.6	1,346	3.8	1,061	-47.8	
RE, 1948-95	P					1,242	-4.2	987	-51.4	#
RE, 1948-99	P							1,617	-20.5	

Notes: RSE denotes robust standard errors variant, and RE denotes the random-effects variant. Ex ante forecasts are highlighted. ## denotes best pre-NAFTA (1993) forecast for 1999, # best near-term (1995) forecast for 1999.

Table 8 Qualitative summary of gravity model prediction results

	Predictions for 1999		
	Long-term (1990 or 1993)	Medium-term (1995)	Long- and medium-term
Mercosur			
Robust standard errors variant			
Number of predictions	6	6	12
Number of "best" predictions	2	2	4
Average absolute error, percent	60.4	44.0	52.2
Random-effects variant			
Number of predictions	6	6	12
Number of "best" predictions	4	4	8
Average absolute error, percent	32.8	42.1	37.4
Both variants			
Number of predictions	12	12	24
Average absolute error, percent	46.6	43.0	44.8
NAFTA			
Robust standard errors variant			
Number of predictions	3	3	6
Number of "best" predictions	1	0	1
Average absolute error, percent	49.5	72.3	60.9
Random-effects variant			
Number of predictions	3	3	6
Number of "best" predictions	2	3	5
Average absolute error, percent	59.0	64.5	61.8
Both variants			
Number of predictions	6	6	12
Average absolute error, percent	54.3	68.4	61.3
Mercosur and NAFTA			
Robust standard errors variant			
Number of predictions	9	9	18
Number of "best" predictions	3	2	5
Average absolute error, percent	56.8	53.4	55.1
Random-effects variant			
Number of predictions	9	9	18
Number of "best" predictions	6	7	13
Average absolute error, percent	41.5	49.5	45.5
Both variants			
Number of predictions	18	18	36
Average absolute error, percent	49.2	51.5	50.3

Sources: Tables 6 and 7.

Notes: Long-term forecasts are undertaken in 1990 for Mercosur and in 1993 for NAFTA. Values in the column for long-term and medium-term predictions combined exclude the random standard errors variant predictions for 1999 based on the 1948-93 estimation results.

Table 9 Estimated impact of NAFTA on member economy trade flows (percent change)

	Canada			United States			Mexico		
	Total	United States	Mexico	Total	Canada	Mexico	Total	Canada	United States
Simulation 1: 1995-97									
a) Initial trade flow (1995)[1]	198,795.6	148,103.6	1,043.0	717,659.2	119,085.2	48,486.8	83,737.1	2,867.1	63,538.3
b) Final trade flow (1997)[2]	222,720.1	162,165.1	1,212.1	822,379.5	130,201.1	65,815.3	111,110.9	3,613.0	83,326.2
c) Percentage change 1995-97	12.0	9.5	16.2	14.6	9.3	35.7	32.7	26.0	31.1
d) Naïve prediction	-3.4	-3.2	-11.7	-3.5	-3.0	-3.8	-3.7	-4.1	-3.6
e) Actual trade reform	-4.0	-4.2	-17.1	-3.8	-4.8	-6.6	-4.9	-4.8	-5.2
f) All tax adjustments	-8.7	-7.4	-18.7	-13.5	-18.1	-15.4	-6.3	-9.8	-5.5
g) f + factor accumulation	-1.7	-0.9	21.7	0.4	-12.8	19.1	50.1	57.0	55.2
h) g + factor productivity	-1.4	2.9	26.5	-8.8	-9.5	23.6	49.1	60.2	56.1
Simulation 2: 1997-2001									
a) Initial trade flow (1997)[3]	230,960.7	168,165.2	1,257.0	852,807.6	135,018.6	68,250.5	115,222.0	3,746.7	86,409.2
b) Final trade flow (2001)[4]	250,579.9	187,164.9	2,630.0	830,114.4	134,766.7	84,243.2	154,379.4	5,194.5	121,748.0
c) Percentage change 1997-2001	8.5	11.3	109.2	-2.7	-0.2	23.4	34.0	38.6	40.9
d) Naïve prediction	-5.5	-5.1	15.8	-6.2	-4.1	-2.9	-4.6	-4.1	-4.2
e) Actual trade reform	-6.1	-5.8	25.8	-6.4	-5.5	-5.0	-5.3	-4.9	-5.0
f) All tax adjustments	-5.4	-7.9	15.9	-5.2	-8.2	-4.2	-6.2	-6.2	-8.2
g) f + factor accumulation	0.2	-3.3	45.2	14.3	-2.7	26.1	34.4	27.0	32.1
h) g + Factor productivity	5.1	8.4	68.4	2.7	3.5	55.8	38.2	33.0	42.5

1. 1995 US$ millions. *Source* : GTAP4 database.
2. 1995 US$ millions. *Source* : GTAP5.4 database.
3. 1997 US$ millions. *Source* : GTAP5.4 database.
4. 1997 US$ millions. *Source* : GTAP6 database.

Table 10 Estimated impact of Mercosur on member economy trade flows (percent change)

	Argentina			Brazil			Uruguay		
	Total	**Brazil**	**Uruguay**	**Total**	**Argentina**	**Uruguay**	**Total**	**Argentina**	**Brazil**
Simulation 1: 1995-97									
a) Initial trade flow (1995)[1]	23,734.7	5,752.6	646.7	53,960.7	4,579.8	786.9	3,370.0	295.8	918.3
b) Final trade flow (1997)[2]	27,546.3	7,614.4	770.9	55,817.5	6,332.2	761.2	3,847.4	342.9	921.7
c) Percentage change 1995-97	16.1	32.4	19.2	3.4	38.3	-3.3	14.2	15.9	0.4
d) Naïve prediction	13.4	108.7	13.2	2.1	82.9	51.8	11.3	91.3	54.4
e) Actual trade reform	-5.3	-16.7	-17.1	-4.5	-15.6	-19.7	-5.4	-17.0	-19.3
f) All tax adjustments	-3.8	15.5	-13.3	-5.2	-15.7	0.2	-8.4	-25.6	26.4
g) f + factor accumulation	41.9	46.6	17.8	10.0	-13.9	-1.7	-10.0	-30.6	17.4
h) g + factor productivity	13.8	33.7	-4.3	-5.1	5.3	-7.7	-10.4	-9.6	25.0
Simulation 2: 1997-2001									
a) Initial trade flow (1997)[3]	28,565.5	7,896.1	799.4	57,882.7	6,566.5	789.3	3,989.8	355.6	955.8
b) Final trade flow (2001)[4]	28,192.3	5,764.3	704.0	62,764.0	4,733.6	603.7	2,922.2	295.4	465.2
c) Percentage change 1997-2001	-1.3	-27.0	-11.9	8.4	-27.9	-23.5	-26.8	-16.9	-51.3
d) Naïve prediction	25.0	158.4	24.9	8.2	144.7	65.0	8.8	87.7	73.4
e) Actual trade reform	8.9	78.2	29.1	0.2	66.3	45.8	5.7	105.1	44.2
f) All tax adjustments	39.3	83.9	45.4	38.4	68.2	86.6	9.6	30.1	3.3
g) f + factor accumulation	17.5	65.3	37.8	-22.4	4.9	24.5	7.9	46.8	20.1
h) g + factor productivity	32.3	25.5	35.3	18.8	-15.0	21.9	-6.5	-22.3	-31.4

1. 1995 US$ millions. *Source* : GTAP4 database.
2. 1995 US$ millions. *Source* : GTAP5.4 database.
3. 1997 US$ millions. *Source* : GTAP5.4 database.
4. 1997 US$ millions. *Source* : GTAP6 database.

