The Incidence of Geography[*][†]

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Abstract

Previously neglected properties of the structural gravity model offer a theoretically consistent and operational method to estimate trade costs and their incidence, disaggregated by commodity and region, and then aggregated into forms useful for economic geography. We focus on the incidence of geography in Canada's provinces, 1992-2003. Incidence falls on average some five times more on sellers than on buyers. Sellers' incidence falls over time due to increasing regional specialization, even though gravity coefficients remain constant. This drives significant reductions in 'constructed home bias', the effect of trade costs in driving up the share of local trade. Our results also show that aggregation bias in previous gravity estimates is large downward.

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The incidence of trade costs is what matters for most questions of regional specialization patterns, welfare and policy. Intuitively the incidence of trade costs appears likely to fall unequally on buyer and seller, and the division ought to vary with relative size and relative economic distance. Previously neglected properties of the structural gravity model offer a theoretically consistent and operational method to estimate trade costs and their incidence, disaggregated by commodity and region, and then aggregated into forms useful for economic geography. We focus on the incidence of geography in Canada's provinces, 1992-2003. Canada's trade is especially interesting because of Canadian physical geography, and because a prominent literature has focused on it. It has the great additional advantage of good bilateral shipments data.

Our methods solve important conceptual problems. With multiple trading regions, incidence is simultaneous. Also, n regions implies n^2 bilateral trade costs. Practically, consistent aggregation is required as a basis for many economic modeling purposes such as drawing implications for patterns of regional specialization. Our methods resolve the aggregation and incidence problems together.

We use the gravity model to infer the bilateral trade costs. Then we create indexes of their aggregate incidence for each province and product. The conceptual foundation is Anderson and van Wincoop's development of the gravity model and their concept of multilateral resistance (2003, and especially 2004). As emphasized in Anderson (2007), outward multilateral resistance measures the general equilibrium incidence of all trade costs (direct plus indirect) that face shippers in a particular province in a particular good. It is as if each shipper faced a single trade cost to take his goods to a single world market. Inward multilateral resistance measures the general equilibrium incidence of trade costs on consumers in a province, as if consumers purchased from a single world market.[1] Our measures stand in

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[1] Ontario's food shipments illustrate. Ontario's aggregate outward food product shipments depend on an appropriate average of its bilateral costs across trading partners, while Ontario faces competition in each market that is affected by the trade costs of all other trading partners selling into that market. The net effect of all these forces results in the supply side incidence of trade costs that falls on food shipments from Ontario. Similarly, inward multilateral resistance gives the demand side incidence facing buyers of food products in Ontario that originate from all sources. Our indexes of bilateral costs, in this general equilibrium setting, ideally answer the question of how large are the trade costs facing sellers or buyers in each province, product line and year.

contrast to the partial equilibrium market access and supplier access variables that have been used in the economic geography literature to proxy the effect of trade costs. These do not resolve the question of incidence and do not aggregate consistently with the theory of gravity. See for example Redding and Venables (2004).

We also provide indexes of the average *domestic* trade cost facing provincial shippers on their trade within Canada for each product and year. The concept is akin to multilateral resistance. It is as if each provincial shipper sent his goods to a single Canadian market, along with sending goods to other markets in the rest of the world. Another useful index is "constructed home bias", the measure of how the general equilibrium effects of trade costs increase a province's trade with itself.

Gravity model inference of trade costs has mostly been drawn at highly aggregated levels. Our results reveal that aggregation bias is severely downward. We find distance effects that are double and border effects that are 3 or more times larger than those reported in Anderson and van Wincoop (2003).[2] The effects of distance and borders vary widely by commodity in patterns that make intuitive sense. Our gravity regressions fit well and are reasonably stable over time, the same properties that have legitimized the aggregate gravity literature.

Outward multilateral resistance is always larger than inward multilateral resistance, incidence falls about 5 times more on supply than on demand. This striking regularity is due to the force of specialization, as explained below. Outward multilateral resistance varies widely across industries for a single province and across provinces for a single product line. The pattern of variation makes good sense for the most part. More remote regions face trade costs that are larger while products that appear likely to have high distribution costs relative to cost of production have larger trade costs. Similarly, the within-Canada domestic trade cost indexes have sensible patterns of variation and magnitudes, as do the constructed home bias indexes.

We conduct simulations to gauge how hypothetical domestic cost reductions would affect overall trade cost indexes within Canada. These experiments correspond to the intent of the Agreement on Internal Trade (AIT) of 1995, which was an attempt to lower internal Canadian trade costs.[3] A

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[2] The directional asymmetry of border effects reported in Bergstrand, Egger and Larch (2007) also appears to be due to aggregation. We find no directional asymmetry in disaggregated border effects.

[3] Our econometric work finds no consistent evidence that the AIT can be picked out

striking result from the simulations provides an example of the general theoretical possibility of 'immiserizing globalization': a uniform fall in trade costs can actually harm the welfare of small remote regions through terms of trade effects that benefit richer and closer regions as they trade more intensively with each other.

There is good reason to believe that trade costs have declined over time. Nevertheless, gravity regressions typically imply stability, implying what some authors call the 'missing globalization puzzle' (Coe, Subramanian and Tamarisa, 2002). The economic theory of gravity (Anderson and van Wincoop, 2004) implies that gravity regressions pick up *relative* trade costs in a cross section, and cannot reflect changes in the level. Compression of trade costs could occur over time as external trade costs fall relative to internal ones, but this force is apparently absent. Below, we derive Constructed Home Bias statistics that reveal the powerful force of globalization in reducing the proportion of trade shipped to local destinations in Canada, 1992-2003. Because the underlying gravity coefficients are stable over time, globalization acts on Constructed Home Bias through the general equilibrium force of changing specialization patterns on multilateral resistance.[4]

Differences in trade costs across products and regions act on resource allocation and expenditure allocation just like differential taxes do. Thus in a prescriptive direction the results of the proposed research matter for framing regional development plans or industrial strategies. In a positive economic direction the trade cost measures are likely to help in explaining patterns of production and expenditure across goods and regions.

The succeeding material outlines the conceptual base of the project in Section 1. Section 2 deals with the application methods and Section 3 describes the data used, with further details in the appendix. Section 4 presents the results.

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from other forces that affect Canada's trade.

[4] The effect of the fall in the *level* of trade costs might also be picked up by time-and-region dummy variables in the gravity model. (Unfortunately these can also reflect forces other than trade costs, such as scale economies, nonhomothetic preferences or other size related unobservable variables.) Our results do not reveal any systematic decline in trade cost levels over time via this channel.

1 Conceptual Base

The economic theory of gravity[5] is based on *trade separability*: two stage budgeting obtains in both final demand and intermediate demand. Under separability, the upper level general equilibrium determines the value of production and the level of expenditure on each good in each region or country while the lower level gravity equilibrium determines the allocation of supply and demand across countries (henceforth the description ignores regions) for each class of goods, conditional on the values of production and expenditure given from the upper level equilibrium.

Begin with definitions of variables. Let k denote a class of goods, let i denote a country of origin and let j denote a country of destination. Let X_{ij}^k denote the value of shipments at destination prices from i to j of good k. Further, let E_j^k denote the expenditure at destination j on goods of class k from all origins, while Y_i^k denotes the sales of goods at destination prices from i in goods class k to all destinations. Expenditure levels, the E's, and sales levels, the Y's, are determined in the upper level general equilibrium. The budget constraints (one for each country's total expenditure on each goods class) and the market clearance equations (one for each goods class for goods from each country of origin) together with a CES demand specification combine to yield the gravity model.

Let $t_{ij}^k \geq 1$ denote the variable trade cost factor on shipment of goods from i to j in class k. σ_k is the elasticity of substitution parameter for goods class k. We abstract from fixed costs because our econometric work will not be able to identify them.

The CES demand function (for either final or intermediate products) gives expenditure on goods of class k shipped from origin i to destination j as:

$$X_{ij}^k = (\beta_i^k p_i^{*k} t_{ij}^k / P_j^k)^{(1-\sigma_k)} E_j^k. \tag{1}$$

Here, the value of shipments includes the trade costs while p_i^* is the factory gate price and β_i^k is a CES share parameter. The price index is $P_j^k = [\sum_i (\beta_i^k p_i^{*k} t_{ij}^k)^{1-\sigma_k}]^{1/(1-\sigma_k)}$, an implication of the budget constraint.

Now impose market clearance: $Y_i^k = \sum_j (\beta_i^k p_i^{*k})^{1-\sigma_k} (t_{ij}^k / P_j^k)^{1-\sigma_k} E_j^k$. Outward multilateral resistance aggregates the set of bilateral trade costs as if in effect country i shipped its product k to a single world market at markup

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[5] See Anderson and van Wincoop (2004).

Π_i^k. Define $Y^k \equiv \sum_i Y_i^k$. In a world with globally common CES preferences, the expenditure shares must effectively be generated by

$$(\beta_i^k p_i^{*k} \Pi_i^k)^{1-\sigma_k} = Y_i^k / Y^k, \tag{2}$$

The left hand side of (2) is a behavioral share equation for the globally common CES preferences when all countries face a common world price $p_i^{*k}\Pi_i^k$ because the price index is equal to one due to summing (2): $\sum_i (\beta_i^k p_i^{*k} \Pi_i^k)^{1-\sigma_k} = 1$.

To complete the derivation of the structural gravity model, use (2) to substitute for $\beta_i^k p_i^{*k}$ in (1), the market clearance equation and the CES price index. Then:

$$\begin{aligned} X_{ij}^k &= \frac{E_j^k Y_i^k}{Y^k} \left(\frac{t_{ij}^k}{P_j^k \Pi_i^k} \right)^{1-\sigma_k} && (3) \\ (\Pi_i^k)^{1-\sigma_k} &= \sum_j \left(\frac{t_{ij}^k}{P_j^k} \right)^{1-\sigma_k} \frac{E_j^k}{Y^k} && (4) \\ (P_j^k)^{1-\sigma_k} &= \sum_i \left(\frac{t_{ij}^k}{\Pi_i^k} \right)^{1-\sigma_k} \frac{Y_i^k}{Y^k}. && (5) \end{aligned}$$

Here, Π_i^k denotes outward multilateral resistance. P_j^k denotes inward multilateral resistance, equivalent to the CES price index.

1.1 Properties of Multilateral Resistance

Anderson and van Wincoop (2004) show that multilateral resistance is an ideal index of bilateral trade costs in the sense that, if the actual set of bilateral trade costs were to be replaced by $\widetilde{t}_{ij}^k = P_j^k \Pi_i^k$, all budget constraints and market clearance conditions would continue to hold, so that no disturbance of the upper level general equilibrium would occur.

Pushing the implication further, the set of multilateral resistance indexes simultaneously decompose trade costs into their supply (outward) and demand (inward) incidence while aggregating bilateral costs such that the general equilibrium allocation at the upper level of budgeting is independent of the details of bilateral allocation (under the hypothesis of trade separability). In other words, it is as if each province i shipped its product k to a single world market facing supply side incidence of trade costs of Π_i^k, while each province j bought its goods k from a single world market facing demand side incidence of P_j^k. See Anderson (2007) for more discussion.

Since (4)-(5) solves for $\{\Pi_i^k, P_j^k\}$ only up to a scalar for each class k, an additional restriction from a normalization is needed. Relative multilateral resistances are what matters for resource allocation in general equilibrium, so the normalization can be chosen for convenience in computation or interpretation. Given the information on the factory gate prices from general equilibrium, the natural normalization is $\sum_i (\beta_i^k p_i^{*k} \Pi_i^k)^{1-\sigma_k} = 1$. Operationally, in the absence of this information, normalization through a units choice can be imposed — $\beta_i^k p_i^{*k} = 1, \forall k$ for some convenient reference country i.

Two special cases yield propositions about the properties of multilateral resistance that help in understanding our results, despite their being derived in a less restricted world.

Proposition 1 *Given $\sigma_k > 1$, if the trade frictions are uniform border barriers, the multilateral resistances (inward and outward) are decreasing in the supply shares of economies and increasing in the expenditure shares of economies. For given expenditure shares, multilateral resistances are increasing in net import shares.*[6]

The intuition is this. In the conditional general equilibrium, the product of the factory gate price and the supply side incidence of trade costs is lowered by larger supply share. Does a lower factory gate price permit a higher Π? Proposition 1 gives a sufficient condition, uniform border barriers, for lower supply side incidence. While the uniform border barrier assumption is special, the intuition of Proposition 1 should apply more generally. Proposition 1 also states that the larger the expenditure share, all else equal, the larger is inward multilateral resistance. General equilibrium links the outward and inward multilateral resistances together. Proof is in Appendix D.

Next, we extract a formal property that explains why we find outward multilateral resistance larger than inward in our results.

Proposition 2 *If regions have equal sized supplies and expenditures and bilaterally symmetric trade costs, then increases in supply from low trade cost regions raises outward multilateral resistance above inward.*

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[6] The proposition extends that of Anderson and van Wincoop (2003), which deals with a the introduction of a small uniform border barrier in a one good balanced trade economy for which $P^j = \Pi^j$.

Proof *Under the equal shares condition (4)-(5) implies*

$$\Pi_i^{1-\sigma} = \frac{1}{n}\sum_j (t_{ij}/P_j)^{1-\sigma}$$

while

$$P_j^{1-\sigma} = \frac{1}{n}\sum_i (t_{ij}/\Pi_i)^{1-\sigma} + \sum_i (t_{ij}/\Pi_i)^{1-\sigma}(Y_i/Y - 1/n).$$

Here, n *is the number of regions. If supply share are also equal to* $1/n$ *then* $P_i = \Pi_i$*. Now allow a small amount of specialization in supply. The preceding equation at given* Π*'s is the sum of an average and a covariance that is positive on the hypothesis that supply shares on average will rise as bilateral trade costs to* j *fall. This force pushes* P_j *downward, below the given* Π_j*. In the first equation above, this downward movement of* P_j *pushes* Π_i *upward. So specialization tends to drive the* Π*'s above the* P*'s.*

1.2 Domestic Trade Cost Indexes

It is useful to construct ideal index numbers for trade costs within Canada along the same lines as the multilateral resistance index that consistently aggregates all trade costs. Now the idea is to find the uniform trade cost for inter-provincial trade that preserves each province's shipments to Canada as a whole, and thus each province's shipments to the world as a whole.

Consider a generic product shipped from i to j within Canada, deleting the k superscript for clarity. The gravity equation tells us that

$$Y\frac{X_{ij}}{Y_i} = E_j(\frac{t_{ij}}{\Pi_i P_j})^{1-\sigma} \tag{6}$$

where Y is world trade. The aggregate volume shipped from i to locations within Canada divided by i's market share is given by

$$\bar{Y}_{iC} = \sum_{j\in C} E_j(\frac{t_{ij}}{\Pi_i P_j})^{1-\sigma}. \tag{7}$$

On the left hand side of (7) is the fitted volume of trade from i to locations within Canada, all divided by i's market share. On the right hand side is the formula that gives this volume summing equation (6).

Now to calculate the theoretical uniform trade cost, we have two alternatives. The easiest to implement is a partial equilibrium calculation that takes the MR's as given. The domestic trade cost within Canada is given by

$$\bar{Y}_{iC} = \sum_{j \in C} E_j \left(\frac{t_{iC}}{\Pi_i P_j}\right)^{1-\sigma}. \tag{8}$$

This single equation can be solved for t_{iC} for each province i. Basically t_{iC} is a CES aggregator. And it has the explicit solution

$$t_{iC}^{1-\sigma} = \frac{\bar{Y}_{iC}}{\sum_{j \in C} E_j (\Pi_i P_j)^{\sigma-1}}. \tag{9}$$

The general equilibrium alternative is to solve for the t_{iC}'s simultaneously with the MR system. Thus for each $i \in C$ we have an equation in the form of (8). This system in combination with the system of equations for MR's is simultaneously solved for the t_{iC}'s and the new MR's. Computation is speeded by substituting (9) into the MR system for all $t_{ij}; i, j \in C$.

In the preceding setup, t_{ii} is part of the t_{iC}. An alternative computation is to keep t_{ii} at its original value and impose a uniform cost for interprovincial trade. Then in the preceding steps, t_{iC} is defined as above for all $i \neq j; i, j \in C$ while all other t_{ij}'s remain unchanged: those inside Canadian provinces and those for all trade that is not interprovincial. This alternative allows us to compare provincial trade costs in two components; those for trade within province and those for trade between provinces. Outward multilateral resistance in contrast aggregates trade costs for each province's trade with all destinations.

