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Effects of the North American Free Trade Agreement*

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Abstract

The North American Free Trade Agreement (NAFTA) continues to be controversial. Using an econometric model of import demand and export supply, the effects of NAFTA on bilateral trade between NAFTA partners are estimated. The model accounts for NAFTA effects separately from the impacts of exchange rate movements between NAFTA members, growth in import demand due to changes in gross domestic product, and rest-of-the-world exchange rate effects. Quarterly time series data from 1986 to 2005 are employed. Counterfactual comparisons of model predictions indicate NAFTA has increased bilateral trade between the United States and Mexico. The effects of NAFTA on U.S.-Canadian and Canadian-Mexican trade are mixed and less pronounced.

Keywords: Free trade agreements, import demand, export supply, nonnested tests, instability tests

6JEL Classication: F02, F15, F17

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Abstract

The North American Free Trade Agreement (NAFTA) continues to be controversial. Using an econometric model of import demand and export supply, the effects of NAFTA on bilateral trade between NAFTA partners are estimated. The model accounts for NAFTA effects separately from the impacts of exchange rate movements between NAFTA members, growth in import demand due to changes in gross domestic product, and rest-of-the-world exchange rate effects. Quarterly time series data from 1986 to 2005 are employed. Counterfactual comparisons of model predictions indicate NAFTA has increased bilateral trade between the United States and Mexico. The effects of NAFTA on U.S.-Canadian and Canadian-Mexican trade are mixed and less pronounced.

Effects of the North American Free Trade Agreement

From 1990 to 2000, world exports of merchandise grew at an average annual rate of 7.0% while world merchandise production and GDP grew at 2.5% and 2.0% (WTO). Much of the growth in exports in the 1990's coincided with the implementation of regional trading arrangements such as the European Union (EU) with the Maastricht treaty of 1992, the North American Free Trade Agreement (NAFTA) which was signed in 1992, and the Southern Cone Common Market (MERCOSUR) with the Treaty of Asuncion signed in 1991. During the same period, NAFTA countries experienced some of the fastest growing trade of any of the regional trade agreements: imports increased at an average annual rate of 10% while exports grew at an 8% rate annually (WTO). Only the Association of South East Asian Nations (ASEAN) posted comparable growth rates.

As regional trade agreements have become more prominent, economists and policy makers have debated whether such trade agreements have salutary effects on world trade and welfare (Robinson and Thierfelder 2002). Critics of regional trade agreements contend they are "stumbling blocs" rather than building blocs for enhancing multinational trade (Bhagwati and Panagariya 1996). Others suggest regional trade agreements may be a logical outcome of enhanced multilateral trade (Ethier 1998).

One of the most contentious regional trade agreements has been the North American Free Trade Agreement (NAFTA). Much of the contention concerning NAFTA arguably owes to the fact that Mexico, a less developed country with a small economy, joined the United States, a developed country with a large economy. In addition, the Canada-U.S. Free Trade Agreement (CUSFTA) had already been ratified, suggesting NAFTA might have little effect on U.S.-Canada bilateral trade. Both Mexico and Canada depend on the United States for about three quarters of their exports whereas the United States has a more highly diversified set of trading partners with no single country accounting for more than half of its exports. Critics on both sides of the Rio Grande predicted dire consequences while many economists predicted only moderate impacts on trade among NAFTA partners (USITC 1992). Now, more than a decade after the implementation of NAFTA, the debate continues over the effects of NAFTA on North American trade patterns and welfare.

The purpose of the present paper is to provide a careful *ex-post* analysis of the effects of NAFTA on aggregate trilateral trade among NAFTA partners. Such analysis of trilateral trade is important for several reasons. First, a host of other events have occurred during the gradual formulation and implementation of NAFTA: Mexico's accession into GATT in 1986; the advent of U.S.-Canada free trade agreement in 1989; a precipitous devaluation of

the Mexican Peso in 1994; and more recently, implementation of the Mexico-EU Free Trade Agreement in 2000. Naïve comparisons of trade volumes before and after implementation of NAFTA without controlling for the effects of these and other economic phenomena could spuriously attribute changes in trade to NAFTA. Several economists have argued that isolating NAFTA's effects from these other events is not a trivial task (Kose et al. 2004; Krueger 1999, 2000; Romalis 2004).

Second, many *ex-ante* analyses of NAFTA using computable or applied general equilibrium (CGE) models suggested quite modest effects on trilateral trade (USITC 1992; Francois and Shiells 1994; Kehoe and Kehoe 1995). Yet casual comparison with subsequent trade volumes indicates these *ex-ante* studies may have seriously underestimated the impacts of NAFTA. In his systematic *ex-post* assessment of the applied general equilibrium models used to predict the impacts of NAFTA, Kehoe finds that most CGE models did not predict the substantial growth in trade in sectors, which prior to NAFTA accounted for relatively small portions of trade. *Ex-post* calibration of CGE models is essential for assessing modeling assumptions and bolstering the credibility of model results for policy purposes. However, *ex-post* calibration of CGE models is not designed to disentangle and isolate the effects of NAFTA as distinct from other economic phenomena. Our *ex-post* econometric analysis, on the other hand, is expressly designed for attempting to identify the impact of NAFTA as distinct from other economic events.

Before introducing our econometric model, we review past studies in order to assess how our study may contribute to understanding the impacts of NAFTA on trade patterns.

Econometric Studies of NAFTA

A plethora of econometric studies has analyzed the impacts of regional trade agreements. For brevity, we limit attention to those assessing the impacts of NAFTA. Econometric studies using aggregate data to measure the impacts of NAFTA fall roughly into two general categories: (i) gravity models; and (ii) import/export analyses. A third category of models—trade creation and diversion studies—use disaggregate data to identify sectors and industries contributing growth or decline in trade. We review the gravity studies first (see Table 1). The three studies employing gravity models (Gould 1998; Krueger 1999, and Aussilloux and Pajot 2002) differ in the types of data used. Gould employs bilateral trade data only for the three NAFTA trading partners whereas the other two us time series-cross sectional observations for 23 (Aussilloux and Pajot) and 61 countries (Krueger). Krueger's gravity model employs a shorter sample period—odd years from 1987 to 1997—whereas the other two studies use annual observations beginning in 1980. Perhaps not surprisingly, the statistically significant effects of NAFTA on trade

found in each study differ. Gould estimated a 7.3% increase in U.S. exports to Mexico as a result of NAFTA. Aussialloux and Pajot estimated anywhere from a 25% to 44% increase in trade flows among NAFTA members, depending on the particular model specified. Krueger, by contrast, finds some mild evidence in favor of trade diversion: a 46% drop in exports from NAFTA members to non-member countries.

The remaining econometric studies employ import and export equations of one sort or another to assess NAFTA's impacts on trade flows. Using roughly comparable times series data, both Garcés-Díaz and Konno and Fukeshige found evidence of structural changes well before ratification of NAFTA. In both studies, the changes are apparently substantial enough that any subsequent effects owing to NAFTA were overshadowed. Both Romalis and Fukao et al., using disaggregated data to assess trade diversion as well as creation, find evidence of moderate trade diversion in selected sectors.

Romalis' results generally coincide with those of Gould and Aussilloux and Pajot: NAFTA has caused some detectable increase in member countries' bilateral trade. But Garcés-Díaz as well as Konno and Fukeshige found evidence that economic changes prior to NAFTA have had more pervasive effects on bilateral trade than has NAFTA. That the latter two studies should produce such differing results is perhaps surprising because the sample data used by Gould, Aussilloux and Pajot, Garcés-Díaz, and Konno and Fukeshige all cover roughly the same time period from 1980 to 2000. Complementing the assessment of trade creation, Krueger and Fukao et al. found modest evidence of trade diversion as a result of NAFTA. Taken as a whole, the econometric evidence does not lead to an unequivocal consensus about the impacts of NAFTA on trade.

It is worth emphasizing that most of the studies cited have employed data covering at most the first five years of NAFTA's implementation. Although tariff rates on many products declined during this period, some tariffs will not be fully removed under NAFTA until 2008. Further, during the latter half of the 1990s, all three countries' GDPs grew at near record levels, fueling production, exports, and demand for imports. But that growth in incomes was not sustained into the following decade. Finally, the Mexico-European Union Free Trade Agreement, implemented in 2000, might be expected to attenuate some of the impacts of NAFTA. Hence, we think it opportune to reassess the impacts of NAFTA on North American trade volumes using data available through the first quarter of 2005.

Models of Bilateral Trade Flows

The foregoing review of econometric studies suggests there are two distinct empirical approaches commonly used to analyze the evolution and determinants of aggregate bilateral trade flows: the gravity model and import-demand and export-supply (IE) models. Both approaches are attractive for empirical studies because data requirements are relatively modest, their econometric specifications are easily estimated while the estimation results typically have good explanatory power and are easily interpreted. Both approaches yield reduced-form equations of a partial equilibrium nature. One of the key differences between the two approaches is a matter of focus: gravity models typically account for trade among many countries using cross-sectional or panel data whereas IE models tend to concentrate on trade between selected countries using time series data while treating other countries as the rest of the world. Although each approach has relative merits, we choose an IE model given our particular interest in North American trade.

Our IE model specifies bilateral trade flows as a function of the importing country's gross domestic product and the real exchange rate between the exporting and importing countries (Krugman and Obstfeld, 1994). Gross domestic product plays a role analogous to that of income in consumer demand; namely, gross domestic product (GDP) represents the budget constraint on aggregate consumption. Growth in GDP stimulates imports because augmented income permits more purchases of all goods, domestic and imported. Real exchange rates act as the prices of imports, providing a measure of the cost of consuming foreign goods relative to domestic goods. Numerous studies have found that including exchange rates as a measure of the relative costs of imports and exports is important for explaining bilateral trade flows (Krugman and Baldwin, 1987; Carter and Pick, 1989; Lawrence, 1990; and Noland, 1989).