Table 11 Estimated impact of the Uruguay Round Agreement on trade flows, 1995-97 (percent change)

Country/region	a[1]	b[2]	c	d	e	f	g	h
Australia	60,981.1	68,050.7	11.6	-0.6	0.3	1.0	-0.4	-6.0
New Zealand	17,011.2	16,419.5	-3.5	1.3	0.2	-3.8	3.5	1.5
Indonesia	52,940.7	54,862.0	3.6	-2.0	-3.6	-2.7	4.4	3.4
Malaysia	84,368.8	91,697.0	8.7	-1.8	0.0	1.7	16.1	9.4
Philippines	25,814.9	39,532.4	53.1	0.1	11.8	-1.2	4.8	8.4
Singapore	120,503.4	121,247.7	0.6	-2.3	1.6	-1.8	7.8	13.7
Thailand	66,176.9	68,182.5	3.0	-1.3	-2.7	-3.8	-1.4	-7.9
Vietnam	7,038.2	8,799.4	25.0	-3.2	-2.4	-12.5	26.9	46.1
Canada	198,795.6	222,720.0	12.0	-3.0	-3.8	-8.7	-1.7	-1.4
United States	717,659.2	822,379.5	14.6	-2.0	-2.6	-13.5	0.4	-8.8
Mexico	83,737.1	111,110.9	32.7	-3.1	-4.5	-6.3	50.1	49.1
Japan	484,058.6	472,966.7	-2.3	-0.4	-0.7	25.8	-4.9	22.2
China	284,776.0	282,302.3	-0.9	-3.9	-3.2	1.3	17.4	20.1
Korea	139,488.7	143,978.4	3.2	-2.1	-2.7	-7.3	-1.5	-6.6
Taiwan	129,807.5	131,545.7	1.3	-3.9	-3.4	-1.2	2.8	3.0
European Union	2,253,198.5	2,275,883.8	1.0	-3.1	-3.3	-0.7	-5.5	-5.6
Rest of world	749,874.9	845,558.8	12.8	-1.3	-2.1	-5.2	1.5	-3.7
Central America & Caribbean	38,311.7	37,864.0	-1.2	-1.3	-3.7	-1.7	13.6	13.8
Rest of South America	3,566.0	4,278.3	20.0	-2.9	-4.8	-15.6	-2.3	-1.7
Colombia	13,276.4	14,760.7	11.2	-1.3	-6.4	-10.6	-0.7	4.9
Venezuela	19,287.4	22,676.0	17.6	-2.4	-4.7	-8.9	-2.9	-5.7
Rest of Andean Pact	12,769.5	14,248.8	11.6	0.3	-5.3	-9.9	1.2	-3.7
Argentina	23,734.7	27,546.3	16.1	0.6	-1.7	-3.8	41.9	13.8
Brazil	53,960.7	55,817.5	3.4	-0.6	-1.9	-5.2	10.0	-5.1
Chile	17,815.7	18,130.3	1.8	-2.5	-4.9	-5.7	-4.9	1.9
Uruguay	3,370.0	3,847.4	14.2	-0.6	-4.4	-8.4	-10.0	-10.4

a) Initial trade flow (1995), b) Final trade flow (1997), c) Percentage change (1995-97), d) Naïve prediction, e) Actual trade reform, f) All tax adjustments, g) f + factor accumulation, and h) g + factor productivity.

1. 1995 US$ millions. *Source* : GTAP4 database.

2. 1995 US$ millions. *Source* : GTAP5.4 database.

Table 12 Estimated impact of the Uruguay Round Agreement on trade flows, 1997-2001 (percent change)

Country/region	a[1]	b[2]	c	d	e	f	g	h
Australia	70,568.6	67,145.1	-4.9	3.3	1.1	-8.6	-15.2	-14.2
New Zealand	17,027.0	17,254.6	1.3	4.5	15.1	5.2	-11.0	-17.2
Indonesia	56,891.9	65,815.8	15.7	1.8	4.7	-2.4	-18.7	-34.2
Malaysia	95,089.8	117,364.1	23.4	1.6	0.7	-4.8	-4.6	-20.1
Philippines	40,995.1	35,756.0	-12.8	2.0	5.4	-1.3	-10.1	-14.5
Singapore	125,733.8	107,343.1	-14.6	1.1	0.3	1.2	-5.1	-8.2
Thailand	70,705.3	74,899.2	5.9	1.3	2.4	-3.9	-19.8	-29.4
Vietnam	9,125.0	13,564.0	48.6	-0.1	-0.9	-6.4	45.0	59.8
Canada	230,960.7	250,579.9	8.5	0.5	1.0	-5.4	0.2	5.1
United States	852,807.6	830,114.4	-2.7	1.4	2.2	-5.2	14.3	2.7
Mexico	115,222.0	154,379.4	34.0	0.5	0.8	-6.2	34.4	38.2
Japan	490,466.4	423,411.7	-13.7	2.9	3.0	-5.8	-7.7	6.9
China	292,747.5	448,130.8	53.1	-0.3	-1.6	-4.9	6.8	14.1
Korea	149,305.6	165,025.2	10.5	1.3	1.8	-0.9	-2.9	-5.3
Taiwan	136,412.9	127,520.6	-6.5	-0.5	-1.5	-3.8	-4.7	-9.2
European Union	2,360,091.5	2,350,442.0	-0.4	0.4	0.5	-5.9	-7.9	-9.0
Rest of world	876,844.5	963,708.5	9.9	2.3	6.3	1.1	-5.9	-7.0
Central America & Caribbean	39,264.9	58,569.9	49.2	1.5	5.7	0.3	79.9	119.2
Rest of South America	4,436.6	4,593.2	3.5	5.3	5.5	1.2	-10.7	-19.0
Colombia	15,306.9	12,680.1	-17.2	2.3	10.5	17.9	17.0	3.1
Venezuela	23,515.0	21,782.3	-7.4	1.1	6.5	-0.9	31.2	32.9
Rest of Andean Pact	14,776.0	14,749.3	-0.2	3.6	12.6	11.1	6.0	2.1
Argentina	28,565.5	28,192.3	-1.3	4.6	16.9	39.3	17.5	32.3
Brazil	57,882.7	62,764.0	8.4	3.3	10.2	38.4	-22.4	18.8
Chile	18,801.1	20,182.8	7.3	0.9	4.8	-1.5	-4.7	-17.6
Uruguay	3,989.8	2,922.2	-26.8	2.9	17.1	9.6	7.9	-6.5

a) Initial trade flow (1995), b) Final trade flow (1997), c) Percentage change 1995-97, d) Naïve prediction, e) Actual trade reform, f) All tax adjustments, g) f + factor accumulation, and h) g + factor productivity.

