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Recent vs Historical Migrants: A Study on the Canadian Provincial Trade-Migration Nexus

Abstract

We contribute to the literature by exploring the variation in the trade-creating effect of migration networks across historical migrants and recent migrants by applying a micro-founded gravity model of trade. Both the stock of historical migrants and recent migrants variables are constructed by merging Canadian Census data with the migration data available in Statistics Canada. We address the endogeneity issue by applying IV estimators including two-step feasible GMM and PPML with IV and fixed effects by utilizing the imputed annual migration flow, the historical stock, and recent stock of migrants as instrumental variables proposed by Peri and Requena (2010). Taking Canadian geographical features into account, this study also applies carefully measured gravity variables. We control for the time-varying, exporter-year fixed effects, and importer-year fixed effects in a panel estimation. Estimated results show that annual migration, recent provincial stock of migrants, and historical stock of migrants significantly increase Canadian interprovincial trade. This impact is stronger for the stock of historical migrants relative to the stock of recent migrants and annual migration flow. Sub-sample analysis shows that both recent and historical migration consistently increase interprovincial service trade, only but not interprovincial goods trade. A greater combination of English and French-speaking provinces-pair significantly increases interprovincial trade. Regional trade agreements significantly impact the interprovincial trade of Canada. Our estimated results are robust to different estimation methods and alternative measures for the migrants' stock and flow variables.

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1 Introduction

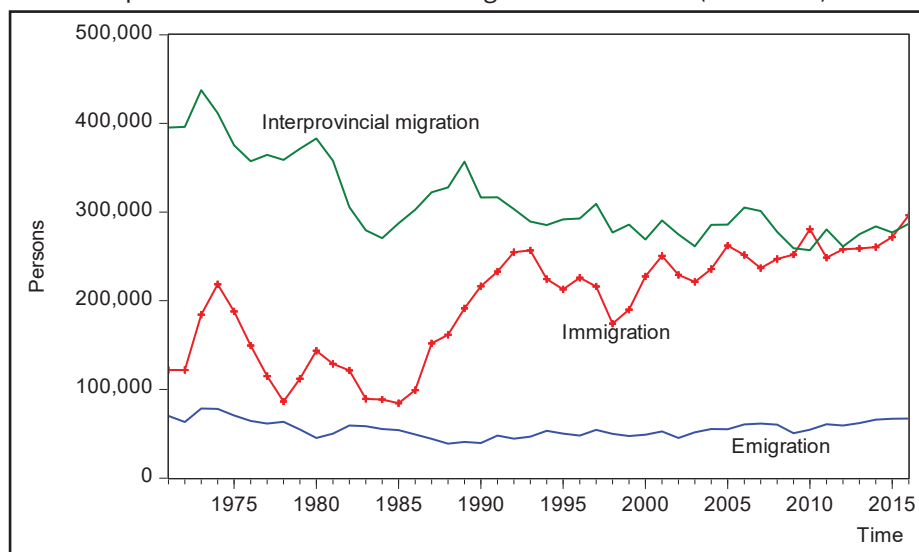
Theoretical and empirical works (Kemp, 1966; Markusen, 1983; Markusen & Svensson, 1985; Wong, 1986, 1988) show that commodity trade and factor trade (such as labour migration) form a complementary relationship under the H-O-S model. McCallum (1995) permits immigrants to have a preference for goods produced in their country of origin and identifies the “preference channel” or “home bias effect” linking trade to migration. The other channel that can influence trade is the “network effect”. This channel works mainly through the information network (Rauch & Trindade, 2002).

Since the 1960s, Canadian natural rate of population growth has been declining in almost all provinces. Since then, interprovincial migration and immigration are the most important components of population growth and labour supply in most of the provinces and territories of Canada (Dion & Coulombe, 2008; Bloom et al., 1995). Canadian interprovincial migration has been higher than net immigration (see Figure 1). Over the past 35 years (1971–2016), on average, approximately 294 thousand Canadians moved between provinces every year which is much greater than Canadian average annual immigration (212 thousand foreign immigrants) (see, Aziz et al., 2023; Aziz & Mahar, 2019). The number of interprovincial migrants in each province is much higher if we consider the stock of interprovincial migrants (see, APPENDIX B).

New migrants to a province bring knowledge of home-province markets, language, business contacts, and other information and skills to the destination and reduce trade costs between the source and the destination of migrants. A sizable migration, therefore, does not only creates new demand for goods and services but also contributes to the supply of goods and services, thereby, increases trade. Although there are studies that estimate the impact of immigration on the international trade in Canada (see, Head & Ries, 1998), studies on the impact of interprovincial migration on interprovincial trade in Canada are lacking.

Not only the size of the migrants’ population but also the time span that the migrants stay in a province, may influence the trade between the origin and destination provinces. Intuitively, the longer the migrants stay in a province the more they can contribute to interprovincial trade.

Figure 1 Interprovincial and International Migration of Canada (1971–2016)



Source: Authors’ calculations, based on data from Statistics Canada (CANSIM Tables 0510018 & 0510037).

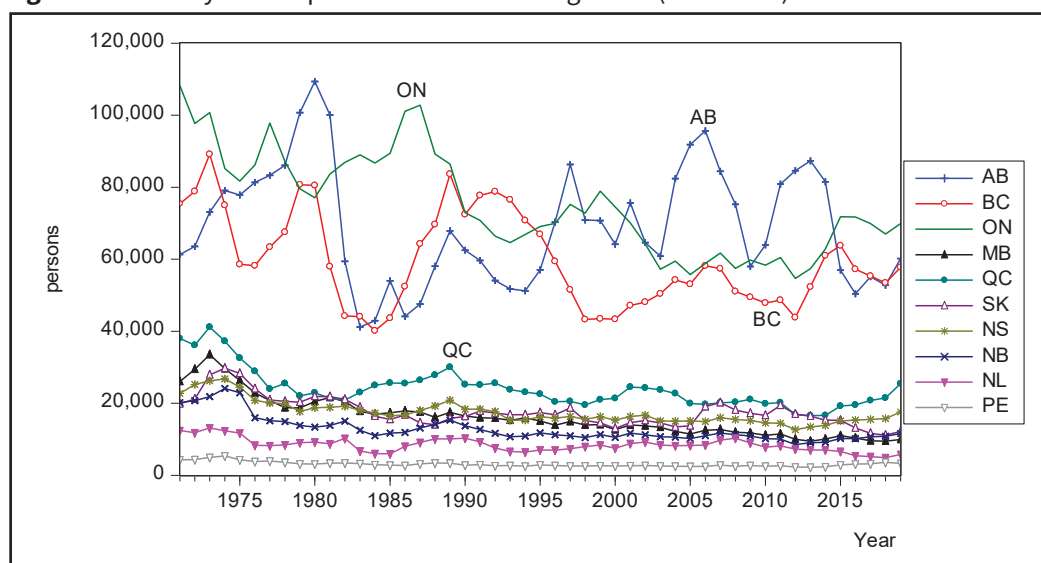
That is, historical migrants (longer-stay migrants) and recent migrants might affect interprovincial trade differently. Therefore, this study estimates the impact of historical stock, recent stock, and the annual flow of migrants¹ on interprovincial trade in Canada. We also examine if the contributions of historical migrants, recent migrants, and the annual flow of migrants are statistically different.

There is substantial literature that investigates the determinants of Canadian interprovincial migration (Day & Winer, 2006; Helliwell, 1996; Newbold, 1996; Day, 1992; Courchene, 1970). However, only limited studies estimated the impact of interprovincial migration on macroeconomic indicators (Sharpe & Ershov, 2007; Coulombe, 2006; Beine, Coulombe, & Vermeulen, 2015). While these papers analyze the impact of Canadian interprovincial migration on aggregate output, labour productivity, and macroeconomic adjustment process in Canada, there is hardly any study that analyzes the potential association between bilateral interprovincial migration and bilateral interprovincial trade flow exploiting bilateral panel structure at a sub-national level.

Interprovincial migration has played an increasingly important role in Canada's economy over the last few decades. Changing economic opportunities such as strong economic growth and increased employment always attracted a large proportion of migrants to flow between provinces. Canadian migration data (1971 - 2020) shows that interprovincial migration is significantly higher in the provinces of Ontario (75,242), Alberta (69,218), British Columbia (69,626), and Quebec (23,978) compared to the other provinces including Saskatchewan (17,633), Nova Scotia (17,462), Manitoba (16,105), New Brunswick (12,795), Newfoundland and Labrador (8,375), and Prince Edward Island (3,065) of Canada (see, Figure 2). This indicates that some provinces are preferable to migrants over others.