Finally, it is useful to summarize the effect of all trade costs on each province's trade with itself in the form of Constructed Home Bias

$$t_{ii}/\Pi_i P_i.$$

In a constant returns/homothetic preferences theoretical model, Constructed Home Bias raised to the power $1 - \sigma$ gives the sized-adjusted internal trade flow. Constructed Home Bias is normally less than one, increasing local trade relative to trade across provincial borders and doing so more for more geographically disadvantaged provinces. In a frictionless constant returns/homothetic preferences world, Constructed Home Bias would be equal to one, so $(t_{ii}/\Pi_i P_i)^{1-\sigma}$ is the factor by which trade costs induce home bias in shipments. In the presence of scale effects, additional size effects operate on size-adjusted trade.

Constructed Home Bias is more useful than a straight comparison of internal trade costs t_{ii} across regions i. Two regions i and j with the same internal trade cost $t_{ii} = t_{jj}$ may have quite different Constructed Home Bias because they face different Π's and P's. These incidences of outward and inward trade costs reflect conditional general equilibrium forces summarizing the effects of trade costs between all bilateral pairs. Constructed Home Bias is independent of the normalization used in constructing the multilateral resistances, since it is a function of the product of inward and outward multilateral resistance.

2 Application Methods

The structural gravity model can be consistently estimated with ordinary least squares on (3) after dividing through by $E_j^k Y_i^k$ and using fixed effects to control for multilateral resistance.[7] Estimates of multilateral resistance will be calculated from (4)-(5) based on the estimated t_{ij}'s, the remainder of the estimated fixed effect being assigned to other sources of regional fixed effects.

The proposed research will conclude with an investigation of the patterns of multilateral resistance, addressing cross-commodity and cross-region variation. Plausibly, trade costs and multilateral resistance vary across goods and regions in richly informative ways. Some regions can be anticipated to have systematically higher multilateral resistance, while some commodities are expected to have lower multilateral resistance. But the cross-commodity pattern may differ over regions in such a way as to powerfully affect the efficient patterns of production.

Theory provides some guidance. Our results give only mixed support to the pattern of Proposition 1, presumably due to the much more complex pattern of trade costs. But Proposition 2 is confirmed by the data.

The application description is completed by putting structure on the unobservable trade costs and error terms. Freight rates and tariffs can be observed with measurement error. The unobservable costs are assumed to

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[7] The structural gravity model can alternatively be estimated with full information methods that calculate the multilateral resistance variables iteratively using (3)-(4)-(5) with a normalization condition, extending Anderson and van Wincoop (2003). Feenstra (2004) advocates using fixed effects to avoid custom programming. Fixed effects also allows for region or country fixed effects apart from multilateral resistance.

be related to observable z's, indexed by h. Trade costs are assumed to be given by

$$\ln t_{ij}^k = \sum_h \gamma_h^k z_{ij}^k(h) \tag{10}$$

The z's include variables such as the log of bilateral distance, contiguous borders, and the presence or absence of a provincial or international border. Some z variables are questionably exogenous, such as freight rates or tariffs. See Anderson and van Wincoop (2004) for more discussion of the specification of (10). With panel estimation in which observations are taken over time as well as trade partners, the presence or absence of the AIT enters as a dummy variable in the list of the z's.

Tariff factors τ_{ij}^k enter (10) in logs with coefficient $-\sigma_k/(1-\sigma_k)$, so that (3) yields the cif value of shipments. Accounting for tariffs leads to a minor modification of the formula for inward multilateral resistance:

$$P_j^{1-\sigma_k} = \sum_i (t_{ij}^k/\Pi_i^k)^{1-\sigma_k} \tau_{ij}^k Y_i^k/Y^k.$$

The econometric model is completed by substituting (10) for t_{ij}, then expanding the gravity equation with a multiplicative error term. The structural model implies that size-adjusted trade is the natural dependent variable in the gravity regression:

$$X_{ij}^k/Y_i^k E_j^k = \frac{1}{Y^k}\left(\frac{t_{ij}^k}{\Pi_i^k P_j^k}\right)^{1-\sigma_k} \epsilon_{ij}^k \tag{11}$$

where ϵ_{ij}^k is the error term. This form tends to control for heteroskedasticity in the error term. The unobservable multilateral resistance terms are proxied by directional fixed effects for each region. The final step in getting an operational econometric model is to translate (11) into a logarithmic form and to substituting for the observable trade costs to get:

$$\begin{aligned} ln\left(\frac{X_{ij}^k}{Y_i^k}\right) &= \alpha_0 + \alpha_1 LNDIST_{ij} + \alpha_2 CB\_PROV\_PROV_{ij} + \alpha_3 CB\_PROV\_STATE_{ij} + \\ &+ \alpha_4 CAN\_USA_{ij} + \alpha_5 USA\_CAN_{ij} + \alpha_6 CAN\_ROW + \alpha_7 SMCTRY_{ij} + \\ &+ \alpha_8 ln\Pi_i^k + \alpha_9 lnP_j^k + \varepsilon_{ij}^k, \end{aligned} \tag{12}$$

where: $LNDIST_{ij}$ is the logarithm of bilateral distance between trading partners i and j. Motivated by Brown and Anderson (2002), who find that provinces and states that share a common border tend to have higher levels of trade, we introduce two variable in order to capture contiguity: $CB\_PROV\_PROV_{ij}$ is a dummy variable equal to one if the two trading partners are provinces and they share a common border, and $CB\_PROV\_STATE_{ij}$ is a dummy variable that reflects the presence of contiguous border between two trading partners when one of them is a province and the other is a state. Using aggregate cross section data Bergstrand et al (2007) find that the border effect between Canada and the US is not symmetric. Motivated by their results we use three dummy variables to account for a Canadian border: CAN_USA_{ij} is equal to one when a province exports to a state, USA_CAN_{ij} is equal to one when a state exports to a province, and CAN_ROW_{ij} captures the border between Canada and the rest of the world for any direction of trade flows. Finally, $SMCTRY_{ij}$ takes a value of one for internal trade, e.g. when a province trades with itself. Our dependant variable deviates from the specification in (11) because, due to lack of data on total imports of individual states, we were not able to construct expenditures at the state level. Therefore the effect of the missing expenditures in our specification is picked up by the directional fixed effects, which we also use to control for multilateral resistance.

We use directional fixed effects OLS with robust standard errors to consistently estimate Equation (12) for each commodity and each year in our sample. Then, employing Equation (10), we construct trade costs from the gravity estimates, which in turn we use to calculate multilateral resistance as ideal trade cost indexes. The remaining values of the fixed effects capture the effects of expenditure shares as well as influences outside the strict theoretical model, including possible scale economies or nonhomotheticity in preferences.

Multilateral resistance variables are computed using the estimated t's in (3)-(5), which, as discussed earlier, solves for the set of multilateral resistances, $\{\Pi_i^k, P_j^k\}$, only up to a scalar for each class k. Relative multilateral resistances are what matters for resource allocation in general equilibrium. Therefore, for computational convenience and in order to facilitate interpretation of our results, we impose an additional restriction in the form of a normalization. We solve (3)-(5) for each year by setting Alberta's inward multilateral resistances to be equal to one for each good, $(P_{AB}^k)^{1-\sigma_k} = 1$. Thus, for each year and product, multilateral resistances for all other provinces and territories are relative to the inward multilateral resistances of Alberta for the corresponding year and commodity.

We have to address one more issue before being able to calculate multilateral resistances. In order to solve (3)-(5) we need data on individual state expenditures at the commodity level, which, unfortunately, we are not able to construct due to lack of data on total US state imports. The problem of missing state expenditure data is resolved as follows. We aggregate to the US level for calculating multilateral resistances for Canadian provinces. Thus, the inputs needed to solve the multilateral resistances system are the provincial outputs and expenditures, the US output and expenditure and the ROW output and expenditure along with the bilateral trade costs. The original bilateral trade costs come from gravity equations that give province to individual US state bilateral trade costs. These costs must be aggregated consistently to form the appropriate US to province bilateral trade costs for the multilateral resistance calculations. We form an aggregate bilateral trade cost from each Canadian province to the US (aggregate), from the US (aggregate) to each Canadian province as follows. The generic commodity ships from Canadian province i to US state j with trade cost (from gravity) given by t_{ij}. The average bilateral trade cost to the US from province j is given by:

$$\bar{t}_{i,US}^{1-\sigma} = \sum_{j \in US} w_{ij} t_{ij}^{1-\sigma},$$

where $w_{ij} = X_{ij} / \sum_{j \in US} X_{ij}$. The average bilateral trade cost from the US to Canadian province i is given by:

$$\bar{t}_{US,i}^{1-\sigma} = \sum_{j \in US} w_{ji} t_{ji}^{1-\sigma},$$

where $w_{ji} = X_{ji} / \sum_{j \in US} X_{ji}$. The last step in setting the system (3)-(5) in operational form is to aggregate trade costs from the US (aggregate) to ROW, and from ROW to the the US (aggregate). We follow the same procedure and define the aggregate trade cost from the US to the rest of the world as:

$$\bar{t}_{US,ROW}^{1-\sigma} = \sum_{j \in US} w_{j,ROW} t_{j,ROW}^{1-\sigma},$$

where $w_{j,ROW} = X_{j,ROW} / \sum_{j \in US} X_{j,ROW}$. Finally, aggregate costs from ROW to the the US (aggregate) are defined as:

$$\bar{t}_{ROW,US}^{1-\sigma} = \sum_{j \in US} w_{ROW,j} t_{ROW,j}^{1-\sigma},$$

where $w_{ROW,j} = X_{ROW,j} / \sum_{j \in US} X_{ROW,j}$. After aggregating the US costs, we are able to solve (3)-(5) for the inward and outward multilateral resistances at the commodity level for each province and territory, the US as a whole, and the rest of the world. Before we provide and analyze our results, we discuss several refinements of the estimation approach and procedures and we describe the data.

2.1 Refinements

Several refinements remain to be completed. First, the multilateral resistance and internal trade cost variables are constructed and reported without standard errors. Standard errors will be constructed by bootstrapping. This is a computationally intensive process that we deferred pending completion of our basic project goals.

Second, good empirical practice requires convincing robustness checks on the benchmark methods. We have reported on some of this but will do more. A common practice in the empirical literature is to estimate the log of the preceding equation with OLS, using fixed effects to control for multilateral resistance. Santos Silva and Tenreyro (2006) argue that this practice causes inconsistent estimation when the error term is heteroskedastic with variance rising with the dependent variable. The problem is potentially important because there are many zeroes in the bilateral trade flows, ruling out spherical error structure. Their preferred method assumes a Poisson distribution. Another expedient is to estimate in levels with nonlinear least squares.

3 Data Description

This study covers trade during 1992-2003 where trading partners include all Canadian provinces and territories,[8] the fifty US states and the District of Columbia, and the rest of the world (ROW), which we define as an aggregated region consisting of all other countries. A list of all trading partners and their corresponding abbreviations is provided in Table **??**. Data availability allowed us to investigate 19 commodities. A list of those products is

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[8] We treat Northwest Territories and Nunavut as one unit, even though they are separate since April 1, 1999.

presented in Table **??**. Commodity selection is based on (but is not completely identical to) the S-level of aggregation as classified in the Statistics Canada's Hierarchical Structure of the I-O Commodity Classification (Revised: January 3, 2007). In order to estimate gravity and calculate multilateral resistances as the ideal trade cost indexes, we use industry level data on bilateral trade flows, output, and expenditures for each trading partner all measured in current Canadian dollars for the corresponding year. In addition, we need data on bilateral distances, population, contiguous borders, and the presence or absence of provincial or international borders.

We define bilateral trade flows as the value of exports, measured in current Canadian dollars, from partner (province or territory, state, or ROW) i to partner (province or territory, state, or ROW) j. We use several sources to collect trade data: Interprovincial trade flows at producer prices are from Statistics Canada's tables 386-0001 and 386-0002.[9] Data on trade between Canadian provinces and territories and individual states, as well as trade between the provinces and territories and the rest of the world are from the Trade Data Online web interface of Industry Canada, which provides access to Canadian and US trade data by product classified according to NAICS.[10] A great advantage of this database is that it reports the imports of individual provinces and territories from individual states valued F.O.B. (free on board). The United Nation Statistical Division (UNSD) Commodity Trade (COMTRADE) Data Base provides data on bilateral trade flows for more than 130 countries starting as early as 1962. We use this database to calculate trade flows within ROW, which we define as the difference between total world exports and the exports from the world to Canada and the US. We also use COMTRADE to get US exports and imports to and from the rest of the world. We need the latter data in order to be able to calculate total US expenditures at the commodity level, which we use in the calculations of the multilateral resistances due to lack of data on the imports of individual states from the world.[11] COMTRADE reports trade flow values in annual

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[9] It should be noted that data on interprovincial trade flows for five categories of commodities including furniture, fabricated metals, machinery, transportation, and miscellaneous was clearly missing in the original data, as opposed to having values of zero, for the years before 1996. We have interpolated those missing values.

[10] Due to the specifics of the S-level of aggregation, as compared to other industrial classifications, we needed to generate several tables of concordance specifically for this project. We present those in the Table **??**.

[11] Every 5 years, starting at 1993, the US department of transportation publishes a

US dollars and, in order to convert the values to Canadian dollars, we use the exchange rates tables of the Federal Reserve Bank of Saint Louis.[12]

Industrial output level data comes from several sources. Provincial output at the S-level of commodity disaggregation is from tables 386-0001 and 386-0002 of Statistics Canada.[13] The primary source of output data for individual states are the Regional Economic Accounts of the Bureau of Economic Analysis, U.S. Department of Commerce, which provides industry output data at producer prices in current US dollars classified according to SIC for the years before 1998 and according to NAICS for the years after 1998. Data on output for ROW is mainly from United Nations' UNIDO Industrial Statistics database, which reports industry level output data at the 3 and 4-digit level of ISIC Code (Revisions 2 and 3). In addition to UNIDO, we have use the World Database of International Trade (BACI) database, constructed by CEPII, as a secondary source of product level output data. Unfortunately, neither UNIDO nor BACI provide data on agricultural and mining output. Therefore, we use two additional data sources: the United Nations Food and Agriculture Organization (FAOSTAT) web page provides data on agricultural output, and the Energy Information Administration provides official energy statistics on the value of fuel production (including oil, natural gas, and coal) for the world.

We experiment with several distance variables based on different approaches in the calculation of internal as well as bilateral distances. Detailed description of the different distance variables that we have created is available upon request.[14] Here we just describe the distance variable that we have chosen to use in our main estimations.[15] To calculate bilateral distances we adopt the procedure from Mayer and Zignago (2006), which is based on Head and Mayer (2000). We use the following formula to generate weighted

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database, the Commodity Flow Survey, which includes interstate trade flows and individual state exports to the world. Unfortunately, data for individual state imports is not available, therefore we cannot calculate individual state expenditures.

[12] Url: http://research.stlouisfed.org/fred2/categories/283 The original source of the data is the Board of Governors of the Federal Reserve System.

[13] As in the case of interprovincial trade, data on the same five commodities is missing in the original tables for the years before 1996. We interpolate those values.

[14] Head and Mayer (2000) provide a nice summary and discussion of the alternative approaches of distance calculations.

[15] Our results are pretty robust to the choice of alternative distance measures.

distances:

$$d_{ij} = \sum_{k \in i} \frac{pop_k}{pop_i} \sum_{l \in j} \frac{pop_l}{pop_j} d_{kl}$$

where pop_k is the population of agglomeration k in trading partner i, and pop_l is the population of agglomeration l in trading partner j.[16] To calculate population weights, we take the biggest 20 agglomerations (in terms of population) in each trading partner when the partner is a province, a territory, or a state, and the biggest 50 cities when the partner is ROW.[17] Finally, d_{kl} is the distance between agglomeration k and agglomeration l, measured in kilometers, and calculated by the Great Circle Distance Formula.[18] All data on latitude, longitude, and population is from the World Gazetteer web page. A very appealing argument for the use of this particular approach in calculating the distances for our analysis is that the same procedure is applied when we calculate internal distances and bilateral distances. In addition, and what is especially important for us, this procedure allows us to also consistently aggregate the distances between any given partner and the rest of the world.