1. 1995 US$ millions. *Source* : GTAP5.4 database.

2. 1995 US$ millions. *Source* : GTAP6 database.

Table 13 Estimated mean over/under prediction of trade

	Average deviation (percent)	**Weighted average deviation** (percent)	**Standard deviation of mean** (percent)	**Sign correctly predicted** (percent)	**Observations**
Simulation 1: 1995-97					
Total trade	-3.7	-3.2	14.4	38.5	26
Bilateral trade	55.4	-1.9	367.7	60.1	676
Bilateral/sectoral trade	12.9	-1.5	1,182.1	52.5	15,548
Sectoral output	1.6	-2.2	68.1	64.4	598
Simulation 2: 1997-2001					
Total trade	6.2	0.5	26.6	46.2	26
Bilateral trade	9.7	0.8	137.1	64.2	676
Bilateral/sectoral trade	2.5	-1.9	234.7	53.0	15,548
Sectoral output	-2.2	-2.2	64.3	78.6	598

Table A.1 Estimated impact of NAFTA on member economy sectoral output, 1995-97 (percent change)

	Canada			United States			Mexico		
Category	**Initial value** (millions of 1995 dollars)	**Actual percent change**	**Estimate percent change**	**Initial value** (millions of 1995 dollars)	**Actual percent change**	**Estimate percent change**	**Initial value** (millions of 1995 dollars)	**Actual percent change**	**Estimate percent change**
Grains	5,643.3	21.0	-32.9	63,288.8	-17.9	21.0	6,144.2	54.3	45.6
Vegetables and fruit	3,270.4	26.4	6.4	30,409.7	10.8	8.3	10,343.2	20.0	31.3
Other crops	4,019.2	3.3	-27.9	46,740.2	5.1	7.8	3,534.6	22.5	25.5
Other agriculture	9,519.7	27.1	10.6	118,369.7	-10.4	11.1	12,351.4	33.1	52.9
Forestry and fisheries	12,539.6	8.2	11.9	39,823.0	-62.8	13.4	3,276.2	35.4	90.1
Coal	2,366.8	15.8	16.8	28,809.2	9.5	24.4	216.9	53.9	79.5
Oil and gas	33,430.2	3.1	2.6	128,233.2	-37.5	8.2	25,123.6	-2.5	28.3
Food products	42,854.0	10.6	7.0	544,394.3	-1.5	8.1	46,765.5	32.5	28.5
Textiles	7,423.6	9.8	12.2	114,499.7	-6.0	9.6	8,546.7	47.1	54.4
Wearing apparel	7,693.8	6.3	15.3	120,259.5	-18.1	7.2	11,983.0	31.2	92.3
Lumber	25,257.7	11.4	11.3	143,213.4	19.2	17.0	6,322.9	50.8	54.6
Pulp and paper	47,609.6	-8.9	10.7	298,240.0	0.3	13.2	8,031.7	35.5	51.0
Petroleum and coal products	14,651.6	9.5	-9.6	118,725.4	34.1	14.3	16,532.5	-29.9	49.6
Chemicals	42,354.4	4.5	9.7	510,318.8	8.5	11.3	25,492.3	36.4	50.1
Nonmetallic minerals	6,897.1	23.8	13.5	89,274.0	2.3	13.5	6,984.1	59.5	53.3
Metals	26,232.9	11.0	11.3	199,087.4	-2.6	7.1	14,108.2	42.9	61.9
Fabricated metal products	16,871.1	4.3	11.3	215,867.6	0.4	12.2	6,675.2	38.8	58.5
Motor vehicles	55,795.0	0.1	-13.3	313,140.8	12.8	-0.6	17,022.3	71.0	64.2
Transportation equipment	10,004.0	-14.0	18.9	249,471.8	-38.9	10.7	4,792.0	-55.0	93.5
Electronic equipment	17,576.0	-1.4	12.3	311,269.6	-10.0	10.5	13,156.9	46.3	69.3
Machinery	32,249.4	36.1	14.1	515,834.1	18.4	7.3	21,762.6	46.9	70.8
Other manufactures	4,406.6	0.0	-17.6	55,753.1	-18.9	-14.4	4,101.1	11.4	9.8
Services	575,520.4	6.4	9.2	7,933,941.0	21.0	19.6	221,586.4	33.1	38.3

Sources : GTAP4 and GTAP5.4 databases.

Table A.2 Estimated impact of NAFTA on member economy sectoral output, 1997-2001 (percent change)

	Canada			United States			Mexico		
Category	**Initial value** (millions of 1997 dollars)	**Actual percent change**	**Estimate percent change**	**Initial value** (millions of 1997 dollars)	**Actual percent change**	**Estimate percent change**	**Initial value** (millions of 1997 dollars)	**Actual percent change**	**Estimate percent change**
Grains	7,078.7	-35.3	57.8	53,900.0	-52.5	19.8	9,833.1	-57.2	15.8
Vegetables and fruit	4,287.6	-48.7	1.7	34,953.2	-30.2	17.2	12,873.0	-37.3	29.1
Other crops	4,305.0	8.9	21.3	50,922.8	-3.0	11.2	4,491.0	115.9	40.2
Other agriculture	12,550.1	-12.7	5.3	109,960.0	-20.7	16.6	17,052.2	-39.6	32.2
Forestry and fisheries	14,068.8	-10.3	11.6	15,370.8	32.3	28.9	4,599.2	55.6	79.6
Coal	2,842.5	-6.6	16.6	32,701.1	-6.6	41.7	346.2	-6.2	118.7
Oil and gas	35,745.0	-8.6	26.9	83,149.9	3.9	37.9	25,390.9	2.9	60.3
Food products	49,156.2	5.3	1.3	556,329.6	25.2	13.9	64,245.4	51.9	26.3
Textiles	8,449.0	1.2	0.2	111,569.7	21.4	20.5	13,041.7	47.7	48.7
Wearing apparel	8,481.4	-0.5	-13.7	102,131.5	15.7	12.3	16,303.6	47.4	52.7
Lumber	29,166.6	0.0	9.8	176,993.5	19.9	29.1	9,890.3	46.8	67.0
Pulp and paper	44,998.0	-8.2	9.7	310,167.5	18.3	24.1	11,283.2	58.1	65.5
Petroleum and coal products	16,632.4	-8.2	18.0	165,142.6	-7.1	34.2	12,023.5	-10.1	85.7
Chemicals	45,908.6	-4.0	10.5	573,930.6	16.8	22.4	36,053.9	47.5	61.8
Nonmetallic minerals	8,854.7	-0.4	6.0	94,685.0	26.0	23.0	11,554.5	49.1	65.9
Metals	30,193.9	-6.1	2.4	201,119.0	18.0	23.5	20,908.1	38.7	66.0
Fabricated metal products	18,247.7	6.4	6.8	224,697.7	20.6	24.8	9,605.2	54.9	67.4
Motor vehicles	57,941.2	4.4	10.8	366,300.8	19.3	26.4	30,185.1	44.9	83.2
Transportation equipment	8,920.2	48.0	-1.1	158,054.6	15.2	18.2	2,238.1	87.1	82.1
Electronic equipment	17,967.8	13.3	13.9	290,664.6	12.9	20.4	19,958.5	96.8	46.7
Machinery	45,501.0	2.1	7.2	633,468.3	16.2	21.7	33,155.7	41.3	61.2
Other manufactures	4,567.6	10.9	4.4	46,886.9	28.1	16.9	4,739.7	45.7	63.8
Services	635,008.6	8.1	10.8	9,958,251.0	18.4	26.2	305,730.4	54.8	65.0

Sources : GTAP5.4 and GTAP6 databases.