Interprovincial trade in Canada has grown over time. There has been a 4.2% growth (on average) in interprovincial trade in Canada between 1981 and 2014 (Statistics Canada, March 2016). Provincial import data between 1981 and 2016 indicates that Ontario (28%), Quebec

Figure 2 History of Interprovincial Inflow of migration (1971-2020)

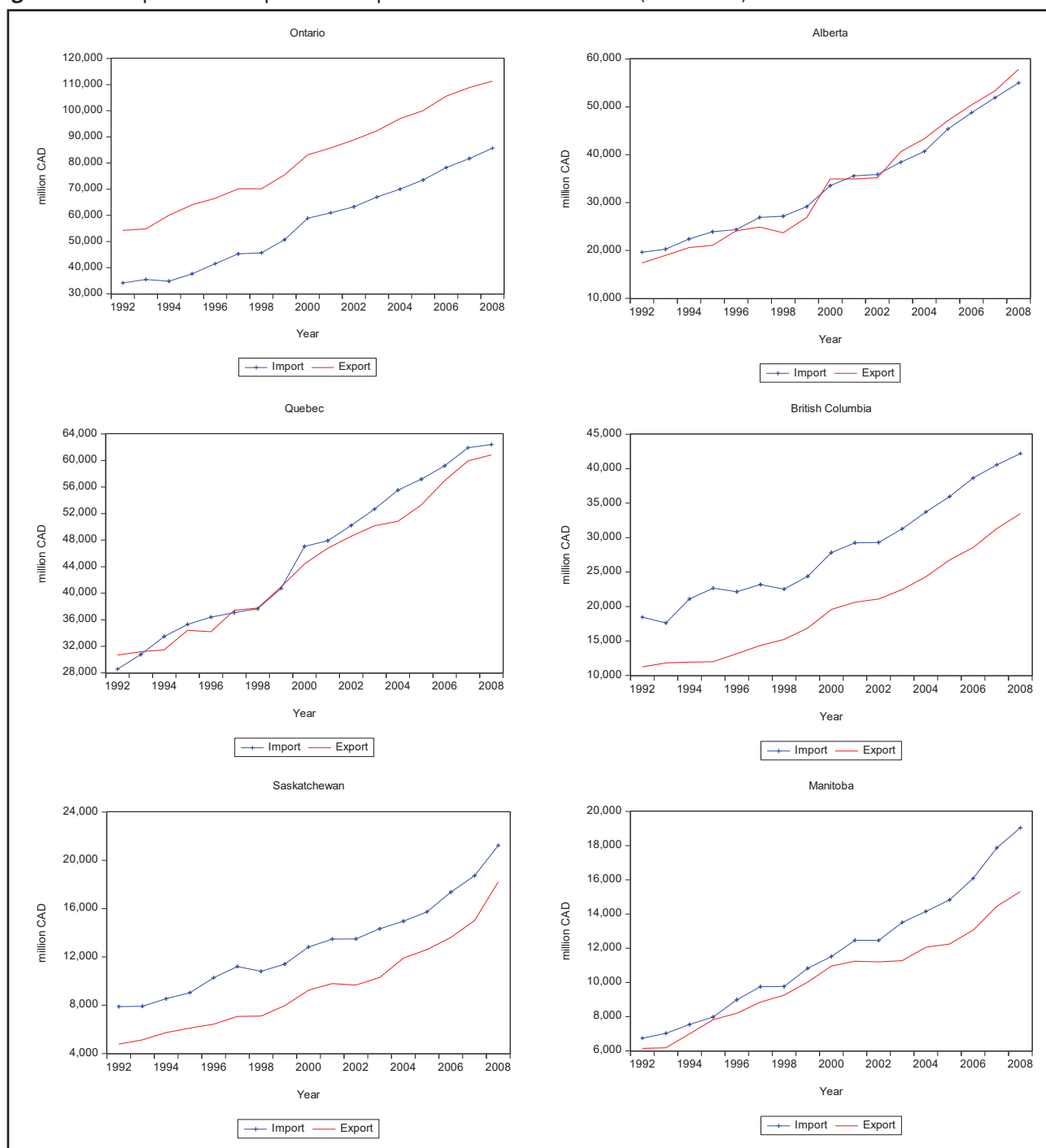


Source: Authors' calculation, based on data from Statistics Canada (CANSIM, Table 1710002101).

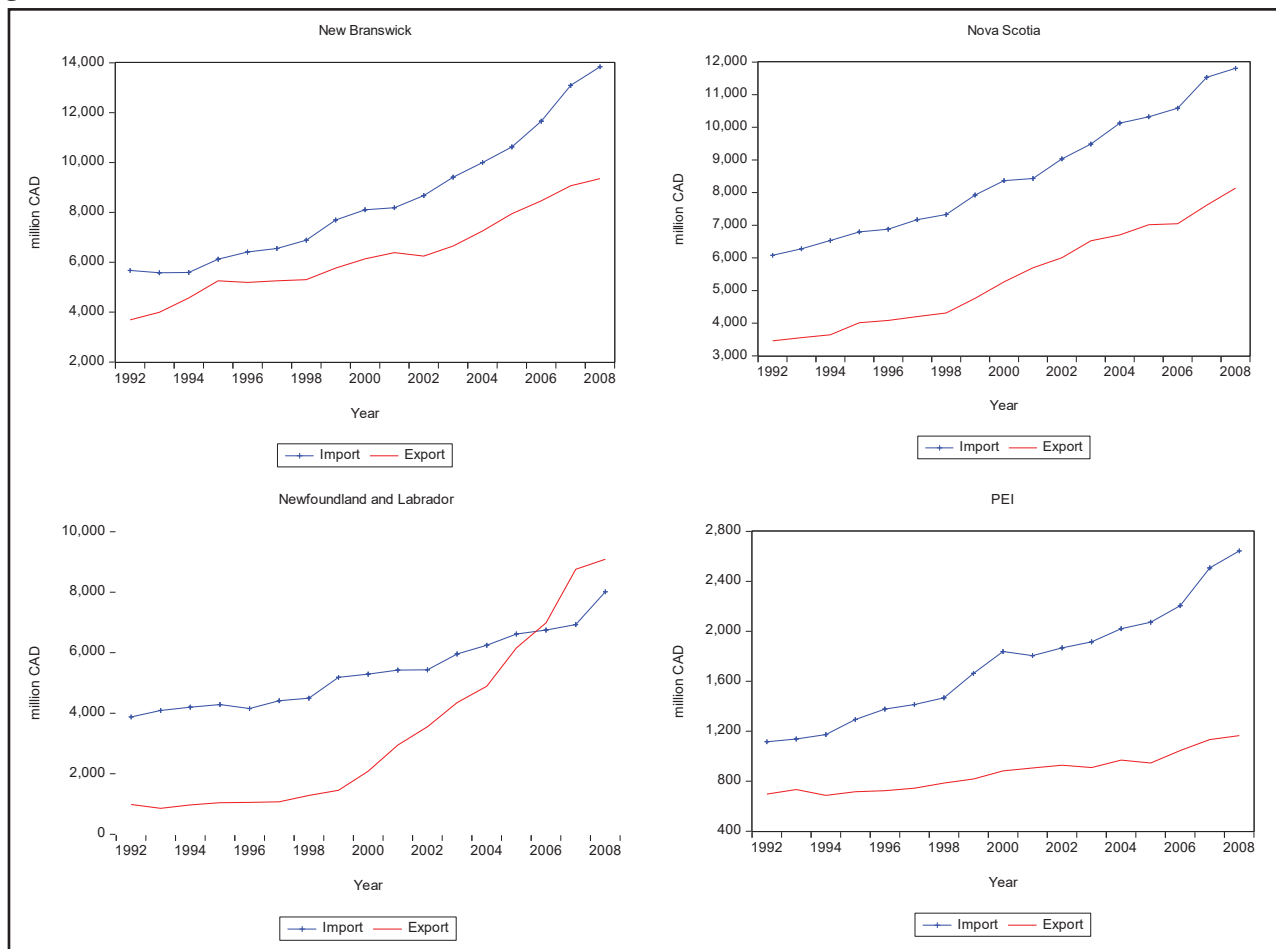
¹ See, Appendix A for the definitions of historical and recent migrants.

(20%), Alberta (16%), and British Columbia (13%) are the major trading provinces followed by Saskatchewan (6.5%), Manitoba (5.5%), Nova Scotia (4%), New Brunswick (4%) Newfoundland and Labrador (2.6%) and Prince Edward Island (less than 1%). Similarly, Canadian major exporting provinces for the same period are Ontario (37%), Quebec (20.5%), Alberta (17%), British Columbia (8.6%) followed by Saskatchewan (4.5%), Manitoba (4.5%), New Brunswick (3%), Nova Scotia (2%) Newfoundland and Labrador (2%) and Prince Edward Island (less than 0.5%). Canadian interprovincial trade pattern during our sample period (1992-2008) was also the same. Figure 3 shows interprovincial export and import of Canadian provinces.

Figure 3 Interprovincial Export and Import of Canadian Provinces (1992-2008)



(Continued)

Figure 3 Continued

Source: Authors' calculations, based on data from Statistics Canada (CANSIM Tables 1210008501 and 1210008601).

Figure 2 (see, the top interprovincial migrant recipient provinces) and Figure 3 (see, the vertical axis that shows the amount of trade in million Canadian dollars) indicate that Canadian major migration host provinces (e.g., Ontario, Alberta, British Columbia, and Quebec) contribute more to Canadian interprovincial trade. There appears to be a relationship between interprovincial migration and interprovincial trade. For further evidence and more insight, this paper empirically estimates the impact of interprovincial migration on interprovincial trade by using several panel estimation methods.

The trade openness data show that international trade openness in Canada is much higher (international trade and GDP ratio is 66 percent) than interprovincial trade openness (interprovincial trade and interprovincial GDP ratio is about 21 percent) (Aziz et al., 2023; Aziz & Mahar, 2019). In 2017, the Federal and Provincial governments of Canada signed the Canadian Free Trade Agreement (Tkachuk & Day, 2016) to overcome the main barriers to trade and labour migration and foster economic growth in Canada. The Standing Senate Committee of Banking, Trade, and Commerce (2016) predicts that the elimination of internal trade barriers would increase Canada's GDP ranging between 0.05% and 7.0% (Tkachuk and Day 2016). However, the size and the significance of the impact of interprovincial migration on interprovincial trade in Canada are yet to be investigated. This study intends to fill the gap in the literature. Evidence of a significant relationship between interprovincial migration and trade will warrant attention to the provincial and federal policymakers to revisit the existing migration and trade policy.