Real exchange-rate effects often accumulate slowly through time due to stickiness in prices, delays in deliveries, and rigidities in contracts previously negotiated (Noland 1989). The lagged response of imports and exports to movements in real exchange rates may result in the "J-curve" whereby a real depreciation will initially worsen the deficit in the balance of trade but will ultimately improve it as prices, deliveries, and contracts adjust (Doroodian, Jung, and Boyd, 1999, Rose and Yellen 1989, and Rose 1991). In order to capture these temporal adjustments, current and lagged values of exchange rates are included.

Although IE models of aggregate trade are not designed to measure trade creation and diversion, trade conditions with the rest of the world (ROW) are accounted for here by including real exchange rates of the principle

non-NAFTA trading partners. These exchange rates provide a measure of the relative cost of imports from non-NAFTA members and the attractiveness of NAFTA exports to those countries. Including non-NAFTA exchange rates appears to be consistent with the approach of Winters and Chang (2000) and Chang and Winters (2002) who argue that the terms of trade should be employed as a measure of the welfare impacts of preferential trading arrangements on non-member countries.

Relatively few studies employing IE models evaluate the effects of preferential trading arrangements despite considerable evidence that such arrangements have significant impacts on bilateral trade flows (Eichengreen and Irwin, 1998; Krueger 1999; Rose, 2000; and Frankel and Rose, 2002). Whether in gravity or IE models, the effects of regional trade agreements are usually measured using indicator variables. Although the use of indicator variables for this purpose has been criticized (Winters, 1987), indicators are widely used because appending an indicator variable requires no additional trade data. As such, indicators only serve as a proxy for reductions in tariffs resulting from trade agreements. But the effects of preferential trade arrangements often go beyond simple removal of tariffs: non-tariff barriers are reduced, foreign direct investment (FDI) is stimulated, institutional ties are forged and strengthened, and business codes are revamped. While tariff and FDI levels lend themselves to quantitative measurement, enhanced institutional ties and revised legal codes represent qualitative changes for which quantitative measures may not exist. Because of the rigorous data requirements necessary for constructing tariff and FDI measures, we employ indicator variables as a residual measure of the impacts of NAFTA on bilateral trade.

The model is specified as,

$$\begin{aligned} IM_{ij} &= IM_{ij}\left(GDP_j, PCGDP_j, ER_{ij}, ER_{ik}, NAFTA_j\right) \quad i, j \in \{NAFTA\} \\ EX_{ji} &= EX_{ji}\left(GDP_i, PCGDP_i, ER_{ij}, ER_{jk}, NAFTA_i\right) \quad k \in \{Non-NAFTA\} \end{aligned} \qquad i \neq j \tag{1}$$

where IM_{ij} and EX_{ji} denote the value of aggregate imports and exports within NAFTA members, and GDP_i , GDP_j , $PCGDP_i$, and $PCGDP_j$ represent gross domestic product and GDP per capita in the destination countries, ER_{ij} , ER_{ik} and ER_{jk} denote real exchange rates between NAFTA and non-NAFTA countries, and $NAFTA_i$ and $NAFTA_j$ represent indicator variables for measuring the effects of NAFTA.

Although (1) is not formally derived from a structural model, we do have some expectations about the effects of the covariates on imports and exports. Gross domestic product, jointly through its aggregate and per capita effects, is expected to stimulate imports and exports. Denominating real exchange rates with importing country's currency relative to the exporter's currency, an increase in ER_{ij} is tantamount to a real depreciation in the

importer's currency. Such a depreciation is expected to dampen imports; hence, we would expect an increase in ER_{ij} to reduce imports. Maintaining the definition of ER_{ij}, we would expect exports to respond positively to an increase in their real exchange rate because now the increase is seen as a real appreciation of the destination country's currency. Of course, if J-curve effects are observed, there may be lags in the adjustment of imports and exports to changes in real exchange rates. The effects of changing real exchange rates between NAFTA and non-NAFTA partners have interpretations analogous to those of real exchange rates among NAFTA members. If a NAFTA member's currency depreciates relative to a non-NAFTA partner's currency, we would expect an increase in imports from NAFTA members because non-member imports become more expensive.

Data and Descriptive Statistics

Sources for the data employed are displayed in the appendix Table A.1.[1] All data employed in the econometric analysis are for aggregate trade; no disaggregation by sectors is performed. Imports, exports, and GDP were all denominated in real terms. Real exchange rates were constructed by weighting nominal rates with the ratio of consumer price indices to account for relative changes in inflation between pairs of countries. Exchange rates for the principle trading partners that are not members of NAFTA were included in addition to exchange rates between NAFTA members. The introduction of the Euro as official currency in January of 2002 posed some difficulty since individual nominal exchange rates for member countries of the European Monetary Union immediately disappeared. We completed the individual real exchange rate series for the European countries involved by substituting the particular nominal exchange rate for the Euro nominal exchange rate. We included an indicator variable taking the value of 1 from the first quarter of 2002 and subsequent periods because substitution of the Euro creates a discrete jump in the real exchange rate series. Because annual tariff rates at the aggregate level are not available for all the years included in the sample, tariff levels are not included in the data.[2] Quarterly observations from 1986 through

[1] One reason our sample begins in 1986 is that prior to that date, many of the series for exchange rates with other countries are missing. Informal conversations with staff at the Mexican Ministry of Finance also indicated some prior Mexican data might be of poorer quality.

[2] Several difficulties exist with the construction of tariff measures for aggregate trade. First, the number of products with individual tariffs is quite large. Second, both unit and *ad valorem* tariffs are employed. Third, tariffs on some products vary depending on the time of year as well as country of origin. All these factors make calculation of a non-weighted average tariff quite onerous. The World Bank has calculated simple average tariffs for some years but

the first quarter of 2005 were available for all series with the exception of population. As a result, per capita GDP is constructed using annual population figures.

Sample means for the variables employed appear in Table 2. The means are presented for pre-NAFTA (1986:I-1993:IV) and post-NAFTA (1994:I-2005:I) periods as well as for the entire sample.[3] Comparing the sample means for exports and imports in the pre- and post-NAFTA periods indicates substantial growth in bilateral trade between NAFTA partners. Imports and exports for Canada and the United States were roughly triple those of the United States and Mexico prior to NAFTA. However, after 1994 U.S.-Mexico bilateral trade grew relatively more quickly so that U.S.-Canada imports and exports are only about twice those of the United States and Mexico. While Canada-Mexico trade has also grown substantially with the advent of NAFTA, the Canada-Mexico bilateral trade is dwarfed by the levels of U.S.-Canada and U.S.-Mexico bilateral trade.

The relative magnitudes of real GDP across the three countries are evident from the sample means in Table 1. Although GDP and GDP per capita in Mexico and the United States display significant growth on average, Canada's GDP and GDP per capita have tended to decline. Part of the decline is due to the continued depreciation of the Canadian Dollar relative to the U.S. Dollar during the decade of the 1990's. Although Mexico's GDP and GDP per capita are low compared to those of Canada and the United States, both income measures posted the highest growth rates of the three countries.

Several tendencies in exchange rate behavior are notable from the sample means reported in Table 1. First, the Canadian Dollar has depreciated relative to most of its trading partners' currencies. By contrast, the Mexican Peso has appreciated relative to the currencies of its major trading partners. The U.S. Dollar shows slightly less pronounced effects relative to other countries' currencies.

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these series are deficient for use here because they are only annual observations, no distinction between country of origin of imports is made, and there are substantial gaps in the years available.

[3] The terms pre- and post-NAFTA use the implementation of NAFTA in January 1994 as the point of demarcation. Of course, firms and consumers anticipated the agreement even before it was signed in December 1992. And even with its implementation in 1994, tariffs were not all removed immediately. Hence, the point of demarcation is somewhat arbitrary but it serves as a reasonable benchmark.

Estimation and Hypothesis Testing

The import-demand and export-supply equations in (1) were specified as a seemingly unrelated regression (SUR) model. The SUR framework is postulated because unobserved shocks to one country's exports (imports) are likely to perturb exports (imports) of another country, resulting in contemporaneous correlation.[4]

Lags in Exchange-Rate Effects

The explanatory variables included are: GDP, GDP per capita, exchange rates for NAFTA and principle non-NAFTA trading partners, quarterly indicators to capture seasonal effects, a NAFTA indicator taking values of zero until 1993:IV and values of one thereafter as well as a NAFTA indicator multiplied by a time trend, and a NAFTA indicator multiplied by the square of a time trend variable. The specification is a static, linear one. As noted, there is ample reason to believe lags in real exchange-rate effects may occur. Most empirical studies find lags of no more than two years (Krugman and Baldwin, 1987; Lawrence, 1990). Accordingly, a lag length of as many as 8 quarters for exchange rates was considered. Exchange rates for NAFTA and principle non-NAFTA trading partners were included. Non-NAFTA countries were considered "principle" trading partners if NAFTA member exports to those countries accounted for more than 1% of respective total exports in a given year. For the United States, there were 8 non-NAFTA exchange rates to consider while for Canada and Mexico, there were 5 and 4 exchange rates, respectively. If 8 lags were included for all exchange rates in each equation, sufficient degrees of freedom would not exist. Even with a smaller number of lags, degrees of freedom would still be a problem. As an alternative, up to 8 lags in the exchange rates for the importing (exporting) pairs of countries only were specified. For example, up to 8 lags in only the U.S.-Mexico exchange rate in the U.S.-Mexico import-demand equation were specified; all other U.S. exchange rates in the import-demand equation include no lags.

[4] Unit roots tests were performed on all levels, first differences, and some second differences of the time series. The results of these tests based on the weighted-symmetric tau test statistic established an order of integration of one for the majority of the variables. The exception were Canada's GDP, GDP per capita, and the U.S.-Canada real exchange rate with an order of integration of two and the Canada-ROW real exchange rate with an order of integration of zero. These results imply care should be taken in the interpretation of any cointegration relationship between the variables. Therefore, other methods such as the Cochrane-Orcutt adjustment for first-order serial correlation of the residuals should be used to avoid the problem of spurious regression (Hamilton 1994). The unit root test results are available upon request.