Finally, we generate several dummy variables to pick up contiguous borders and the presence or absence of provincial or international border, as well as the effects of the implementation of the Agreement on Internal Trade (AIT). We assign a value of one to the dummy variable capturing contiguity when the two trading partners share a common border. We also generate a dummy variable to capture the presence of provincial border, which takes a value of one for internal trade, that is when the province trades with itself. Next, we assign a value of one to a dummy variable when the two trading partners are from the same country in order to capture the effect of an international border. Lastly, we use dummy variable approach in order to explore the effects the Agreement on Internal Trade (AIT) on trade flows and trade costs within Canada. Our expectations are that provincial borders presumably have less trade destroying impact after the AIT (July, 1995) than before, though it may take time to have real effects and the time of adjustment may vary by province.

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[16] Head and Mayer (2000) propose the use of GDP shares rather than population shares as weights in the distance formula. Even though using GDP shares is the better approach, data availability did not allow us to use it in our analysis.

[17] In the few instances, where data was not available for 20 agglomerations within a single trading partner, we take only the cities for which data is available.

[18] Following Mayer and Zignago (2006), we use 32.19 kilometers as inner-city distance.

4 Results

We begin by presenting and interpreting our results from the estimation of gravity equation (12) for each year and commodity in our sample. Next, we calculate and analyze inward and outward multilateral resistances by province, commodity and year. Then, we construct ideal domestic cost indexes to measure the average trade costs facing provincial shippers within Canada. Next, we present indexes of constructed home bias due to trade costs, a measure of the extent to which local shipments' share of total shipments is increased relative to a frictionless world. Finally, we provide assessments of the effects of the Agreement on Internal Trade on trade and trade costs, and perform some counterfactual experiments to gauge how hypothetical cost reductions from AIT would affect trade cost indexes within Canada.

4.1 Gravity Results

Our gravity estimation results are as expected. We find that coefficient estimates from gravity vary significantly across commodities and are relatively stable over time. The latter allows us to provide useful summary statistics. The values in Table **??** are calculated as the average of our estimates over time weighted by the yearly trade share for each commodity in the sample.[19]

The coefficient on the distance variable is always negative and significant with an average value of -1.51 (std.err. 0.362) calculated across all goods and years. It is interesting to note that while the distance coefficient is fairly stable for each good over time,[20] we find significant variability in the effect of distance on trade across different commodities. We summarize distance effects for the products in our sample in column (2) of Table **??** in Appendix A. It is clear from our results that distance is a bigger obstacle to trade for some commodities such as Agricultural Products and Petroleum and Coal Products, while for other commodities such as Electrical Products and Hosiery and Clothing, distance is less of an impediment to trade. Transportation costs are a natural explanation for such findings.

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[19] Estimation results for individual commodities and each year are available upon request.

[20] The only exception is the distance coefficient for Fuels, which is relatively unstable over the years.

Our empirical results indicate that contiguity matters, especially when the common border is between a province and a state. We find weak evidence in support of a negative relationship between contiguity between provinces and trade. As can be seen from Column (3) of Table **??**, the coefficient of the dummy variable capturing contiguous borders between provinces is almost always negative[21] and often significant. The value of the coefficient varies across commodities and the effect is strongest for Lumber and Wood Products and Wood Pulp and Paper Products. In column (4) of Table **??**, we present evidence in support of the argument in Brown and Anderson (2002) that contiguous provinces and states trade more with each other.[22] This should not be surprising since almost all provinces are contiguous to at least one US state, and this is likely to be a major trade partner as well. For example, Ontario is contiguous to Michigan, Ohio, and NY while Quebec is contiguous to NY and some smaller New England states. Once again, Fuels is the only commodity category for which the coefficient on the dummy variable capturing contiguity between provinces and states is consistently not significant. It is also worth noting that the common border effect between states and provinces is relatively stable over time.

We find strong empirical evidence in support of the presence of international Canadian border and its effect on trade. With very few exceptions, the coefficients of all three variables employed to capture the border effect are always negative and significant. As can be seen from the estimation results presented columns (5), (6), and (7) of Table **??**, the Canadian border effect is large and varies widely across commodities. We do not find any clear evidence in support of symmetric or asymmetric border effects between Canada and US.[23] In addition, our results indicate that the directional border effect between Canada and US is unstable over time. Such instability of the

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[21] Fuels are an exception.

[22] As suggested by Brown and Anderson (2002), breaking the contiguity dummy variable into two is important. Estimation results, available upon request, with a single common border dummy variable show no significant effects of contiguity on trade, which should not be surprising in the light of our findings that contiguity between provinces and contiguity between provinces and states work in opposite directions.

[23] Estimation results at the commodity level show that even when the same commodity is considered, the relationship between the border coefficient when Canada is the exporter and the corresponding coefficient when US is the exporter varies over time. For example, the coefficient on CAN_USA for Printing and Publishing Products in 1995, 1999, and 2002 is significantly smaller than the corresponding coefficient on USA_CAN for the same years, while the relationship is reversed for the rest of the years in our sample.

directional border coefficients may be due to the fact that they are not separately identified in the data. Empirical experiments[24] indicate that imposing a symmetry in border effects results in relatively stable, but still very large, border coefficients between Canada and US. therefore, we choose to use our estimates with a symmetric border to construct multilateral resistances.

As compared to the border between Canada and the US, the border between Canada and the rest of the world seems to be smaller and fairly stable over time. One possible explanation for the first result is that the effects of contiguity and border are being confounded for the US-Canada border. Therefore, one should calculate the net border effect between Canada and the US as the sum between the coefficients on the US-Canada border variable(s) and the dummy for contiguous provinces and states. The fact that the border between Canada and ROW is relatively stable over time reinforces our argument that imposing a symmetry in border effects results in more stable border coefficients.

The border effects reported here are mostly much larger than those inferred from aggregate trade flow data in Anderson and van Wincoop (2003). It is similarly notable that the distance elasticities reported in Table **??** are mostly twice as large as those inferred from aggregate data in Anderson and van Wincoop (2003). Thus a major implication of our results is that aggregation (a feature of almost all gravity investigations) biases gravity estimates downward. We anticipate that this is a general result, rather than one specific to our data. Anderson and van Wincoop (2004) provide an extensive discussion of aggregation bias in gravity estimation, setting out forces pushing in either direction, and concluding that no theoretical presumption can be created.

To check whether the differences between the commodity level border effects estimated here and the corresponding values obtained with aggregate data in previous studies are indeed due to aggregation bias, we perform several experiments. We start by estimating the gravity equation using data on aggregate trade flows and output obtained by summing up commodity level values for each province and state.[25] Estimation results for each year in our sample are reported in tables **??** and **??** of Appendix A. As can be seen

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[24] Estimation results are presented in Table **??** from Appendix A.

[25] It should be noted that the estimates obtained by aggregating our data will not be identical to estimates obtained with aggregated data from government agencies. One reason is that data for some products such as tobacco and alcoholic beverages is often not reported at the commodity level but included in the aggregate statistics.

from the tables, the aggregate border effects are significantly lower than the average border effects estimated with commodity level data. These results support the argument that aggregation biases downward the border effects. Another important result obtained with the aggregated data, which is also in accordance with previous studies, is that the border dummy CAN_USA, which indicates that the direction of the trade flow is from provinces to states, loses significance. Our findings suggest that the asymmetry in the border effects found by Bergstrand, Egger and Larch (2007) might be attributed to aggregation.

Next, we test whether our aggregated border effect estimates are close to those from McCallum (1995) and Anderson and van Wincoop (2004) by keeping only the 30 states and 10 provinces employed in their estimations and by combining the two border dummies between US and Canada into one. As can be seen from the results reported in tables **??** and **??** of Appendix A, the aggregated border effects estimates are in accordance with findings from previous studies and are less than a third of the average border effects for some individual products. A possible explanation could be that international trade flows data is reported at the first destination of shipments and, therefore, one would expect that reported trade between border states and provinces will be more intense than it actually is. Such bias is partially corrected for by dropping the remote states and provinces to match the sample from McCallum (1995). We perform an additional experiment by dropping Agricultural products and Fuels out of our sample to find that border effects estimated with aggregated data are consistently lower than the corresponding coefficients obtained with commodity level data. In addition, as discussed earlier, the effects of contiguity and border are being confounded for the US-Canada border, which implies that the net US-Canada border effect is even lower than the values obtained from estimations including both dummy variables. Overall, our tests and experiments imply that indeed aggregation biases gravity estimates downward.

Finally, we look for province level border effects with the coefficient of the variable SMCTRY to find no empirical evidence that internal provincial trade is higher or lower than interprovincial and international trade.[26] Three commodities constitute exceptions: Internal provincial trade is significantly higher in the case of Printing and Publishing Products for the years before

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[26] In contrast, Wolf (2000) found evidence of US state border effects using aggregate shipments data.

1996. The effect is largest in 1992 and gradually decreases in magnitude to become insignificant in 1996. Food Products and Petroleum and Coal Products are the other two commodity categories for which the coefficients on the dummy variables for internal trade are consistently significant. In both cases, the coefficients are negative. In the case of Food Products, the coefficient gains significance in 1996 and is relatively stable over time. The coefficient for Petroleum and Coal Products gains significance in 1995 and increases in magnitude since then. The most plausible explanation is that the functional form for trade costs imposed in (10) is inaccurate for Petroleum and Coal Products and increasingly so with Alberta's resource boom. For comparability of results over commodities we have elected to keep the common form of trade costs in this report.

The puzzle of large border and distance effects as we disaggregate raises the question of how believable are the results. The good fit and relative stability of coefficients over time argue that the gravity regression picks up a genuine statistical regularity, while the economic theory of gravity assigns economic significance to those coefficients. These properties have legitimized the empirical gravity literature based on aggregate data, so we think they legitimize the disaggregated results we have found. We think that the large magnitudes reflect three forces. First, trade costs really are large; results surveyed in Anderson and van Wincoop (2004) suffer from downward aggregation bias. Second, fixed costs of exporting impose a selection effect that recent research emphasizes. Our estimates of variable trade costs are probably biased upward by our inability to control for selection due to the nature of the data.[27] Third, what we call "trade costs" may relect home bias in preferences. Our approach assumes common preferences and so identifies variations in consumption patterns with relative price differences due to trade costs. But it could equally well be true that preferences differ, with home goods (at the provincial level) getting more weight. There is no way in a pure gravity setting to decompose the two forces.

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[27] Helpman, Melitz and Rubinstein (2007) developed a formal model of selection. Potential exporters must absorb fixed costs to enter a market, screening out the less productive ones. Unfortunately, we are unable to implement the HMR technique because it requires an exogenous variable that enters selection but is excluded from determination of the volume of trade. In their cross country case, common religion was the excluded variable whereas in our state and province based data set there is no plausible variable that differs across the observations.

4.2 Multilateral Resistance Results

Inward and outward multilateral resistance indexes are calculated by solving system (4)-(5).[28] In order to be able to solve this system, we impose a normalization by setting the inward multilateral resistances for each good in Alberta to be equal to one for each year. Thus, all reported MR's, both inward and outward, are relative to the inward multilateral resistances of Alberta. The normalization procedure means that intertemporal comparisons of inward multilateral resistances do not imply changes in *levels* of trade costs. We report MR's for each year in the sample as an evidence that the *relative* pattern of multilateral resistance is remarkably stable over time.

We find significant variation, within reasonable bounds, in IMR's across provinces and territories. Tables **??** and **??** from Appendix A summarize the evolution over time of IMR's by province an territory across all product lines.[29] The values in each table represent the yearly average inward multilateral resistances for each province across all goods weighted by the provincial expenditure share on each commodity. Overall, we find that the values of IMRs are stable over time, and even though significantly different across provinces, they are small in magnitude compared to OMR's. The pattern of IMR variation makes good intuitional sense. As expected, more 'remote' regions, geographically and in terms of industry concentration, face larger trade costs: The Northwest Territories (NT)(including Nunavut), the Yukon Territories (YT), and Newfoundland and Labrador (YT) are consistently among the regions with largest IMR indexes. On the other hand, Ontario (ON) and Quebec (QC) are consistently among the regions with lowest inward trade costs.

A very interesting region that is quite representative of our empirical findings is Alberta (our choice for normalization). Inward trade costs for most commodity categories put Alberta somewhere in the middle as compared to the high-costs NT, YT, and NL on the one hand, and the low-costs ON and QC on the other. There are, however, a few expected exceptions. Alberta has very low relative IMR indexes for several commodity categories including Agricultural Products, Fuels, Mineral Products, Petroleum and Coal Prod-

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[28] Mechanically, we solve system (4)-(5) for $\{(\Pi_i^k)^{1-\sigma_k}, (P_j^k)^{1-\sigma_k}\}$. To get the set $\{(\Pi_i^k), (P_j^k)\}$, we use our own estimates of elasticity of substitution at the commodity level based on country level data.

[29] Individual figures presenting the variation of internal multilateral resistance across regions are available upon request.

ucts, and Chemical Products. Given Alberta's fuels resources, it should be no surprise that the inward trade costs for Fuels and Petroleum and Coal Products are relatively low. The low inward multilateral resistance for Agricultural Products should also be expected given that Alberta is one of the highest agricultural producing provinces in Canada. Chemical Products is another industry where Alberta has low inward multilateral resistance index, higher only than the corresponding indexes for Ontario and Quebec. Once again, this result is driven by the fact that, along with ON and QC, Alberta dominates production in this industry, especially when Petrochemicals and Synthetic Resins are considered. Finally, we find that Alberta has the fourth lowest inward trade cost for Mineral Products, which reflects the province's fourth place, after Ontario, Quebec, and British Columbia, in terms of output share in in this industry.

Next, we turn to the variation of inward multilateral resistances across products. To facilitate the analysis and interpretation of our results we construct Laspeyres type summary IMR values for each commodity category across all provinces and territories.[30] Results are presented in tables **??** to **??** of Appendix A. Once again, we report the indexes for each year to show that the relative distribution of inward trade costs is remarkably stable over time.

It is clear from the tables and the corresponding figures that Agricultural Products, Chemical Products, Petroleum and Coal Products and Fuels have consistently high relative inward multilateral resistances across almost all provinces and territories. On the other hand, Leather, Rubber and Plastic Products, Printing and Publishing Products, Transportation Products, and Textile Products have consistently low relative IMR indexes across different provinces and territories. A natural explanation for such findings could be industry concentration: On the one hand, Agriculture, Fuels, and Petroleum and Coal Products are all resource industries with high concentration in certain regions. On the other hand, Printing and Publishing Industry is considered the most widely dispersed Canadian manufacturing industry. Industry concentration does not explain the low inward multilateral resistance in the Textile and Apparel industry, which is mainly concentrated in Ontario and Quebec. Through intensive capital investment over the last several decades, the Canadian Textile and Apparel industry has gained efficiency and has be-

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[30] Individual figures depicting the variation of IMR's across different commodities for a given province are also available upon request.

come more and more competitive on the world market. A big proportion of domestic demand is met by domestic production, which naturally translates into lower trade costs for the Canadian Consumer.

The IMR values in principle are comparable to price indexes, and in particular their variation across provinces might be expected to reflect variation in consumer (or user) price indexes across provinces. The IMR's have more variation than CPI's, and they only loosely track variations in consumer price indexes. The difference does not necessarily indicate problems with our approach of calculating IMR's. The difference has a number of explanations. First, the inward incidence of trade costs probably falls on intermediate goods users in a way that does not show up in measured prices. Second, the production weighted IMR's are not really conceptually comparable to the consumer price indexes of final goods baskets. Third, home bias in preferences may be indicated by our results. Home bias in preferences results in attributions to 'trade costs' that cannot show up in prices. But fourth, the IMR's are no doubt are subject to measurement error and are based on a CES model that itself may be mis-specified. We think it is premature to adopt this negative interpretation that vitiates our approach.

Outward multilateral resistance are considerably larger than the inward multilateral resistances. In other words, the incidence of trade costs falls systematically much more on the supply side than on the demand side of the market. This is a striking regularity. The reason is that specialization effectively makes supply less elastic than demand. Supply shares tend to be higher for low trade cost shippers (due to upper level general equilibrium forces, all else equal) and this force is more powerful than than the analogous expenditure share force. See Proposition 2 for formal insight.[31]

Turning to variation in the OMR's, they vary widely across industries for a single province and across provinces for a single product line. The pattern of variation makes good sense for the most part. As in the case of IMR's, we first analyze the OMR's variation across provinces and territories by product, then we turn to the patterns of variation across commodity categories by province or territory.