Table A.3 Estimated impact of Mercosur on member economy sectoral output, 1995-97 (percent change)

	Argentina			Brazil			Uruguay		
Category	**Initial value** (millions of 1995 dollars)	**Actual percent change**	**Estimate percent change**	**Initial value** (millions of 1995 dollars)	**Actual percent change**	**Estimate percent change**	**Initial value** (millions of 1995 dollars)	**Actual percent change**	**Estimate percent change**
Grains	5,334.1	41.4	63.5	11,804.7	11.0	-5.8	543.5	25.0	15.6
Vegetables and fruit	7,613.3	32.9	21.7	22,467.6	63.5	13.1	414.2	5.2	-3.0
Other crops	10,313.6	-5.5	33.3	36,182.7	-24.1	-25.3	217.4	1.2	36.4
Other agriculture	14,753.3	17.5	32.1	26,237.8	9.6	10.8	1,633.1	2.4	15.7
Forestry and fisheries	1,846.5	-1.9	39.5	4,404.9	8.1	16.9	232.0	-5.0	3.0
Coal	20.8	-46.4	20.1	139.9	-35.0	19.4	0.0	-99.7	7.3
Oil and gas	9,994.9	-18.5	11.7	16,516.2	6.2	-12.3	78.2	7.3	-6.0
Food products	63,455.5	17.8	21.2	115,626.6	8.5	10.1	4,135.4	4.5	4.1
Textiles	21,679.9	19.2	32.3	35,232.8	7.2	7.4	691.4	5.8	-14.3
Wearing apparel	12,638.6	11.6	36.6	34,354.0	5.4	12.0	756.7	3.6	22.2
Lumber	4,294.3	38.8	46.8	18,986.1	6.6	15.4	243.5	0.0	0.4
Pulp and paper	11,882.2	9.4	39.7	31,159.8	1.3	11.7	514.2	11.2	2.3
Petroleum and coal products	3,961.5	21.7	-5.2	13,978.9	-3.1	-10.3	235.0	8.7	-16.3
Chemicals	35,003.5	21.7	40.0	90,165.8	5.3	0.9	1,403.5	5.6	8.0
Nonmetallic minerals	7,068.9	51.9	41.0	18,622.9	7.5	10.2	367.8	8.3	0.0
Metals	15,644.3	43.2	37.9	50,767.5	0.6	-2.8	116.3	56.9	-1.2
Fabricated metal products	11,067.2	29.8	42.4	27,756.8	6.6	7.0	333.2	3.4	5.1
Motor vehicles	10,713.7	132.6	31.2	25,884.6	61.8	-10.8	266.6	-9.0	-4.5
Transportation equipment	11,478.5	-70.1	41.8	16,886.5	-60.6	6.2	18.7	7.9	-11.3
Electronic equipment	7,397.3	-18.0	46.1	30,976.1	-49.4	5.3	175.7	5.0	5.9
Machinery	7,990.5	98.3	45.8	39,327.1	46.2	-0.3	143.8	29.5	-6.6
Other manufactures	956.7	-13.9	12.4	21,277.8	4.3	3.6	41.0	1.6	-14.7
Services	160,923.8	19.8	42.9	691,459.4	4.3	18.3	15,628.4	6.8	8.5

Sources : GTAP4 and GTAP5.4 databases.

Table A.4 Estimated impact of Mercosur on member economy sectoral output, 1997-2001 (percent change)

	Argentina			Brazil			Uruguay		
Category	**Initial value** (millions of 1997 dollars)	**Actual percent change**	**Estimate percent change**	**Initial value** (millions of 1997 dollars)	**Actual percent change**	**Estimate percent change**	**Initial value** (millions of 1997 dollars)	**Actual percent change**	**Estimate percent change**
Grains	7,819.5	-33.3	-6.4	13,587.3	-73.6	-24.8	704.8	-29.9	56.4
Vegetables and fruit	10,494.2	-73.7	-26.1	38,099.1	-95.5	-32.2	451.7	-21.1	-9.8
Other crops	10,111.6	-46.3	-18.5	28,484.6	-41.1	-29.1	228.0	-31.2	-15.8
Other agriculture	17,981.2	-59.7	-19.3	29,812.3	-56.9	-26.2	1,734.9	-10.8	1.4
Forestry and fisheries	1,878.0	-58.0	-35.5	4,936.1	-71.5	-45.9	228.6	-1.3	-12.6
Coal	11.6	-2.6	-28.7	94.3	-6.9	-85.3	0.0	120.5	-15.3
Oil and gas	8,445.4	-6.4	-22.3	18,188.8	-32.8	-24.1	87.0	-17.2	-16.3
Food products	77,497.8	-54.7	-22.7	130,052.7	-50.5	-28.0	4,480.8	-13.5	1.4
Textiles	26,806.8	-89.5	-38.0	39,167.8	-71.5	-45.7	758.4	-54.2	-26.5
Wearing apparel	14,626.8	-53.5	-37.4	37,533.0	-71.4	-48.2	813.3	-8.4	-33.3
Lumber	6,183.2	-42.8	-44.0	20,992.9	-71.7	-50.2	252.5	3.9	-25.5
Pulp and Paper	13,484.1	-44.7	-40.8	32,733.2	-49.3	-46.4	593.0	-26.9	-21.8
Petroleum and coal products	4,998.4	-8.9	-32.2	14,052.7	-9.9	-44.9	264.8	-6.5	-14.4
Chemicals	44,176.8	-65.2	-41.9	98,465.5	-59.0	-45.4	1,536.9	-17.2	-21.9
Nonmetallic minerals	11,132.0	-59.1	-45.3	20,765.2	-48.8	-47.2	413.0	-6.6	-25.9
Metals	23,233.1	-78.8	-33.3	52,953.4	-56.8	-37.2	189.2	-32.6	-30.2
Fabricated metal products	14,899.4	-78.9	-53.5	30,681.4	-54.5	-48.5	357.4	-15.0	-24.9
Motor vehicles	25,845.0	-78.5	-38.4	43,426.1	-61.5	-51.4	251.7	-28.2	-13.2
Transportation equipment	3,560.8	-72.3	-38.5	6,904.8	103.5	-23.3	21.0	-5.8	-29.8
Electronic equipment	6,291.8	-66.2	-52.4	16,259.4	-29.6	-54.8	191.3	-10.5	-22.7
Machinery	16,432.8	-73.1	-47.8	59,611.9	-57.2	-51.2	193.0	-44.8	-28.3
Other manufactures	854.3	463.0	-36.8	23,012.9	-56.8	-50.0	43.2	10.4	-23.3
Services	199,915.8	19.1	-50.5	747,926.8	-38.6	-54.7	17,308.1	-2.0	-15.4

Sources : GTAP5.4 and GTAP6 databases.