Rest-of-the-World (ROW) Exchange Rates

Given the potential problems with degrees of freedom in exploring lag lengths, another alternative is to consider various aggregate exchange rates for non-NAFTA countries which could subsume individual exchange rates into a composite variable. Three specifications of these rest-of-the-world exchange rates were considered in this regard: (i) the most disaggregate in which almost all relevant exchange rates are included country by country (denoted ROW_D); (ii) an intermediate case in which some of the individual exchange rates are aggregated and some left disaggregated (denoted ROW_I); and (iii) the most aggregated in which all relevant exchange rates are subsumed in a single rest-of-the-world rate (denoted ROW_A). All the ROW aggregates are simple averages of the countries' real exchange rates. Appendix table A2 provides the specific details.

Non-Nested Tests

If only the appropriate lag lengths of NAFTA-country exchange rates were considered, nested tests would be suitable for specification searches. But the inclusion of rest-of-the-world exchange rates at varying levels of aggregation necessitates non-nested tests because using a more aggregate composite exchange rate is not equivalent to imposing zero restrictions on the parameters associated with individual exchange rates. A drawback of considering the appropriate level of aggregation of non-NAFTA-country exchanges rates while determining the appropriate lag length for NAFTA-country exchange rates is that the testing procedure is necessarily sequential. One can fix the lag length and then perform the non-nested tests. For a different lag length, the non-nested tests must be performed again. Alternatively, one might choose a level of aggregation for the ROW exchange rates and then perform nested tests to determine the appropriate lag length of the NAFTA exchange rates. But there is no way to test both lag length and aggregation simultaneously. Given this drawback we chose to limit the number of sequential tests by considering a limited number of lags. We first tested 4 against 6, 4 against 8, and 6 against 8 lags using sequential Lagrange multiplier tests. The null could not be rejected in any case. We proceeded to test longer lag lengths—8 against 10, 8 against 12, and 10 against 12—and again failed to reject the null. In the interest of preserving degrees of freedom, only four lags were included for NAFTA-country exchange rates in each equation because longer lag structures appeared not to provide much additional information about potential J-curve phenomena.

Once the lag lengths were determined, three non-nested models remained corresponding to the three levels of aggregation for non-NAFTA country exchange rates (see Table A.2 for details). Multivariate non-nested tests

(Davidson and MacKinnon 1983) were employed to discriminate between the three alternative specifications (see Table 3).[5]

The pair-wise and joint non-nested tests suggest the ROW_D model is preferred. Neither competing model rejects ROW_D individually nor do the two competing models jointly reject ROW_D. In what follows, we consider only the ROW_D model in which rest-of-the world exchange rates are treated in the most dissaggregate fashion.

Having settled on the appropriate specification of the IE model, several additional econometric issues remain. First, given the time series data employed, we test for serial correlation. Second, although the model is considered a reduced form, we suspect there may be correlation between the error terms and GDP as well as exchange rates. We conduct Durbin-Wu-Hausman tests for detecting such correlation.[6] Table 4a shows the combined results of the foregoing tests. All autoregressive parameters are individuallly statistically significant. The Durbin-Wu-Hausman tests rejected the null hypotheses of no correlation of GDP and real exchange rates, individually and jointly, with the errors. These outcomes led us to estimate an AR(1) version of the model using three-stage least squares.

Given our focus on evaluating the effects of institutional changes on trade, we test further for evidence of parameter stability throughout the sample period. Even with quarterly data, there are only 77 observations from 1986:I to 2005:I. This relatively small sample precludes use of many tests of parameter stability requiring estimates of parameters using sub-samples. But several appropriate tests are available. Two tests for parameter instability at any particular point during the sample period were used (see LaFrance 2000, pp. 9-11 for details). One test is developed to assess stability of the mean errors while a second test statistic is designed to detect instability of the error variances. Both tests are implemented equation by equation as well as for the entire system. For brevity, the

[5] The same non-nested tests reported here were conducted for other lag lengths of NAFTA-country exchange rates. In several of these cases, no particular model was capable of rejecting another model, suggesting that all such models were equally weak.

[6] The instruments employed were M1, M2 in Mexico and in the United States, foreign direct investment in Mexico, the Libor, Federal Funds, and Cetes rates, several industrial production indices from Mexico and the United States, and government expenditures for Mexico. Moreover, all the instrumental variables were lagged one year (four quarters). Lagging the instruments is consistent with economic agents observing government policies and subsequently updating their expectations. The sources for these series are documented in Table A.1.

full set of test statistic values and p-values are not reported. The evidence given by the tests points to possible instability of the variance in the post-NAFTA period. Accordingly, we use a sandwich estimator of the parameter covariance matrix to obtain consistent estimates of standard errors.

Parameter instability may also be associated with structural changes owing to particular institutional changes at specific dates. In the sample period employed, the Canada-U.S. Free Trade Agreement was implemented in the first quarter of 1989 while the Mexico-European Union Free Trade Agreement was established in the third quarter of 2000 (Slootmaekers 2004). Andrews' end-of-sample tests for parameter stability are well suited for assessing whether these two free trade agreements result in unstable parameters across the sample period (Andrews 2003). Table 4b displays the equation-by-equation results from Andrews' tests. The empirical p-values suggest some type of instability, either in the parameters or the distribution of the errors, coinciding with CUSFTA. But the instability is not limited to U.S.-Canada trade equations. In an effort to capture the instability, we included an indicator variable for CUSFTA in all equations as well as the CUSFTA indicator interacted with a trend, and the square of the CUSFTA indicator interacted with the trend. Running the Andrews' tests once again having included the indicator variables seems to mitigate the instability effects owing to CUSFTA but does not eliminate the effects entirely. Despite this partial accounting for CUSFTA, we include the CUSFTA indicator and interactions in all models discussed hereafter.

The last parameter instability test conducted was for the Mexico-EU Free Trade Agreement, implemented beginning in 2000:III. According to the empirical p-values of the Andrews' test, the only place where there is any evidence of instability is in the U.S. imports from Mexico equation. But when the CUSFTA indicator variables are included in the model, there is no evidence of instability owing to the Mexico-EU Free Trade Agreement. With no demonstrable effect on the stability of the parameters or error distribution, we ignore the Mexico-EU Free Trade Agreement in what follows.

Estimation Results

The estimated parameters and p-values from the model are displayed in Table 5. In general, the estimated parameters, when statistically significant, conform to expectations about their signs. Although our main focus is on evaluating the impacts of NAFTA on bilateral trade among NAFTA member countries, we discuss briefly the signs and significance of the estimated parameters.

GDP Effects

The statistical significance of the marginal effect (or elasticity) of GDP on bilateral trade cannot be discerned from the individual coefficients because the marginal effect of GDP is given by the GDP coefficient plus the GDP per capita coefficient time the reciprocal of population, e.g. $\partial IM_{ij} \big/ \partial GDP_i = \hat{\beta}_{GDP_i} + \hat{\beta}_{GDP_i} \cdot POP_i^{-1}$. Below are the elasticities of GDP before and during NAFTA with their associated p-values in parentheses.

	U.S. Imports from Mexico	U.S Exports to Mexico	U.S. Imports from Canada	U.S. Exports to Canada	Canadian Imports from Mexico	Canadian Exports to Mexico
Pre-NAFTA Avg.	-0.69 (0.561)	1.18 **(0.000)**	0.87 (0.151)	0.47 **(0.050)**	3.87 **(0.000)**	3.84 **(0.004)**
NAFTA Avg.	-0.18 (0.757)	0.73 **(0.000)**	0.90 **(0.054)**	0.38 **(0.009)**	1.11 **(0.001)**	3.03 **(0.002)**

When statistically significant, the elasticities of GDP exert the expected positive effect on imports and exports. Perhaps surprisingly, the only statistically significant elasticity of U.S. GDP appears for U.S. imports from Canada during the NAFTA period. Also perhaps surprising are the large elasticity values for Canadian and Mexican GDP in the Canada-Mexico bilateral trade equations. Regardless of the surprises, GDP plays a clear role in stimulating imports and exports, particularly for Canada and Mexico during the NAFTA period.

Effects of Real Exchange Rates between NAFTA Members

Current and lagged values of exchange rates between pairs of NAFTA trading partners were included to capture any potential J-curve effects. In all equations involving the United States, the real exchange rates are constructed with the United States designated as the "home" country. For bilateral trade between Canada and Mexico, Canada is the home country. Accordingly, an increase in the real exchange rate in the import equations would be expected to dampen imports because the home country currency has depreciated in relative terms. For current exchange rates, U.S. imports from Mexico and Canadian imports from Mexico register statistically significant reductions as real exchange rates increase. Otherwise, current real exchange rates do not display statistically significant effects. Only nine of the twenty four lagged exchange rate coefficients are statistically different from zero. Using Wald statistics, the null hypothesis for J-curve effects—the sum of the current and lagged exchange rate parameters is zero—could not be rejected in any particular equation nor considering all six equations jointly. In general, the bilateral exchange rates do not affect trade significantly in the export equations, and there is no evidence of J-curve effects.

In each import and export equation, the exchange rate with the third NAFTA country is also included to account for potential intra-NAFTA exchange rate effects. In the U.S.-Mexico and U.S.-Canada import and export equations, the United States is the home country; in the Canada-Mexico import and export equations, Canada is the home country. An increase in the real exchange rate with the third country in an import equation is expected to have a positive effect. To understand the positive effect, consider the case of U.S. imports from Mexico. An increase in the U.S.-Canada real exchange rate is tantamount to a depreciation of the U.S. Dollar relative to the Canadian Dollar. Other things equal, imports from Canada are more expensive for the United States, so imports from Mexico become more attractive. Conversely, in export equations, negative coefficients on third-country NAFTA exchange rates are expected. We observe statistically significant negative effects of the third-country exchange rate in all three export equations. In the Canadian-imports-from-Mexico equation, the sign on the U.S.-Canada real exchange rate parameter is not unexpected because the United States is designated as the home country

Effects of Real Exchange Rates between NAFTA and Non-NAFTA Members

Real exchange rates of each member's non-NAFTA principal trading partners were included to account for the impact of relative prices of trading partners in the rest of the world. Accounting for these effects is imperative because the United States trades with a large number of countries and, therefore, movements in non-NAFTA exchange rates could affect bilateral trade flows between NAFTA members. Canada and Mexico trade with a relatively smaller set of countries because a large portion of their trade occurs with the United States. Real exchange rates between Canada and Mexico with their non-NAFTA trading partners might be expected to influence NAFTA bilateral trading less due to proportionally smaller trade volumes between those countries.