We estimate a gravity model using bilateral interprovincial exports as the dependent variable and provincial migration, geographical distance, language proximity, and trade openness as explanatory variables. In doing so we utilize a sizable body of empirical works, including Gould (1994), Head and Ries (1998), Girma and Yu (2002), Law et al. (2013), Herander and Saavedra (2005), Parsons (2005), White (2007b), White (2007a), White and Tadesse (2008a), White and Tadesse (2008b), and White (2009). It is worth mentioning here that before Anderson and Van Wincoop (2003), gravity model specifications have not controlled for multilateral resistance term. Unlike bilateral resistance, multilateral resistance accounts for trade frictions with all countries or regions, and this can affect bilateral trade volume. The most recent studies that estimate immigration effects on bilateral trade incorporating multilateral resistance terms are Egger et al. (2012), Felbermayr and Jung (2009), and Parsons (2012). Some studies estimate the immigration trade relationship of the host country's states/provinces with partner countries. Bardhan and Guhathakurta (2004), Co et al. (2004), Dunlevy (2006), and Bandyopadhyay et al. (2008) investigate the relationship between the US regions (states) and foreign countries. Combes et al. (2005) and Briant et al. (2009) look at France's region-level trade and immigration relationship. Peri and Requena-Silvente (2010) have done the same empirical test for the Spanish provinces. Helliwell (1997), Wagner et al. (2002), and Partridge and Furtan (2008) study Canadian province-level trade flows. While the latter two estimate the effect of immigration from various source countries on Canadian imports and exports by province, Helliwell (1997) estimates the extent to which patterns of Canadian province - province and Canadian province - US state migration are responsible for differences in the intensity of trade linkages using only the cross-sectional variation.

Unlike any of the above-mentioned studies, we construct and apply the bilateral historical stock and recent stock of migrants' variables in this study. We also construct the great circle distance and the population-weighted distance variables for Canadian provinces and apply these variables as the interprovincial proximity measures. Recognizing the fact that the causal effect of migration might not be straightforward as there might be a reverse causality and endogeneity problem in the empirical model, we closely follow the method proposed by Peri and Requena (2010) and construct and apply imputed stock of historical migrants, recent migrants, and annual migration flows instrumental variables (IV). The panel structure of our data set strengthens identification by controlling for time-varying origin and destination fixed effects. We employ PPML with IV and fixed effects as our preferred estimator. However, for robustness, we also estimate empirical models using two-step feasible Generalized Method of Moments (GMM) with fixed effects, Feasible Generalized Least Square (FGLS) with fixed effects, and Ordinary Least Square (OLS) with fixed effects estimators.

Estimated results show that interprovincial annual flow, recent stock, and historical stock of migrants significantly increase interprovincial trade in Canada. The historical stock of interprovincial migrants is more influential in increasing interprovincial trade than the recent stock and annual flow of migrants². Similar to other studies on the migration-trade nexus, we find that distance significantly reduces interprovincial trade. A greater combination of English and French-speaking provinces-pair significantly increases interprovincial trade. Regional trade agreements significantly impact the interprovincial trade of Canada. Our estimated results are

² Note: Both recent stock of migrants and annual migrants flow represent our "recent migrants" concept.

robust to different estimation methods and alternative measures for the migrants' stock and flow variables.

The rest of the sections are organized as follows. Section 2 discusses the theoretical background and empirical specification, section 3 explains the data, variables, and methods of analysis, section 4 reports and discusses the empirical results, and finally section 5 concludes the study.

2 Theoretical Background and Empirical Specification

With many trading partners and bilateral trade costs, "classical" trade theories (Ricardo, Heckscher-Ohlin) fell short in providing a generalized setup for empirical work. The majority of the literature that investigates the causal relationship running from migration networks to trade flows has instead utilized the so-called gravity framework (due to its similarity with Newton's law of gravitation) and enjoyed enormous empirical success. Over the years, the gravity equation has emerged from mostly a statistical relationship to a theoretically founded empirical tool. This section discusses the theoretical derivation of the gravity equation for trade and then introduces migration networks in the model for empirical estimation.

2.1 The Framework of the Gravity Equation

Tinbergen (1962) was the first to apply the gravity equation in explaining trade flows. In the context of this paper, the simplest form of the gravity equation states that trade (export) of province i to province j , T_{ij} , is proportional to the product of the origin province's GDP, Y_i and the destination province's GDP, Y_j and inversely proportional to the distance between the two provinces, $Dist_{ij}$:

$$T_{ij} = \Phi \left(\frac{Y_i Y_j}{Dist_{ij}} \right) \quad (1)$$

Higher (Y_i) implies a higher export capacity of the origin province and (Y_j) suggests larger export markets for the destination province's products. The $Dist_{ij}$ variable is the proxy for transportation cost and Φ is the constant of proportionality.

However, the gravity equation explained above was lacking microfoundation until Anderson and Van Wincoop (2003) noted that trade barriers between two regions must be seen relative to the barriers each of these two regions face with all their trading partners (including domestic or internal trade). The innovation of their approach is to include 'multilateral trade resistance' (MTR) in the structural gravity framework instead of the 'bilateral trade resistance' (BTR) that we see in the traditional gravity model (1). After Anderson and Van Wincoop (2003), more structural demand-sided models such as Melitz (2003) or symmetric Dixit-Stiglitz-Krugman monopolistic competition model have been proposed. In our framework, we follow the gravity approach of Combes et al. (2005) and Felbermayr and Toubal (2012), introduce monopolistic competition in the model, and focus on ethnic networks as one of the determinants of trade.

By applying a comprehensive set of exporter and importer fixed effects to capture unobservable origin and destination effects (Combes et al., 2005; Feenstra, 2004; Redding & Venables, 2004) and taking log the fixed effect gravity model can be written as follows:

$$\ln T_{ij} = \beta \ln d_{ij} + \ln \gamma_i + \ln \delta_j + \varepsilon_{ij} \quad (2)$$

Since d_{ij} are observed and $\ln \gamma_i$ and $\ln \delta_j$ can be estimated by including dummy variables for each origin province and each destination province, β can be estimated consistently by applying the fixed effects estimator to equation (2). The exporter and importer fixed effects, γ_i and δ_j , can be consistently estimated from the coefficients on the dummy variables.

2.2 Trade Costs & Migration

Estimation of (2) requires assumptions about the functional form of ad valorem trade cost d_{ij} . The gravity literature discusses the different ways to measure the dyadic term, d_{ij} . Following recent literature like Felbermayr and Jung (2009), Felbermayr and Toubal (2012) in our model, d_{ij} collects indicators of cultural and geographical proximity such as geographical distance, presence of common border, and common language between trade partners along with a bilateral trade policy indicator in the form of the regional trade agreement (RTA). To capture the trade cost-reducing effect of migration network, we follow Combes et al. (2005), Felbermayr and Jung (2009), and Giovannetti and Lanati (2017) and assume that trade costs are also correlated with the migrant networks between provinces i and j . In particular, we write information costs related to transactions between provinces i and j as I . Literature relating to trade and migration has in most cases proxy this information channel with the flow of migrants from region j to region i , M_{ji} . We follow the same notion and write I as a function of M_{ji} , at least in the benchmark model. It is reasonable to assume that I decreases with the flow of migrants M_{ji} . In a more general trade model, I should also depend on the flow of migrants from region i to j , M_{ij} . However, as M_{ij} might bring additional identification issues between the preference channel and information channel, we opted to only consider the information channel through which migrants at destination provinces (M_{ji}) bring their source province information to potentially influence the destination province's export back to their source province. We assume that different types of trade costs all take the iceberg form and enter multiplicatively into the bilateral component of ad valorem trade costs d_{ij} :

$$d_{ij} = \left[I(M_{ji}) \text{distance}_{ij} \exp^{(\text{contiguity}_{ij} \text{ common language}_{ij} \text{ RTA}_{ij})} \right]$$

Since the data structure is a panel in nature, we allow the two region dummies to vary over time and denote them as (γ_{it}) and (δ_{jt}) or exporter-year fixed effect and importer-year fixed effect. The baseline specification we estimate is then the following two-way fixed effect log-linearized equation:

$$\ln T_{ijt} = \alpha \ln M_{jit} + \zeta \ln \text{Dist}_{ij} + \theta \text{Lang}_{ij} + \lambda \text{RTA}_{ijt} + \gamma_{it} + \delta_{jt} + \varepsilon_{ijt} \quad (3)$$

We add an error term ε_{ijt} that controls for all unobservable time-varying dyadic terms uncorrelated with the explanatory variables. It is worth mentioning here that we use provincial

data in this study. Contiguity is not a similar phenomenon as it is in the case of bilateral international migration and trade. We do not have the contiguity as a control variable. However, the Population-Weighted Distance variable that we used in this study, captures the proximity between provinces both in terms of geographical coordinates and the economic size of provinces. The issue of contiguity has been well-addressed using the population-weighted distance. Section 3 explains it in detail.

3 Data, Variables, and Methods of Analysis

Bilateral interprovincial trade and migration data are collected from Statistics Canada. We use Canadian interprovincial trade data based on the Standard Industrial Classification (SIC) code for 10 provinces from 1992-2008. Available interprovincial trade data after 2008 uses the North American Industry Classification System (NAICS) code. It is worth mentioning here that there is a significant difference between SIC and NAICS codes. The SIC codes-based data points (number of observations) are greater than the NAICS codes-based data points. Besides, previous studies estimate Canadian trade models using SIC data. Hence, we use SIC code-based data to estimate the interprovincial trade model of Canada which gives us a larger number of observations and a comparison standard. It is worth noting that in turn, bilateral exports of a province are imports for its trade partner. Therefore, our dependent variable, exports represent the interprovincial trade of Canada. We also estimate Canadian interprovincial trade models separately for goods and services in addition to the total trade of goods and services. On average, Canadian interprovincial service trade has been greater than goods trade during our sample period (see, Statistics Canada. Table 12-10-0086-01).

We use three different measures of interprovincial migrants in this study- the flow of annual migrants, historical stock of migrants, and recent stock of migrants. Our annual migration flow variable includes annual bilateral migration between provinces from 1992-2008. We collect annual bilateral provincial migration series from Statistics Canada.