We summarize our findings about the variation of OMR's across provinces

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[31] The large OMR's may at first appear implausible, since they may appear to imply large relative factor price differences between regions for immobile factors. But this is not a necessary implication because the large amount of regional specialization allows substantial factor price equality to coexist with large differences in OMR's. Note that our method allows the construction of a Π_i^k for a province i that produces no k.

in Tables **??** and **??**. This time, we use commodity shipment shares as weights in order to calculate the average OMRs for each province or territory across all goods. As expected, our empirical findings suggest that more remote regions face trade costs that are larger: Yukon Territories (YT), and Newfoundland and Labrador (NL) are consistently the two regions with largest outward multilateral resistance indexes, while Ontario (ON) and Quebec (QC) are always among the regions with lowest outward trade costs which, in addition to their geographical location, is due to the strong and diverse industry concentration in these regions.

It is interesting to note that the Northwest Territories (NT)(including Nunavut), British Columbia, and Alberta are among the regions with low outward multilateral resistances. In the case of the Northwest Territories, this result is driven by the fact that Fuels, which take more than 70% of NT's shipments, are a commodity category with relatively low outward trade cost. Fuels also explain the low OMR values for Alberta. Finally, British Columbia has very low relative outward multilateral resistances for some commodity categories such as Food, Leather, Rubber, and Plastic Products, Printing and Publishing, Fabricated Metals, and Machinery, which represent the leading manufacturing industries in the province.

Even though, as discussed earlier, OMR indexes vary significantly across provinces and territories, it is clear from the figures that some commodities are subject to higher outward trade costs than others. We summarize those findings by calculating the average outward multilateral resistance by commodity category across all provinces and territories. Tables **??** to **??** present the summary Laspeyres type indexes. As can be seen from the table and from the corresponding figures, Textile Products, Printing and Publishing Products, and Non-metallic Mineral Products are always the three commodity categories with highest outward trade costs regardless of the province or territory in question, while Fuels, Machinery, Electrical Products, Petroleum and Coal Products, and Chemical Products are consistently among those with lowest OMR indexes. World competition is a natural candidate to explain our findings: Given, Canadian resources, Fuels and Petroleum and Coal Products are among the products for which Canada has clear advantage on the world market, while at the same time, it faces fierce competition in sectors such as Textile Products. In both cases we draw intuition from Proposition 1 that in the special case of uniform inter-regional trade costs, the OMR is decreasing in supply share.

More generally, the empirical regularity suggested by Proposition 1 holds up strikingly well in our data when applied to OMR's: they are significantly decreasing in output shares and increasing in expenditure shares in regressions run at the product or province level. Tables **??** to **??** illustrate our results at the commodity level:[32] The coefficients on output shares are always negative and significant at least at the 5% level.[33] The coefficients on expenditure shares are always positive and always significant. Similar results about the relationship between OMR's and output and expenditure shares at the province level are presented in Tables **??** and **??**. All coefficients on output shares are negative and significant,[34] while all coefficients on expenditure shares are positive and significant at any level.

In contrast, the sign pattern is reversed for IMR's (except for IMR's at the product level for remote provinces). Tables **??** to **??** illustrate our results at the commodity level: Without any exception, the coefficients on output shares are positive and significant at any level, while the coefficients on expenditure shares are always negative and significant.[35] Our regressions indicate a mixed relationship between IMR's and output and expenditure shares at the province level. As can be seen from Tables **??** and **??**, IMRs and output shares are positively and significantly related for most of the provinces and negatively related for the remote regions such as NL, NT, and YT. Similarly, the coefficients on expenditure shares are negative for most regions with the exception of NL, NT, YT, and PE. What seems to explain this pattern is that for given Π's the P's are inversely related to the Π's by (5). Most of the incidence of trade costs falls on the Π's and this incidence is driven by the forces suggested by Proposition 1, hence due to (5) these forces reverse sign in explaining the pattern of the P's.

Over time there is evidence of a decline in OMR's. See Tables (**??**)-(**??**). Since gravity coefficients are stable over time, we take the suggestion from Proposition 1 that the decline in OMR's is interpreted as driven by increased specialization.[36]

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[32] To obtain these estimation results, we regress MR's to the power of $(1-\sigma)$ on output and expenditure shares for each commodity in our sample.

[33] The only exception is Lumber, where the coefficient has the expected sign but is not significant.

[34] NT is the only province for which the output share coefficient is negative but not significant.

[35] Machinery and Fuels are the only two exceptions, where the coefficients on expenditure shares are still negative but no longer significant.

[36] No formal link is claimed; the general equilibrium comparative statics of shifts in supply shares are far too complex for analytic results.

The importance of theory-based indexes of trade costs is highlighted by the sharp contrast of the MR's with share-weighted Laspeyres indexes of bilateral trade costs. Share-weighted indexes are 'naive incidence' measures that put all incidence on alternately the seller or buyer.[37] First, we aggregate the implied bilateral trade costs by province, weighting the bilateral trade costs for each province by its shipments share and then aggregating across all its partners. Results are presented in Tables **??** and **??** from Appendix A. Several properties stand out. First, share-weighted trade costs vary across provinces in a counter-intuitive way. Thus, for example the Yukon Territories are consistently among the regions with lowest trade costs. Our methods yield more plausible rankings. Second, even though there is no a clear trend in the time evolution of bilateral trade costs, the share-weighted index suggest that they have increased over time. Our methods show a decrease.

We also construct share-weighted trade cost indexes by product. Results are presented in Tables **??** to **??** from Appendix A. We find wide variability of implied trade costs across commodities: Mineral Products and Mining have significantly higher values, while Electrical Products and Chemical Products are among the commodities with low implied values. While we find no clear trend in the time evolution of gravity trade costs at the commodity level, the share-weighted index suggests an increase in costs over time for some categories such as Mineral Products and Printing and Publishing Products. In contrast, outward multilateral resistance indexes fall over time at the product level. We find a strong positive correlation of OMR with the corresponding share-weighted indexes at the province level. Results are illustrated in column 3 of Table **??**. IMR, on the other hand has no systematic correlation with its counterpart share-weighted index. Results from column 2 of Table **??** indicate that IMR's and share-weighted trade costs are positively related for the remote regions, such as NL, NT, SK, and YT, and negatively related for the more developed regions. Finally, the correlation coefficients presented in Table **??** suggest no systematic correlation between MR's and share-weighted trade costs indexes at the commodity level.

4.3 Domestic Trade Cost Indexes

It is informative to construct ideal index numbers for trade costs within Canada along the same lines as the multilateral resistance index that consis-

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[37] Such measures have been used by Redding and Venables (2004).

tently aggregates all trade costs. The idea is to find the uniform trade cost for inter-provincial trade that preserves each province's shipments to Canada as a whole, and thus each province's shipments to the world as a whole.

We construct Domestic Trade Cost (DTC) indexes following our analysis and procedures from Section 1.2 where we define the unform cost from each Canadian province or territory to all other provinces and territories for a generic commodity as:[38]

$$t_{iC}^{1-\sigma} = \frac{\bar{Y}_{iC}}{\sum_{j \in C} E_j (\Pi_i P_j)^{\sigma-1}}, \tag{13}$$

where $\bar{Y}_{iC}$ is sum of the predicted by gravity trade from province i to all destinations in Canada, excluding the province itself, divided by the province's share in world's output, and all other variables from Equation (13) are previously defined. We use a general equilibrium system to solve for the t_{iC}'s simultaneously with the multilateral resistance indexes.[39]

Summary results for the Domestic Trade Costs in Canada (DTCC's) for each province and territory across all commodities and for each year in our sample are presented in tables **??** and **??**. As expected, the uniform trade costs to Canada for each province are significantly lower than the corresponding provincial OMR's which measure the uniform costs for each provincial shipper to the whole world market. We perform mean comparison tests to find that, without any exception, each province faces significantly lower uniform trade costs to its Canadian partners as compared to the world as a whole. Our results indicate that, on average, the provincial domestic trade costs to Canada are a little less than half than the corresponding multilateral resistances. We also find that our DTCC indexes are very stable over time and uniform across provinces and territories.

We find some differences and some similarities between the distributions of OMR's and provincial domestic trade costs to Canada when we compare them at the commodity level. Tables **??** to **??** report the average DTCC's by product over time. On the one hand, our results indicate that, just like in the case of OMR's, Printing and Publishing Products and Non-metallic

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[38] The same procedure is readily applicable for calculating provincial uniform costs to the US and to ROW.

[39] Sensitivity checks show that the uniform internal Canadian costs calculated in a general equilibrium system are very close to the the corresponding costs obtained when we first solve for the MR's using system (3)-(5), and then substitute those MR's directly into to (13).

Mineral Products are among the commodity categories with highest DTCC's, while Electrical Products and Chemical Products are consistently among the products with lowest DTCC's. On the other hand, we find that the some commodities such Textiles, which are subject to high OMR, experience relatively low domestic Canadian trade costs, while other products such as Petroleum and Coal Products, which have relatively low outward multilateral resistance, are subject to significant DTCC's. Finally, our mean comparison tests indicate that Fuels is the only category for which OMR's are not significantly different than the DTCC's.

Next, we construct an intuitive summary statistic to capture the effect of trade costs on local trade, Constructed Home Bias. We define Constructed Home Bias (CHB) as the ratio of internal trade costs for each province and the product of its inward and outward multilateral resistances:

$$\tau_i^k = \frac{t_{ii}^k}{\Pi_i^k P_i^k}, \tag{14}$$

where t_{ii}^k is the estimated from gravity internal trade cost for province or territory i and commodity k relative to the smallest internal provincial trade cost for commodity k across all provinces and territories.[40] Π_i^k is the outward multilateral resistance faced by each shipper of product k from province i, and P_i^k is the inward multilateral resistance for the consumers of good k in province i. Intuitively, CHB captures the deviation of actual trade flows from frictionless trade flows.[41] Crucially, the normalization used to solve system (3)-(5) does not play any role: (14) is independent of the normalization. [42] Finally, since our results show that the underlying gravity model coefficients are stable over time, changes in Constructed Home Bias reflect the general equilibrium forces that act on multilateral resistance through changing production and expenditure shares.

Tables **??** and **??** display summary the variation and the evolution of the home bias statistic across provinces and territories for each product in our

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[40] In most cases, the smallest internal provincial cost is the one in Prince Edward Island due to its small size and, therefore, small internal distance.

[41] An alternative approach, with similar intuitive meaning, which captures another aspect of the effect of time on trade flows through unobservable variables such as scale economies, nonhomothetic preferences, and regional characteristics, is to calculate *residual fixed effects* as the difference between directional fixed effects and OMRs.

[42] Notice also that (14) is independent of scalar changes in the level of trade costs: it reflects relative costs only.

sample. Our results reveal that the pattern of home bias is fairly stable over time for most provinces. Ontario and Quebec are the two provinces for which the constructed home bias index increases over time, while Alberta and the Northwest Territories experience a small decrease in CHB over time.

The volume effects of CHB on trade are measured for each province and territory as the weighted average of commodity level values of $(t_{ii}/\Pi_i P_i)^{1-\sigma}$. Over time, all provinces except the Yukon Territories[43] experience a significant and relatively stable decrease in constructed home bias effects. Table **??** reports the percentage change in the volume effects on CHB on trade for each province between 1992 and 2003. As can be seen from the table, the decrease in the CHB volume effect on trade is significant and varies from 29% for British Columbia to 86% for the Northwest Territories. The volume effects differ by region but all decrease over time. This is a measure of the effect of 'globalization', a fall in external (both international and inter-provincial) trade costs relative to internal trade costs.

The fall in volume home bias is due to the general equilibrium effect of changes in production and expenditure shares on multilateral resistance, the fitted t_{ij}'s being nearly constant because the gravity coefficients are stable over time. Nevertheless, a fall in the *level* of trade costs[44] may be the driving force behind this fall in constructed home bias. Lower trade costs may drive more specialization over time, which acts through changes in multilateral resistance to reduce the proportion of shipments to local destinations.[45]

4.4 Assessing the AIT

We finish our analysis of Canadian trade costs by assessing the effect of the Agreement on Internal Trade (AIT) on trade costs. AIT came into effect on July 1, 1995. One of its main objectives is to reduce barriers to trade within Canada.

To capture the AIT effect we estimate Equation 12 using directional fixed effects in a panel setting. To obtain our main estimation results, which are presented in Tables **??**-**??** of Appendix A, we introduce a dummy variable to account for the presence of the AIT, which takes a value of one for the

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[43] This result is driven by the unexpectedly high CHB value for 2003, which is not in accordance with the decrease in CHB for previous years.

[44] Not identifiable from gravity.

[45] Size-adjusted trade is invariant to equiproportionate reductions in bilateral trade costs.

years after 1995 and a value of zero for the years before 1996.[46]As can be seen from the estimation tables, our econometric work finds no consistent evidence that the AIT has a significant effect on Canada's internal trade costs. The coefficient of the AIT dummy variable varies in sign and is insignificant for almost all commodity categories. Three exceptions are Fuels, Paper and Pulp Products, for which the AIT coefficient is positive and significant, and Transportation Products, for which the coefficient is negative and significant. Given the magnitude of those coefficients however, we believe that they capture the effect of forces other than the AIT.

Even though, our empirical results provide no evidence that the Agreement on Internal Trade leads to a significant trade cost reduction at the commodity level, we find it useful and instructive to perform some counterfactual experiments in order to gauge how hypothetical cost reductions from AIT, or any other policy, would affect overall trade cost indexes within Canada. To do so, we assume the following simple scenario: the first year after the introduction of the AIT, which is 1996, it lead to a uniform decrease of 5% in the explicit internal Canadian costs and to an additional 5% during the following year. Using the trade costs from gravity, which we recalculate accounting for the hypothetical cost reduction due to AIT, we then calculate the new multilateral resistance indexes and use the changes in trade costs, as compared to trade costs without the hypothetical cost reduction, to estimate the welfare effects of the AIT on the Canadian consumers and producers in each province and territory.[47]

We find that, on average, a trade policy which leads to a uniform decrease in bilateral interprovincial trade costs will have a significant effect on inward and outward provincial trade costs: both OMR's and IMR's will decrease in response to a uniform decrease in bilateral interprovincial trade costs. More importantly, we find that the responses of IMR's and OMR's to a uniform decrease internal Canadian costs vary significantly across industries for a single province and across provinces for a single product line, and its effect is much stronger for the outward multilateral resistances. The latter finding

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[46] Moving the cutoff date for the "AIT" variable forward and back in time to an earlier or a later year did not have any effect on the significance of our estimation coefficients.

[47] It is worth noting that our methodology could be used to trace the AIT welfare effects through the change in DTCC's and to decompose the effects on producers and consumers in any province to those due to a domestic trade cost reduction and those due to a total outward trade cost reduction. In addition, the same techniques could be applied to trace the welfare effects on producers and consumers by commodity category.

is in accordance with our earlier discussion that the incidence of trade costs falls more on the supply side.

We use the changes in OMR's and IMR's to trace the welfare effects of AIT. Assume for simplicity that no rent is associated with the trade barriers. Fix all the supply and expenditure shares for a first order approximation to the change in real GDP by province.[48] The gross effect of AIT on shipments from a particular province or territory is given by the decrease in trade costs across all commodities shipped by the province to a single world market, weighted by the share of shipments of each product in the total provincial shipments. Formally:

$$\sum_i \Delta OMR_{i,k} WS^w_{i,k},$$

where $\Delta OMR_{i,k}$ is the percentage decrease (as a positive number), due to AIT, in the outward multilateral resistances that each province i faces when shipping product k to the rest of the world, including all other Canadian provinces and territories, and $WS^w_{i,k}$ is product k's shipment share in province i's shipments to the rest of the world.[49] These gross welfare effects on producers by province of origin are reported in column 3 of Tables **??** and **??**, which present the effects of a 5%, and a 10% uniform decrease in bilateral interprovincial trade costs respectively. The gross gains are positive across all provinces and territories and largest in the more developed regions and less in the more remote regions. In addition, as expected, the effects of a 10% cost decrease are stronger than the corresponding values for obtained for a 5% cost decrease.

The AIT gross effect on consumers (including intermediate input consumers) is give by:

$$\sum_i \Delta IMR_{i,k} WD_{i,k},$$

where $\Delta IMR_{i,k}$ is the percentage decrease, due to AIT, in the trade costs faced by consumers in province k, and $WD_{i,k}$ is product i's expenditure share in province k's total expenditure. Gross effects on provincial consumers are reported in column 2 of Tables **??** and **??**. Our findings indicate that consumers in most provinces will gain from a reduction in interprovincial trade

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[48] A full general equilibrium treatment requires specifying the upper level supply and expenditure allocation processes, while treating rents requires marginal dead weight loss calculations.