Real exchange rates between NAFTA and non-NAFTA countries were constructed making the destination country act as the "home" country. The interpretation of these non-NAFTA exchange rates is straightforward. In import equations, if the exchange rate with any non-NAFTA country increases, the currency of the NAFTA importing country has depreciated relative to that country's currency. Thus, imports from the NAFTA partner would likely be stimulated. In export equations, the NAFTA country is the destination so that an increase in the exchange rate with the non-NAFTA trading partner again is tantamount to a depreciation in the NAFTA country's currency relative to the non-NAFTA country's currency. Now exports from the NAFTA partner to the NAFTA destination would be stimulated. Positive coefficients in both the import and export equations would suggest some type of substitution as changes in exchange rates affect relative prices and, consequently, the mix of imports from or

exports to a particular NAFTA country. This kind of substitution is obviously not synonymous with trade creation or diversion because it reflects responses to changes in relative prices, not preferential trading rules.

Of the 15 exchange rates with non-NAFTA countries included, nine are statistically significant. Of those nine coefficients, four coefficients are positive and they all correspond to exchange rates with Japan. The statistically significant exchange rates for the other non-NAFTA countries—China and Germany—have perhaps unexpected negative coefficients, which might be interpreted as indicating a complementary relationship: for example, even as imports from the non-NAFTA country become more expensive in home country currency, imports from the NAFTA partner decline. At this level of aggregate trade, we can only use the substitute-complement arguments heuristically because imports from non-NAFTA partners may occur in certain sectors or industries, whereas the bulk of imports from NAFTA partners might occur in other sectors or industry. Put differently, at this level of aggregation how the changes in exchange rates affect the sector- or industry-specific composition of bilateral trade is disguised.

Finally, in four of six cases, the rest-of-the-world (ROW) composite exchange rates exert a negative effect in the export equations as well as in the Canadian-imports-from-Mexico equation. Recall, the composite ROW exchange rates are constructed as simple averages of individual countries' exchange rates. Interpretation of these negative coefficients is even more difficult because not only are there composition effects not measured at the aggregate level but, in addition, trade flows might respond qualitatively differently to the individual exchange rates used to construct the composite measure. Aggregation and averaging tend to obscure underlying changes in the composition of trade from individual trading partners.

The foregoing results regarding non-NAFTA exchange rates, whether for individual countries or as a composite measure, indicate that ROW exchange rates do influence intra-NAFTA trade. In the case of NAFTA currencies relative to the Japanese Yen, the effects are especially prominent. The relatively strong impact of the Yen exchange rates is consistent with the fact that Japan has been an important trading partner, especially for the United States, during the past two decades.

Effects of NAFTA on Bilateral Trade

Nearly all the NAFTA indicator variables and their interactions with trends are statistically significant. Only the squared interaction term between NAFTA and the trend is insignificant for Canadian imports from Mexico. Otherwise, these coefficients indicate that a quadratic adjustment beginning in 1994:I adequately captures changes

owing to NAFTA. As part of sensitivity analysis, we included an additional cubic interaction term but in almost cases estimated parameters on the additional term were not statistically significant.

Although the IE model estimated is not without flaws, many of the estimated parameters have plausible signs and magnitudes. And given the battery of hypothesis and specification tests employed, using the model to assess the effects of NAFTA on bilateral trade seems reasonable. Accordingly, we turn to comparisons of in-sample fitted values to quantify NAFTA's impacts on trade.

Counterfactual Predictions

The IE model parameter estimates facilitate a counterfactual comparison of bilateral trade flows between the United States, Canada, and Mexico in the presence and absence of NAFTA. To make such comparisons, we calculated in-sample fitted values for two scenarios: (i) using estimated values of all parameters to generate the "with NAFTA" fitted series; and (ii) setting NAFTA-related parameters to zero to generate a counterfactual "without NAFTA" series. Having generated the two fitted series for each bilateral trade flow, we then generate the 95% confidence interval about each fitted series using the delta method.[7] If the two confidence intervals from the "with NAFTA" and "without NAFTA" series do not overlap, we can infer that NAFTA exerted a statistically distinguishable effect on bilateral trade. Of course, overlapping confidence intervals suggest the two fitted series are not distinguishable statistically from one another.

Figures 1a-3b display the results of the counterfactual experiments. Bilateral trade between the United States and Mexico appears to be the most substantially affected by NAFTA. The dashed lines represent the upper and lower bounds of the confidence intervals of the "with NAFTA" fitted series while the dotted lines correspond to the upper and lower bounds on the confidence intervals of the "without NAFTA" fitted values. The "with NAFTA" values of U.S. imports from and exports to Mexico are both statistically different from their "without NAFTA" counterparts for the entire NAFTA period from 1994:I through 2005:I.[8] Moreover, the magnitudes of the differences are large: imports with NAFTA rise to just under three times those without NAFTA (Figure 1a); and exports grow to roughly double those without NAFTA (Figure 1b). The continuous growth in U.S. imports from

[7] The approximate standard error must be generated for the fitted value at each sample point for the fitted values.

[8] The lower bound of the confidence interval for the "with NAFTA" U.S. imports from Mexico falls below the upper bound of the confidence interval for the "without NAFTA" series in the first 4 quarters of the NAFTA period, i.e. 1994:II till 1995:I. But the two confidence intervals do not ovelap thereafter.

Mexico is impressive because even as GDP tended to reach a plateau or decline in the NAFTA countries around the year 2000, imports continued to grow albeit at a slower rate. Clearly, NAFTA has resulted in a substantial increase, nearly doubling or tripling U.S.-Mexico bilateral trade since its inception.

The effects of NAFTA on U.S.-Canada and Canada-Mexico bilateral trade are less pronounced. United States imports from Canada do not differ statistically in the two scenarios; the two confidence intervals overlap during the entire NAFTA period (Figure 2a). Exports from the United States to Canada, on the other hand, do differ statistically but only for the four-year period from 1997:IV until 2001:III (Figure 2b). That U.S.-Canada bilateral trade should be influenced less by NAFTA is not surprising given that CUSFTA preceded NAFTA by five years. Nonetheless, there is evidence of a short-lived impact of NAFTA on U.S. exports to Canada.

NAFTA's effect on Canada-Mexico bilateral trade is also mixed. Although Canadian exports to Mexico appear to decline in the presence of NAFTA, the two sets of fitted values do not differ statistically from one another (Figure 3b). In contrast, Canadian imports from Mexico, are statistically different in the two scenarios from 1997:IV to the end of the sample. Here again, as with U.S.-Mexico bilateral trade, the impact of NAFTA is substantial: in the last three years of the sample, Canadian exports to Mexico double relative to the without NAFTA counterfactual series.

Several caveats regarding the counterfactual comparisons are in order. As mentioned previously, indicator variables are residual measures of phenomena in econometric models. That is, after all other variables are accounted for in the model, the indicator simply measures the remaining variation in bilateral trade during the indicated period. In our model, there may be other phenomena besides NAFTA contributing to the observed differences. Some of those phenomena could be measured with considerable effort—tariff reduction and foreign direct investment, for example—but others such as modifications of commercial codes, changes in non-tariff barriers, and altered phytosanitary standards are not easily quantified. Accordingly, while indicator variables are not direct measures of NAFTA's institutional changes, they may be the only way to measure some phenomena which are difficult to quantify.

As often occurs, we are constrained by sample size in the kinds of tests of structural change we can perform. If more frequent observations were available—say, monthly instead of quarterly—or if data for a longer sample period could be obtained, we might be able to estimate the entire model for subsets of the data to compare parameter vectors and covariance matrices across sub-sample periods. But data prior to 1986 may be of poorer

quality and more frequent measures of GDP and population are not consistently available. Given these constraints, we must employ tests for parameter instability that do not require estimating parameters for what would be relatively small sub-samples of data in our sample.

Conclusions

Circumstantial evidence suggests that the emergence of preferential trading arrangements may be partially responsible for world exports growing at a faster rate in the 1990's than world manufacturing production or world GDP. Rapid growth in exports coinciding with the increased prominence of preferential trade agreements suggests that it is important to evaluate the effects of such trade agreements on trade for partners within the agreements as well as on trade between member and non-member countries. In this context, the more specific and modest objective of this paper was to measure the impacts of NAFTA on bilateral trade among member countries while accounting for exchange rate movements of major trading partners outside NAFTA.

In order to evaluate the impacts of NAFTA, an econometric model in the spirit of import demand-export supply models was specified to account for the determinants of trade flows. The model borrows elements from import demand and export supply models. For example, gross domestic product—aggregate and per capita—are posited to be an important determinants of trade flows. Also, the model accounts for trade with the rest of the world by using an approach similar to that proposed by Winters and Chang (2000) and Chang and Winters (2002) whereby exchange rates with non-member countries are included.

The estimation results yield several statistically significant effects, which largely conform to *a priori* expectations. On one hand, GDP was a statistically important determinant of trade flows and its quantitative effect on those flows was considerable. Almost all statistically significant GDP elasticities are large; only two are less than 0.50. This result gives an appealing explanation for the considerable increase in world exports: growth in real GDP has fueled substantial growth in bilateral trade. However, the magnitude of GDP elasticities tends to decline slightly after the implementation of NAFTA in 1994 as the rapid growth of GDP in NAFTA countries in the 1990s was attenuated after 2000. On the other hand, the effects of real exchange rates between NAFTA member currencies are mixed. Exchange rates between NAFTA partners affect imports more than exports. There is no statistical evidence consistent with J-curve phenomena whereby adjustments in trade flows to changes in exchange rates occur through time.