“Historical migrants’ stock” is a bilateral stock of migrants that are living in a particular province from another trading partner province. Historically these migrants have been living in the considered province from its partner province. These migrants were born in the partner province and migrated to the considered province. The base year data for “historical stock” came from the Canadian census 1981 (Source: Statistics Canada, Census of Population (1981) and Statistics Canada (2017)). The historical stock of migrants for 1981 includes the stock of migrated people that came to one province from another province starting from 1871 onward. We collected data from Census 1981 and then we added annual bilateral in-migration data every year. We checked the constructed annual series with the census data that is published once every five years. Our estimated historical stock of migrants series (1992-2008) matches with the census data for the stock of historical migrants.

“Recent migrants’ stock” includes the stock of migrants in a province from another province from 1975 onward (the base year data came from the census of 1981 and then annual bilateral migrants’ data was added to the base every year from 1982-2008). By this method, we construct bilateral recent migration series (1992-2008) for each province pair. Therefore, recent migrants’ stock does not include bilateral migrants’ stock before 1975. We find a match of the constructed annual series with the census data that is published once every five years.

Geographical and language proximity and status of trade liberalization are used to capture the impact of gravity on interprovincial trade. It is worth mentioning that the great circle distance (geographic distance) variable carefully measures the bilateral distance of provinces using latitude, longitude, and elevation (Piperakis, Milner, & Wright, 2003; Bacchetta et al., 2012). However, it has been observed during the study that some provinces in Canada are much closer to others in terms of population distribution if we compare it with the traditionally measured distance between provincial capitals. Population weighted distance variable (Helliwell & Verdier 2001; Head and Mayer, 2002; Steingress 2018) captures the proximity between provinces both in terms of geographical coordinates and the economic size of provinces. Therefore, the issue of contiguity has been addressed using the great circle distance and the population-weighted distance. The trade liberalization dummy variables include Canadian interprovincial regional trade agreements (RTA) that have been signed between Canadian provinces since the early 1990s; the Trade, Investment and Labour Mobility Agreement (TILMA) in 2007 between British Columbia and Alberta; the Atlantic Procurement Agreement (APA) in 1996 between New Brunswick, Newfoundland and Labrador, Nova Scotia, and Prince Edward Island; and the Agreement on the Opening of Public Procurement (OPP) in 1993 between New Brunswick and Quebec. Information for the dummy variables for regional trade agreements came from Beauleu and Zaman (2019). We use one continuous and three discrete variables to examine the impact of language on bilateral trade. The official language variable is constructed by taking the difference between the percentage of the French-speaking population in a bilateral set-up of provinces. The larger the difference means the bigger the combination of English and French speakers. A description of all variables and data sources is given in Appendix A.

Our empirical model is a log-linearized gravity model (equation 3). We apply pooled OLS with Fixed Effects, Feasible Generalized Least Square (FGLS) with Fixed Effects, Two-Step Feasible Generalized Method of Moments with fixed effects, and Poisson Pseudo Maximum Likelihood (PPML) with Instrumental Variable (IV) and fixed effects regressions. We address any possible heteroscedasticity problem using the FGLS estimator. Our applied fixed effects in all models address any province-pair-specific heterogeneity. The endogeneity issue is addressed by using IV models. Two-step feasible GMM allows for efficient estimation in the presence of heteroskedasticity of unknown form. In addition, the PPML estimator addresses the problem of heteroscedasticity, and it remains consistent with and without any zero-trade value in a trade model.

As the IVs, we construct the imputed migration flow (for the in-migration and the sum of reciprocal migration flows), imputed historical stock, and recent stock of migrants by closely following the method proposed by Peri and Requena (2010). Using the distribution of interprovincial migrants by destination and origin provinces in 1992 (the initial year of our data set), we attribute to each province pair the net growth of interprovincial migrants in Canada. That is, in each case, we allocate the total number of migrants to each province, for each year, proportional to the initial distribution of migrants across provinces in 1992. If migrants tend to settle in provinces following the footstep of the existing cohort of migrants, the imputed series provides a supply-driven variation in the inflow of migrants and will follow the actual one (see, e.g., Card, 2001, 2007; Ottaviano & Peri 2006; Peri & Requena 2010) that can be used as an instrument. These newly constructed instruments are not affected by any province-specific demand shock as they are based on the initial distribution of migrants from the year 1992.

Therefore, they should be effective in dealing with issues of reverse causality. For more details about the instrument construction please see Peri and Requena (2010).

Kleibergen–Paap (2006) F-statistic confirms the validity of the applied instrumental variables. The F-statistic checks the weakness of the instruments. We compare these F-statistics with the Stock–Yogo critical values for the Cragg–Donald (1993) F-statistic with one and two endogenous regressors (Stock & Yogo, 2005). We also check if there is any identification problem using the Hansen J statistic (overidentification test) (Sargan, 1958). Estimated results are presented and discussed in the following section.

4 Estimated Results

Applying the Variance Inflation Factors (VIF) and Tolerance tests we investigate if there is any potential multicollinearity problem in our empirical model. The rule of thumb is that a larger VIF than 10, or a less than 0.1 tolerance level, indicates a serious multicollinearity problem. The test results indicate that there is no evidence of a multicollinearity problem (APPENDIX C).

Since we cannot ignore the issue of endogeneity in a trade-migration model, IV regressions are our preferred estimations. We apply the two-step feasible generalized method of moments (including external IVs) with fixed effects estimators in this study that addresses the endogeneity issue. As the standard errors are inconsistent in the presence of heteroskedasticity that prevents valid inference in the standard IV estimates, we apply a two-step feasible Generalized Method of Moments (GMM) estimator (including external IVs) with fixed effects (FE). It is worth noting that two-step feasible GMM does not only address the endogeneity issue but also allows efficient estimates in the presence of heteroskedasticity of unknown form. PPML with IV and FE addresses the issues with endogeneity, heteroscedasticity, and zero values in bilateral exports series. Consequently, PPML with IV and fixed effects is our preferred estimator (see, Tables 4A–5C). However, in addition to PPML results, we report the OLS with fixed effects, the feasible GLS with fixed effects, the two-step feasible generalized method of moments with IV and fixed effects results in the study (see, Tables 1, 2, 3A, 3B, and 3C in Appendices).

We report regression results using simple distance, great circle distance, and population weighted distance (Tables 3A, 3B, 3C in the appendices and Tables 4A, 4B, and 4C in the main text) that were used as proxies for the distance (or geographic proximity) variable. It is important to note here that as we use provincial data, we do not have borders as a control variable. Subsequently, we prefer the models that include the population weighted distance (over simple distance and great circle distance) as the proxy for geographic proximity. The superiority of the population-weighted distance is that this variable captures the proximity between provinces both in terms of geographical coordinates and the economic size of provinces.

We find that historical stock, recent stock, and the bilateral annual flow of migrants significantly increase Canadian interprovincial trade. The coefficient of historical stock is the highest followed by recent stock and the annual flow of migrants, indicating that as time passes existing migrants contribute more and more to interprovincial trade (Table 4A, and Table 3A). Fisher's permutation test of differences in coefficient estimates confirms that the difference between historical migration and recent migration coefficients are statistically significant (Tables 4A(i), and 5A(i), and also Table 3A(i) in the appendices). PPML with IV and

Table 4A Estimated Results using PPML with IV and FE (GOODS & SERVICES)

Variable	Simple Distance			Great Circle Distance			Population Weighted Distance		
Dependent: Interprovincial Exports (G&S)									
Ln Mji	0.238*** (0.067)			0.165* (0.086)			0.173* (0.100)		
Ln Mji(hs)		0.326*** (0.087)			0.257** (0.114)			0.306** (0.132)	
Ln Mji(rs)			0.299*** (0.083)			0.224** (0.108)			0.252** (0.125)
Ln DISTij	-0.557*** (0.088)	-0.475*** (0.104)	-0.511*** (0.098)	-0.564*** (0.097)	-0.482*** (0.120)	-0.519*** (0.111)	-0.484*** (0.098)	-0.375** (0.121)	-0.427*** (0.112)
LANGij	0.641 (0.397)	0.815* (0.429)	0.690* (0.401)	1.273*** (0.448)	1.332*** (0.461)	1.268*** (0.445)	0.769* (0.450)	0.951** (0.475)	0.822* (0.448)
RTaij	0.681*** (0.157)	0.680*** (0.159)	0.654*** (0.155)	0.874*** (0.190)	0.856*** (0.189)	0.845*** (0.187)	0.878*** (0.187)	0.864*** (0.185)	0.850*** (0.183)
CONSTANT	10.68*** (1.224)	8.098*** (1.837)	8.795*** (1.719)	11.07*** (1.436)	8.749*** (2.248)	9.489*** (2.078)	10.55*** (1.601)	7.472** (2.513)	8.585*** (2.329)
OBSERVATIONS	1224	1224	1224	1224	1224	1224	1224	1224	1224
WALD χ^2	506.49***	432.30***	471.05***	467.46***	476.18***	429.96***	468.45***	457.36***	451.30***
PSEUDO R2	0.980	0.980	0.980	0.980	0.980	0.979	0.979	0.979	0.978
Exporter_Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Importer_Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Robust Standard errors (adjusted for clusters in provincial pair) in parentheses. M_{ji} is annual in-migration from province j (origin) to province i (destination). M_{ij} is out-migration from province i to province j . M_{ji}/hs is the stock of historical in-migration from province j to province i . M_{ji}/rs is the stock of recent migration from province j to province i . The stock of recent migration includes people who migrated between 1975-2008 from a partner province while the stock of historical migration includes people that came and live in a particular province any time after 1871 from a partner province.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 4B Estimated Results using PPML with IV and FE (GOODS)