[49] The gross gains are not equivalent to GDP gains because they do not reflect changes in intermediate goods prices.

costs. The three exceptions are Manitoba, Ontario and Quebec. A possible intuitive explanation for this interesting result is that when domestic Canadian trade costs are decreased firms from these industrial regions find it more profitable to "export" to the rest of Canada, which naturally increases internal prices in the three provinces and, therefore, hurts consumers. Comparing our results from the two tables, one can see that both the positive and negative effects on consumers will be stronger the bigger the reduction in interprovincial trade costs is.

It is also interesting and important to note that producers are the ones to gain most from the reduction in trade costs. Comparing the numbers from columns 2 and 3 in Tables **??** and **??**, one can see that the welfare effects on producers is systematically higher. Such result is driven by our earlier finding that the incidence of trade costs falls consistently much more on the supply side than on the demand side of the market.

To quantify the net welfare AIT effect on provincial producers, we take the difference between column 2 and column 3 from Tables **??** and **??**. The numbers presented in column 4 of each table should be interpreted as real GDP changes for each province. Our results from Table **??** indicate that the Northwest Territories will suffer a loss in real GDP as a result of a 5% uniform reduction in interprovincial trade costs. This interesting general equilibrium effect illustrates a general theoretical possibility arising through terms of trade effects. A uniform fall in trade costs can cause the 'core' regions to trade more intensively with each other, resulting in terms of trade losses on the periphery.

It is clear from our counterfactual experiment that the effect of a uniform decrease in bilateral interprovincial trade costs will vary widely across provinces and commodities. Such a result has important policy implications and implies that any program or policy that targets a uniform decrease in internal trade costs is not optimal. In order to be effective and efficient, such policy should be tailored with particular industries and particular provinces in mind. The techniques presented here and used in the analysis of the effects of AIT are readily applicable to different policy issues and exogenous shocks. For example, we could perform a similar counterfactual experiment to trace the effects on trade costs and welfare from the inauguration, in 1997, of the Confederation Bridge linking Prince Edward Island to the continental part of Canada. Another potential candidate is the investment and labor mobility agreement (TILMA) between Alberta and British Columbia, which became effective in April 2007.

5 Conclusion

The trade costs for Canada that are estimated in this paper place help to map a poorly marked territory. Our disaggregated gravity model estimation procedure turns up larger distance and border effects than the previous aggregate gravity literature. Aggregation bias explains the difference.

We pioneer the application of multilateral resistance index theory to Canadian trade data. Thus we aggregate and decompose the bilateral trade costs inferred from gravity into their aggregate incidence on demand and supply sides of the market. We also estimate ideal indexes of internal (to Canada) trade costs, and estimates of the home bias conferred by our estimated trade costs to each province. The disaggregated gravity estimates imply large variation in the provincial and commodity multilateral resistance indexes and the indexes of internal trade costs. For the most part the variations make intuitive sense. Where they do not, we conjecture on the causes as fruitful lines of future research.

Finally, we investigate the importance of the AIT on Canada's trade. We find no convincing empirical evidence of its effect. A separate counterfactual exercise examines the effects of a parametric assumed fall in internal trade costs on within-Canada trade. An important implication is that general equilibrium effects can offset the direct effect of a fall in internal trade costs.

Our results turn up many unanswered questions. Border effects and distance effects become puzzlingly large again. The cross sectional variation of multilateral resistance over provinces and commodities is large. Are these too large? If we take them seriously, they have large implications for resource and expenditure allocation. Or, is there large home bias in preferences even within provinces relative to other Canadian provinces? Are our methods reliable? Where do we go from here? We anticipate that gravity research still has a lot to teach us about a proper map of Canada and the world.

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Table 1: Commodity Level Weighted Average Gravity Coefficients

(1) Commodity	(2) LNDIST	(3) CB_P_P	(4) CB_P_S	(5) CA_US	(6) US_CA	(7) CA_ROW	(8) SMCTRY
Agriculture	-2.237	-0.123	0.553	-4.363	-4.952	-1.021	-0.002
Chemical Products	-1.505	-0.753	1.091	-8.881	-5.932	-2.528	0.068
Electrical Products	-0.816	-0.216	1.047	-3.309	-1.856	-2.714	1.532
Fabricated Metal Products	-1.488	-0.808	0.922	-6.527	-5.824	-3.139	-0.437
Food	-1.712	-0.863	0.628	-6.310	-6.923	-2.396	-1.210
Fuels	-1.461	1.468	0.318	-0.982	-4.437	-2.522	1.080
Furniture	-1.291	-0.663	0.814	-6.584	-6.206	-3.496	-0.300
Hosiery and Clothing Products	-1.014	-1.030	1.076	-7.780	-6.644	-4.502	-0.056
Leather, Rubber, and Plastic Products	-1.501	-0.914	0.893	-7.224	-4.280	-3.093	-0.666
Lumber and Wood Products	-1.669	-1.050	0.752	-8.605	-5.545	-3.049	-0.813
Machinery	-1.254	-0.312	0.758	-4.315	-2.859	-2.062	0.864
Mineral Products	-1.595	-0.351	1.002	-4.937	-6.077	-3.325	0.483
Miscellaneous Products	-1.201	-1.000	0.836	-8.124	-5.331	-4.018	0.595
Petroleum and Coal Products	-2.313	-0.477	1.156	-7.245	-9.472	-2.118	-1.471
Primary Metal Products	-1.581	-0.536	0.839	-6.399	-6.388	-2.115	-0.233
Printing and Publishing Products	-1.459	-0.895	0.756	-8.008	-5.395	-4.820	1.081
Textile Products	-1.215	-0.605	1.044	-8.479	-5.751	-4.295	-0.085
Transportation Products	-1.512	-0.771	0.950	-5.634	-2.711	-2.661	-0.498
Wood Pulp and Paper Products	-1.786	-1.333	0.404	-7.372	-7.367	-2.093	-1.207

Table 2: Commodity Level Weighted Average Gravity Coefficients (Symmetric US-CA Border)

(1) Commodity	(2) LNDIST	(3) CB_P_P	(4) CB_P_S	(5) CA_US	(6) CA_ROW	(7) SMCTRY	(8)
Agriculture	-2.237	-0.123	0.553	-7.137	-1.021	-0.002	
Chemical Products	-1.505	-0.753	1.091	-8.003	-2.528	0.068	
Electrical Products	-0.816	-0.216	1.047	-4.579	-3.208	1.532	
Fabricated Metal Products	-1.488	-0.808	0.922	-9.075	-3.139	-0.437	
Food	-1.712	-0.863	0.628	-7.485	-2.396	-1.210	
Fuels	-1.461	1.468	0.318	-2.432	-2.522	1.080	
Furniture	-1.291	-0.663	0.814	-5.480	-3.496	-0.300	
Hosiery and Clothing Products	-1.014	-1.030	1.076	-6.804	-4.951	-0.056	
Leather, Rubber, and Plastic Products	-1.501	-0.914	0.893	-5.106	-3.093	-0.666	
Lumber and Wood Products	-1.669	-1.050	0.752	-4.457	-3.049	-0.813	
Machinery	-1.254	-0.312	0.758	-3.023	-2.390	0.864	
Mineral Products	-1.595	-0.351	1.002	-7.272	-3.325	0.483	
Miscellaneous Products	-1.201	-1.000	0.836	-6.524	-3.387	0.595	
Petroleum and Coal Products	-2.313	-0.477	1.156	-9.857	-2.118	-1.471	
Primary Metal Products	-1.581	-0.536	0.839	-6.587	-2.115	-0.233	
Printing and Publishing Products	-1.459	-0.895	0.756	-6.030	-4.820	1.081	
Textile Products	-1.215	-0.605	1.044	-5.816	-4.295	-0.085	
Transportation Products	-1.512	-0.771	0.950	-6.991	-2.661	-0.498	
Wood Pulp and Paper Products	-1.786	-1.333	0.404	-7.458	-2.093	-1.207	

Gravity with Aggregated Data

Table 3: Gravity with Aggregated Data: 1992-1997

	1992	1993	1994	1995	1996	1997
LNDIST	-1.493	-1.538	-1.503	-1.545	-1.546	-1.573
	(0.097)**	(0.097)**	(0.101)**	(0.098)**	(0.095)**	(0.100)**
CB_PROV_PROV	-0.437	-0.542	-0.390	-0.667	-0.555	-0.569
	(0.428)	(0.428)	(0.448)	(0.424)	(0.423)	(0.445)
CB_PROV_STATE	0.895	0.775	0.869	0.772	0.918	0.901
	(0.260)**	(0.269)**	(0.269)**	(0.274)**	(0.275)**	(0.284)**
CAN_USA	-2.855	-0.388	-0.384	-0.274	0.770	-3.269
	(0.496)**	(0.612)	(0.512)	(0.755)	(0.643)	(0.691)**
USA_CAN	-4.365	-3.319	-3.163	-3.480	-3.919	-3.520
	(0.623)**	(0.657)**	(0.926)**	(0.592)**	(0.475)**	(0.533)**
CAN_ROW	-2.490	-2.398	-2.449	-2.174	-2.199	-2.304
	(0.468)**	(0.431)**	(0.416)**	(0.480)**	(0.380)**	(0.477)**
SMCTRY	0.069	-0.068	0.075	-0.042	-0.073	-0.171
	(1.217)	(1.203)	(1.268)	(1.141)	(1.152)	(1.133)
CONST	-18.463	-18.572	-18.261	-17.959	-17.844	-16.846
	(1.075)**	(0.875)**	(0.909)**	(0.879)**	(0.856)**	(1.043)**
N	1242	1240	1247	1261	1248	1281
r2	0.706	0.688	0.678	0.664	0.672	0.644

Table 4: Gravity with Aggregated Data: 1998-2003

	1998	1999	2000	2001	2002	2003
LNDIST	-1.581	-1.528	-1.586	-1.602	-1.651	-1.582
	(0.098)**	(0.097)**	(0.100)**	(0.100)**	(0.104)**	(0.101)**
CB_PROV_PROV	-0.456	-0.506	-0.423	-0.494	-0.354	-0.457
	(0.470)	(0.443)	(0.451)	(0.455)	(0.526)	(0.458)
CB_PROV_STATE	0.792	0.970	0.767	0.850	0.796	0.820
	(0.260)**	(0.270)**	(0.277)**	(0.277)**	(0.285)**	(0.272)**
CAN_USA	0.052	0.813	0.501	-0.658	-1.534	-3.079
	(0.605)	(0.801)	(0.894)	(0.744)	(0.824)+	(0.601)**
USA_CAN	-3.439	-4.060	-2.581	-2.316	-3.985	-1.408
	(0.500)**	(0.684)**	(0.565)**	(0.550)**	(0.507)**	(0.609)*
CAN_ROW	-2.310	-2.333	-2.139	-1.877	-2.055	-2.016
	(0.434)**	(0.412)**	(0.436)**	(0.300)**	(0.363)**	(0.328)**
SMCTRY	-0.202	-0.145	-0.247	-0.348	-0.386	-0.301
	(1.156)	(1.113)	(1.114)	(1.096)	(1.213)	(1.135)
CONST	-16.908	-16.528	-18.778	-17.246	-15.255	-17.265
	(1.009)**	(0.953)**	(1.063)**	(1.033)**	(1.156)**	(1.037)**
N	1277	1292	1280	1264	1265	1244
r2	0.649	0.661	0.649	0.658	0.661	0.677

Table 5: Gravity with Aggregated Data: 1992-1997

	(1) 1992	(2) 1993	(3) 1994	(4) 1995	(5) 1996	(6) 1997
LNDIST	-1.472	-1.487	-1.519	-1.503	-1.535	-1.593
	(0.105)**	(0.101)**	(0.102)**	(0.100)**	(0.104)**	(0.111)**
CB_PROV_PROV	-1.142	-1.116	-1.005	-0.946	-0.867	-0.893
	(0.469)*	(0.463)*	(0.461)*	(0.454)*	(0.513)+	(0.510)+
CB_PROV_STATE	0.708	0.664	0.535	0.546	0.604	0.543
	(0.349)*	(0.346)+	(0.335)	(0.334)	(0.346)+	(0.351)
CAN_USA	-2.636	-3.388	-2.300	-1.317	-2.328	-2.812
	(0.729)**	(0.715)**	(0.532)**	(0.469)**	(0.719)**	(0.334)**
CAN_ROW	-1.451	-1.459	-1.425	-1.187	-1.325	-1.171
	(0.281)**	(0.290)**	(0.269)**	(0.292)**	(0.302)**	(0.288)**
SMCTRY	-0.522	-0.519	-0.581	-0.460	-0.549	-0.647
	(0.907)	(0.889)	(0.886)	(0.902)	(0.919)	(0.936)
CONST	-19.317	-17.876	-18.124	-18.333	-17.944	-17.276
	(1.422)**	(1.324)**	(0.915)**	(0.896)**	(0.932)**	(0.995)**
N	602	597	600	603	598	601
r2	0.758	0.753	0.742	0.736	0.731	0.728

Standard errors in parentheses

+ $p < 0.10$, * $p < .05$, ** $p < .01$

Table 6: Gravity with Aggregated Data: 1998-2003

	(1) 1998	(2) 1999	(3) 2000	(4) 2001	(5) 2002	(6) 2003
LNDIST	-1.627	-1.579	-1.567	-1.615	-1.595	-1.576
	(0.111)**	(0.118)**	(0.121)**	(0.121)**	(0.113)**	(0.114)**
CB_PROV_PROV	-0.948	-0.916	-0.854	-0.934	-0.833	-0.831
	(0.501)+	(0.492)+	(0.489)+	(0.498)+	(0.504)+	(0.565)
CB_PROV_STATE	0.535	0.589	0.577	0.428	0.334	0.398
	(0.345)	(0.347)+	(0.348)+	(0.350)	(0.316)	(0.324)
CAN_USA	-3.092	-3.545	-3.156	-3.058	-2.717	-1.754
	(0.471)**	(0.450)**	(0.689)**	(0.540)**	(0.492)**	(0.467)**
CAN_ROW	-1.219	-1.325	-1.213	-1.291	-1.375	-1.406
	(0.282)**	(0.278)**	(0.304)**	(0.296)**	(0.292)**	(0.320)**
SMCTRY	-0.749	-0.678	-0.586	-0.800	-0.770	-0.790
	(0.937)	(0.930)	(0.936)	(0.954)	(0.916)	(0.963)
CONST	-16.867	-17.378	-17.494	-14.120	-17.079	-19.128
	(1.000)**	(1.056)**	(1.085)**	(1.375)**	(1.015)**	(1.356)**
N	601	601	603	604	605	602
r2	0.744	0.741	0.736	0.742	0.758	0.766

Standard errors in parentheses

+ $p < 0.10$, * $p < .05$, ** $p < .01$

Evolution of Gravity Implied Trade Costs by Province

Table 7: Evolution of Gravity Implied Trade Costs by Province I

Year	AB	BC	MB	NB	NL	NS
1992	10.610	15.342	6.065	7.204	11.653	7.963
1993	12.196	6.914	5.990	6.752	13.846	7.024
1994	6.768	7.874	4.981	5.635	6.409	4.675
1995	4.820	8.016	5.723	6.596	8.741	5.854
1996	6.783	7.304	8.016	8.247	13.269	7.849
1997	8.778	12.577	8.356	7.695	10.049	6.313
1998	5.353	9.438	8.402	8.074	11.043	9.451
1999	7.861	9.652	9.153	8.773	14.506	8.084
2000	13.536	9.195	15.253	16.630	35.447	15.069
2001	12.646	11.687	9.072	9.433	16.049	9.120
2002	7.573	19.859	11.628	11.798	10.967	11.163
2003	16.154	19.007	10.300	10.790	14.100	10.569

Table 8: Evolution of Gravity Implied Trade Costs by Province II

Year	NT	ON	PE	QC	SK	YT
1992	8.342	4.792	6.913	4.613	9.263	2.394
1993	10.765	3.877	8.492	3.925	9.861	3.200
1994	8.000	5.610	4.410	5.234	6.737	2.684
1995	3.647	5.694	5.371	5.188	6.525	2.060
1996	5.970	6.477	10.966	5.514	7.636	2.926
1997	12.175	6.743	7.514	6.754	9.393	5.614
1998	4.165	7.486	6.746	6.836	7.645	3.123
1999	8.620	5.041	12.417	5.877	9.795	5.638
2000	7.899	6.317	61.039	6.735	13.372	5.465
2001	17.916	5.066	15.737	5.669	11.059	11.130
2002	4.451	6.311	12.996	8.449	9.176	4.297
2003	7.538	5.025	9.757	6.844	11.399	5.133