One innovation in the import demand-export supply approach used here was to include real exchange rates between the currencies of NAFTA and non-NAFTA trading partners as a mean of incorporating trade conditions from the rest of the world. The elasticities calculated for these member, non-member exchange rates displayed mixed results. In essence, changes in the purchasing power of NAFTA currencies relative to those of other trading partner countries can either enhance trade with non-NAFTA members or induce substitution in the sources of imports or the destinations of exports. The effects of changes in these third-party exchange rates should not be confused, however, with the trade diversion or trade creation resulting from preferential trade agreements. The exchange rate effects simply account for real depreciations or appreciations in a NAFTA country's currency relative to the currencies of non-NAFTA trading partners; they do not measure the costs of producing tradable goods.

Having controlled for the important determinants of bilateral trade—gross domestic products and all relevant exchange rates—the effects of NAFTA are measured as a residual through separate indicator variables, indicators interacted with a trend variable, and indicators interacted with a squared trend variable for each trade flow. Systematic checks for parameter instability were performed. There was some evidence of non-constant variance of the errors, so heteroskedastic-consistent standard errors were estimated. We also explored the impacts of the U.S.-Canada and Mexico-EU Free Trade Agreements. CUSFTA does introduce parameter instability while the Mexico-EU FTA does not. Accordingly, IE model was modified to account for the effects of CUSFTA.

Although indicator variables are less than perfect measures of the effects of free trade agreements, given the inherently qualitative nature of some of the changes embodied in free trade agreements such as NAFTA, there do not appear to be better alternatives for measuring the effects of NAFTA on bilateral trade. By allowing for interaction between the NAFTA indicator with a trend and trend squared, we allow for flexibility in tracking any changes induced by NAFTA through time. Using the indicator variables and their interactions with trends, we generate counterfactual predictions for a "without NAFTA" series of fitted values in sample. The "without NAFTA" fitted values can be compared statistically with the fitted values from the "with NAFTA" fitted series by comparing the confidence bounds for the two series.

The counterfactual experiments indicate a substantial increase in U.S.-Mexico bilateral trade as the result of NAFTA: U.S. imports from Mexico are nearly triple what they would be without NAFTA; and U.S. exports to Mexico almost double relative to the without NAFTA values. The effects of NAFTA on U.S.-Canada and Canada-Mexico bilateral trade flows are less impressive. NAFTA apparently boosted U.S. exports to Canada by about 20 to

25% during the four-year span from mid-1997 to mid-2001 but any NAFTA effects vanish thereafter. Canadian imports from Mexico were affected more substantially by NAFTA but apparently lagged the implementation of NAFTA. After 1997, Canada's imports from Mexico have continued to grow to nearly double what they would have been without NAFTA. However, no statistical differences in trade flows resulting from NAFTA were detected as regards U.S. imports from Canada and Canadian exports to Mexico. After controlling for the effects of growth in gross domestic products and exchange rates within as well as outside of North America, NAFTA has apparently induced a substantial increase in U.S.-Mexico bilateral trade as well as Canadian imports from Mexico.

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Table 1. Selected Econometric Studies of the Effects of NAFTA

	Date of Publication	Type of Model	Sample Data	Statistically Significant Findings
Gould	1998	Import & export equations derived from a gravity model	Quarterly, 1980-1996, Mexico, U.S., & Canada	7.3% increase in U.S. exports to Mexico
Krueger	1999	Gravity, among others	Annual cross-sections of 61 countries, odd years from 1987-97 countries	46% drop in imports if the exporting country is a NAFTA member but the importer is not.
Aussilloux & Pajot	2002	Import & export equations derived from a gravity model	Annual time series-cross section of bilateral trade between 23 countries, 1980-1999	25 to 44% increase in NAFTA member country trade
Fukao et al.	2003	Import share equations with country & time fixed effects	Annual 1992-998, 60 HS-2 and HS-4 categories	Trade diversion effect of NAFTA on textiles and apparel
Romalis	2004	Demand & inverse supply elasticities estimated to simulate trade and welfare effects	Annual trade data on about 4,000 6-digit commodity groups, 1989-1999	Increase in Mexico's bilateral trade volume with Canada and the United States of 23% and 24%, respectively, but loss of 10% in ROW trade volume.[a]
Garcés-Díaz	2001	Export supply and import demand functions	Monthly bilateral trade—total and maquiladora—for U.S. and Mexico, 1980-2000	Time series properties suggest GATT affected U.S.-Mexico bilateral trade but NAFTA did not.
Konno & Fukeshige	2003	Import demand functions with gradual structural change	Quarterly, 1981:I-1990:IV	Gradual change beginning well before ratification of NAFTA (1985:IV). No distinct NAFTA effect.

[a] Romalis simulates the effects of NAFTA. As such, there is no standard error of the simulated effects.

Table 2. Sample Means (Real 1982-84 U.S.$ except for Exchange Rates)

Variables	1986:I - 1993:IV	1994:I - 2005:I	1986:I - 2005:I
Exports (Millions)			
U.S. to Canada	14,965	23,145	19,745
U.S. to Mexico	5,171	12,183	9,269
Canada to Mexico	98	187	150
Imports (Millions)			
U.S. from Canada	17,147	28,349	23,694
U.S. from Mexico	5,432	15,659	11,409
Canada from Mexico	314	956	689
Gross Domestic Product (Millions)			
United States	1,091,281	1,373,547	1,256,242
Canada	102,294	104,221	103,420
Mexico	48,595	73,598	63,207
Gross Domestic Product Per Capita			
United States	4,382	4,952	4,715
Canada	3,752	3,410	3,552
Mexico	567	749	673
Real Exchange Rates			
U.S.-Canada	0.72	0.58	0.64
U.S.-Mexico	0.16	0.18	0.17
Canada-Mexico	0.22	0.32	0.28
U.S.-United Kingdom	1.05	1.05	1.05
U.S.-France[a]	0.12	0.27	0.21
U.S.-Germany[a]	0.38	0.46	0.43
U.S.-Japan	0.0054	0.0054	0.0054
U.S.-China	0.15	0.073	0.10
U.S.-S. Korea	0.00061	0.0006	0.0006
U.S.-Taiwan	0.022	0.0196	0.0207
U.S.-Singapore	0.37	0.38	0.38
Canada-United Kingdom	1.46	1.83	1.67
Canada-Germany[a]	0.53	0.79	0.68
Canada-Japan	0.0075	0.0093	0.0085
Canada-China	0.21	0.13	0.16
Canada-Saudi Arabia	0.27	0.27	0.27
Mexico-Germany[a]	2.44	2.54	2.50
Mexico- Japan	0.035	0.03	0.03
Mexico-New Zealand	2.48	2.06	2.24
Mexico-S. Africa	1.84	0.98	1.34

[a]These series contain data for the Euro that became the official currency on January 2002.

Table 3. Non-Nested Hypothesis Tests for ROW Exchange Rates

Null/Alternative	ROW_A	ROW_I	ROW_D	Other Two Jointly*
ROW_A		2.72 **(.007)**	3.40 **(.001)**	5.85 **(.003)**
ROW_I	1.04 (.300)		2.53 **(.012)**	3.62 **(.028)**
ROW_D	0.85 (.398)	1.00 (.317)		0.60 (.549)

***** The other two models were considered jointly as the alternative to the specific null hypothesis p-values in parentheses.

Table 4a. Specification Tests

	U.S. Imports from Mexico	U.S Exports to Mexico	U.S. Imports from Canada	U.S. Exports to Canada	Canadian Imports from Mexico	Canadian Exports to Mexico
	Esitmated AR(1) Parameters					
ρ	0.55 **(.000)**	0.72 **(.000)**	0.82 **(.000)**	0.75 **(.000)**	0.37 **(.000)**	0.60 **(.000)**
	Durbin-Wu-Hausman Tests					
	GDPs		**Exchange Rates**		**Both**	
χ^2	2,054.06		14,322.20		1,239.06	
p-value	**(0.00)**		**(0.00)**		**(0.00)**	
d.f.	12		12		24	

p-values in parentheses

Table 4b. Beginning- and End-of-Sample Instability Tests

	Empirical p-values			
Equation	CUSFTA	CUSFTA[1]	Mexico-EUFTA	Mexico-EUFTA[1]
U.S. Imports from Mexico	0.170	0.321	**0.075**	0.575
U.S. Exports to Mexico	**0.019**	**0.057**	0.375	0.575
U.S. Imports from Canada	0.226	0.245	0.150	0.375
U.S. Exports to Canada	**0.057**	**0.057**	0.300	0.425
Canadian Imports from Mexico	**0.000**	**0.000**	0.500	0.775
Canadian Exports to Mexico	**0.094**	0.226	0.450	0.575

[1] Model augmented with CUSFTA indicator variable, CUSFTA indicator times trend, and squared CUSFTA indicator times trend.