Variable	Simple Distance			Great Circle Distance			Population Weighted Distance		
Dependent: Interprovincial Exports (G&S)									
Ln Mji	0.184** (0.076)			0.0894 (0.104)			0.0736 (0.126)		
Ln Mji(hs)		0.254** (0.101)			0.149 (0.139)			0.170 (0.167)	
Ln Mji(rs)			0.237** (0.094)			0.137 (0.129)			0.143 (0.155)
Ln DISTij	-0.683*** (0.111)	-0.620*** (0.131)	-0.642*** (0.122)	-0.698*** (0.131)	-0.646*** (0.159)	-0.659*** (0.147)	-0.624*** (0.135)	-0.543*** (0.165)	-0.569*** (0.151)
LANGij	0.702 (0.503)	0.830 (0.534)	0.739 (0.510)	1.530*** (0.532)	1.555*** (0.544)	1.519*** (0.537)	0.864* (0.524)	0.974* (0.541)	0.908* (0.524)
RTAij	0.807*** (0.188)	0.804*** (0.189)	0.784*** (0.188)	1.066*** (0.215)	1.052*** (0.218)	1.046*** (0.217)	1.052*** (0.209)	1.044*** (0.211)	1.036*** (0.211)
CONSTANT	11.49*** (1.470)	9.477*** (2.193)	9.918*** (2.011)	12.02*** (1.813)	10.59*** (2.802)	10.87*** (2.558)	11.80*** (2.078)	9.746*** (3.243)	10.31*** (2.950)
OBSERVATIONS	1104	1104	1104	1104	1104	1104	1104	1104	1104
WALD χ^2	326.60***	355.19***	358.99***	297.70***	330.14***	322.11***	284.70***	321.19***	307.52***
PSEUDO R2	0.972	0.973	0.973	0.971	0.971	0.971	0.970	0.969	0.969
Exporter_Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Importer_Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Robust Standard errors (adjusted for clusters in provincial pair) in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 4C Estimated Results using PPML with IV and FE (SERVICES)

Variable	Simple Distance			Great Circle Distance			Population Weighted Distance		
Dependent: Interprovincial Exports (G&S)									
Ln Mji	0.344*** (0.065)			0.309*** (0.083)			0.339*** (0.093)		
Ln Mji(hs)		0.443*** (0.074)			0.431*** (0.098)			0.504*** (0.107)	
Ln Mji(rs)			0.414*** (0.078)			0.382*** (0.101)			0.432*** (0.112)
Ln DISTij	-0.399*** (0.065)	-0.300*** (0.070)	-0.346*** (0.071)	-0.382*** (0.075)	-0.268*** (0.087)	-0.329*** (0.085)	-0.305*** (0.074)	-0.165* (0.085)	-0.242*** (0.084)
LANGij	0.787** (0.317)	1.032*** (0.329)	0.856*** (0.303)	1.226*** (0.366)	1.353*** (0.364)	1.233*** (0.345)	0.929** (0.376)	1.217*** (0.385)	0.997*** (0.355)
RTAij	0.574*** (0.165)	0.577*** (0.167)	0.539*** (0.160)	0.714*** (0.191)	0.693*** (0.188)	0.670*** (0.183)	0.734*** (0.190)	0.716*** (0.185)	0.687*** (0.180)
CONSTANT	7.821*** (1.041)	4.566*** (1.431)	5.414*** (1.465)	7.815*** (1.281)	4.346** (1.843)	5.498*** (1.841)	7.048*** (1.389)	2.714 (1.968)	4.309*** (1.995)
OBSERVATIONS	1104	1104	1104	1104	1104	1104	1104	1104	1104
WALD χ^2	618.91***	544.23***	563.68***	616.87***	545.59***	574.73***	648.71***	562.83***	597.45***
PSEUDO R2	0.986	0.986	0.986	0.985	0.986	0.986	0.985	0.985	0.985
Exporter_Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Importer_Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Robust Standard errors (adjusted for clusters in provincial pair) in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 5A Estimated Results with Additional Migration Variables using PPML with IV and FE (GOODS & SERVICES)

Variable						
Dependent: Interprovincial Exports (G&S)			Goods & Services			
Ln Mji	0.173*					
	(0.100)					
Ln M (sum)		0.194**				
		(0.098)				
Ln Mji(hs)			0.306**			
			(0.132)			
Ln M (sum-hs)				0.201*		
				(0.114)		
Ln Mji(rs)					0.252**	
					(0.125)	
Ln M (sum-rs)						0.237**
						(0.119)
Ln DISTij	−0.484***	−0.471***	−0.375***	−0.464***	−0.427***	−0.440***
	(0.098)	(0.093)	(0.121)	(0.106)	(0.112)	(0.108)
LANGij	0.769*	0.792*	0.951**	0.829*	0.822*	0.796*
	(0.450)	(0.435)	(0.475)	(0.448)	(0.448)	(0.431)
RTAij	0.878***	0.887***	0.864***	0.871***	0.850***	0.854***
	(0.187)	(0.185)	(0.185)	(0.188)	(0.183)	(0.183)
CONSTANT	10.55***	10.11***	7.472***	9.291***	8.585***	8.701***
	(1.601)	(1.623)	(2.513)	(2.256)	(2.329)	(2.309)
OBSERVATIONS	1224	1224	1224	1224	1224	1224
WALD χ^2	417.71	455.62	467.59	392.99	446.90	433.23
PSEUDO R2	0.977	0.978	0.978	0.977	0.978	0.978
Exporter_Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Importer_Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Note: Robust Standard errors (adjusted for clusters in provincial pair) in parentheses. M (sum) is the *sum* of the inflow and outflow of migrants. M(sum-hs) is the *sum* of the bilateral stock of historical migration. M(sum-rs) is the *sum* of the bilateral stock of recent migration. Here, DISTij refers to population weighted distance.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

fixed effects results (Tables 4A, 5A) are consistent with the results of other estimators (Tables 1, 2, and 3A in the Appendices).

PPML with IV and fixed effects estimation results show that historical stock (0.31), recent stock (0.25), and the annual flow of provincial migration (0.17 – 0.19) significantly increase Canadian interprovincial trade. While the historical stock of migrants can increase bilateral exports by approximately 30 percent; the recent stock of migrants increases interprovincial exports by 25 percent, and the annual flow of migrants increases interprovincial exports by 17 to 19 percent (see, Tables 4A & 5A). A positive and significant impact of historical and recent stock of migrants on interprovincial trade is consistent across all estimators except OLS with fixed effects models (see, Tables 2, 3A, and 4A). OLS with fixed effects shows that only

Table 5B Estimated Results with Additional Migration Variables using PPML with IV and FE (GOODS)

Variable						
Dependent: Interprovincial Exports (G)		Goods				
Ln Mji	0.0736 (0.126)					
Ln M (sum)	0.0960 (0.122)					
Ln Mji(hs)	0.170 (0.167)					
Ln M (sum-hs)	0.112 (0.139)					
Ln Mji(rs)	0.143 (0.155)					
Ln M (sum-rs)	0.130 (0.145)					
Ln DISTij	−0.624*** (0.135)	−0.606*** (0.130)	−0.543*** (0.165)	−0.593*** (0.142)	−0.569*** (0.151)	−0.580*** (0.144)
LANGij	0.864* (0.524)	0.882* (0.516)	0.974* (0.541)	0.916* (0.523)	0.908* (0.524)	0.889* (0.513)
RTAij	1.052*** (0.209)	1.057*** (0.209)	1.044*** (0.211)	1.050*** (0.210)	1.036*** (0.211)	1.037*** (0.210)
CONSTANT	11.80*** (2.078)	11.39*** (2.096)	9.746*** (3.243)	10.76*** (2.825)	10.31*** (2.950)	10.46*** (2.883)
OBSERVATIONS	1104	1104	1104	1104	1104	1104
WALD χ^2	284.70	302.98	321.19	286.69	307.52	296.18
PSEUDO R2	0.969	0.969	0.969	0.969	0.969	0.969
Exporter_Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Importer_Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Note: Robust Standard errors (adjusted for clusters in provincial pair) in parentheses. M (sum) is the *sum* of the inflow and outflow of migrants. M(sum-hs) is the *sum* of the bilateral stock of historical migration. M(sum-rs) is the *sum* of the bilateral stock of recent migration. Here, DISTij refers to population weighted distance.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

historical migration is a significant determinant (for bilateral exports between Canadian provinces) among all bilateral migration variables (see Table 1 in the appendices).

Both in-migration and out-migration may affect interprovincial exports. However, we cannot use both in-migration and out-migration variables in the same empirical model due to the high degree of multicollinearity problem³. Subsequently, we use the bilateral in-migration variable (see, Tables 4A, 4B, and 4C) and the sum of reciprocal bilateral migration (in-migration

3 We examine using OLS (with fixed effects) estimator if both bilateral in-migration and out-migration can influence interprovincial exports. Estimated results show that both annual in-migration and out-migration are insignificant determinants of interprovincial exports (Models 1, 5, and 9 of Table 1). We test for multicollinearity and found that bilateral annual in-migration and out-migration variables are highly correlated. Hence, both bilateral annual in-migration and out-migration variables are not used in the same model.