Table A.5 Estimated impact of Uruguay Round Agreement on sectoral output, 1995-97 (part 1) (percent change)

	Australia		New Zealand		Indonesia		Malaysia		Philippines	
Category	**Actual percent change**	**Estimate percent change**	**Actual percent change**	**Estimate percent change**	**Actual percent change**	**Estimate percent change**	**Actual percent change**	**Estimate percent change**	**Actual percent change**	**Estimate percent change**
Grains	49.5	12.3	3.8	16.6	-26.9	4.8	-87.6	-42.3	3.6	-15.2
Vegetables and fruit	-8.2	9.1	1.8	-0.5	10.4	3.9	-16.5	12.0	23.0	1.7
Other crops	-0.9	61.3	-6.1	-0.2	-37.9	4.7	-74.1	31.1	-63.2	28.6
Other agriculture	-6.7	3.0	-3.7	7.7	-39.4	5.5	-26.2	22.3	96.5	3.0
Forestry and fisheries	30.8	11.8	-4.5	2.6	-15.3	6.1	-8.3	18.8	-43.6	5.4
Coal	6.0	9.5	13.5	16.0	23.7	18.5	107.2	26.1	-42.1	34.2
Oil and gas	14.0	-9.7	-25.5	0.8	1.3	-3.4	-23.8	-3.0	-38.6	7.5
Food products	-0.8	7.3	8.1	18.3	18.1	3.5	-23.9	-0.9	-3.1	-0.8
Textiles	34.3	2.3	52.4	2.6	150.1	12.3	16.6	15.7	45.2	22.4
Wearing apparel	8.2	18.0	5.3	10.9	-12.0	3.9	-20.1	-11.3	-18.1	118.1
Lumber	21.8	6.7	8.1	-0.1	-2.5	5.5	-17.8	17.1	-20.9	10.1
Pulp and paper	42.3	7.5	-2.9	4.0	25.8	19.2	31.1	17.6	-26.2	9.0
Petroleum and coal products	-8.0	-2.7	-33.6	-17.3	-8.9	-3.1	8.5	7.4	32.1	0.9
Chemicals	-4.0	2.9	-1.5	9.6	38.3	8.2	69.7	34.8	9.3	3.6
Nonmetallic minerals	17.2	7.0	10.4	9.8	45.1	10.9	73.4	16.1	46.8	0.4
Metals	51.8	-7.1	5.3	-5.9	7.0	20.2	72.2	15.7	78.1	-2.3
Fabricated metal products	6.2	8.7	6.7	10.0	-0.6	12.5	54.9	25.1	81.6	-9.5
Motor vehicles	38.1	-20.1	10.3	-9.8	448.5	-12.2	128.3	48.1	273.0	-46.5
Transportation equipment	37.7	0.3	1.6	14.2	3.5	6.4	-84.5	121.0	26.0	12.0
Electronic equipment	-4.4	-1.0	-37.3	3.1	-12.4	7.5	169.6	27.3	436.1	6.6
Machinery	5.3	0.7	39.9	-3.5	12.9	1.0	-44.5	31.2	-48.1	-17.1
Other manufactures	31.3	-31.2	9.2	-45.5	17.4	-5.8	51.5	-3.2	77.5	-58.8
Services	7.5	13.3	6.3	7.5	5.0	0.8	24.0	34.1	19.5	14.8

Sources : GTAP4 and GTAP5.4 databases.

Table A.6 Estimated impact of Uruguay Round Agreement on sectoral output, 1995-97 (part 2) (percent change)

	Singapore		Thailand		Vietnam		Japan		China	
Category	**Actual percent change**	**Estimate percent change**	**Actual percent change**	**Estimate percent change**	**Actual percent change**	**Estimate percent change**	**Actual percent change**	**Estimate percent change**	**Actual percent change**	**Estimate percent change**
Grains	30.9	61.3	-34.6	-48.4	30.9	22.1	-56.3	-71.4	-11.0	34.4
Vegetables and fruit	8.6	7.0	23.2	-12.8	-52.1	38.0	-60.9	-20.0	49.7	26.5
Other crops	-67.7	60.4	-72.5	9.7	-67.7	62.0	88.1	-5.1	-23.8	13.2
Other agriculture	-82.5	-2.9	-3.1	-27.8	89.3	90.6	-61.8	-19.7	23.2	28.7
Forestry and fisheries	29.9	15.6	-35.0	-9.7	44.2	61.6	-66.4	-14.3	20.4	31.2
Coal	-99.6	20.5	-14.0	2.3	59.2	56.3	-80.8	-1.5	-72.3	64.1
Oil and gas	-86.2	18.3	-27.1	-6.1	35.8	46.0	-57.3	-22.7	65.1	28.7
Food products	-16.1	145.7	-12.6	-36.3	39.2	38.3	-47.6	-17.5	39.9	20.9
Textiles	-12.2	138.1	26.0	2.6	15.0	29.7	-64.3	-14.2	31.1	-10.4
Wearing apparel	-37.6	23.8	-14.2	-7.6	40.2	-8.1	-43.4	-20.7	14.6	-33.2
Lumber	-50.8	13.7	-49.6	-6.4	63.5	52.1	-71.9	-27.0	50.7	2.8
Pulp and paper	3.1	18.6	16.4	-2.9	108.2	97.0	-36.5	-21.2	24.6	20.4
Petroleum and coal products	-25.9	-0.7	73.0	-8.1	518.5	6.0	-17.4	-34.5	37.1	20.1
Chemicals	27.5	12.2	31.9	10.9	93.9	95.9	-48.3	-20.4	26.1	13.8
Nonmetallic minerals	90.2	43.9	-0.2	7.4	26.2	80.5	-42.2	-19.6	67.0	16.2
Metals	19.5	22.9	106.3	11.9	217.2	135.8	-17.4	-13.9	7.0	20.3
Fabricated metal products	48.1	50.8	-22.5	-3.1	270.0	120.5	-41.1	-19.8	41.5	10.3
Motor vehicles	-12.9	91.6	32.3	-19.1	-71.8	-28.6	51.5	-2.9	31.4	127.0
Transportation equipment	60.2	31.9	-41.5	106.8	84.3	252.6	-25.7	-6.7	118.8	38.9
Electronic equipment	74.8	12.3	116.7	-3.3	112.2	109.0	-5.2	-26.1	79.9	15.0
Machinery	-49.0	-1.1	-29.1	-5.8	40.8	116.4	-43.7	-14.9	11.5	17.6
Other manufactures	-53.1	15.1	45.4	-30.8	218.3	84.5	-1.6	-29.5	44.1	164.4
Services	24.4	11.6	27.0	-5.7	68.6	52.9	-17.5	-27.0	15.9	22.1

Sources : GTAP4 and GTAP5.4 databases.

