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Abstract

Debates over the desirability a preferential trading area (PTA) begin with the supposition that it will have two effects on the volume of trade: it will increase trade between PTA members, and decrease trade between members and non-members. This paper demonstrates, however, that at the regional level the effects of NAFTA have been much more complicated than what is normally supposed should happen. Specifically, NAFTA has meant (i) less trade between Eastern Canada and the United States and Mexico, (ii) more trade between Central Canada and the United States and Mexico, and (iii) more trade between Western Canada and Mexico, but no change in the volume of trade between Western Canada and the United States. I also find that NAFTA has decreased trade between Canadian regions and both Europe and Asia, while increasing Mexico's trade with Asia. (JEL F13, R11)

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NAFTA and the Geography of North American Trade

This paper estimates the effects of the North American Free Trade Agreement (NAFTA) on the geographic pattern of North American trade. Specifically, it looks at the effects of NAFTA on aggregate trade flows between subnational regions within North America, and between North American regions and the non-NAFTA world. The importance of a regional analysis of the effects of NAFTA is evident from the wide variety of regional post-NAFTA experiences. Between 1993 and 1997, real trade between Canada and the United States increased by more than 50 percent. Over the same period, Central Canadian exports to the Southwest and Rocky Mountain regions of the United States and Eastern Canadian exports to the Southeast of the United States all increased by more than 110 percent. In contrast, Eastern Canadian real imports from the Great Lakes, Plains, and Southeast regions of the United States were actually lower in 1997 than they were in 1993. Further, while real Canadian exports to Mexico increased by 46 percent over the period, those from Western Canada rose by over 90 percent while those from Eastern Canada rose by only less than 1 percent.[1]

Estimates of the regional effects of NAFTA are interesting in themselves, but they also serve a more general purpose. Specifically, they provide support for the hypothesis that, because it does not account for the spatial or geographic effects of integration, standard customs union theory is inadequate for capturing the effects of preferential trading areas (PTAs). The geographic approach is a break from standard empirical analyses of PTAs in that it recognizes

[1] See Tables A1-A4 in the data appendix for the available percent differences in real region-region, region-country, and country-country trade between 1993 and 1997. See also Krueger (2000) for a broader discussion of the changes in trade between NAFTA partners.

that the nation is not always the relevant unit of reference for international trade (Krugman, 1991a).

Viner (1950) established the general principle that the welfare effect of joining a PTA such as NAFTA is ambiguous. In a simple partial equilibrium model under perfect competition, a PTA will increase trade between members, whether countries or regions, because the tariff between them has been eliminated (trade creation). If the most-efficient producer of a good is outside the PTA, the effect is to import more from the less-efficient member-producer (trade diversion). The net effect of a PTA on trade volume (as a proxy for welfare) depends, therefore, on the relative sizes of trade creation and trade diversion. Over time, the Vinerian dichotomy has evolved beyond this highly stylized model, and trade creation has become a catchall for the presumed positive effect that entering a PTA will have on trade between members. Similarly, trade diversion has become the catchall for the presumed negative effect on all trade, imports and/or exports, between a PTA member and the rest of the world.

Despite the presumed certainty of trade creation and trade diversion, the ways in which integration affects trade are many and varied, and few fit into the simple Vinerian dichotomy. One significant non-Vinerian way for integration to affect trade volumes is through increasing returns to scale, a topic typically absent from the empirical literature, although prominent in the theoretical literature. It has also been central to the public discussion of North American integration, as, for example, Canadian firms have long argued that access to the US market would allow them to exploit economies of scale. Not only would this allow them to increase their exports to the rest of North America, but also to the rest of the world. Increasing returns also affects the volume of trade in inputs and intermediate goods used by increasing returns

industries. This is because firms that expand production and exploit economies of scale need to purchase more inputs and intermediate products, which might be imported from inside or outside of North America. Thus, in contrast with the Vinerian effects, with economies of scale, NAFTA may increase trade between members *and* between members and non-members.