Table 5C Estimated Results with Additional Migration Variables using PPML with IV and FE (SERVICES)

Variable						
Dependent: Interprovincial Exports (\$)			Services			
Ln Mji	0.339*** (0.093)					
Ln M (sum)	0.332*** (0.092)					
Ln Mji(hs)			0.504*** (0.107)			
Ln M (sum-hs)					0.343*** (0.110)	
Ln Mji(rs)					0.432*** (0.112)	
Ln M (sum-rs)					0.384*** (0.114)	
Ln DISTij	-0.305*** (0.074)	-0.320*** (0.072)	-0.165* (0.085)	-0.304*** (0.084)	-0.242*** (0.084)	-0.281*** (0.086)
LANGij	0.929** (0.376)	0.932** (0.369)	1.217*** (0.385)	0.987** (0.402)	0.997*** (0.355)	0.928*** (0.360)
RTAij	0.734*** (0.190)	0.748*** (0.189)	0.716*** (0.185)	0.721*** (0.199)	0.687*** (0.180)	0.697*** (0.185)
CONSTANT	7.048*** (1.389)	6.948*** (1.433)	2.714 (1.968)	5.547*** (2.069)	4.309** (1.995)	4.918** (2.113)
OBSERVATIONS	1104	1104	1104	1104	1104	1104
WALD χ^2	648.71	713.87	562.83	521.24	597.45	604.20
PSEUDO R2	0.985	0.985	0.985	0.984	0.985	0.985
Exporter_Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Importer_Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Note: Robust Standard errors (adjusted for clusters in provincial pair) in parentheses. M (sum) is the *sum* of the inflow and outflow of migrants. M(sum-hs) is the *sum* of the bilateral stock of historical migration. M(sum-rs) is the *sum* of the bilateral stock of recent migration. Here, DISTij refers to population weighted distance.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

plus out-migration) variables in alternative models (see Tables 5A, 5B, and 5C). Both in-migration and the sum of reciprocal migration are found to be statistically significant.

Estimated results show that both in-migration and the sum of bilateral reciprocal migration are statistically significant determinants of interprovincial exports. We apply Fisher's permutation test of differences in coefficient estimates to test if annual migration, recent stock of migrants, and historical stock of migrants are statistically different. Estimated results show that all three (annual flow, recent stock, and historical stock) in-migration variables are statistically different (see, Tables 3A(i), and 4A(i)). However, if we test based on the sum of reciprocal migration variables, the test results show that only historical stock and annual flow migrants variables are statistically different (Table 5A(i)).

Provincial distance significantly reduces interprovincial trade. As expected, the simple distance, great circle distance, and population-weighted distance are found to be negative and significant determinants in interprovincial exports. Regional trade agreements (RTA) are found to be very influential in increasing interprovincial trade. While TILMA has shown support for the ‘domino theory of regionalism’ (Baldwin, 1993) from the Canadian interprovincial trade perspective, the rest of the regional trade agreements (APA and OPP) have shown a positive impact on interprovincial trade (regional trade agreement specific results are not reported as regional trade agreements are not the focus of this study, however, available upon request). A greater combination of English and French-speaking population, (compared to a smaller combination) in a bilateral set-up, can significantly increase interprovincial trade. We apply a continuous variable and three dummy variables (dummy variables results are not reported as language proximity is not the focus of this study, but available upon request) to examine the impact of language on interprovincial trade. The estimated results of all variables are aligned. While pair-dummy of English and French-speaking provinces are found to be positive, English dummy (dummy equals one if the official language of both provinces is English, otherwise zero) and French dummy (dummy equals one if the official language of both provinces is French, otherwise zero) are found to be negative. A greater combination of English and French-speaking provinces-pair is more likely to contribute to interprovincial trade than either English or French-biased provinces-pair. The English and French combination dummy as well as the continuous variable using the difference between the percentage of France speaking population in a bilateral set-up give a consistent result. This confirms the robustness of the finding.

Sub-sample Analysis

To examine if interprovincial migrants contribute more to service trade or goods trade, we estimate the gravity model (equation 3) using sub-samples of interprovincial services trade and goods trade separately (Tables 4B, 4C, 5B, and 5C, and Tables 3B, 3C in the appendices). Estimated results using IV estimators show that historical stock, recent stock, and annual flow of migration significantly increase provincial bilateral services trade (Tables 3C, 4C, and 5C) but not the goods trade (Tables 3B, 4B, and 5B). The coefficients of the migration variables are greater in the services trade (Tables 3C, 4C, and 5C) than in the combined goods and services trade (Tables 3A, 4A, and 5A). The estimated results, therefore, show that interprovincial migrants significantly contribute to interprovincial services exports but not goods exports. As usual, geographic, and cultural (language) proximities are found to be significant determinants in both interprovincial services trade and goods trade. Trade liberalization is also found to be significant in increasing both interprovincial services trade and goods trade.

5 Conclusion

This study estimates the impact of historical stock, recent stock, and annual flow of bilateral interprovincial migrants on bilateral interprovincial trade in Canada using a microfounded gravity model. We construct and apply historical stock and recent stock of interprovincial

migrants, and also use the bilateral annual flow of migrant variables in this study. We apply provincial simple distance, great circle distance, and population-weighted distance variables. Population weighted distance that captures the proximity between provinces both in terms of geographical coordinates and the economic size of provinces is our preferred geographic proximity variable. We also control for language proximity and trade openness in the interprovincial trade model. Potential heteroscedasticity, multicollinearity, endogeneity, and the zero value issue in the dependent variable have been taken care of by using PPML with IV and fixed effects estimator.

Estimated results show that historical stock, recent stock, and the annual flow of bilateral interprovincial migration significantly increase interprovincial trade in Canada. Fisher's permutation test of differences in coefficient estimates confirms that the stock of historical migrants contributes more to interprovincial trade than recent migrants (both recent stock and annual flow of migrants). This indicates that the contribution of older migrants is greater than relatively recent migrants to interprovincial exports in Canada. We find that historical stock, recent stock, and the annual flow of migrants significantly increase Canadian interprovincial service trade, but not goods trade.

Although our preference goes for the population-weighted distance, all gravity measures including simple distance, great circle distance, and population-weighted distance are found to be negative and significant determinants of interprovincial trade. Similar to Beaulieu and Zaman (2019) we find that regional trade agreements significantly increase interprovincial trade in Canada. The results reinforce Tkachuk and Day's (2016) prediction that if the Canadian Free Trade Agreement 2017 can effectively reduce interprovincial barriers to migration and trade, the labour mobility and trade between provinces would become much higher, and the economy would grow much faster than the current rate of growth.

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APPENDICES

Table 1 Estimated Results using OLS with FE (EXPORTS)

Variable	Goods & Services			Goods			Services		
Dependent: ln (Interprovincial Exports)									
lnMij	0.0605 (0.183)	0.171 (0.140)	-0.0610 (0.245)	0.0623 (0.168)			0.0605 (0.183)	0.171 (0.140)	
lnMij	0.124 (0.189)		0.139 (0.264)				0.124 (0.189)		
lnMij(i/hs)		0.325** (0.139)			0.171 (0.188)			0.325** (0.139)	
lnMij(rs)			0.269 (0.166)			0.144 (0.208)			0.269 (0.166)
lnDISTij	-0.861*** (0.142)	-0.874*** (0.134)	-1.003*** (0.188)	-1.016*** (0.178)	-0.908*** (0.211)	-0.945*** (0.210)	-0.861*** (0.142)	-0.874*** (0.134)	-0.714*** (0.150)
LANGij	2.312*** (0.465)	2.301*** (0.479)	2.332*** (0.469)	2.499** (0.750)	2.572*** (0.747)	2.538** (0.743)	2.312*** (0.465)	2.301*** (0.479)	2.403*** (0.478)
RTAij	1.321*** (0.234)	1.325*** (0.235)	1.285*** (0.240)	1.489*** (0.335)	1.464*** (0.346)	1.465*** (0.343)	1.321*** (0.234)	1.325*** (0.235)	1.284*** (0.236)
CONSTANT	11.10*** (2.107)	11.30*** (1.980)	9.062*** (2.839)	12.30*** (2.689)	10.30*** (3.548)	10.92*** (3.708)	11.10*** (2.107)	11.30*** (1.980)	7.827*** (2.565)
OBSERVATIONS	1224	1224	1224	1104	1104	1104	1224	1224	1224
R2	0.962	0.962	0.963	0.946	0.947	0.947	0.962	0.962	0.962
Exporter_Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Importer_Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Robust Standard errors (adjusted for clusters in provincial pair) in parentheses. Mij is annual in-migration from province j (origin) to province i (destination). Mij is out-migration from province i to province j. Mij(i/hs) is the stock of historical in-migration from province i. Mij(rs) is the stock of recent migration from province j to province i. The stock of recent migration includes people who migrated between 1975-2008 from a partner province while the stock of historical migration includes people that came and live in a particular province any time after 1871 from a partner province. Here, DISTij refers to population weighted distance.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 2 Estimated Results using FGLS with FE (GOODS & SERVICES)

Variable	GOODS & SERVICES			GOODS	SERVICES		
Dependent: Ln (Interprovincial Exports)							
Ln Mji	0.133*** (0.027)			0.0520 (0.040)		0.0912*** (0.020)	
Ln Mji(hs)		0.493*** (0.044)			0.365*** (0.087)		0.600*** (0.040)
Ln Mji(rs)			0.463*** (0.044)			0.315*** (0.083)	0.631*** (0.042)
Ln DISTij	-1.033*** (0.032)	-0.662*** (0.048)	-0.732*** (0.044)	-1.084*** (0.051)	-0.774*** (0.092)	-1.026*** (0.028)	-0.529*** (0.044)
LANGij	0.962*** (0.153)	1.349*** (0.157)	1.296*** (0.154)	0.824*** (0.247)	1.186*** (0.269)	1.027*** (0.168)	1.514*** (0.160)
RTAIj	0.128*** (0.041)	0.104*** (0.038)	0.101*** (0.039)	0.234*** (0.075)	0.212*** (0.073)	0.172*** (0.038)	0.129*** (0.033)
CONSTANT	14.16*** (0.466)	6.493*** (0.895)	7.397*** (0.851)	15.14*** (0.724)	8.764*** (1.750)	13.67*** (0.378)	3.164*** (0.818)
OBSERVATIONS	1224	1224	1224	1104	1104	1104	1104
Exporter_Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Importer_Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Standard errors in parentheses. Here, DISTij refers to population weighted distance.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 3A Estimated Results using Two-Step Feasible Generalized Method of Moments (GOODS & SERVICES)