Table A.7 Estimated impact of Uruguay Round Agreement on sectoral output, 1995-97 (part 3) (percent change)

Category	Korea		Taiwan		European Union		Rest of world		Central America	
	Actual percent change	Estimate percent change	Actual percent change	Estimate percent change	Actual percent change	Estimate percent change	Actual percent change	Estimate percent change	Actual percent change	Estimate percent change
Grains	-67.9	-4.3	-12.2	-65.8	-32.4	6.9	30.9	13.7	-19.2	24.1
Vegetables and fruit	-40.8	4.5	12.6	5.5	-27.0	2.6	12.1	9.0	4.4	6.8
Other crops	16.8	11.0	-25.5	21.2	-6.5	-10.3	0.7	18.2	-16.1	-2.2
Other agriculture	-47.1	-0.5	-27.2	3.9	-27.1	0.9	24.3	12.0	11.0	10.8
Forestry and fisheries	-47.5	0.8	-2.9	8.6	-1.0	-8.9	37.5	8.2	-11.7	6.5
Coal	-91.5	0.4	-87.1	11.1	-69.3	-7.5	-1.0	6.7	-99.9	30.8
Oil and gas	-35.9	-6.9	-11.5	5.5	-50.6	-10.4	-7.2	-0.9	-31.2	3.2
Food products	-44.0	-4.5	-21.7	5.4	-13.4	-7.0	16.7	8.2	2.9	12.7
Textiles	-31.4	6.2	-9.4	20.9	-18.6	-3.6	-14.5	1.3	197.9	42.7
Wearing apparel	-16.4	-6.6	-34.0	12.9	-17.1	-1.3	-13.7	5.7	-1.0	40.7
Lumber	-55.0	-5.6	-34.3	3.2	-30.5	-12.0	-13.1	5.9	56.0	9.9
Pulp and paper	-1.0	-1.3	-5.5	8.6	-10.7	-8.6	-3.7	6.3	33.3	11.4
Petroleum and coal products	37.0	-11.2	-17.9	-2.7	-49.1	-48.1	-40.7	-5.8	-27.2	-5.0
Chemicals	-11.4	0.4	6.2	9.4	-8.4	-6.6	-8.3	4.5	-18.4	2.3
Nonmetallic minerals	-23.7	-1.9	8.6	6.0	3.6	-8.4	27.9	6.6	117.4	11.2
Metals	-22.6	-1.0	-20.5	3.1	-12.8	-6.6	14.2	-0.7	76.7	19.0
Fabricated metal products	20.9	-2.2	-4.4	9.2	-23.8	-12.7	-25.1	5.2	26.0	13.2
Motor vehicles	84.9	-17.4	1.2	7.3	-14.2	-12.3	46.6	-11.3	16.4	-4.9
Transportation equipment	-7.7	3.6	-7.8	-1.2	-29.2	-6.3	6.6	2.8	18.5	5.0
Electronic equipment	13.4	-1.7	48.2	-2.8	24.2	-9.1	-21.4	3.4	-21.5	9.8
Machinery	15.3	0.8	-7.6	0.2	-13.7	-3.7	2.7	1.1	47.7	11.1
Other manufactures	-9.4	-26.7	-3.6	2.4	-1.7	-24.1	79.6	-3.6	180.8	-29.0
Services	-1.0	-2.0	7.2	7.1	-14.6	-10.7	14.2	7.7	-0.3	3.1

Sources : GTAP4 and GTAP5.4 databases.

Table A.8 Estimated impact of Uruguay Round Agreement on sectoral output, 1995-97 (part 4) (percent change)

	South America		Colombia		Venezuela		Andean Pact		Chile	
Category	**Actual percent change**	**Estimate percent change**	**Actual percent change**	**Estimate percent change**	**Actual percent change**	**Estimate percent change**	**Actual percent change**	**Estimate percent change**	**Actual percent change**	**Estimate percent phange**
Grains	37.0	12.3	-13.2	27.2	14.1	23.0	5.5	26.1	23.1	9.0
Vegetables and fruit	85.0	15.3	262.6	15.4	13.6	14.0	7.5	6.8	21.2	10.7
Other crops	-9.1	98.4	-34.9	5.6	16.4	18.6	-0.1	8.7	-29.1	15.0
Other agriculture	46.1	47.7	25.0	17.7	15.9	13.1	4.9	12.1	21.3	-0.4
Forestry and fisheries	1.3	2.0	42.3	25.1	14.5	13.7	-9.7	13.5	9.1	7.4
Coal	-100.0	14.9	48.7	15.5	-8.8	15.6	-77.1	38.6	-54.9	20.4
Oil and gas	-35.7	-25.3	4.8	32.2	-9.7	4.2	-5.0	6.7	-1.2	-1.3
Food products	27.6	10.2	55.4	18.4	15.8	15.9	4.0	9.0	19.7	-0.5
Textiles	62.5	5.2	31.9	7.9	9.5	15.8	4.5	10.4	21.4	16.8
Wearing apparel	53.3	37.3	42.0	0.1	9.5	18.5	-2.3	13.4	19.0	19.1
Lumber	34.2	-3.5	-5.3	24.8	15.2	22.3	1.4	19.7	9.6	8.4
Pulp and paper	96.9	30.7	32.5	23.3	13.2	17.6	3.8	15.8	-14.7	13.6
Petroleum and coal products	-94.3	-3.5	73.9	20.7	112.0	0.5	7.1	7.6	30.6	-2.7
Chemicals	-5.2	16.2	4.3	22.5	0.6	13.0	2.1	8.8	21.9	17.4
Nonmetallic minerals	173.6	14.4	-30.9	26.3	37.1	14.6	15.5	17.3	27.1	13.7
Metals	621.6	-21.9	-7.5	22.2	-1.0	0.7	18.4	12.4	18.1	18.6
Fabricated metal products	110.5	32.8	-34.5	27.6	11.8	17.9	9.4	15.6	25.5	16.9
Motor vehicles	307.9	11.0	8.3	20.7	13.5	13.9	15.6	2.4	51.1	10.4
Transportation equipment	445.7	51.0	-59.7	93.8	26.8	31.2	22.0	20.2	-39.2	26.1
Electronic equipment	43.0	40.5	-57.6	22.4	11.8	14.3	-2.7	9.8	-39.5	20.7
Machinery	126.4	14.1	59.7	19.9	19.1	16.0	9.4	-11.6	69.9	20.4
Other manufactures	78.4	-29.8	165.0	-4.1	27.7	-12.7	1.6	-1.9	10.3	-17.1
Services	1.7	31.8	66.9	22.2	6.6	22.8	10.2	17.5	13.3	15.6

Sources : GTAP4 and GTAP5.4 databases.