The trade creation, trade diversion, and scale economies effects arise whether one looks at trade from a national or a regional standpoint, and they would drive much of the regional variation in the effects of a PTA. This is simply because, like countries, regions differ in their abilities to match their comparative advantages to the preferences of consumers in other member and non-member regions. However, the recent literature under the rubric of the New Economic Geography suggests that things are actually much more interesting when account is taken of firms changing their locations as a response to joining a PTA. This literature, spearheaded by Krugman (1991a,b), models various ways in which production patterns (and therefore trade patterns) can change with integration because of its effects on firms' optimal location decisions.[2]

One of the reasons that a PTA affects geographic trade patterns is that it alters the spatial distributions of firms' customers and suppliers. For example, consider a firm initially located in Massachusetts. By adding Mexico to the Canada-US Free Trade Area, the spatial distributions of the firm's customers and suppliers are shifted southward, creating greater incentive for the firm to move closer to Mexico, if not into Mexico itself. If the firm relocates, regional trade patterns will change because goods that were exported from Massachusetts to Canada, Mexico, and the rest of the world would instead be exported from, say, Arizona. At the same time,

[2] Also see Krugman (1998) and Fujita, Krugman, and Venables (1999). Hanson (1996, 1998a, 1998b) and Krugman and Hanson (1993) discuss the effects that previous stages of North American integration have had on location decisions.

because the firm has moved across the continent, it is in a better position for exporting to Asia, and a worse position for exporting to Europe. Also, the firm would be more likely to import intermediate products from Asia, and the regional import pattern would change accordingly.

A second reason that a PTA affects geographic trade patterns is that it expands the set of possible places for firms to locate. Under NAFTA, Canadian and US firms that move to Mexico can do so without losing tariff-free access to their domestic markets. This affects intra-NAFTA trade by switching what had been exports, say, from Canada to the US and Mexico, into exports from Mexico to the US and Canada. Extra-NAFTA trade would also be affected, as a firm that was exporting from Canada to the rest of the world would instead export from Mexico. The New Economic Geography literature suggests that these location effects are much stronger when there are cross-firm linkages whereby a firm's marginal costs are lower when other firms are nearby. With these linkages there is a tendency for linked firms to agglomerate, creating industry centers.

These examples are by no means exhaustive, but they do provide sufficient illustration of the theoretical inadequacies of the Vinerian dichotomy. The remainder of the paper is devoted to seeing whether these theoretical inadequacies translate into empirical ones. I find ample evidence that the effects of NAFTA have not conformed to the Vinerian dichotomy, and conclude that the customs union theory needs to be reworked to include a substantial accounting of geography and scale economies.

The empirical model that I use, the gravity model, has become the workhorse for estimating the effects of PTAs on trade volume. In a gravity model, bilateral trade is assumed to be an increasing function of the national incomes of the trading partners, and a decreasing function of the distance between them. The effects of PTAs are modeled with dummy variables.

For my present purposes, the gravity model has advantages and disadvantages, both arising from its simplicity. While it allows me to examine the effects of NAFTA on large number of trading combinations, it is not versatile enough to attribute the effects on aggregate trade to trade creation, trade diversion, the mobility of firms, agglomeration, etc.

From a practical standpoint, the major advantage of the gravity model is that the researcher does not need to specify the underlying trade processes, although that it is largely *ad hoc* has meant that the gravity model has met with much suspicion by international trade theorists. Deardorff (1984, p. 504), however, concluded that the gravity model tells "us something very important about what happens in international trade, even if they do not tell us why." Recently, though, the gravity model has "gone from an embarrassing poverty of theoretical foundations to an embarrassment of riches."[3] In fact, as shown by Bergstrand (1985, 1989) and Deardorff (1998), among others, the gravity model can be derived within a variety of standard theoretical frameworks. The estimates I present below demonstrate vividly the greatest strengths and weaknesses of the gravity model. On the one hand, its simplicity allows for the estimation of a large number of region-to-region NAFTA effects that would be extremely difficult to obtain using any other method. On the other hand, it provides little guidance to explain why the NAFTA effects that it detects. Nevertheless, the results to suggest that geography may have played an extremely large role.

Two recent gravity studies that also look at the effects of NAFTA on aggregate trade between NAFTA members, both using national-level data only. Krueger (1999) found that NAFTA has had no statistically significant effect on intra-North American trade, although she did find a statistically significant decrease in imports from Europe. Gould (1998), who only considered intra-North American trade, found that NAFTA has had a significant effect on trade

between the United States and Mexico, but not on trade between the United States and Canada or Mexico and Canada.[4] One reason for these lukewarm results is the small number of observations of post-NAFTA national-level trade volume. As will be apparent below, this is not a problem in the present study.