Table 5. Parameter Estimates and P-Values in Parentheses

	U.S. Imports from Mexico		U.S. Exports to Mexico		U.S. Imports from Canada		U.S. Exports to Canada		Canadian Imports from Mexico		Canadian Exports to Mexico	
	Parameter	p-value	Parameter	p-value	Parameter	p-value	Parameter	p-value	Parameter	p-value	Parameter	p-value
GDP	0.01	(.503)	0.08	(.199)	0.06	**(.001)**	0.21	**(.024)**	0.001	(.887)	0.006	(.176)
GDP per capita	-3.56	(.325)	3.48	(.564)	-12.31	**(.004)**	-3.83	(.167)	0.26	(.162)	0.10	(.837)
Exchange Rate[1]	-18,117	**(.000)**	-15,624	(.372)	-1,771	(.839)	-11,156	(.175)	-597	**(.022)**	205	(.650)
Exchange Rate(-1)	14,588	**(.003)**	19,628	**(.000)**	8,909	(.208)	-454	(.934)	409	(.120)	-33	(.843)
Exchange Rate(-2)	-785	(.777)	-1,711	(.744)	-9,312	(.197)	-4,126	(.358)	249	(.271)	-124	(.378)
Exchange Rate(-3)	8,356	**(.007)**	-1,652	(.604)	22,162	**(.004)**	10,014	**(.062)**	15	(.962)	52	(.736)
Exchange Rate(-4)	-8,487	**(.006)**	-14,116	**(.000)**	1,696	(.833)	5,632	(.356)	-462	**(.023)**	-399	**(.011)**
Ex. Rate, Canada	10,251	**(.040)**	-15,940	**(.012)**								
Ex. Rate, Mexico					-11,492	(.242)	-8,134	**(.014)**				
Ex. Rate, U.S.									-1,988	**(.006)**	-3,889	**(.001)**
Ex. Rate, Japan	644,421	**(.000)**	129,227	**(.000)**	700,829	**(.041)**	296,638	(.160)	39,317	**(.000)**	1,857	(.344)
Ex. Rate, China	-31,046	**(.017)**			-6,492	(.754)	-33,800	**(.005)**	-2,994	**(.000)**		
Ex. Rate, UK	-182	(.897)			251	(.877)						
Ex. Rate, Germany	-5,205	(.245)	-601	**(.039)**	-15,534	**(.085)**					6.24	(.788)
Exchange Rate ROW	-6,924	(.669)	-2,240	**(.020)**	41,341	(.241)	-3,420	**(.019)**	-486	**(.001)**	-100	**(.073)**
Euro Indicator	1,553	(.394)			-486	(.878)						
NAFTA	-29,412	**(.000)**	-13,258	**(.001)**	-21,416	**(.028)**	-31,835	**(.000)**	-1,202	**(.001)**	359	(.106)
NAFTA*Trend	1,113	**(.000)**	577	**(.000)**	877	**(.031)**	1,243	**(.000)**	38	**(.009)**	-14	(.120)
NAFTA*Trend^2	-7.27	**(.000)**	-4.09	**(.003)**	-7.88	**(.043)**	-10.50	**(.000)**	-0.17	(.158)	0.12	(.141)
CUSFTA	6,119	**(.035)**	-2,556	(.269)	13,308	**(.027)**	13,481	**(.002)**	49	(.875)	22	(.832)
CUSFTA*Trend	-621	**(.049)**	262	(.301)	-1,373	**(.039)**	-1,440	**(.003)**	-5.67	(.853)	-3.46	(.758)
CUSFTA*Trend^2	14.03	**(.043)**	-5.25	(.354)	28.02	**(.055)**	30.75	**(.003)**	0.20	(.756)	0.08	(.743)
1st Quarter	-486	**(.001)**	-161	(.138)	-549	**(.029)**	375	(.124)	21	(.290)	-9.9	(.211)
2nd Quarter	10.9	(.938)	-132	(.163)	400	**(.087)**	1,228	**(.000)**	47	**(.008)**	-10.3	(.135)
3rd Quarter	-122	(.161)	192	**(.080)**	-1,315	**(.000)**	-1,313	**(.000)**	-68	**(.000)**	-0.23	(.984)
Constant	6,713	**(.302)**	6,652	**(.061)**	-12,321	(.431)	18,791	(.031)	1,387	**(.005)**	580	**(.005)**
AR(1)	0.65	**(.000)**	0.71	**(.000)**	0.81	**(.000)**	0.71	**(.000)**	0.32	**(.000)**	0.59	**(.000)**

[1] Exchange Rate refers to the current and lagged values of each exchange rate between the two trading partners. In the first equation, for example, this means the exchange rate of U.S. Dollars to Mexican Pesos.

Figure 1a. U.S. Imports from Mexico (1982-84 U.S. Dollars)

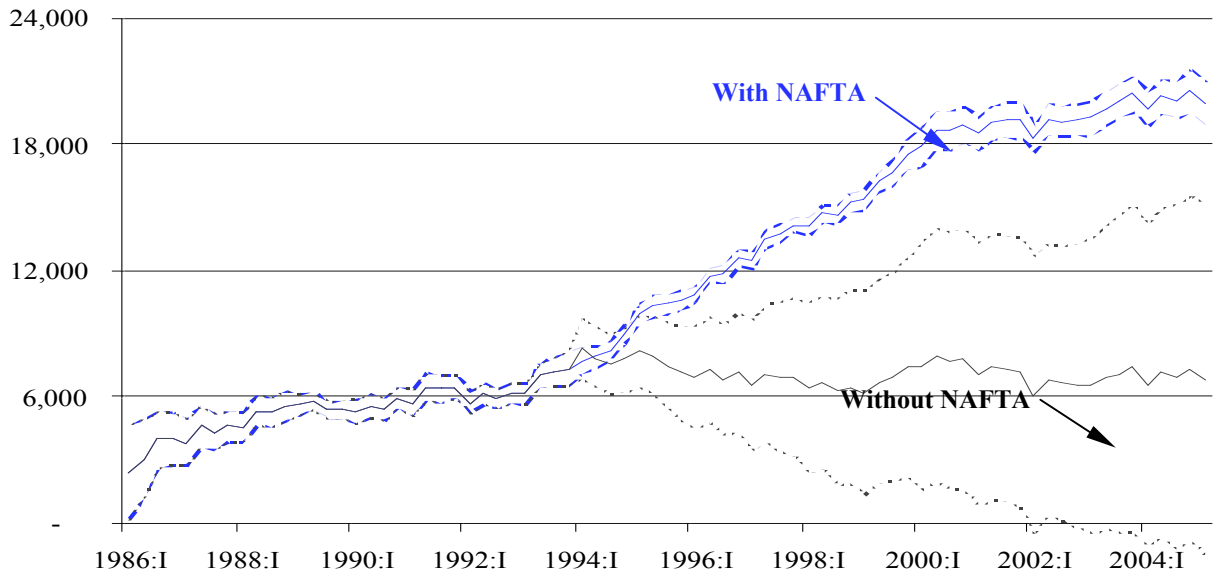

Figure 1b. U.S. Exports to Mexico (1982-84 U.S. Dollars)

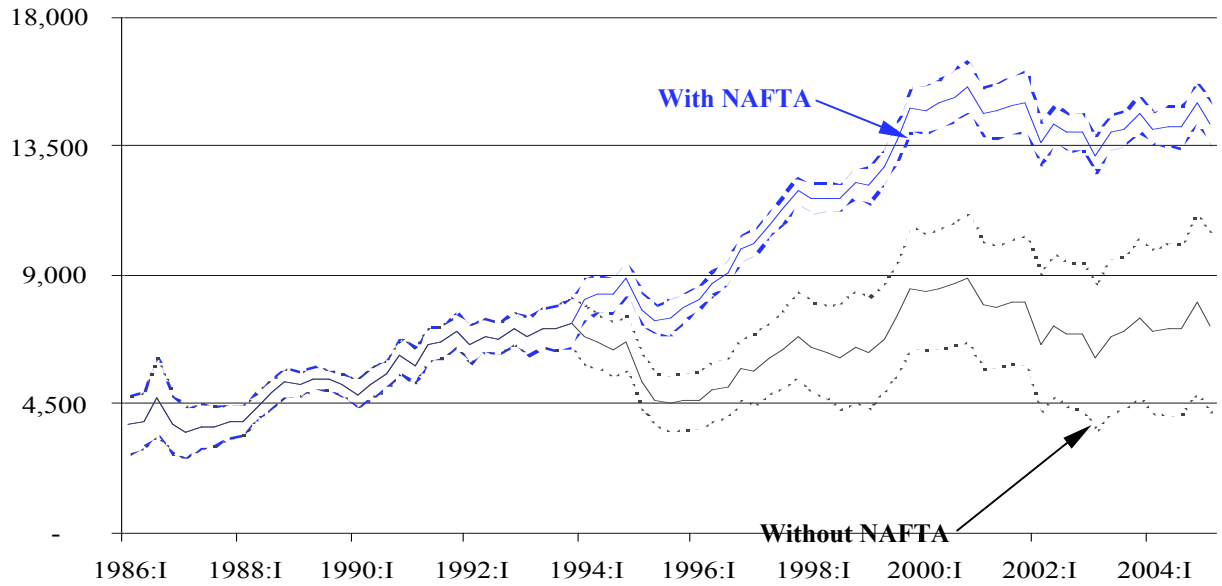

Figure 2a. U.S. Imports from Canada (1982-84 U.S. Dollars)

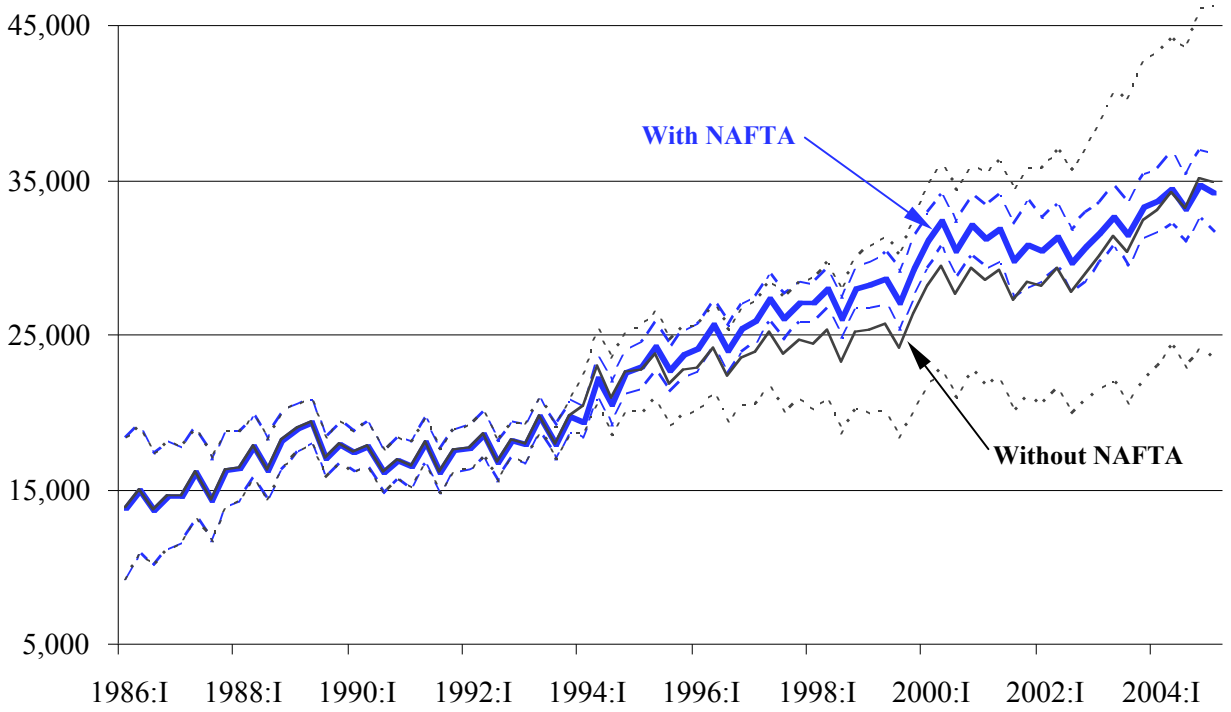

Figure 2b. U.S. Exports to Canada (1982-84 U.S. Dollars)