Evolution of Gravity Implied Trade Costs by Product

Table 9: Evolution of Gravity Implied Trade Costs by Product I

Year	Agriculture	Mining	Food	Leather	Textile	Hosiery	Lumber
1992	7.928	17.756	10.229	7.760	7.047	6.600	21.145
1993	9.197	22.705	11.034	7.206	7.921	4.102	7.694
1994	7.307	15.578	7.200	6.861	7.665	4.293	9.542
1995	10.258	3.724	8.955	6.135	8.091	4.851	12.557
1996	8.586	8.116	12.310	5.785	5.021	4.909	8.767
1997	10.855	19.287	12.478	5.543	7.879	6.093	14.464
1998	12.650	3.980	11.717	8.003	6.612	5.945	12.696
1999	11.657	12.305	15.292	6.992	7.013	5.265	11.767
2000	10.267	11.195	23.895	6.757	11.346	3.974	10.443
2001	10.675	31.349	13.969	7.080	8.745	5.960	14.373
2002	13.228	6.887	16.051	6.442	13.151	10.277	28.457
2003	10.755	13.305	15.883	6.421	13.137	5.611	27.662

Table 10: Evolution of Gravity Implied Trade Costs by Product II

Year	Furniture	Paper	Printing	Pri_Metal	Fab_Metal	Machinery
1992	6.924	3.954	7.441	3.248	6.136	2.837
1993	5.268	3.990	9.160	3.745	6.204	2.893
1994	6.878	5.055	10.212	3.950	8.030	3.388
1995	9.860	5.585	10.765	2.689	6.401	3.091
1996	8.122	5.592	13.106	3.212	4.969	3.236
1997	9.121	5.883	9.797	4.028	7.327	3.318
1998	11.486	7.046	16.049	3.856	7.745	3.442
1999	8.062	6.517	12.557	3.447	5.407	3.206
2000	9.928	5.719	14.504	3.298	6.968	3.115
2001	10.337	6.424	16.841	2.812	6.816	3.543
2002	13.603	6.287	18.328	3.629	6.629	2.987
2003	11.486	5.276	13.565	3.403	6.289	2.781

Table 11: Evolution of Gravity Implied Trade Costs by Product III

Year	Transportation	Electrical	Minerals	Petroleum	Chemicals	Miscellaneous
1992	3.265	3.124	12.267	3.815	3.378	2.466
1993	2.773	2.909	11.938	4.443	3.494	2.550
1994	4.345	2.909	10.295	4.754	3.579	2.598
1995	4.124	2.933	12.633	6.384	3.286	3.102
1996	4.617	2.575	13.516	5.644	3.442	2.646
1997	4.931	2.475	13.533	4.613	3.343	2.883
1998	5.102	2.743	11.550	5.084	3.485	2.748
1999	3.274	2.724	13.619	4.766	3.933	2.713
2000	3.817	2.577	13.717	5.210	3.369	3.146
2001	3.435	2.312	16.928	5.459	4.112	2.850
2002	4.872	2.225	18.629	4.606	3.019	3.046
2003	3.526	2.453	21.890	4.342	2.976	3.026

Evolution of Inward Multilateral Resistances by Province

Table 12: Evolution of IMR by Province I

Year	AB	BC	MB	NB	NL	NS
1992	1.000	1.009	0.974	1.116	1.161	1.092
1993	1.000	0.993	0.959	1.137	1.179	1.076
1994	1.000	0.993	0.980	1.076	1.157	1.045
1995	1.000	1.012	0.983	1.171	1.203	1.079
1996	1.000	1.008	0.972	1.193	1.224	1.072
1997	1.000	0.991	0.962	1.148	1.204	1.059
1998	1.000	0.990	0.964	1.184	1.193	1.060
1999	1.000	0.998	0.966	1.077	1.155	1.026
2000	1.000	0.988	0.983	1.050	1.251	1.103
2001	1.000	0.972	0.975	1.222	1.224	1.079
2002	1.000	1.007	0.970	1.204	1.185	1.053
2003	1.000	0.988	0.970	1.185	1.203	1.068

Table 13: Evolution of IMR by Province II

Year	NT	ON	PE	QC	SK	YT
1992	1.209	0.898	0.978	0.866	1.056	1.223
1993	1.199	0.868	0.965	0.864	1.040	1.198
1994	1.213	0.868	0.992	0.865	1.032	1.205
1995	1.241	0.887	0.975	0.890	1.037	1.223
1996	1.241	0.866	0.969	0.885	1.036	1.211
1997	1.217	0.826	0.969	0.862	1.025	1.178
1998	1.206	0.829	0.929	0.850	1.030	1.179
1999	1.212	0.813	0.944	0.853	1.022	1.182
2000	1.237	0.890	0.977	0.907	1.029	1.170
2001	1.229	0.873	0.934	0.879	1.039	1.136
2002	1.222	0.832	0.935	0.870	1.039	1.178
2003	1.236	0.861	0.932	0.889	1.039	1.169

Evolution of Inward Multilateral Resistances by Product

Table 14: Evolution of IMR by Product I

Year	Agriculture	Mining	Food	Leather	Textile	Hosiery	Lumber
1992	1.101	1.596	0.845	0.798	0.719	0.833	0.848
1993	1.127	1.573	0.870	0.772	0.793	0.858	0.929
1994	1.201	1.134	0.882	0.780	0.805	0.821	0.909
1995	1.196	1.672	0.878	0.841	0.811	0.844	0.888
1996	1.210	1.682	0.859	0.803	0.797	0.804	0.920
1997	1.188	1.498	0.882	0.775	0.825	0.841	0.865
1998	0.997	2.049	0.884	0.806	0.694	0.815	0.907
1999	1.170	1.359	0.867	0.736	0.698	0.809	0.965
2000	1.128	1.587	0.893	0.736	0.754	0.863	0.927
2001	1.042	1.563	0.883	0.727	0.770	0.787	0.887
2002	1.171	1.539	0.887	0.781	0.719	0.813	0.824
2003	1.141	1.618	0.882	0.739	0.771	0.818	0.830

Table 15: Evolution of IMR by Product II

Year	Furniture	Paper	Printing	Pri_Metal	Fab_Metal	Machinery
1992	0.941	0.813	0.619	0.813	0.891	1.011
1993	0.888	0.814	0.638	0.784	0.861	1.006
1994	0.905	0.832	0.660	0.797	0.842	0.969
1995	0.865	0.845	0.690	0.838	0.846	0.930
1996	0.823	0.825	0.623	0.777	0.828	0.940
1997	0.765	0.821	0.695	0.783	0.828	0.906
1998	0.749	0.811	0.698	0.758	0.836	0.957
1999	0.783	0.833	0.701	0.769	0.804	0.963
2000	0.832	0.845	0.654	0.820	0.799	0.946
2001	0.793	0.810	0.614	0.798	0.843	0.966
2002	0.755	0.819	0.660	0.835	0.798	0.940
2003	0.784	0.829	0.697	0.785	0.812	0.935

Table 16: Evolution of IMR by Product III

Year	Transportation	Electrical	Minerals	Petroleum	Chemicals	Miscellaneous
1992	0.923	0.907	0.912	1.163	0.972	0.832
1993	0.811	0.893	0.931	1.141	1.016	0.866
1994	0.855	0.919	0.873	1.120	1.068	0.866
1995	0.836	0.928	0.849	1.134	1.064	0.907
1996	0.784	0.941	0.898	1.134	1.035	0.912
1997	0.701	0.899	0.857	1.112	1.055	0.930
1998	0.684	0.902	0.827	1.097	1.064	0.925
1999	0.695	0.926	0.822	1.082	1.092	0.897
2000	0.777	0.914	0.891	1.199	1.104	0.918
2001	0.788	0.924	0.884	1.059	1.088	0.933
2002	0.683	0.914	0.822	1.084	1.107	0.911
2003	0.707	0.890	0.840	1.062	1.103	0.952

Evolution of Outward Multilateral Resistances by Province

Table 17: Evolution of OMR by Province I

Year	AB	BC	MB	NB	NL	NS
1992	4.687	5.623	5.681	5.721	7.028	5.876
1993	4.799	5.372	5.834	5.538	7.018	5.905
1994	4.394	4.883	5.393	5.190	6.736	5.726
1995	4.233	5.009	5.527	5.245	6.774	5.761
1996	4.277	4.869	5.655	5.240	6.334	6.165
1997	4.591	5.250	5.857	5.511	6.469	6.404
1998	4.364	5.128	5.961	5.754	6.533	6.579
1999	4.515	4.902	5.877	5.733	6.883	6.794
2000	4.079	4.781	5.607	5.525	5.645	6.113
2001	4.499	4.949	5.926	5.310	5.994	6.104
2002	4.158	5.229	6.153	5.349	5.097	6.183
2003	3.909	4.919	5.824	4.862	4.956	5.664

Table 18: Evolution of OMR by Province II

Year	NT	ON	PE	QC	SK	YT
1992	5.524	4.252	6.858	5.144	5.654	6.281
1993	5.701	4.319	6.711	4.964	5.765	6.403
1994	6.011	4.140	5.954	4.657	5.078	6.126
1995	4.969	4.188	6.227	4.684	5.219	5.836
1996	4.985	4.407	6.502	4.842	5.151	6.425
1997	5.856	4.574	6.426	4.852	5.540	5.915
1998	4.477	4.714	6.618	5.008	5.556	5.491
1999	5.209	4.523	6.828	4.900	5.554	6.031
2000	4.061	4.244	6.519	4.587	5.207	5.169
2001	5.545	4.300	6.816	4.772	5.345	6.079
2002	5.400	4.782	6.520	5.064	5.256	5.604
2003	3.823	4.307	6.183	4.652	5.079	5.190

Evolution of Outward Multilateral Resistances by Product

Table 19: Evolution of OMR by Product I

Year	Agriculture	Mining	Food	Leather	Textile	Hosiery	Lumber
1992	5.482	3.440	9.222	7.819	9.319	7.054	8.344
1993	5.559	3.628	9.102	7.388	8.180	6.391	6.730
1994	4.538	3.167	7.889	7.204	7.876	6.596	6.147
1995	4.938	2.336	8.628	6.808	7.822	6.262	6.734
1996	4.629	2.812	8.987	7.221	7.361	7.050	5.818
1997	5.019	3.470	8.763	6.742	7.306	6.407	6.879
1998	5.666	2.352	8.610	7.150	8.111	6.592	6.409
1999	5.015	3.053	9.294	8.087	7.840	6.534	5.899
2000	4.957	2.865	8.818	7.928	8.570	4.909	5.768
2001	5.270	3.710	8.574	7.987	7.700	4.957	6.447
2002	5.384	2.558	8.537	6.879	9.213	7.568	7.480
2003	5.237	3.005	7.965	6.820	8.002	6.537	6.888

Table 20: Evolution of OMR by Product II

Year	Furniture	Paper	Printing	Pri_Metal	Fab_Metal	Machinery
1992	5.314	3.756	11.649	3.253	5.806	2.596
1993	5.300	3.746	11.525	3.467	5.926	2.542
1994	5.543	3.761	11.160	3.298	6.105	2.727
1995	6.485	3.743	10.777	2.947	5.647	2.737
1996	6.834	3.794	12.311	3.332	5.535	2.794
1997	7.624	3.805	10.238	3.393	5.690	2.862
1998	8.602	3.908	10.723	3.559	5.441	2.672
1999	7.396	3.701	10.338	3.357	5.543	2.605
2000	6.822	3.678	11.311	3.049	5.704	2.626
2001	6.499	3.849	12.532	3.079	5.205	2.649
2002	7.747	3.595	11.188	3.037	5.681	2.632
2003	6.620	3.406	8.686	3.193	5.194	2.453

Table 21: Evolution of OMR by Product III

Year	Transportation	Electrical	Minerals	Petroleum	Chemicals	Miscellaneous
1992	2.383	2.672	9.649	2.750	2.879	2.927
1993	2.804	2.697	9.729	2.925	2.726	2.744
1994	2.826	2.549	9.670	2.987	2.585	2.781
1995	2.913	2.554	10.746	3.146	2.610	2.727
1996	3.210	2.431	10.076	2.872	2.642	2.601
1997	3.814	2.486	10.334	2.991	2.586	2.533
1998	3.943	2.517	10.275	2.966	2.557	2.475
1999	3.661	2.462	10.340	2.954	2.530	2.548
2000	3.232	2.472	9.326	2.691	2.472	2.568
2001	3.026	2.358	9.038	3.021	2.516	2.425
2002	4.269	2.365	10.459	2.915	2.346	2.546
2003	3.643	2.313	9.817	2.598	2.285	2.238

Outward Multilateral Resistance Correlations by Product

Table 22: OMR Correlations by Product I

	(1) Agriculture	(2) Fuels	(3) Food	(4) Leather	(5) Textile	(6) Hosiery	(7) Lumber
OUT_SHARE	-0.087	-1.916	-0.102	-0.044	-0.077	-0.032	-0.006
	(0.015)**	(0.771)*	(0.010)**	(0.006)**	(0.016)**	(0.015)*	(0.006)
EXP_SHARE	0.133	8.833	0.124	0.052	0.091	0.080	0.042
	(0.019)**	(4.266)*	(0.011)**	(0.006)**	(0.015)**	(0.012)**	(0.015)**
CONST	0.000	0.004	0.000	0.000	0.000	0.000	0.000
	(0.000)**	(0.003)	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**
N	144	144	144	144	144	144	144
r2	0.461	0.163	0.642	0.545	0.638	0.371	0.334

Standard errors in parentheses

+ $p < 0.10$, * $p < .05$, ** $p < .01$

Table 23: OMR Correlations by Product II

	(1) Furniture	(2) Paper	(3) Printing	(4) Pri_Metal	(5) Fab_Metal	(6) Machinery
OUT_SHARE	-0.041	-0.003	-0.104	-0.009	-0.119	-0.180
	(0.006)**	(0.001)*	(0.014)**	(0.003)**	(0.025)**	(0.035)**
EXP_SHARE	0.084	0.011	0.114	0.015	0.140	0.171
	(0.007)**	(0.002)**	(0.015)**	(0.004)**	(0.028)**	(0.024)**
CONST	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)**	(0.000)**	(0.000)*	(0.000)**	(0.000)**	(0.000)**
N	144	144	144	144	144	144
r2	0.498	0.477	0.695	0.369	0.688	0.731

Standard errors in parentheses

+ $p < 0.10$, * $p < .05$, ** $p < .01$

Table 24: OMR Correlations by Product III

	(1) Transportation	(2) Electrical	(3) Minerals	(4) Coal	(5) Chemicals	(6) Miscellaneous
OUT_SHARE	-0.069	-0.192	-0.175	-0.031	-0.326	-0.096
	(0.018)**	(0.037)**	(0.019)**	(0.006)**	(0.054)**	(0.012)**
EXP_SHARE	0.101	0.228	0.181	0.051	0.370	0.110
	(0.025)**	(0.029)**	(0.018)**	(0.008)**	(0.052)**	(0.011)**
CONST	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**
N	144	144	144	144	144	144
r2	0.265	0.749	0.672	0.278	0.668	0.703

Standard errors in parentheses

+ $p < 0.10$, * $p < .05$, ** $p < .01$

Outward Multilateral Resistance Correlations by Province

Table 25: OMR Correlations by Province I

	(1) AB	(2) BC	(3) MB	(4) NB	(5) NL	(6) NS
OUT_SHARE	-0.042	-0.028	-0.111	-0.085	-0.093	-0.128
	(0.005)**	(0.004)**	(0.024)**	(0.020)**	(0.023)**	(0.027)**
EXP_SHARE	0.091	0.131	0.323	0.419	0.283	0.327
	(0.009)**	(0.013)**	(0.039)**	(0.076)**	(0.054)**	(0.042)**
CONST	0.000	0.000	0.000	-0.000	0.000	0.000
	(0.000)**	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
N	216	216	216	216	216	216
r2	0.377	0.308	0.339	0.210	0.232	0.320