I. The Data

In constructing my empirical model, many of the choices are driven by the availability of data on North American regional trade. This study is based on a unique data set from Statistics Canada on provincial merchandise imports and exports to and from all 50 US states, the District of Columbia, and most countries of the world. It is the same data set that formed the basis of earlier studies of the effect of the U.S.-Canada border on trade (see McCallum, 1995 and Helliwell, 1996). However, because I do not wish to consider the additional complication of the border effect, I do not include data on intra-provincial trade.

In addition to provincial trade data for 1990-97, I include data from *World Trade Flows, 1980-1997* on bilateral trade between combinations of Mexico and 8 non-NAFTA countries: China, France, Germany, Hong Kong, Japan, and Korea, the Netherlands, and the United Kingdom.[5] The non-NAFTA countries are needed as a control group under the assumption that trade between them has not been affected by NAFTA.[6]

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[3] Frankel (1998, p. 2).

[4] For estimates of the industry-level partial equilibrium effects, see Krueger (1999), Busse (1996), Devados, *et al* (1995), Espinosa and Noyola (1997), Hinojosa-Ojeda, *et al* (1996), Karamera and Ojah (1998), USITC (1997), and Wylie (1995). Also, see the volume edited by Kehoe and Kehoe (1995) for applied general equilibrium estimates.

[5] See Feenstra (2000) and Feenstra, Lipsey, and Bowen (1997) for descriptions of this data set.

[6] Of course, in the most general of general equilibrium model, NAFTA would affect also trade between any two non-NAFTA countries. Nonetheless, these effects are small enough to ignore for present purposes.

The two data shortcomings are the absence of comparable state-level data on U.S. merchandise trade with countries other than Canada, and the absence of Mexican state-level data of any sort.[7] Nonetheless, the data set is extremely rich, providing a panel of 1272 bilateral trading pairs, with 11,340 observations.[8] Note that all values in the data set are transformed into real 1992 Canadian dollars at market exchange rates. I use market exchange rates rather than purchasing-power-parity exchange rates to reflect the fact that what matters for international trade is the size of a country's economy at world prices, rather than domestic prices. Thus, in the spirit of gravity models, fluctuations in the value of a country's currency are captured by fluctuations in its economic size.

In principle, I could estimate the model with every state, province, and non-NAFTA country as its own region. However, I need to collect them into regions so as to yield enough observations to provide reliable estimates of the regional NAFTA dummies. Thus, I divide North America into 13 regions; three in Canada: Eastern, Central, and Western Canada; nine in the United States: New England, Mideast, Great Lakes, Plains, Southeast, South Central, Southwest, Rocky Mountain, and Far West; and Mexico.[9] I also divide the eight non-NAFTA countries into two regions: Asia and Europe. So, although my model allows for the effects of NAFTA to differ across regions, the estimated effects of NAFTA are assumed to be uniform across the locations (states, provinces, or countries) within a region.

Given the data set, there are 39 pairs of regions. Because I have data for both directions of trade for all 39 pairs, there are 78 unidirectional trading pairs—60 for intra-NAFTA trade, 8

[7] The U.S. does collect state-level export data, but it is not compatible with the Canadian data. See Coughlin and Wall (2003) for an analysis of NAFTA and U.S. state exports.
[8] See the data appendix for details about data sources.
[9] See the data appendix for the assignment of states, provinces, and countries to regions.

for imports into North America, 8 for exports from North America, and 2 for trade between Asia and Europe. To estimate these interregional effects, I include region-pair dummy variables for all 76 of the region pairs that include at least one North American region.

II. Estimation

I estimate bilateral trade with a gravity equation specifying the level of exports from location *i* to location *j* as a function of their GDPs, the distance between them, and any number of fixed cultural and geographic measures such as language and contiguity. Departing somewhat from the standard gravity model, I do not impose the restriction that the intercepts be the same across pairs of locations and directions of trade. This follows Mátyás (1997), Bayoumi and Eichengreen (1997), Cheng and Wall (2002), Glick and Rose (2001), Pakko and Wall (2001), and Egger (2002) who argue that gravity models that restrict the intercepts to equality suffer from heterogeneity bias.