Table A.9 Estimated impact of Uruguay Round Agreement on sectoral output, 1997-2001 (part 1) (percent change)

	Australia		New Zealand		Indonesia		Malaysia		Philippines	
Category	**Actual percent change**	**Estimate percent change**	**Actual percent change**	**Estimate percent change**	**Actual percent change**	**Estimate percent change**	**Actual percent change**	**Estimate percent change**	**Actual percent change**	**Estimate percent change**
Grains	-28.3	-5.4	-81.2	14.6	-40.3	-25.6	-56.0	-10.3	-5.6	-12.4
Vegetables and fruit	55.3	-0.9	23.0	-15.0	-53.3	-24.2	-41.7	-13.4	-11.4	5.1
Other crops	-15.7	-10.8	-43.3	-35.4	4.8	-17.5	21.2	-28.3	39.5	-16.0
Other agriculture	-18.6	4.5	-15.3	2.0	-37.9	-27.4	-40.5	-5.1	-9.1	-5.5
Forestry and fisheries	-40.4	-4.0	-13.0	-21.3	-32.3	-26.6	-35.5	-10.5	-6.6	1.5
Coal	-6.5	-9.0	-7.0	-23.3	-6.7	-19.6	-6.3	-12.4	-6.5	-12.4
Oil and gas	-2.7	-2.6	-26.3	-30.3	-9.0	-20.3	-1.6	-7.9	-6.9	-7.2
Food products	-10.2	0.0	-16.6	26.8	-35.8	-17.0	-30.5	-24.2	-7.0	-4.9
Textiles	-52.4	-19.0	-56.6	-50.1	-11.4	-46.2	-31.3	-15.6	16.7	-15.8
Wearing apparel	-23.2	-13.3	-44.5	-63.0	-5.2	-56.4	-13.2	-12.5	4.2	-8.4
Lumber	-53.4	-20.1	-29.3	-41.3	-25.7	-38.0	-19.0	-11.7	-3.5	-15.3
Pulp and paper	-18.2	-18.2	-26.4	-32.6	6.1	-33.0	-19.3	-18.3	-7.2	-18.1
Petroleum and coal products	-0.1	-9.6	-7.8	-31.5	-7.6	-33.0	-7.1	-20.6	-5.1	-10.5
Chemicals	-14.0	-18.8	-12.5	-35.1	-25.4	-35.5	-14.7	-17.0	-5.9	-16.7
Nonmetallic minerals	-30.1	-18.6	-42.2	-37.5	-38.2	-38.8	-36.2	-19.7	-4.3	-21.6
Metals	-10.2	-17.5	-35.7	-57.2	-13.7	-48.4	-28.6	-22.3	13.0	-19.9
Fabricated metal products	-28.2	-20.1	-38.3	-39.7	-42.7	-40.8	-38.4	-21.5	-7.1	-23.3
Motor vehicles	-16.4	-19.2	-14.5	-65.0	-46.0	-70.2	-43.7	-16.8	-5.9	-30.9
Transportation equipment	-41.1	-28.7	-55.9	-57.7	-36.0	-51.9	-25.4	-31.8	31.2	-33.5
Electronic equipment	-1.9	-30.9	30.9	-50.5	44.7	-44.0	28.5	-13.7	31.9	0.2
Machinery	-13.4	-25.5	-35.8	-57.5	-2.7	-33.3	-8.3	-23.3	26.3	-7.1
Other manufactures	126.8	-17.6	490.0	-59.0	-14.7	-40.4	-33.2	-16.4	-3.6	-22.4
Services	-11.3	-18.5	-26.8	-31.3	-44.5	-31.1	-28.2	-15.1	-26.6	-13.5

Sources : GTAP5.4 and GTAP6 databases.

Table A.10 Estimated impact of Uruguay Round Agreement on sectoral output, 1997-2001 (part 2) (percent change)

	Singapore		Thailand		Vietnam		Japan		China	
Category	**Actual percent change**	**Estimate percent change**	**Actual percent change**	**Estimate percent change**	**Actual percent change**	**Estimate percent change**	**Actual percent change**	**Estimate percent change**	**Actual percent change**	**Estimate percent change**
Grains	19.3	-18.1	-8.0	-16.3	68.5	90.1	-34.7	-11.3	-21.4	19.8
Vegetables and fruit	-28.4	-12.9	-35.7	-23.2	75.7	40.6	-27.7	-12.1	45.5	22.2
Other crops	28.8	37.2	90.7	-21.5	24.0	33.9	-21.8	-19.9	-11.9	27.8
Other agriculture	-58.5	-28.3	-12.1	-17.6	52.1	47.1	-25.7	-11.5	18.0	26.5
Forestry and fisheries	-44.0	-2.0	-26.5	-16.8	39.3	56.6	-9.1	-2.1	21.2	31.4
Coal	-93.2	6.3	-6.6	-40.7	-6.6	57.7	-6.0	9.2	-6.5	40.5
Oil and gas	27.9	10.5	-22.0	-28.8	14.5	53.9	-13.2	3.8	8.2	44.2
Food products	2.0	-1.9	-15.5	-16.6	53.9	41.2	-12.1	-9.2	13.5	16.1
Textiles	7.2	12.8	-16.5	-34.7	50.8	66.7	-0.6	-0.9	23.4	20.1
Wearing apparel	3.6	-9.9	-21.1	-36.6	43.1	95.2	-12.6	-8.9	24.5	14.5
Lumber	-43.0	17.8	-2.4	-31.6	51.6	66.0	-16.1	-5.0	59.0	34.3
Pulp and paper	-4.8	-3.6	-22.2	-31.4	30.6	65.3	-8.7	-7.9	30.3	28.7
Petroleum and coal products	-7.1	15.9	-7.6	-26.4	-8.3	53.4	-6.9	-2.4	-6.9	39.2
Chemicals	-21.5	6.9	-7.2	-31.7	61.4	63.2	-5.7	-3.2	31.9	29.3
Nonmetallic minerals	-18.0	0.7	-43.4	-33.0	65.0	56.2	-14.1	-6.3	27.2	28.1
Metals	-39.1	21.3	-35.5	-37.0	56.2	106.3	-15.6	0.5	32.4	34.5
Fabricated metal products	-45.5	-2.5	-18.8	-35.3	84.9	84.9	-16.6	-6.7	31.8	29.2
Motor vehicles	-67.8	-22.8	-37.7	-43.4	57.0	166.9	-10.3	-0.2	29.3	48.5
Transportation equipment	-8.9	-9.0	-28.3	-48.3	84.8	78.2	-7.2	30.0	27.6	29.8
Electronic equipment	-27.8	-1.6	-14.1	-27.4	50.2	52.4	-18.6	-1.4	57.7	32.8
Machinery	-15.2	4.8	0.7	-33.7	96.3	48.5	-16.0	-4.1	32.6	30.9
Other manufactures	-16.0	-26.7	-21.8	-32.9	68.3	59.1	-10.3	-8.1	45.2	30.7
Services	-10.2	-9.4	-37.7	-28.7	47.8	27.4	-7.4	-9.8	22.6	25.5

Sources : GTAP5.4 and GTAP6 databases.