Standard errors in parentheses

+ $p < 0.10$, * $p < .05$, ** $p < .01$

Table 26: OMR Correlations by Province II

	(1) NT	(2) ON	(3) PE	(4) QC	(5) SK	(6) YT
OUT_SHARE	-0.410	-0.051	-0.595	-0.030	-0.106	-5.950
	(0.910)	(0.007)**	(0.163)**	(0.010)**	(0.015)**	(1.092)**
EXP_SHARE	0.269	0.075	2.373	0.081	0.219	3.118
	(0.096)**	(0.010)**	(0.473)**	(0.019)**	(0.026)**	(0.396)**
CONST	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)**	(0.000)**	(0.000)	(0.000)	(0.000)	(0.000)**
N	216	216	216	216	216	216
r2	0.046	0.311	0.216	0.141	0.391	0.170

Standard errors in parentheses

+ $p < 0.10$, * $p < .05$, ** $p < .01$

Inward Multilateral Resistance Correlations by Product

Table 27: IMR Correlations by Product I

	(1) Agriculture	(2) Fuels	(3) Food	(4) Leather	(5) Textile	(6) Hosiery	(7) Lumber
OUT_SHARE	1069.71	41.47	448.77	1517.06	907.99	522.49	184.11
	(135.64)**	(1.58)**	(88.71)**	(198.87)**	(223.77)**	(64.18)**	(25.59)**
EXP_SHARE	-958.88	-7.60	-348.88	-1056.40	-389.11	-193.14	-185.00
	(131.23)**	(4.97)	(99.17)**	(171.78)**	(193.83)*	(31.47)**	(39.31)**
CONST	0.37	0.11	1.05	2.00	1.26	1.34	0.48
	(0.05)**	(0.02)**	(0.10)**	(0.13)**	(0.07)**	(0.05)**	(0.04)**
N	144	144	144	144	144	144	144
r2	0.41	0.56	0.30	0.57	0.73	0.84	0.73

Standard errors in parentheses

+ $p < 0.10$, * $p < .05$, ** $p < .01$

Table 28: IMR Correlations by Product II

	(1) Furniture	(2) Paper	(3) Printing	(4) Pri_Metal	(5) Fab_Metal	(6) Machinery
OUT_SHARE	296.63	535.37	2244.78	2424.38	763.48	253.34
	(50.50)**	(37.40)**	(307.75)**	(344.23)**	(105.56)**	(72.45)**
EXP_SHARE	-149.60	-544.70	-1460.49	-2230.83	-448.28	-53.33
	(40.63)**	(44.21)**	(232.36)**	(391.75)**	(92.83)**	(45.61)
CONST	0.94	1.20	1.92	1.89	1.25	0.84
	(0.05)**	(0.15)**	(0.27)**	(0.15)**	(0.09)**	(0.04)**
N	144	144	144	144	144	144
r2	0.68	0.67	0.71	0.78	0.75	0.54

Standard errors in parentheses

+ $p < 0.10$, * $p < .05$, ** $p < .01$

Table 29: IMR Correlations by Product III

	(1) Transportation	(2) Electrical	(3) Minerals	(4) Coal	(5) Chemicals	(6) Miscellaneous
OUT_SHARE	941.13	774.52	1227.76	70.50	292.28	1000.32
	(303.07)**	(112.35)**	(304.95)**	(12.54)**	(31.88)**	(312.36)**
EXP_SHARE	-634.44	-362.56	-850.13	-59.98	-203.68	-635.90
	(345.21)+	(85.08)**	(288.60)**	(10.68)**	(27.63)**	(231.47)**
CONST	2.46	1.05	0.68	0.42	0.32	1.60
	(0.37)**	(0.06)**	(0.05)**	(0.06)**	(0.02)**	(0.21)**
N	144	144	144	144	144	144
r2	0.65	0.75	0.78	0.12	0.61	0.57

Standard errors in parentheses

+ $p < 0.10$, * $p < .05$, ** $p < .01$

Inward Multilateral Resistance Correlations by Province

Table 30: IMR Correlations by Province I

	(1)	(2)	(3)	(4)	(5)	(6)
	AB	BC	MB	NB	NL	NS
OUT_SHARE	0.000	177.754	995.516	93.038	-306.235	529.126
	(0.000)	(23.067)**	(170.217)**	(55.915)+	(46.291)**	(132.905)**
EXP_SHARE	0.000	-184.233	-818.891	-310.747	429.685	-534.478
	(0.000)	(46.905)**	(185.950)**	(199.116)	(99.524)**	(182.999)**
CONST	1.000	1.554	1.486	1.419	0.520	1.449
	.	(0.151)**	(0.160)**	(0.111)**	(0.043)**	(0.131)**
N	216	216	216	216	216	216
r2	.	0.539	0.227	0.011	0.101	0.090

Standard errors in parentheses

+ $p < 0.10$, * $p < .05$, ** $p < .01$

Table 31: IMR Correlations by Province II

	(1)	(2)	(3)	(4)	(5)	(6)
	NT	ON	PE	QC	SK	YT
OUT_SHARE	-1099.612	648.137	1400.947	373.404	126.745	-5545.277
	(2014.960)	(144.069)**	(752.168)+	(94.152)**	(46.551)**	(5380.367)
EXP_SHARE	330.068	-354.607	3257.245	-379.961	-107.745	2186.170
	(430.448)	(111.586)**	(1848.520)+	(165.207)*	(42.403)*	(2258.841)
CONST	0.407	0.521	1.417	4.810	0.877	0.507
	(0.033)**	(0.810)	(0.171)**	(0.804)**	(0.041)**	(0.044)**
N	216	216	216	216	216	216
r2	0.005	0.395	0.042	0.097	0.079	0.006

Standard errors in parentheses

+ $p < 0.10$, * $p < .05$, ** $p < .01$

Table 32: IMR and OMR Correlations with Share-Weighted Trade Costs Indexes by Province

Province	IMR	OMR
Alberta		.3166702
British Columbia	-.2642099	.3609433
Manitoba	.0041226	.3211284
New Brunswick	-.0202212	.3184878
Newfoundland and Labrador	.091838	.1754505
Northwest Territories	.3093609	.330305
Nova Scotia	-.0611895	.3657702
Ontario	-.1883683	.4872436
Prince Edward Island	-.1957324	.1777058
Quebec	-.177604	.4324464
Saskatchewan	.1642961	.4066874
Yukon Territories	.2532978	.2516487

Table 33: IMR and OMR Correlations with Share-Weighted Trade Costs Indexes by Product

Product	IMR	OMR
Agriculture	-.5220182	.3302768
Chemical Products	-.4457099	-.2852142
Electrical Products	-.1608767	-.351073
Fabricated Metal Products	-.3820005	-.2905018
Food	.001749	.1374995
Fuels	-.4034334	.4845394
Furniture	-.2746574	.1571306
Hosiery and Clothing Products	-.0950439	-.1925139
Leather, Rubber, and Plastic Products	-.267798	-.115293
Lumber and Wood Products	-.2745203	.2008189
Machinery	-.3322208	-.3214472
Mineral Products	.1251366	.1091852
Miscellaneous Products	-.268569	-.2863306
Petroleum and Coal Products	.1213266	.2858645
Primary Metal Products	-.3297206	-.0040776
Printing and Publishing Products	-.2339618	.0347607
Textile Products	-.3460929	-.2391249
Transportation Products	-.408792	-.0226013
Wood Pulp and Paper Products	-.2250981	.0293366

Evolution of Domestic Trade Costs by Province

Table 34: Evolution of DTC by Province I

Year	AB	BC	MB	NB	NL	NS
1992	2.690	3.334	2.888	2.599	2.816	2.670
1993	2.806	3.448	2.967	2.721	3.019	2.765
1994	2.636	3.256	2.858	2.633	2.836	2.727
1995	2.592	3.179	2.898	2.632	3.048	2.720
1996	2.836	3.322	3.026	2.767	3.102	2.878
1997	2.784	3.239	2.980	2.814	3.186	2.896
1998	2.676	3.207	2.987	2.720	3.041	2.890
1999	2.757	3.216	2.960	2.805	2.982	2.858
2000	2.590	3.269	2.947	2.680	2.819	2.990
2001	2.795	3.316	3.086	2.803	2.999	3.051
2002	2.746	3.297	3.190	2.854	2.571	2.951
2003	2.824	3.156	2.985	2.676	2.666	2.822

Table 35: Evolution of DTC by Province II

Year	NT	ON	PE	QC	SK	YT
1992	2.372	2.408	2.706	2.453	2.992	2.658
1993	2.536	2.504	2.681	2.396	3.132	2.481
1994	2.335	2.511	2.584	2.357	3.034	2.563
1995	2.018	2.537	2.885	2.368	3.130	2.680
1996	2.226	2.661	2.848	2.435	3.288	2.422
1997	2.362	2.718	2.795	2.466	3.189	2.354
1998	1.846	2.796	2.904	2.476	2.986	2.071
1999	2.062	2.775	2.900	2.456	3.016	2.336
2000	1.678	2.940	2.872	2.477	2.857	2.170
2001	2.143	2.944	3.005	2.527	3.239	2.763
2002	2.158	3.123	3.262	2.646	2.988	2.581
2003	1.817	2.984	3.088	2.600	3.018	2.224

Evolution of Domestic Trade Costs by Product

Table 36: Evolution of DTC by Product I

Year	Agriculture	Mining	Food	Leather	Textile	Hosiery	Lumber
1992	3.570	2.754	3.930	2.869	2.764	2.409	4.026
1993	3.744	3.180	3.848	2.635	2.687	2.303	3.638
1994	3.684	2.786	3.601	2.673	2.567	2.148	3.495
1995	3.995	2.388	3.950	2.499	2.437	1.992	3.663
1996	3.869	3.174	4.119	2.829	2.301	2.196	3.502
1997	3.863	3.176	4.119	2.642	2.420	2.147	3.608
1998	3.797	2.638	3.996	2.804	2.393	2.187	3.893
1999	3.724	2.812	4.030	3.051	2.342	2.186	4.080
2000	3.630	2.472	4.231	3.033	2.863	1.811	4.374
2001	3.754	3.065	4.193	3.142	2.496	1.940	4.145
2002	4.058	2.661	4.357	2.772	2.975	3.021	4.334
2003	3.718	2.999	4.339	2.921	2.904	2.781	4.034

Table 37: Evolution of DTC by Product II

Year	Furniture	Paper	Printing	Pri_Metal	Fab_Metal	Machinery
1992	2.258	2.256	5.959	1.833	2.435	1.936
1993	2.274	2.296	5.942	1.962	2.558	1.914
1994	2.542	2.337	5.481	1.917	2.709	2.016
1995	2.687	2.301	4.801	1.839	2.431	1.903
1996	2.739	2.376	5.400	1.899	2.488	1.986
1997	2.833	2.281	4.463	1.985	2.551	1.944
1998	3.118	2.303	4.760	2.096	2.492	1.967
1999	2.828	2.258	4.800	2.020	2.438	1.949
2000	3.388	2.392	5.230	1.951	2.753	1.981
2001	2.958	2.393	5.555	1.923	2.753	2.001
2002	2.941	2.092	5.089	2.118	2.846	1.931
2003	3.462	2.138	4.457	2.149	2.896	1.915

Table 38: Evolution of DTC by Product III

Year	Transportation	Electrical	Minerals	Petroleum	Chemicals	Miscellaneous
1992	1.480	1.589	4.579	2.759	1.912	1.741
1993	1.695	1.570	4.806	2.905	1.913	1.708
1994	1.805	1.528	4.495	2.926	1.907	1.754
1995	1.883	1.530	4.957	3.146	1.830	1.768
1996	2.058	1.483	5.047	2.744	1.816	1.724
1997	2.234	1.524	5.157	2.653	1.868	1.760
1998	2.350	1.541	5.186	2.645	1.866	1.793
1999	2.306	1.561	5.097	2.810	1.890	1.753
2000	2.428	1.616	5.188	2.846	1.877	1.900
2001	2.382	1.588	4.891	2.876	1.844	1.780
2002	2.786	1.496	5.419	2.916	1.781	1.850
2003	2.486	1.552	5.302	2.558	1.801	1.693

Evolution of Constructed Home Bias by Province

Table 39: Evolution of CHB by Province I

Year	AB	BC	MB	NB	NL	NS
1992	0.687	0.442	0.380	0.464	0.383	0.403
1993	0.867	0.481	0.393	0.592	0.489	0.464
1994	0.652	0.519	0.375	0.514	0.386	0.390
1995	0.512	0.476	0.426	0.546	0.416	0.397
1996	0.539	0.448	0.412	0.572	0.496	0.395
1997	0.708	0.483	0.489	0.565	0.519	0.426
1998	0.552	0.502	0.516	0.569	0.458	0.423
1999	0.524	0.448	0.438	0.505	0.434	0.396
2000	0.483	0.494	0.462	0.524	0.436	0.422
2001	0.652	0.548	0.497	0.581	0.478	0.447
2002	0.486	0.501	0.474	0.522	0.351	0.397
2003	0.467	0.442	0.425	0.518	0.367	0.388

Table 40: Evolution of CHB by Province II

Year	NT	ON	PE	QC	SK	YT
1992	0.742	0.479	0.297	0.453	0.580	0.232
1993	1.023	0.518	0.316	0.473	0.683	0.258
1994	0.620	0.479	0.295	0.455	0.608	0.280
1995	0.301	0.501	0.352	0.480	0.607	0.254
1996	0.361	0.533	0.306	0.490	0.563	0.212
1997	0.615	0.593	0.373	0.526	0.733	0.267
1998	0.322	0.584	0.419	0.540	0.721	0.204
1999	0.386	0.536	0.347	0.483	0.620	0.190
2000	0.360	0.639	0.371	0.537	0.566	0.199
2001	0.595	0.634	0.362	0.540	0.702	0.246
2002	0.284	0.640	0.403	0.530	0.580	0.200
2003	0.390	0.596	0.349	0.514	0.479	0.196

Evolution of Constructed Home Bias by Product

Table 41: Evolution of CHB by Product I

Year	Agriculture	Mining	Food	Leather	Textile	Hosiery	Lumber
1992	0.663	1.004	0.349	0.318	0.163	0.207	0.269
1993	0.749	1.353	0.333	0.389	0.166	0.222	0.255
1994	0.689	0.972	0.294	0.325	0.169	0.222	0.292
1995	0.881	0.396	0.335	0.303	0.168	0.219	0.321
1996	0.765	0.442	0.318	0.241	0.183	0.218	0.307
1997	0.965	0.799	0.395	0.314	0.177	0.220	0.301
1998	1.165	0.390	0.405	0.317	0.191	0.218	0.374
1999	0.953	0.453	0.365	0.250	0.196	0.228	0.294
2000	0.925	0.341	0.425	0.288	0.167	0.261	0.409
2001	1.037	0.690	0.414	0.297	0.180	0.289	0.420
2002	0.952	0.367	0.492	0.238	0.164	0.207	0.589
2003	0.714	0.348	0.476	0.293	0.174	0.311	0.489

Table 42: Evolution of CHB by Product II

Year	Furniture	Paper	Printing	Pri_Metal	Fab_Metal	Machinery
1992	0.206	0.663	0.161	0.658	0.221	0.390
1993	0.220	0.742	0.156	0.677	0.302	0.399
1994	0.208	0.721	0.158	0.675	0.313	0.432
1995	0.188	0.786	0.153	0.604	0.291	0.470
1996	0.193	0.803	0.147	0.619	0.319	0.444
1997	0.198	0.680	0.158	0.786	0.387	0.452
1998	0.205	0.884	0.153	0.710	0.364	0.511
1999	0.207	0.788	0.156	0.646	0.281	0.502
2000	0.253	0.852	0.152	0.693	0.360	0.480
2001	0.225	0.791	0.151	0.617	0.344	0.524
2002	0.209	0.577	0.157	0.751	0.332	0.421
2003	0.236	0.533	0.186	0.609	0.310	0.791

Table 43: Evolution of CHB by Product III

Year	Transportation	Electrical	Minerals	Petroleum	Chemicals	Miscellaneous
1992	0.468	0.426	0.146	0.925	0.594	0.443
1993	0.500	0.429	0.139	1.260	0.571	0.444
1994	0.454	0.441	0.125	0.981	0.541	0.436
1995	0.489	0.436	0.178	0.866	0.535	0.419
1996	0.571	0.450	0.202	0.974	0.593	0.434
1997	0.650	0.463	0.192	1.040	0.590	0.435
1998	0.613	0.455	0.144	0.860	0.564	0.447
1999	0.570	0.451	0.130	0.852	0.485	0.451
2000	0.787	0.461	0.127	0.842	0.509	0.432
2001	0.759	0.472	0.201	0.840	0.627	0.451
2002	0.820	0.477	0.177	0.734	0.483	0.442
2003	0.657	0.691	0.213	0.754	0.489	0.555