The gravity equation I estimate is

$$\begin{aligned}\ln(1+x_{ijt}) = {} & \alpha_0 + \alpha_{ij} + \lambda t + \beta \ln Y_{it} + \gamma \ln Y_{jt} + \delta \ln dist_{ij} \\ & + \boldsymbol{\mu}'\mathbf{EU} + \mathbf{d}'\mathbf{IntraNA} + \boldsymbol{?}'\mathbf{NAImp} + \boldsymbol{?}'\mathbf{NAExp} + \varepsilon_{ijt};\end{aligned} \tag{1}$$

where x_{ijt} is real exports from location i to location j in year t, α_0 is the shared intercept, α_{ij} is the trading-pair intercept (without the restriction that $\alpha_{ij} = \alpha_{ji}$), λt is the shared time trend, $dist_{ij}$ is the distance between i and j, and Y_{it} and Y_{jt} are the real GDPs of i and j.[10]

IntraNA is a 60×1 vector of dummy variables to capture the effects of NAFTA on both directions of trade between the 30 region-region combinations within North America. An

element of **IntraNA** takes the value of one when the observation is of post-NAFTA trade from the element's exporting region to its importing region, and is zero otherwise. Similarly, **NAImp** is the 8×1 vector of dummy variables to capture the effects of NAFTA on North American regional imports from Asia and Europe, and **NAExp** is the 8×1 vector of dummy variables to capture the effects of NAFTA on North American regional exports to Europe and Asia. Distance and other standard variables in gravity models such as contiguity, common language, etc., are subsumed into the trading-pair intercept, along with all other observable and unobservable fixed factors related to history, culture, preferences, etc. that would make exports from *i* to *j* differ from trade between other trading pairs.

Because the four European countries in the sample are also members of the European Union (EU), the regression equation also includes dummy variables to control for the transformation of the European Community (EC) into the EU in 1993. Specifically, **EU** is a vector of three dummy variables for post-EU trade: one each for trade between members, trade from a non-member to a member, and trade from a member to a non-member. Note that because the model has trading-pair intercepts, and because the four European countries in the data set were all members of the EC at the start of the sample period, the EU dummy variables only account for the differences between the two regimes. The effect of the EC is already accounted for by the relevant trading-pair intercepts.

The least squares estimates of equation (1) are provided by Tables 1 and 2a. The results in Table 1 are as expected for a gravity equation: the higher the incomes of the two partners are,

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[10] Note that because some observations are of zero trade, the dependent variable is the log of 1 plus exports. Censored data normally requires Tobit estimation, but for gravity models this technique has typically made little difference to the results.

the more they trade. Of the three EU dummies, only the one for the effect of the EU on EU exports to the rest of the world is statistically significant. It suggests that the change in regime from the EC to the EU increased EU exports to non-members by 7.8 percent [$100\times(e^{7.5}-1)$]. In contrast, the estimated coefficients on the other two EU dummies suggest that the EU had little effect on intra-EU trade or on EU imports from non-members. Keep in mind, though, that because the sample is extremely limited in its coverage of European trade, these results are far from definitive.

My primary interest is in the signs and levels of the estimated coefficients on the inter-regional NAFTA dummies, listed in Table 2a and converted into percentage changes in Table 2b. In addition, Tables 3 and 4 provide various aggregations of the inter-regional percentage changes, and are obtained by applying the estimated percentage changes to the average real post-NAFTA trade volumes for 1994-98.

III. Trade Between North American Regions

A. Canada-U.S. trade

According to my results, NAFTA increased Canadian exports to the United States by 29 percent, and Canadian imports from the United States by 14 percent. From the perspective of the three Canadian regions, positive NAFTA effects were far from universal. All 18 of the effects of NAFTA on trade between Eastern Canada and a U.S. region are negative, and all but one is statistically significant. In total, Eastern Canadian exports to the United States were 9 percent lower because of NAFTA, with the largest decreases being in exports to the Rocky Mountain and

Plains regions. Similarly, Eastern Canadian imports from the United States fell by 13 percent, with imports from all U.S. regions seeing roughly similar decreases.

In stark contrast with NAFTA's on Eastern Canada, NAFTA led to large increases in Central Canadian trade with the United States. Central Canadian exports to the United States rose by 43 percent because of NAFTA, and exports to all but one U.S. region saw a large increase. On the import side, NAFTA increased Central Canadian imports from the United States by 18 percent. Although the effects on imports from the Rocky Mountain region and the Far West were small and statistically insignificant, the effects on imports from the other seven regions were all positive.