Table A.11 Estimated impact of Uruguay Round Agreement on sectoral output, 1997-2001 (part 3) (percent change)

	Korea		Taiwan		European Union		Rest of world		Central America	
Category	**Actual percent change**	**Estimate percent change**	**Actual percent change**	**Estimate percent change**	**Actual percent change**	**Estimate percent change**	**Actual percent change**	**Estimate percent change**	**Actual percent change**	**Estimate percent change**
Grains	9.4	9.7	-49.8	-0.6	-12.1	-10.5	-17.4	-4.4	-0.4	107.6
Vegetables and fruit	-30.6	-5.1	-22.6	-1.3	-3.0	1.2	23.6	-6.8	14.1	44.2
Other crops	-4.7	-5.4	-34.5	-4.1	-1.7	-1.2	5.2	-7.6	11.0	93.7
Other agriculture	-1.4	-4.6	-34.6	-0.8	-22.6	-0.8	-5.7	-3.0	72.3	106.9
Forestry and fisheries	-39.4	-2.1	-37.7	0.6	-10.8	-1.0	5.4	-3.8	0.4	124.2
Coal	-6.6	2.6	-6.6	-4.0	-6.6	1.2	-6.4	-2.9	216.5	115.8
Oil and gas	-53.2	-6.3	-20.7	-5.5	-4.1	7.4	-3.9	1.5	30.8	135.0
Food products	-19.7	-5.7	-25.2	-1.0	-11.4	-0.9	6.7	-9.2	76.1	86.9
Textiles	-8.5	-5.4	-16.3	3.9	-14.9	-3.3	25.6	-2.1	37.1	151.5
Wearing apparel	-31.2	-17.3	-21.3	-24.2	-13.1	-9.3	-5.6	9.1	38.6	216.6
Lumber	-5.9	-8.7	-25.7	-4.5	-9.8	-3.9	17.4	-10.6	92.3	203.3
Pulp and paper	-24.4	-8.1	-19.6	-6.2	-6.9	-6.3	6.4	-9.0	137.3	172.2
Petroleum and coal products	-8.0	-1.1	-8.0	-1.1	-7.7	1.4	-2.4	-2.2	-6.2	136.9
Chemicals	-1.0	-4.8	-12.6	-1.5	-1.9	-5.2	11.8	-9.8	96.8	172.9
Nonmetallic minerals	-38.6	-10.6	-28.4	-8.0	-4.9	-5.7	15.7	-9.5	139.9	182.2
Metals	-24.8	-9.7	-23.2	-10.7	-8.1	-3.9	3.6	-10.6	75.2	205.9
Fabricated metal products	-20.9	-6.5	-18.2	-10.5	-4.7	-7.4	19.5	-11.6	104.2	192.3
Motor vehicles	-14.1	-0.7	-5.2	-14.3	-3.1	-9.9	-10.6	-10.6	121.1	230.6
Transportation equipment	3.5	-21.9	-24.7	-17.2	25.1	-2.6	22.5	-14.1	89.2	98.0
Electronic equipment	18.7	8.0	7.3	-3.5	-4.4	-10.0	64.0	-8.8	248.4	171.5
Machinery	-7.4	-10.1	-17.3	-14.2	-5.1	-7.3	0.5	-12.3	116.0	220.5
Other manufactures	-38.2	-6.1	-40.5	-11.4	-3.3	-6.4	-1.1	-7.1	129.8	195.1
Services	-6.4	-7.2	-10.1	-7.6	-5.7	-6.7	-4.1	-4.7	141.2	142.7

Sources : GTAP5.4 and GTAP6 databases.

Table A.12 Estimated impact of Uruguay Round Agreement on sectoral output, 1997-2001 (part 4) (percent change)

	South America		Colombia		Venezuela		Andean Pact		Chile	
Category	**Actual percent change**	**Estimate percent change**	**Actual percent change**	**Estimate percent change**	**Actual percent change**	**Estimate percent change**	**Actual percent change**	**Estimate percent change**	**Actual percent change**	**Estimate percent change**
Grains	-2.7	14.0	-6.7	-9.3	54.0	46.2	-21.9	-3.8	-16.2	0.2
Vegetables and fruit	-2.8	-18.5	-37.7	-10.1	46.8	43.2	-7.7	-16.4	-9.3	-1.4
Other crops	-10.0	11.3	-43.4	-14.0	43.0	37.4	-32.4	-5.3	8.7	-7.5
Other agriculture	-10.2	-14.2	-26.5	-3.1	46.7	39.5	6.0	-6.1	-19.7	-2.9
Forestry and fisheries	20.2	-5.1	-32.2	-12.3	47.1	51.2	-31.3	-3.9	-23.8	-6.1
Coal	1,024.2	1.5	-5.0	-10.2	-6.6	27.9	11.3	-22.7	-6.8	-15.3
Oil and gas	-6.0	13.7	-15.6	-12.7	-5.1	47.4	-0.8	3.1	-4.1	-6.5
Food products	-8.3	-31.0	-40.7	-6.7	44.5	40.3	-18.9	-1.5	-18.5	-5.4
Textiles	-46.4	-29.4	-43.7	-5.7	43.5	49.3	-32.7	-15.5	-25.9	-20.2
Wearing apparel	-32.3	-36.7	-42.6	-9.7	41.8	51.8	-29.7	-19.4	-25.0	-24.3
Lumber	-42.6	0.3	-65.0	-15.5	49.8	63.5	-39.3	-21.2	2.1	-17.9
Pulp and paper	-15.9	-21.6	-30.9	-17.7	43.4	58.4	-18.0	-22.4	-4.2	-23.1
Petroleum and coal products	-15.4	27.8	-6.2	12.2	-6.9	54.2	-13.5	-8.6	-9.7	-18.1
Chemicals	-29.9	-23.2	-36.0	-16.0	44.1	52.0	-19.3	-23.3	-12.5	-21.0
Nonmetallic minerals	-5.3	-34.7	-18.0	-17.9	50.4	44.2	-31.6	-21.8	-29.7	-19.9
Metals	-4.0	-4.0	13.1	-27.0	30.6	43.5	10.7	-29.0	-6.6	-29.4
Fabricated metal products	-45.4	-33.0	-40.4	-20.0	41.0	54.8	-35.6	-24.1	-25.6	-24.7
Motor vehicles	-62.7	-60.4	-49.9	0.4	42.0	74.3	-38.6	-28.8	-21.1	-37.8
Transportation equipment	-22.4	-62.9	-27.1	-54.0	45.1	62.3	-42.9	-28.2	9.0	-42.8
Electronic equipment	-32.4	-42.4	-44.3	-67.0	47.0	53.4	-33.7	-34.4	6.8	-30.4
Machinery	20.1	-38.6	-53.7	-34.7	41.6	52.6	-41.8	-58.3	-26.9	-29.6
Other manufactures	426.7	-30.6	-30.2	-19.6	38.9	50.7	-30.4	-22.1	-14.4	-25.8
Services	-13.5	-17.5	-21.4	-16.8	44.5	60.5	-17.1	-22.3	-19.9	-15.3

Sources : GTAP5.4 and GTAP6 databases.