Variable		Simple Distance			Great Circle Distance			Population Weighted Distance		
Dependent: Ln (Interprovincial Exports (G&S))										
Ln Mji	0.284*** (0.105)				0.277** (0.133)			0.266** (0.132)		
Ln Mji(hs)		0.331*** (0.099)				0.349*** (0.116)			0.370*** (0.111)	
Ln Mji(rs)			0.320*** (0.112)				0.307** (0.139)			0.313** (0.138)
Ln DISTij	-0.915*** (0.113)	-0.840*** (0.119)	-0.880*** (0.119)		-0.809*** (0.133)	-0.718*** (0.129)	-0.783*** (0.137)	-0.790*** (0.127)	-0.671*** (0.125)	-0.749*** (0.131)
LANGij	1.839*** (0.427)	1.899*** (0.420)	1.832*** (0.412)		3.066*** (0.424)	3.023*** (0.431)	3.013*** (0.417)	2.377*** (0.418)	2.436*** (0.414)	2.360*** (0.404)
RTAIj	1.033*** (0.182)	1.043*** (0.181)	1.017*** (0.182)		1.355*** (0.206)	1.334*** (0.206)	1.335*** (0.209)	1.295*** (0.207)	1.270*** (0.205)	1.270*** (0.209)
OBSERVATIONS	1224	1224	1224	1224	1224	1224	1224	1224	1224	1224
F-STAT	161.66***	196.03***	234.99***	208.38***	198.01***		229.49***	255.99***	238.97***	157.84***
CENTERED R2	0.883	0.883	0.887	0.886	0.861		0.856	0.866	0.863	0.855
Exporter_Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Importer_Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HANSEN J STATISTICS (OVER ID TEST)	Exactly Identified	Exactly Identified	Exactly Identified	Exactly Identified	Exactly Identified	Exactly Identified	Exactly Identified	Exactly Identified	Exactly Identified	Exactly Identified
STOCK – YOGO (2005)	Not Valid Instrument	Valid Instrument	Valid Instrument	Valid Instrument	Valid Instrument	Not Valid Instrument	Valid Instrument	Valid Instrument	Valid Instrument	Not Valid Instrument
WEAK ID TEST										

Note: Robust Standard errors (adjusted for clusters in provincial pair) in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 3A(i) Fisher's permutation test (sampling without replacement) of differences in coefficient estimates (POPULATION WEIGHTED DISTANCE)

$H_0: M_{ji}(hs) = M_{ji}(rs)$	$H_0: M_{ji}(hs) = M_{ji}$
Observed Difference = 0.057	Observed Difference = 0.104
Empirical P -Value = 0.02	Empirical P -Value = 0.00
Decision: Reject $H_0 \rightarrow M_{ji}(hs)$ and $M_{ji}(rs)$ are statistically different.	Decision: Reject $H_0 \rightarrow M_{ji}(hs)$ and M_{ji} are statistically different.

Table 3B Estimated Results using Two-Step Feasible Generalized Method of Moments (GOODS)

Variable	Simple Distance			Great Circle Distance			Population Weighted Distance		
Dependent: Ln (Interprovincial Exports (G&S))									
Ln Mji	0.212* (0.123)			0.199 (0.152)			0.169 (0.155)		
Ln Mji(hs)		0.229* (0.131)			0.236 (0.153)			0.243 (0.151)	
Ln Mji(rs)			0.249* (0.139)			0.229 (0.173)			0.217 (0.176)
Ln DISTij	-1.042*** (0.150)	-1.002*** (0.168)	-1.005*** (0.163)	-0.922*** (0.170)	-0.869*** (0.181)	-0.894*** (0.186)	-0.923*** (0.166)	-0.840*** (0.174)	-0.880*** (0.181)
LANGij	1.983** (0.653)	2.003*** (0.650)	1.990*** (0.646)	3.388*** (0.656)	3.354*** (0.663)	3.348*** (0.651)	2.584*** (0.639)	2.622*** (0.640)	2.584*** (0.633)
RTAij	1.156*** (0.276)	1.170*** (0.279)	1.144*** (0.277)	1.540*** (0.293)	1.532*** (0.299)	1.523*** (0.294)	1.458*** (0.291)	1.442*** (0.296)	1.438*** (0.293)
OBSERVATIONS	1104	1104	1104	1104	1104	1104	1104	1104	1104
F-STAT	138.07***	150.40***	141.46***	144.96***	155.09***	148.19***	127.12***	137.78***	130.20***
CENTERED R2	0.832	0.834	0.834	0.810	0.812	0.812	0.807	0.810	0.809
Exporter_Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Importer_Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HANSEN J STATISTICS (OVER ID TEST)	Exactly Identified	Exactly Identified	Exactly Identified	Exactly Identified	Exactly Identified	Exactly Identified	Exactly Identified	Exactly Identified	Exactly Identified
STOCK – YOGO (2005)	Valid Instrument	Valid Instrument	Valid Instrument	Valid Instrument	Valid Instrument	Valid Instrument	Valid Instrument	Valid Instrument	Valid Instrument
WEAK ID TEST	Instrument	Instrument	Instrument	Instrument	Instrument	Instrument	Instrument	Instrument	Instrument

Note: Robust Standard errors (adjusted for clusters in provincial pair) in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 3C Estimated Results using Two-Step Feasible Generalized Method of Moments (SERVICES)

Variable	Simple Distance			Great Circle Distance			Population Weighted Distance		
Dependent: Ln (Interprovincial Exports (G&S))									
Ln Mji	0.380*** (0.085)			0.342*** (0.100)			0.360*** (0.103)		
Ln Mji(hs)		0.465*** (0.072)			0.451*** (0.077)			0.500*** (0.072)	
Ln Mji(rs)			0.443*** (0.089)			0.403*** (0.103)			0.440*** (0.102)
Ln DISTij	-0.712*** (0.081)	-0.588*** (0.075)	-0.650*** (0.085)	-0.667*** (0.091)	-0.533*** (0.075)	-0.611*** (0.092)	-0.620*** (0.092)	-0.460*** (0.075)	-0.549*** (0.089)
LANGij	1.986*** (0.291)	2.089*** (0.253)	1.994*** (0.274)	2.949*** (0.254)	2.885*** (0.222)	2.878*** (0.244)	2.405*** (0.270)	2.475*** (0.224)	2.392*** (0.250)
RTAij	0.950*** (0.147)	0.962*** (0.135)	0.930*** (0.143)	1.207*** (0.156)	1.173*** (0.146)	1.173*** (0.157)	1.158*** (0.161)	1.127*** (0.149)	1.122*** (0.160)
OBSERVATIONS	1104	1104	1104	1104	1104	1104	1104	1104	1104
F-STAT	251.20***	318.37***	274.83***	294.96***	343.69***	308.85***	247.24***	296.31***	261.66***
CENTERED R2	0.917	0.924	0.921	0.908	0.916	0.911	0.898	0.909	0.903
Exporter_Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Importer_Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HANSEN J STATISTICS (OVER ID TEST)	Exactly Identified	Exactly Identified	Exactly Identified	Exactly Identified	Exactly Identified	Exactly Identified	Exactly Identified	Exactly Identified	Exactly Identified
STOCK – YOGO (2005) WEAK ID TEST	Valid Instrument	Valid Instrument	Valid Instrument	Valid Instrument	Valid Instrument	Valid Instrument	Valid Instrument	Valid Instrument	Valid Instrument

Note: Robust Standard errors (adjusted for clusters in provincial pair) in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 3C(i) Fisher's permutation test (sampling without replacement) of differences in coefficient estimates (POPULATION WEIGHTED DISTANCE)

$H_0: M_{ji}(hs) = M_{ji}(rs)$	$H_0: M_{ji}(hs) = M_{ji}$
Observed Difference = 0.057	Observed Difference = 0.134
Empirical P-Value = 0.03	Empirical P-Value = 0.00
Decision: Reject $H_0 \rightarrow M_{ji}(hs)$ and $M_{ji}(rs)$ are statistically different.	Decision: Reject $H_0 \rightarrow M_{ji}(hs)$ and M_{ji} are statistically different.

Table 4A(i) Fisher's permutation test of differences in coefficient estimates (POPULATION WEIGHTED DISTANCE)

$H_0: M_{ji}(hs) = M_{ji}(rs)$	$H_0: M_{ji}(hs) = M_{ji}$
Observed Difference = 0.053	Observed Difference = 0.133
Empirical P-Value = 0.05	Empirical P-Value = 0.00
Decision: Reject $H_0 \rightarrow M_{ji}(hs)$ and $M_{ji}(rs)$ are statistically different.	Decision: Reject $H_0 \rightarrow M_{ji}(hs)$ and M_{ji} are statistically different.

Table 4C(i) Fisher's permutation test of differences in coefficient estimates (POPULATION WEIGHTED DISTANCE)

$H_0: M_{ji}(hs) = M_{ji}(rs)$	$H_0: M_{ji}(hs) = M_{ji}$
Observed Difference = 0.072	Observed Difference = 0.165
Empirical P-Value = 0.03	Empirical P-Value = 0.00
Decision: Reject $H_0 \rightarrow M_{ji}(hs)$ and $M_{ji}(rs)$ are statistically different.	Decision: Reject $H_0 \rightarrow M_{ji}(hs)$ and M_{ji} are statistically different.

Table 5A (i) Fisher's permutation test of differences in coefficient estimates (GOODS & SERVICES)

$H_0: M_{ji} = M(\text{sum})$	$H_0: M(\text{sum-hs}) = M(\text{sum-rs})$	$H_0: M(\text{sum-hs}) = M(\text{sum})$
Observed Difference = 0.021	Observed Difference = -0.035	Observed Difference = 0.008
Empirical P-Value = 0.16	Empirical P-Value = 0.15	Empirical P-Value = 0.05
Decision: Do not Reject $H_0 \rightarrow M_{ji}$ and $M(\text{sum})$ are not statistically different.	Decision: Do not Reject $H_0 \rightarrow M(\text{sum-hs})$ and $M(\text{sum-rs})$ are not statistically different.	Decision: Reject $H_0 \rightarrow M(\text{sum-hs})$ and $M(\text{sum})$ are statistically different.