For Western Canada, mixed region-region effects mean that the effect of NAFTA on the region's total trade with the United States was effectively zero. Nonetheless, there were large differences across U.S. regions in the effects of NAFTA on Western Canada's trade. The one positive and statistically significant effect was to the Great Lakes region. The four negative and statistically significant effects were for exports to the Northeast, Mideast, Southeast, and South Central regions. For Western Canadian imports from the United States, only the estimated effect on imports from the Great Lakes region was positive and statistically significant. The four regions with negative and statistically significant negative effects were the Northeast, South Central, Rocky Mountain, and Far West regions.

Table 3b provides the region-region effects aggregated across the three Canadian regions for each of the U.S. regions. From this perspective it is easy to see that the positive effect of NAFTA on trade between Canada and the United States was fairly general across U.S. regions. Exceptions to this were the Rocky Mountain region, which saw its exports to Canada fall by 6

percent, whereas its imports were effectively unchanged; and the Far West, which saw its exports to Canada fall by an even smaller amount. The Great Lakes and South Central regions saw the largest increases in exports to Canada, while the largest increases in imports from Canada were for the Great Lakes and Southeast regions.

B. Canada-Mexico Trade

As reported in Table 3c, NAFTA had a large effect on trade between Mexico and Canada, with significant regional variation. For Canada as a whole, NAFTA increased exports to Mexico by 12 percent, and imports from Mexico by 48 percent. However, Eastern Canada saw its exports to and imports from Mexico drop by 15 and 12 percent, respectively, whereas Western Canada saw increases of 31 and 26 percent, respectively. For Central Canada, NAFTA had no effect on exports to Mexico, while it increased imports from Mexico by 52 percent.

C. Trade Creation?

As discussed in the introduction, according to the Vinerian dichotomy, NAFTA should have increased the volume of trade between its members, whether these members are countries or regions. Although my results indicate that trade creation held at the level of country-country trade, trade creation was far from universal for region-region or region-country trade. Of the 60 coefficients on intra-NAFTA region-region trade, 27 indicate statistically significant decreases in interregional trade because of NAFTA, with 21 of them associated with Eastern Canadian trade. Aggregating the region-region effects to the region-country level, negative trade effects also arise: the estimated effect on both directions of Eastern Canada's trade with the United States

and Mexico are negative and large. Finally, when the regional effects are aggregated to the country-country level, all results have NAFTA leading to an increase in intra-NAFTA trade.

IV. Trade with the Rest of the World

A. Canada

As reported in Tables 4a and 4b, the effects of NAFTA on Canada's regional exports to Europe and Asia were, for the most part, consistent with the Vinerian prediction of trade diversion. NAFTA's effects on total Canadian exports to Europe and Asia were decreases of 12 and 8 percent, respectively. Although the magnitude of these effects differed across Canadian regions, all regions saw decreased exports to both Asia and Europe. For both continents, Eastern Canada experienced the largest drops in exports (greater than 16 percent), whereas Western Canada had the smallest drop in exports to Europe (6 percent), and Central Canada had the smallest drop in exports to Asia (3 percent).

On the import side, the effect of NAFTA on total Canadian imports from Europe was a small increase of less than 2 percent, whereas its effect on imports from Asia was a small decrease of 3 percent. At the regional level, Eastern and Western Canada both had large decreases in imports from both Europe and Asia, whereas Central Canada saw small and statistically insignificant increases in imports from both continents. So, although the effects of NAFTA on total Canadian imports from each of Asia and Europe were effectively zero, the real story is at the regional level. Consistent with Vinerian trade diversion, Eastern and Western Canada both experienced large decreases in imports from Europe and Asia.

B. Mexico

As reported in Tables 4a and 4b, the effects of NAFTA on Mexico's exports to the rest of the world were mixed. Exports to Europe were unaffected by NAFTA, whereas exports to Asia were 14 percent higher. As for Mexican imports, NAFTA led to an 8 percent drop in imports from Europe, whereas it led to an 11 percent increase in imports from Asia. Note though that none of these estimated effects of NAFTA on Mexican trade with Europe and Asia is statistically significant at traditional level.

C. Trade Diversion?

At the national and regional levels, the effects of NAFTA on Canada's and Mexico's trade with the non-NAFTA world shows that there has been more going on than simple trade diversion. Although most of the results for Canadian trade are consistent with trade diversion, the story was different for Mexico. In particular, the results indicate that NAFTA has increased the volume of trade with Asia, although the estimated effect on exports and imports are statistically significant at only the 18 and 15 percent levels, respectively.