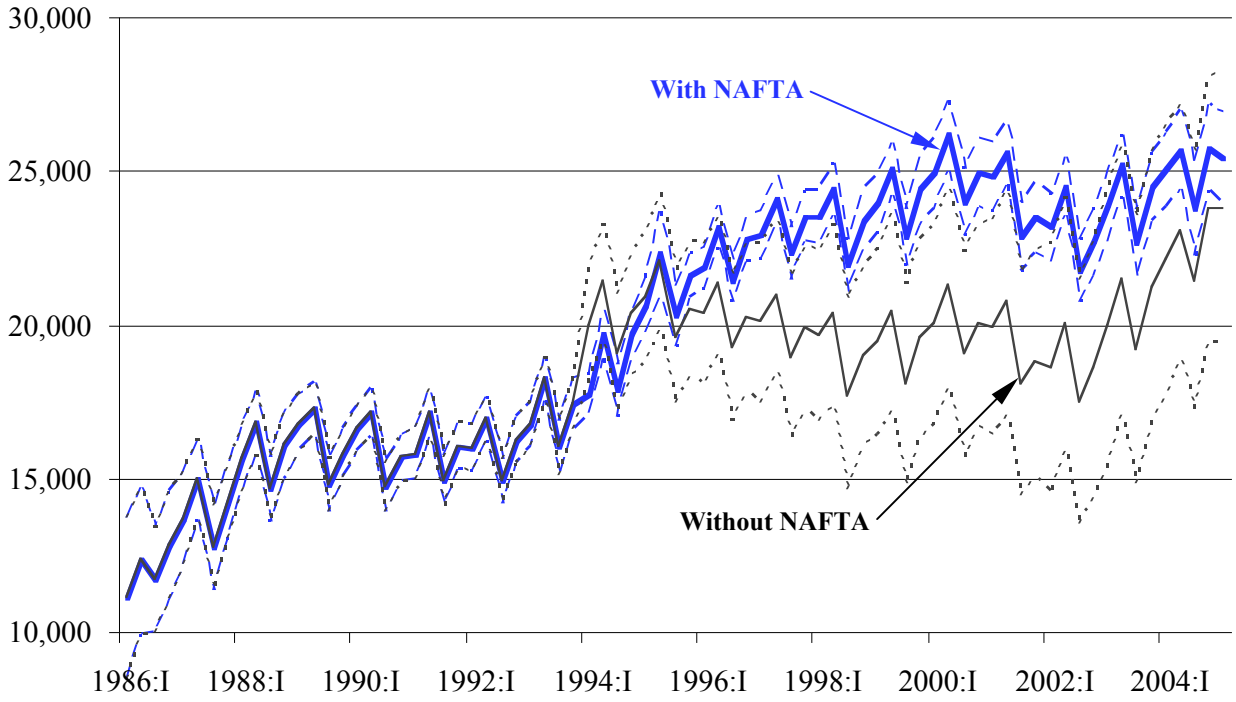

Figure 3a. Canadian Imports from Mexico (1982-84 U.S. Dollars)

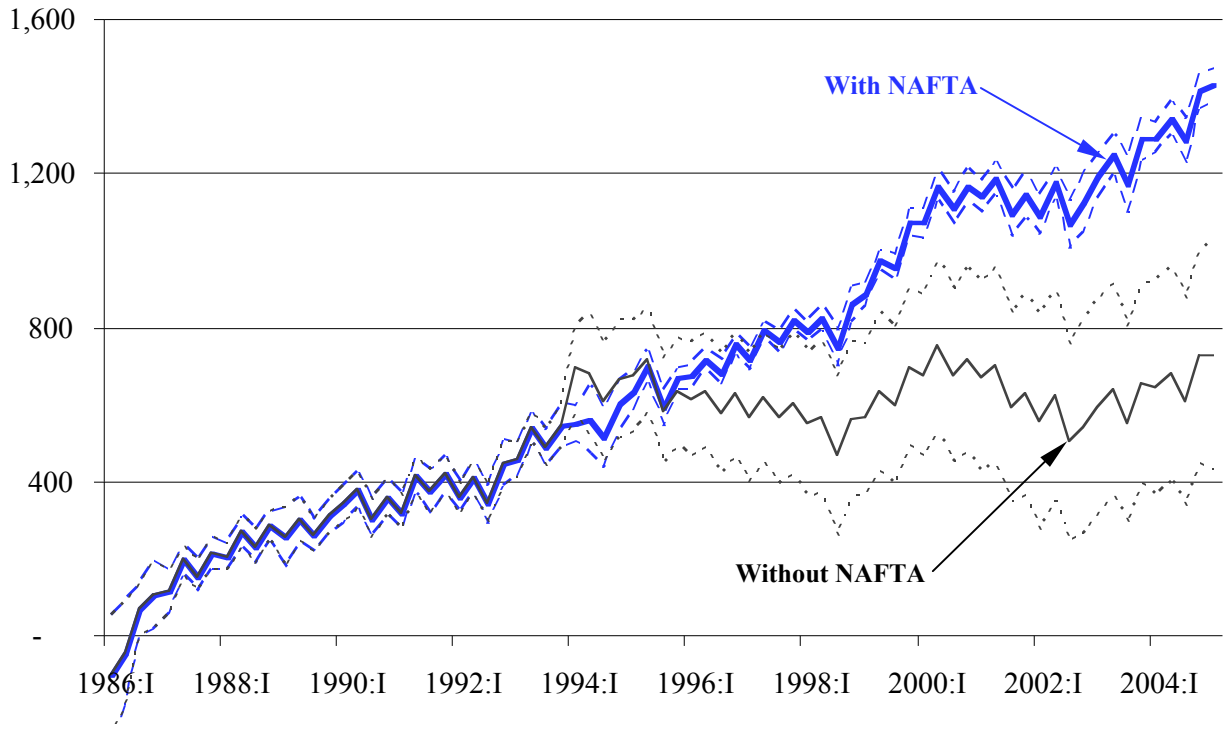

Figure 3b. Canadian Exports to Mexico (1982-84 U.S. Dollars)