Table 5C (i) Fisher's permutation test of differences in coefficient estimates (SERVICES)

$H_0: M_{ji} = M(\text{sum})$	$H_0: M(\text{sum-hs}) = M(\text{sum-rs})$	$H_0: M(\text{sum-hs}) = M(\text{sum})$
Observed Difference = 0.007	Observed Difference = -0.041	Observed Difference = 0.011
Empirical P-Value = 0.37	Empirical P-Value = 0.17	Empirical P-Value = 0.02
Decision: Do not Reject $H_0 \rightarrow M_{ji}$ and $M(\text{sum})$ are not statistically different.	Decision: Do not Reject $H_0 \rightarrow M(\text{sum-hs})$ and $M(\text{sum-rs})$ are not statistically different.	Decision: Reject $H_0 \rightarrow M(\text{sum-hs})$ and $M(\text{sum})$ are statistically different.

APPENDIX A Data and Variables

Variable	Description	Data Sources
T_{ij}	Bilateral exports of goods and services	Tables 12-10-0085 and 12-10-0086 from Statistics Canada
	Bilateral exports of goods	Tables 12-10-0085 and 12-10-0086 from Statistics Canada
	Bilateral exports of services	Tables 12-10-0085 and 12-10-0086 from Statistics Canada
Migration		
Historical Migrants ($M_{ji(hs)}$, $M_{(sum-hs)}$)	The bilateral stock of historical migration. The historical migrants' variable includes the stock of migrants that came and live in a particular province any time after 1871 from a partner province. The stock of historical migrants includes people who migrated from 1871 to 2008. $M_{ji(hs)}$ is the bilateral stock of historical migration in province j, $M_{(sum-hs)}$ is the sum of the reciprocal stock of historical migration	Constructed using census data of 1981 and Table 17-10-0022-01 (CANSIM 051-0019) from Statistics Canada
Recent Migrants ($M_{ji(rs)}$, $M_{(sum-rs)}$)	The bilateral stock of recent migration. The recent stock of migrants includes the migrants that came from a partner province after 1975 and live in a particular province. The stock of recent migrants includes people who migrated from 1975 to 2008. $M_{ji(rs)}$ is the bilateral stock of recent migration in province j, $M_{(sum-rs)}$ is the sum of reciprocal stock of recent migration	Constructed using census data of 1981 and Table 17-10-0022-01 (CANSIM 051-0019) from Statistics Canada
Recent Migrants II (M_{ji} & $M_{ij, M(sum)}$)	The bilateral flow of interprovincial migrants. Annual observations of interprovincial migrants between 1992 and 2008. M_{ji} is the annual inflow of migrants, M_{ij} is the annual outflow of migrants, $M_{(sum)}$ is the sum of the reciprocal (inflow and outflow) of migrants.	Table 17-10-0022-01 (CANSIM 051-0019) from Statistics Canada.
Proximity		
$Dist_{ij}$	Bilateral simple distance. Distance between capitals of provinces in a bilateral set-up. Great circle distance (using the geographic coordinate system) and provincial population weighted distance. We follow Head and Mayer (2002) to construct these variables.	GlobalFeed.com (Distance calculator Canada) Global Rural-Urban Mapping Project, Version 1
Language		
$Lang_{ij}$	Combination of provincial language. Difference between the percentage of France speaking population in a bilateral set up of provinces. The larger the gap means the bigger the combination of English and French speakers. English dummy. Dummy equals one if the official language of both provinces is English, otherwise zero. French dummy. Dummy equals one if the official language of both provinces is French, otherwise zero. English and French speaking pair-dummy. Dummy equals one if the official language in one province in the pair speaks English and another province speaks French, otherwise zero.	Data source: https://en.wikipedia.org/wiki/Languages_of_Canada Constructed Constructed Constructed

(Continued)

Appendix A Continued

Variable	Description	Data Sources
Trade Liberalization		
RTA _{ij}	A dummy variable. Canadian interprovincial regional trade agreements (RTA) have been signed between Canadian provinces since the early 1990s.	Beaulieu and Zaman (2019)
TILMA _{ij}	A dummy variable. Trade, Investment and Labour Mobility Agreement (TILMA) in 2007 between British Columbia and Alberta.	Beaulieu and Zaman (2019)
APA _{ij}	A dummy variable. Atlantic Procurement Agreement (APA) in 1996 between New Brunswick, Newfoundland and Labrador, Nova Scotia, and Prince Edward Island.	Beaulieu and Zaman (2019)
OPPI _{ij}	A dummy variable. Agreement on the Opening of Public Procurement (OPP) in 1993 between New Brunswick and Quebec.	Beaulieu and Zaman (2019)
Instruments		
Imputed annual flow	Instrumental variable for bilateral migrants' flow. Imputed bilateral annual migrants' flow.	Constructed by closely following the method proposed by Peri and Requena (2010).
Imputed historical stock	Instrumental variable for lifetime stock of migrants. The imputed stock of migrants.	Constructed by closely following the method proposed by Peri and Requena (2010)
Imputed recent stock	Instrumental variable for recent stock of migrants. The imputed stock of migrants.	Constructed by closely following the method proposed by Peri and Requena (2010)

APPENDIX B Summary statistics: By Province (1992-2008)

Exports (millions of CAD) and migration (persons)

	N	Mean	SD	Min	Max
Alberta					
Trade Value GS	136	4143.508	4623.199	116	20494.5
Trade Value G	120	3004.501	3351.724	93.7	13685.2
Trade Value S	120	1432.808	1487.152	54.85	6809.4
Migrants	136	8588.765	7656.96	1106	31789
Migration Lifetime	136	216508.9	177755.75	25828	640611
Migration Recent	136	177265.15	159466.04	20828	628361
British Columbia					
Trade Value GS	136	2392.175	3080.311	81.1	13677.5
Trade Value G	124	1126.089	1612.349	23.9	6947.9
Trade Value S	124	1401.962	1666.722	48.8	6729.6
Migrants	136	6831.375	7990.523	370	27518
Migration Lifetime	136	238574.21	222448.84	16512	818099
Migration Recent	136	165824.21	185159.56	10462	688299
Manitoba					
Trade Value GS	136	1277.095	1269.517	30.6	5684.4
Trade Value G	124	687.801	659.115	19.2	2743.3
Trade Value S	124	648.008	667.116	10.3	2941.1
Migrants	136	1680.522	1481.065	163	5199
Migration Lifetime	136	54431.25	46720.722	5922	167400
Migration Recent	136	43500	38638.805	4172	145500
New Brunswick					
Trade Value GS	136	734.7	813.781	27.1	3619.3
Trade Value G	128	510.795	637.1	9.7	2905.5
Trade Value S	128	216.782	213.872	13.6	755.3
Migrants	136	1318.64	1098.945	100	4023
Migration Lifetime	136	38247.022	34224.008	3581	124934
Migration Recent	136	32690.772	29151.89	2731	115184
Newfoundland and Labrador					
Trade Value GS	136	416.053	643.554	10.7	2927
Trade Value G	124	348.075	596.805	1	2788.4
Trade Value S	124	88.003	96.339	8.6	471.1
Migrants	136	963.676	1103.28	40	3935
Migration Lifetime	136	21371.081	25711.324	1590	109599
Migration Recent	136	20658.581	25951.212	1590	109999

(Continued)

APPENDIX B Continued

	N	Mean	SD	Min	Max
Nova Scotia					
Trade Value GS	136	635.648	549.493	39.8	2244.6
Trade Value G	116	405.987	343.432	15.5	1472.9
Trade Value S	116	277.378	240.501	22.4	1073.5
Migrants	136	1876.346	1656.768	204	7023
Migration Lifetime	136	51479.493	44322.614	6127	196700
Migration Recent	136	44891.993	40399.376	4427	182700
Ontario					
Trade Value GS	136	10024.164	10191.3	1773.2	41148.801
Trade Value G	128	4943.982	5479.7	795.9	20938.5
Trade Value S	128	5301.979	5106.336	930.7	22637.6
Migrants	136	8093.074	5909.866	1577	24885
Migration Lifetime	136	288663.5	195634.11	112833	908654
Migration Recent	136	213088.5	163586.99	46933	716304
Quebec					
Trade Value GS	136	5421.889	8445.865	874	35653.102
Trade Value G	120	3693.012	5536.797	594.2	20662.5
Trade Value S	120	2212.544	3381.279	295.7	15582.7
Migrants	136	2708.831	4361.94	174	16717
Migration Lifetime	136	85747.287	131586.83	10812	529096
Migration Recent	136	63759.787	103196.84	4771	432496
Saskatchewan					
Trade Value GS	136	1173.521	1438.696	21	7098.7
Trade Value G	120	895.32	1163.315	9.7	5574.7
Trade Value S	120	314.578	353.968	7	1524
Migrants	136	1983.787	2478.254	99	11221
Migration Lifetime	136	54080.471	57216.398	2059	233526
Migration Recent	136	46255.471	53158.17	1809	225076

Note: GS: Goods and Services; G: Goods; S: Services.

APPENDIX C

Dependent variable: $\ln(\text{interprovincial exports})$

Variable	VIF	Tolerance
$\ln \text{Dist}_{ij}$	1.51	0.663
$\ln M_{ji}$	1.27	0.786
RTA	1.27	0.787
Lang	1.07	0.933
Mean VIF	1.28	

Note: There is no evidence of multicollinearity.

VIF and tolerance of lifetime stock and recent stock also show no multicollinearity problem.