V. Summary and Conclusions

According to my results, the effects of NAFTA on the volume and pattern of North American trade have been significant (statistically and otherwise). I find that, because of NAFTA, 29 percent more merchandise flowed from Canada to the United States, and 14 percent more merchandise flowed from the United States to Canada. I find also that NAFTA increased the flow of merchandise from Canada to Mexico by 12 percent, and that the flow from Mexico to

Canada increased by 48 percent. The volume and pattern of North American trade with Europe and Asia also changed in the wake of NAFTA. Specifically, NAFTA led to large decreases in Canada's exports to Europe and Asia, to a decrease in Mexican imports from Europe, and to a large increase in Mexican trade with Asia.

The geographical approach reveals interesting regional differences in the effects of NAFTA. For Eastern Canada, NAFTA led to large decreases in trade with the United States, Mexico, Asia, and Europe. For Central Canada, NAFTA led to large increases in trade with the rest of North America, and to a large decrease in exports to Europe. For Western Canada, NAFTA had no effect on total trade with the United States, but it did lead to large increases in trade with Mexico, and to decreases in trade with Europe and Asia. For U.S. regions, the increases in trade were spread fairly widely, with the Rocky Mountain and Far West regions as exceptions.

According to the Vinerian dichotomy, NAFTA should have increased trade between North American regions, and decreased trade between each North American region and the rest of the world. Although the gravity methodology is not adequate for separating Vinerian effects from geographic effects, it has provided sufficient evidence that there is more to North American integration than trade creation and diversion. The most significant exceptions to the Vinerian dichotomy were: (i) decreased trade between Eastern Canada and all U.S. regions and Mexico; (ii) decreased trade between Western Canada and some U.S. regions; and (iii) increased trade between Mexico and Asia.

Data Appendix

Data Sources

Province-state and province-country trade data, 1990-98, from Statistics Canada.
Non-Canadian country-country trade, 1990-97, from *World Trade Flows, 1980-1997*.
Nominal Gross Provincial Product, 1990-98, from Statistics Canada.
Nominal Gross State Product, 1990-98, from the Bureau of Economic Analysis.
Nominal Gross Domestic Product, 1990-98, from the World Bank's *World Development Indicators 1999*.
All variables converted into real Canadian dollars using Canadian CPI and $/C$ market exchange rates from Statistics Canada.

The Composition of the Regions

The 9 U.S. regions are based on the 8 Bureau of Economic Analysis (BEA) regions, with the BEA Southeast region split into two: Southeast and South Central. The 3 Canadian regions are according to Statistics Canada. The 8 countries assigned to the Asia and Europe regions are 8 of Canada's 10 most important trading partners, the other two being the United States and Taiwan. Taiwan could not be included because the World Bank does not provide its GDP data.

Eastern Canada:	New Brunswick, Newfoundland, Nova Scotia, and Prince Edward Island
Central Canada:	Ontario and Quebec
Western Canada:	Alberta, British Columbia, Manitoba, and Saskatchewan
New England:	Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont
Mideast:	Delaware, District of Columbia, Maryland, New Jersey, New York, and Pennsylvania
Great Lakes:	Illinois, Indiana, Michigan, Ohio, and Wisconsin
Plains:	Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota
Southeast:	Florida, Georgia, North Carolina, South Carolina, Virginia, and West Virginia
South Central:	Alabama, Arkansas, Kentucky, Louisiana, Mississippi, and Tennessee
Southwest:	Arizona, New Mexico, Oklahoma, and Texas
Rocky Mountain:	Colorado, Idaho, Montana, Utah, and Wyoming
Far West:	Alaska, California, Hawaii, Nevada, Oregon, and Washington
Mexico:	Mexico
Asia:	China, Hong Kong, Japan, and Korea
Europe:	France, Germany, the Netherlands, and the United Kingdom