Table 44: Volume Effects of CHB by Province

Province	%Δ CHB Effect
Alberta	0.66
British Columbia	0.29
Manitoba	0.51
New Brunswick	0.81
Newfoundland Labrador	0.81
Northwest Territories	0.86
Nova Scotia	0.58
Ontario	0.75
Prince Edward Island	0.67
Quebec	0.62
Saskatchewan	0.56
Yukon	-0.08

Panel Gravity Estimations and AIT Effects

Table 45: Panel Gravity with Directional Fixed Effects

	(1)	(2)	(3)	(4)
	Agriculture	Fuels	Food	Leather etc
ln_wdist_one	-2.222	-1.491	-1.698	-1.516
	(0.033)**	(0.149)**	(0.033)**	(0.032)**
contig_prov	-0.103	1.338	-0.803	-0.826
	(0.116)	(0.348)**	(0.101)**	(0.141)**
contig_prov_state	0.562	0.305	0.664	0.888
	(0.088)**	(0.356)	(0.088)**	(0.072)**
ca_usa	-11.114	-7.734	-8.537	-2.102
	(3.037)**	(4.861)	(0.481)**	(1.521)
ca_row	-0.903	-0.889	-2.250	-2.712
	(0.241)**	(0.825)	(0.280)**	(0.214)**
smctry	-0.003	0.974	-1.146	-0.561
	(0.196)	(0.505)+	(0.185)**	(0.269)*
ait	0.363	3.407	0.396	0.877
	(0.602)	(2.002)+	(0.714)	(0.544)
_cons	20.791	13.185	12.178	3.747
	(3.133)**	(4.627)**	(1.995)**	(2.306)
N	10930	3138	11899	12390
r2	0.752	0.722	0.741	0.752

Standard errors in parentheses

+ $p < 0.10$, * $p < .05$, ** $p < .01$

Table 46: Panel Gravity with Directional Fixed Effects

	(1)	(2)	(3)	(4)	(5)
	Textile	Hosiery	Lumber	Furniture	Paper Pulp
ln_wdist_one	-1.207	-1.016	-1.659	-1.277	-1.769
	(0.032)**	(0.038)**	(0.032)**	(0.031)**	(0.036)**
contig_prov	-0.566	-0.913	-1.018	-0.666	-1.298
	(0.125)**	(0.204)**	(0.110)**	(0.133)**	(0.126)**
contig_prov_state	1.038	1.109	0.764	0.842	0.377
	(0.084)**	(0.092)**	(0.086)**	(0.081)**	(0.096)**
ca_usa	-8.198	-9.369	-9.923	-11.316	-0.355
	(3.627)*	(3.124)**	(2.000)**	(2.256)**	(1.113)
ca_row	-4.171	-4.783	-3.189	-3.765	-1.635
	(0.255)**	(0.278)**	(0.256)**	(0.234)**	(0.213)**
smctry	-0.023	0.221	-0.791	-0.287	-1.121
	(0.243)	(0.285)	(0.216)**	(0.279)	(0.251)**
ait	0.330	0.083	-0.333	-0.630	1.184
	(0.602)	(0.659)	(0.619)	(0.603)	(0.685)+
_cons	8.258	10.408	16.651	15.905	9.862
	(3.056)**	(2.908)**	(1.763)**	(1.885)**	(1.938)**
N	10789	10240	11697	10363	11106
r2	0.750	0.746	0.775	0.789	0.729

Standard errors in parentheses

+ $p < 0.10$, * $p < .05$, ** $p < .01$

Table 47: Panel Gravity with Directional Fixed Effects

	(1)	(2)	(3)	(4)	(5)
	Printing	Primary Metal	Fabricated Metal	Machinery	Transportation
ln_wdist_one	-1.444	-1.580	-1.478	-1.250	-1.475
	(0.033)**	(0.034)**	(0.030)**	(0.029)**	(0.037)**
contig_prov	-0.895	-0.486	-0.798	-0.326	-0.629
	(0.147)**	(0.116)**	(0.133)**	(0.142)*	(0.134)**
contig_prov_state	0.803	0.838	0.909	0.766	0.962
	(0.082)**	(0.092)**	(0.074)**	(0.073)**	(0.094)**
ca_usa	-3.868	-2.782	-6.715	-4.711	-0.198
	(2.803)	(0.605)**	(2.302)**	(3.336)	(3.285)
ca_row	-4.758	-2.079	-3.366	-2.459	-3.357
	(0.243)**	(0.281)**	(0.288)**	(0.191)**	(0.273)**
smctry	1.174	-0.277	-0.174	0.951	-0.086
	(0.257)**	(0.257)	(0.250)	(0.295)**	(0.309)
ait	0.163	0.086	-0.575	-0.312	-1.665
	(0.630)	(0.708)	(0.654)	(0.486)	(0.638)**
_cons	4.771	5.163	13.506	7.746	5.872
	(1.799)**	(1.179)**	(1.804)**	(2.122)**	(3.377)+
N	10959	10942	12198	13043	12042
r2	0.792	0.740	0.762	0.783	0.731

Standard errors in parentheses

+ $p < 0.10$, * $p < .05$, ** $p < .01$

Table 48: Panel Gravity with Directional Fixed Effects

	(1)	(2)	(3)	(4)	(5)
	Electrical	Mineral	Petroleum Coal	Chemical	Miscellaneous
ln_wdist_one	-0.848	-1.576	-2.298	-1.505	-1.188
	(0.030)**	(0.031)**	(0.050)**	(0.037)**	(0.031)**
contig_prov	-0.225	-0.384	-0.352	-0.735	-1.035
	(0.137)	(0.125)**	(0.169)*	(0.143)**	(0.130)**
contig_prov_state	1.126	1.034	1.205	1.074	0.859
	(0.087)**	(0.080)**	(0.135)**	(0.090)**	(0.072)**
ca_usa	-1.078	-6.093	-6.859	-5.516	-4.890
	(2.917)	(1.584)**	(3.182)*	(1.191)**	(3.097)
ca_row	-3.252	-3.246	-1.311	-2.243	-3.970
	(0.195)**	(0.241)**	(0.483)**	(0.218)**	(0.228)**
smctry	1.478	0.474	-1.293	0.218	0.803
	(0.304)**	(0.221)*	(0.205)**	(0.315)	(0.294)**
ait	-0.522	0.228	1.804	0.641	-0.345
	(0.498)	(0.621)	(1.185)	(0.588)	(0.572)
_cons	0.239	9.562	17.344	3.335	6.842
	(2.289)	(1.501)**	(4.096)**	(1.917)+	(3.033)*
N	12909	10698	8485	11537	12002
r2	0.800	0.744	0.634	0.753	0.781

Standard errors in parentheses

+ $p < 0.10$, * $p < .05$, ** $p < .01$

AIT Effects by Province

Table 49: Welfare effects of AIT by Province: 5% Decrease in Trade Costs

Province	Consumers	Producers	Real GDP
Alberta	0	.0056557	.0056557
British Columbia	.0056513	.0057871	.0001358
Manitoba	-.0006938	.0173772	.0180711
New Brunswick	.0101609	.0237364	.0135755
Newfoundland and Labrador	.0097973	.0171951	.0073978
Nova Scotia	.0084759	.0274803	.0190044
Northwest Territories	.0129653	.012331	-.0006343
Ontario	-.0155844	.0239812	.0395656
Prince Edward Island	.0109322	.0309557	.0200236
Quebec	-.0067504	.0215225	.0282728
Saskatchewan	.0064498	.0117438	.0052941
Yukon Territories	.0125445	.0174748	.0049303

Table 50: Welfare effects of AIT by Province: 10% Decrease in Trade Costs

Province	Consumers	Producers	Real GDP
Alberta	0	.0128126	.0128126
British Columbia	.0067072	.0220631	.0153559
Manitoba	-.0024124	.0373733	.0397858
New Brunswick	.0204722	.0514981	.0310259
Newfoundland and Labrador	.0185082	.0374914	.0189833
Nova Scotia	.0181965	.0562699	.0380734
Northwest Territories	.0210053	.0309171	.0099119
Ontario	-.0344842	.0490577	.0835419
Prince Edward Island	.0236704	.0589473	.0352768
Quebec	-.0144822	.0405903	.0550725
Saskatchewan	.0111981	.0309609	.0197628
Yukon Territories	.0192888	.0236305	.0043417

Appendix C: Supplemental Tables

Table 51: Trading Partners and Abbreviations

Trading Partner	Abbreviation	Country
Alabama	AL	United States
Alaska	AK	United States
Alberta	AB	Canada
Arizona	AZ	United States
Arkansas	AR	United States
British Columbia	BC	Canada
California	CA	United States
Colorado	CO	United States
Connecticut	CT	United States
Delaware	DE	United States
District of Columbia	DC	United States
Florida	FL	United States
Georgia	GA	United States
Hawaii	HI	United States
Idaho	ID	United States
Illinois	IL	United States
Indiana	IN	United States
Iowa	IA	United States
Kansas	KS	United States
Kentucky	KY	United States
Louisiana	LA	United States
Maine	ME	United States
Manitoba	MB	Canada
Maryland	MD	United States
Massachusetts	MA	United States
Michigan	MI	United States
Minnesota	MN	United States
Mississippi	MS	United States
Missouri	MO	United States
Montana	MT	United States
Nebraska	NE	United States

Trading Partner	Abbreviation	Country
Nevada	NV	United States
New Brunswick	NB	Canada
New Hampshire	NH	United States
New Jersey	NJ	United States
New Mexico	NM	United States
New York	NY	United States
Newfoundland and Labrador	NL	Canada
North Carolina	NC	United States
North Dakota	ND	United States
Northwest Territories (including Nunavut)	NT	Canada
Nova Scotia	NS	Canada
Ohio	OH	United States
Oklahoma	OK	United States
Ontario	ON	Canada
Oregon	OR	United States
Pennsylvania	PA	United States
Prince Edward Island	PE	Canada
Quebec	QC	Canada
Rest of the World	ROW	Rest of the World
Rhode Island	RI	United States
Saskatchewan	SK	Canada
South Carolina	SC	United States
South Dakota	SD	United States
Tennessee	TN	United States
Texas	TX	United States
Utah	UT	United States
Vermont	VT	United States
Virginia	VA	United States
Washington	WA	United States
West Virginia	WV	United States
Wisconsin	WI	United States
Wyoming	WY	United States
Yukon Territories	YT	Canada

Table 52: List of Commodities

Product ID	Product Description
1	Agriculture: crop and animal production
2	Mining: mineral fuels (coal, natural gas, oil)
3	Food
4	Leather, rubber and plastic products
5	Textile products
6	Hosiery, clothing and accessories
7	Lumber and wood products
8	Furniture, mattresses and lamps
9	Wood pulp, paper and paper products
10	Printing and publishing
11	Primary metal products
12	Fabricated metal products
13	Machinery
14	Motorvehicles,othertransportationequipmentandparts
15	Electrical, electronic and communications products
16	Non-metallic mineral products
17	Petroleum and coal products
18	Chemicals, pharmaceutical and chemical products
19	Miscellaneous manufactured products

Table 53: Concordances used in the compilation of the data

S-ID	Product Description	NAICS Code	SIC Code	ISIC Code
1	Grains	1111	11	
2	Other agricultural products	111,112 (1111)	1,2 (11)	
3	Forestry products	113	8	
4	Fish, seafood and hunting and trapping products	114	912, 913	
5	Metal ores and concentrates	2122	10	
6	Mineral fuels	2,112,121	12,13	
7	Non-metallic minerals	2123	14	
9	Meat, fish and dairy products	311,531,163,117	201,202,919	311,131,123,114
10	Fruits,vegetablesandotherfoodproducts andfeeds	311 (3115,3116,3117)	20 (201,202,208)	311 **see below
11	Soft drinks and alcoholic beverages	3121	208	313
12	Tobacco and tobacco products	3122	21	314
13	Leather, rubber and plastic products	316,326	30,31	323,324,355,356
14	Textile products	313,314	22	321
15	Hosiery, clothing and accessories	315	23	322
16	Lumber and wood products	321	24	331
17	Furniture, mattresses and lamps	337	25	332
18	Wood pulp, paper and paper products	322	26	341
19	Printing and publishing	323	27	342
20	Primary metal products	331	33	371,372
21	Fabricated metal products	332	34	381
22	Machinery	333	35	382
23	Motorvehicles,othertransportationequipmentandparts	336	37	384
24	Electrical, electronic and communications products	334,335	36	383
25	Non-metallic mineral products	327	32	361,362,369
26	Petroleum and coal products	324	29	353,354
27	Chemicals, pharmaceutical and chemical products	325	28	351,352
28	Miscellaneous manufactured products	339	38,39	385,390

S-level codes are from Statistics Canada's Hierarchical Structure of the I-O Commodity Classification (Revised: January 3, 2007).

NAICS codes are from Industry Canada's Trade Online Data at $http : //strategis.ic.gc.ca/sc_m rkti/tdst/tdo/tdoSearch.php$.

SIC codes are from WITS interface. Hunting and trapping products do not appear in SIC.

ISIC codes are from UNIDO's industry database.

Industry codes reported in parenthesis are excluded.

**excluding 1511,1512,and 1520 for ISIC rev3 or 3111,3112, and 3114 for ISIC rev2

1 Appendix D: Proof of Proposition 1

Proof of Proposition 1 Assume a *uniform* international trade cost $t > 1$ on all trades across borders, while internal trade (from j to j) assumed to be frictionless, $t_{jj} = 1$. Take a representative good, so the subscript k is suppressed. It then eases notation slightly to move the location indexes from the superscript to the subscript position. Let s_j denote country j's share of world shipments (at delivered prices) of the generic good, while b_i denotes the expenditure share of country i on the generic good.

The system of equations that determine P_i, Π_i for all i, j is given by:

$$P_j^{1-\sigma} = t^{1-\sigma}\bar{h} + (1 - t^{1-\sigma})s_j/\Pi_j^{1-\sigma} \tag{1}$$

$$\Pi_i^{1-\sigma} = t^{1-\sigma}\bar{h}' + (1 - t^{1-\sigma})b_i/P_i^{1-\sigma}. \tag{2}$$

Here, $\bar{h} = \sum_i s_i \Pi_i^{\sigma-1}$ and $\bar{h}' = \sum_j P_j^{\sigma-1} b_j$. Recognizing that $\bar{h} = \sum_j (\beta_j \widetilde{p}_j)^{1-\sigma}$, its value is given by the general equilibrium solution. Multiply both sides of (1) by $\Pi_i^{1-\sigma}$ and multiply both sides of (2) by $P_i^{1-\sigma}$. Use the resulting equality to solve

$$\Pi_i^{1-\sigma} = P_i^{1-\sigma}\frac{\bar{h}'}{\bar{h}} + \frac{(1 - t^{1-\sigma})(b_i - s_i)}{\bar{h}t^{1-\sigma}}.$$

Then substitute into (1) and extract the positive root[1] of the resulting quadratic equation in the transform $P_i^{1-\sigma}$. Impose the normalization $\bar{h} = \bar{h}'$.[2] Then:

$$2P_i^{1-\sigma} = \gamma_i + [\gamma_i^2 + 4(1 - t^{1-\sigma})b_i]^{1/2} \tag{3}$$

where

$$\gamma_i = \bar{h}t^{1-\sigma} - \frac{(1 - t^{1-\sigma})(b_i - s_i)}{\bar{h}t^{1-\sigma}}.$$

At this solution

$$2\Pi_i^{1-\sigma} = \bar{h}t^{1-\sigma} + [\gamma_i^2 + 4(1 - t^{1-\sigma})b_i]^{1/2}.$$

Multilateral resistance (inward and outward) is unambiguously decreasing in supply share s_i at equilibrium and unambiguously increasing in expenditure share b_i in equilibrium. It is unambiguously increasing in the net import share $b_i - s_i$ for given expenditure shares.

The solution for $\bar{h} = \bar{h}'$ is implicit in the next expression, obtained from using the definition of $\bar{h}$ and the preceding solution for Π_i,

$$\bar{h} = 2\sum_i s_i[\bar{h}t^{1-\sigma} + (\gamma_i^2 + 4(1 - t^{1-\sigma})b_i)^{1/2}]^{-1},$$

where γ_i is given as a function of $\bar{h}$ above.

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[1] The positive root of the quadratic is necessary for P to be positive.

[2] Another normalization modifies the parameters of the solution slightly without changing the qualitative results.