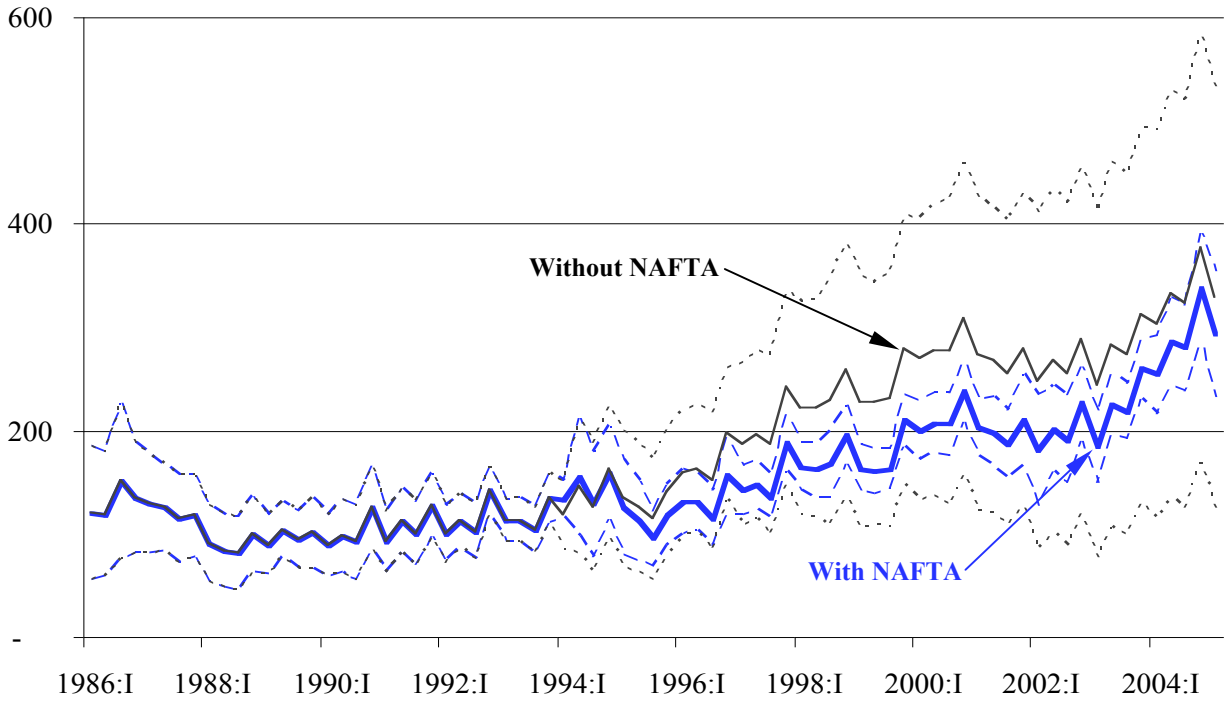

Table A.1. Data Sources

Series	*Institution*	*Source*
Exports (Nominal U.S. $)		
United States to Canada	Federal Reserve Bank of Saint Louis	www.stls.frb.org/fred/data/exchange.html
United States to Mexico	Federal Reserve Bank of Saint Louis	www.stls.frb.org/fred/data/exchange.html
Canada to Mexico	Statistics Canada	http://cansim2.statcan.ca/cgi-win/CNSMCGI.EXE?regtkt=&C2Sub=&LANG=E&TSDB=&C2DB=PRD&C2USER=&C2PASS=&C2APASS=&C2USEWRK=&SDDSLOC=//www.statcan.ca/english/sdds/*.htm&ROOTDIR=CII/&VEC=&RESULTTEMPLATE=CII/CII_PICK&VERSION=2&DETAIL=1&ARRAY_PICK=1&SDDSID=&DRILLFILE=&ARRAYID=2270001&HILITE=
Imports (Nominal U.S. $)		
United States from Canada	Federal Reserve Bank of Saint Louis	www.stls.frb.org/fred/data/exchange.html
United States from Mexico	Federal Reserve Bank of Saint Louis	www.stls.frb.org/fred/data/exchange.html
Canada from Mexico	Statistics Canada	http://cansim2.statcan.ca/cgi-win/CNSMCGI.EXE?regtkt=&C2Sub=&LANG=E&TSDB=&C2DB=PRD&C2USER=&C2PASS=&C2APASS=&C2USEWRK=&SDDSLOC=//www.statcan.ca/english/sdds/*.htm&ROOTDIR=CII/&VEC=&RESULTTEMPLATE=CII/CII_PICK&VERSION=2&DETAIL=1&ARRAY_PICK=1&SDDSID=&DRILLFILE=&ARRAYID=2270002&HILITE=
Gross Domestic Product (Nominal U.S. $)		
Canada	Statistics Canada	cansim2.statcan.ca/cgi-win/cnsmcgi.exe?Lang=E&RootDir=CII/&ResultTemplate=CII/CII_pick&ArrayPick=1&ArrayId=3800002
Mexico	Instituto Nacional de Estadistica, Geografia e Informatica	www.inegi.gob.mx/
United States	Bureau of Economic Analysis	www.bea.gov/bea/dn1.htm.
Population		
Canada	International Monetary Fund, International Financial Statistics	

Mexico	World Bank, Country at a Glance Tables	www.worldbank.org/data/countrydata/ countrydata.html#AAG
United States	Population Reference Bureau	www.prb.org/Content/NavigationMenu/Other_reports/2000-2002/sheet1.html
Nominal Exchange Rates (U.S.$/Country's Currency)		
Britain	Federal Reserve Bank of Saint Louis	www.stls.frb.org/fred/data/exchange.html
Canada	Federal Reserve Bank of Saint Louis	www.stls.frb.org/fred/data/exchange.html
China	Federal Reserve Bank of Saint Louis	www.stls.frb.org/fred/data/exchange.html
France	Federal Reserve Bank of Saint Louis	www.stls.frb.org/fred/data/exchange.html
Germany	Federal Reserve Bank of Saint Louis	www.stls.frb.org/fred/data/exchange.html
Japan	Federal Reserve Bank of Saint Louis	www.stls.frb.org/fred/data/exchange.html
Mexico	Banco de Mexico	www.banxico.org.mx
New Zealand	Federal Reserve Bank of Saint Louis	www.stls.frb.org/fred/data/exchange.html
Saudi Arabia	International Financial Statistics	Various Issues
Singapore	Federal Reserve Bank of Saint Louis	www.stls.frb.org/fred/data/exchange.html
South Africa	Federal Reserve Bank of Saint Louis	www.stls.frb.org/fred/data/exchange.html
South Korea	Federal Reserve Bank of Saint Louis	www.stls.frb.org/fred/data/exchange.html
Taiwan	Central Bank of China	www.cbc.gov.tw/eng/index.html
Consumer Price Indices		
Britain	Statistics Canada	cansim2.statcan.ca/cgi-win/cnsmcgi.exe?Lang=E&RootDir=CII/&ResultTemplate=CII/CII_pick&ArrayPick=1&ArrayId=3800003
Canada	Statistics Canada and Bank of Canada	cansim2.statcan.ca/cgi-win/cnsmcgi.exe?Lang=E&RootDir=CII/&ResultTemplate=CII/CII_pick&ArrayPick=1&ArrayId=3800002
China	Monthly Bulletin of Statistics of the Republic of China	Various Issues

France	Statistics Canada	cansim2.statcan.ca/cgi-win/cnsmcgi.exe?Lang=E&RootDir=CII/&ResultTemplate=CII/CII_pick&ArrayPick=1&ArrayId=3800004
Germany	Statistics Canada	cansim2.statcan.ca/cgi-win/cnsmcgi.exe?Lang=E&RootDir=CII/&ResultTemplate=CII/CII_pick&ArrayPick=1&ArrayId=3800005
Japan	Statistics Canada	cansim2.statcan.ca/cgi-win/cnsmcgi.exe?Lang=E&RootDir=CII/&ResultTemplate=CII/CII_pick&ArrayPick=1&ArrayId=3800006
Mexico	Instituto Nacional de Estadistica, Geografia e Informatica	www.inegi.gob.mx/
New Zealand	Statistics Canada	cansim2.statcan.ca/cgi-win/cnsmcgi.exe?Lang=E&RootDir=CII/&ResultTemplate=CII/CII_pick&ArrayPick=1&ArrayId=3800007
Saudi Arabia	International Financial Statistics	Various Issues
Singapore	International Financial Statistics	Various Issues
South Africa	International Financial Statistics and Statistics South Africa	Various Issues and www.statssa.gov.za/default2.asp
South Korea	National Statistics Office	www.nso.go.kr/cgi-bin/sws_888.cgi
Taiwan	National Statistics of Taiwan, The Republic of China	www.stat.gov.tw/
United States	Bureau of Labor Statistics	www.bls.gov
Instruments		
M1 Mexico	Banco de Mexico	www.banxico.org.mx
M2 Mexico	Banco de Mexico	www.banxico.org.mx
Capital Expenditures from Government Expenditures Mexico	Banco de Mexico	www.banxico.org.mx
Physical Invesmtment from Capital Expenditures Mexico	Banco de Mexico	www.banxico.org.mx
Government Expenditures Mexico	Banco de Mexico	www.banxico.org.mx

Primary Government Expenditures Mexico	Banco de Mexico	www.banxico.org.mx
Industrial Activity Volume Index Mexico	Instituto Nacional de Estadistica, Geografia e Informatica	www.inegi.gob.mx/
Manufacturing Production Volume Index Mexico	Instituto Nacional de Estadistica, Geografia e Informatica	www.inegi.gob.mx/
Construction Volume Index Mexico	Instituto Nacional de Estadistica, Geografia e Informatica	www.inegi.gob.mx/
Foreign Direct Investment Mexico	Instituto Nacional de Estadistica, Geografia e Informatica	www.inegi.gob.mx/
Cetes 28 days Mexico	Banco de Mexico	www.banxico.org.mx
M1 USA	Federal Reserve Bank of Saint Louis	
M2 USA	Federal Reserve Bank of Saint Louis	
Government Consumption Expenditures and Gross Investment	Bureau of Economic Analysis	www.bea.gov
Gross private domestic investment	Bureau of Economic Analysis	www.bea.gov
Federal Funds rate	Federal Reserve Bank of Saint Louis	www.stls.frb.org/
Libor rate 1 month us dollar deposits	Federal Reserve Bank of Saint Louis	www.stls.frb.org/
Industrial Production Total Index	Federal Reserve Bank of Saint Louis	www.stls.frb.org/
Industrial Production Manufacturing Index	Federal Reserve Bank of Saint Louis	www.stls.frb.org/
Industrial Production Industrial Machinery and Equipment	Federal Reserve Bank of Saint Louis	www.stls.frb.org/

Table A.2 Explanation of Non-Nested Models

Non-Nested Models	Equations						Total Number of Parameters[a]
	Imports U.S from Mex	Exports U.S. to Mex	Imports U.S from Can.	Exports U.S. to Can.	Imports Can. from Mex	Exports Can. to Mex	
ROW_A	ROW_A_{US} (t)	ROW_A_{MEX} (t)	ROW_A_{US} (t)	ROW_A_{CAN} (t)	ROW_A_{CAN} (t)	ROW_A_{MEX} (t)	98
ROW_I	ROW_I_{US} (t) U.S.-Japan (t) U.S.-China (t)	ROW_I_{MEX} (t) Mex.-Germany (t) Mex.- Japan (t)	ROW_I_{US} (t) U.S.-Japan (t) U.S.-China (t)	ROW_I_{CAN} (t) Can.-China (t) Can.-S. Arabia (t)	ROW_I_{CAN} (t) Can.-China (t) Can.-S. Arabia (t)	ROW_I_{MEX} (t) Mex.-Germany (t) Mex.- Japan (t)	110
ROW_D	ROW_D_{US} (t) U.S.-Japan (t) U.S.-China (t) U.S.-UK (t) U.S.-Germany (t)	ROW_I_{MEX} (t) Mex.-Germany (t) Mex.- Japan (t)	ROW_D_{US} (t) U.S.-Japan (t) U.S.-China (t) U.S.-UK (t) U.S.-Germany (t)	ROW_I_{CAN} (t) Can.-China (t) Can.-S. Arabia (t)	ROW_I_{CAN} (t) Can.-China (t) Can.-S. Arabia (t)	ROW_I_{MEX} (t) Mex.-Germany (t) Mex.- Japan (t)	114

[a] Total number of parameters includes 92 parameters for the other explanatory variables not changing across non-nested specifications.