Table A1. Percentage Changes in Real Region-to-Region International Trade, 1993-1997

origin\dest'n	Eastern Canada	Central Canada	Western Canada	New England	Mideast	Great Lakes	Plains	South-east	South Central	South-west	Rocky Mtn.	Far West	Mexico	Europe	Asia
E. Canada				37.7	62.0	71.0	33.3	130.8	12.0	104.2	-4.8	3.6	0.9	11.5	38.0
C. Canada				69.2	41.0	48.6	79.6	86.4	80.2	110.5	160.3	101.2	21.7	9.7	69.4
W. Canada				81.2	36.6	48.7	59.7	53.3	71.0	125.8	82.9	42.6	90.7	35.3	27.6
New England	40.7	45.8	50.8												
Mideast	14.3	50.7	48.3												
Great Lakes	-15.7	41.6	33.2												
Plains	-47.9	84.0	60.5												
Southeast	-4.2	63.8	63.3												
South Central	78.7	87.6	62.8												
Southwest	39.4	95.9	87.2												
Rocky Mtn.	39.9	46.2	39.1												
Far West	22.8	53.3	51.2												
Mexico	26.0	69.2	219.1											58.0	70.0
Europe	45.7	49.4	109.5										22.3		
Asia	23.0	28.9	20.2										15.1		

Values are the percentage differences in trade between 1997 and 1993, measured in 1992 Canadian dollars at market exchange rates.

A2. Canada-US by Canadian Regions

Region	Exports to US	Imports from US
Eastern Canada	56.7	11.4
Central Canada	58.4	53.7
Western Canada	55.0	51.9
Canada total	57.6	52.7

A3. Canada-US by US Regions

Region	Exports to Canada	Imports from Canada
New England	45.9	63.0
Mideast	49.9	41.3
Great Lakes	40.3	48.8
Plains	74.0	67.2
Southeast	61.2	83.5
South Central	83.8	75.4
Southwest	92.5	114.0
Rocky Mountain	43.2	99.0
Far West	52.0	66.9
US total	52.7	57.6

A4. Canada-Mexico, Europe, and Asia

	Canadian Exports	Canadian Imports
Mexico	45.6	77.7
Europe	14.6	55.7
Asia	36.4	25.9

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Table 1. Regression Results, Dependent Variable = ln(1+ Exports)

	Model with heterogeneous inter-regional NAFTA effects		
	coefficient[a]	robust s.e.[b]	*t*-statistic
Shared intercept (α_0)	**-5.024**	-0.330	15.205
Log of origin GDP (β)	**0.368**	0.032	11.544
Log of destination GDP (γ)	**0.507**	0.032	15.872
Trend (λ)	0.002	0.002	1.203
EU and intra-EU trade (μ_1)	0.009	0.021	0.438
EU and EU imports (μ_2)	0.013	0.025	0.512
EU and EU exports (μ_3)	**0.075**	0.025	3.080
IntraNA, NAImp, NAExp (d,?,?)		see Table 2	
11340 observations, $\overline{R}^2 = 0.981$, F(82,9986) = 66.79			

The 1272 bilateral region-pair intercepts are suppressed for space considerations.
[a] Bold indicates significance at 5% level.
[b] White-corrected standard errors.

Table 2a. Coefficients on Region-Region NAFTA Dummies

origin\dest'n	Eastern Canada	Central Canada	Western Canada	New England	Mideast	Great Lakes	Plains	South-east	South Central	South-west	Rocky Mtn.	Far West	Mexico	Europe	Asia
E. Canada				**-0.115**	-0.034	**-0.051**	**-0.193**	**-0.106**	**-0.157**	**-0.094**	**-0.224**	**-0.164**	**-0.159**	**-0.179**	**-0.174**
				0.022	*0.026*	*0.020*	*0.011*	*0.019*	*0.015*	*0.035*	*0.013*	*0.013*	*0.035*	*0.030*	*0.025*
C. Canada				**0.367**	**0.204**	**0.438**	**0.206**	**0.467**	**0.402**	**0.316**	-0.088	**0.275**	-0.006	**-0.137**	-0.032
				0.050	*0.034*	*0.042*	*0.033*	*0.039*	*0.042*	*0.050*	*0.090*	*0.061*	*0.074*	*0.042*	*0.054*
W. Canada				**-0.121**	**-0.075**	**0.085**	0.015	**-0.092**	**-0.077**	-0.015	0.052	0.017	**0.269**	-0.060	**-0.107**
				0.019	*0.031*	*0.040*	*0.041*	*0.017*	*0.021*	*0.030*	*0.034*	*0.022*	*0.052*	*0.032*	*0.034*
New England	**-0.129**	**0.155**	**-0.144**												
	0.010	*0.017*	*0.012*												
Mideast	**-0.116**	**0.108**	-0.012												
	0.011	*0.043*	*0.018*												
Great Lakes	**-0.139**	**0.229**	**0.110**												
	0.014	*0.040*	*0.024*												
Plains	**-0.158**	**0.082**	0.023												
	0.010	*0.034*	*0.020*												
Southeast	**-0.157**	**0.200**	-0.034												
	0.013	*0.033*	*0.018*												
South Central	**-0.137**	**0.245**	**-0.038**												
	0.011	*0.033*	*0.015*												
Southwest	**-0.161**	**0.093**	-0.007												
	0.014	*0.040*	*0.022*												
Rocky Mtn.	**-0.180**	-0.022	**-0.115**												
	0.011	*0.036*	*0.015*												
Far West	**-0.157**	0.023	**-0.062**												
	0.013	*0.030*	*0.016*												
Mexico	**-0.132**	**0.416**	**0.231**											0.001	0.134
	0.056	*0.098*	*0.064*											*0.097*	*0.101*
Europe	**-0.137**	0.067	**-0.137**										-0.079		
	0.035	*0.037*	*0.045*										*0.079*		
Asia	**-0.179**	0.028	**-0.146**										0.106		
	0.030	*0.046*	*0.028*										*0.073*		

Numbers in italics are the White-corrected standard errors. Bold indicates significance at the 5% level.

Table 2b. Percentage Changes in Region-Region Trade Due to NAFTA

origin\dest'n	Eastern Canada	Central Canada	Western Canada	New England	Mideast	Great Lakes	Plains	South-east	South Central	South-west	Rocky Mtn.	Far West	Mexico	Europe	Asia
E. Canada				**-10.9**	-3.3	**-5.0**	**-17.6**	**-10.1**	**-14.5**	**-9.0**	**-20.1**	**-15.1**	**-14.7**	**-16.4**	**-16.0**
C. Canada				**44.3**	**22.6**	**55.0**	**22.9**	**59.5**	**49.5**	**37.2**	-8.4	**31.7**	-0.6	**-12.8**	-3.1
W. Canada				**-11.4**	**-7.2**	**8.9**	1.5	**-8.8**	**-7.4**	-1.5	5.3	1.7	**30.9**	-5.8	**-10.1**
New Engl.	**-12.1**	**16.8**	**-13.4**												
Mideast	**-11.0**	**11.4**	-1.2												
Great Lakes	**-13.0**	**25.7**	**11.6**												
Plains	**-14.6**	**8.5**	2.3												
Southeast	**-14.5**	**22.1**	-3.3												
S. Central	**-12.8**	**27.8**	**-3.7**												
Southwest	**-14.9**	**9.7**	-0.7												
Rocky Mtn.	**-16.5**	-2.2	**-10.9**												
Far West	**-14.5**	2.3	**-6.0**												
Mexico	**-12.4**	**51.6**	**26.0**											0.1	14.3
Europe	**-12.8**	6.9	**-12.8**										-7.6		
Asia	**-16.4**	2.8	**-13.6**										11.2		

Bold indicates significance at the 5% level.

Table 3: Aggregated Effects of NAFTA on Intra-NAFTA Trade

a. Canada-US by Canadian Regions

Region	Exports to US	Imports from US
Eastern Canada	-8.8	-13.1
Central Canada	42.8	18.3
Western Canada	0.9	-0.5
Canada total	29.2	14.3

b. Canada-US by US Regions

Region	Exports to Canada	Imports from Canada
New England	12.8	25.9
Mideast	9.9	16.7
Great Lakes	23.9	47.1
Plains	6.2	9.3
Southeast	17.1	40.9
South Central	21.7	27.9
Southwest	6.4	18.1
Rocky Mountain	-5.8	0.6
Far West	-1.7	14.4
US total	14.3	29.2

c. Canada-Mexico by Canadian Regions

Region	Exports to Mexico	Imports from Mexico
Eastern Canada	-14.7	-12.4
Central Canada	-0.6	51.6
Western Canada	30.9	26.0
Canada total	11.5	48.2

Table 4: Aggregated Effects of NAFTA on Extra-NAFTA Trade

a. Europe

Region	Exports to Europe	Imports from Europe
Eastern Canada	-16.4	-12.8
Central Canada	-12.8	6.9
Western Canada	-5.8	-12.8
Canada total	-11.7	1.7
Mexico	0.1	-7.6

b. Asia

Region	Exports to Asia	Imports from Asia
Eastern Canada	-16.0	-16.4
Central Canada	-3.1	2.8
Western Canada	-10.1	-13.6
Canada total	-8.9	-3.0
Mexico	14.3	11.2