

Aziz, Nusrate; Mahar, Gerry

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## Labour mobility and interprovincial trade in Canada

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## **Labour mobility and interprovincial trade in Canada**

**Nusrate Aziz**

School of Business and Economics  
Algoma University  
E-mail: Nusrate.Aziz@algonau.ca

**Gerry Mahar**

School of Business and Economics  
Algoma University  
E-mail: gerry.mahar@algonau.ca

### **Abstract**

This study estimates the impact of interprovincial and international migration on interprovincial trade using annual data from 1981- 2016 for Canadian provinces. We apply both the gravity and the spatial trade models for estimation using a number of panel estimators. We find that the endogeneity issue should be addressed when estimating the relationship between migration and interprovincial trade. Estimated results show that interprovincial and international net migrations are positive and significant determinants for interprovincial trade of Canada. Interprovincial immigration is more influential than international immigration in explaining interprovincial trade. Interprovincial imports are influenced more by interprovincial and international migration than interprovincial exports. Province-wise estimates indicate that Quebec, British Columbia, Saskatchewan, and New Brunswick are positively affected by interprovincial migration. Among them, all except New Brunswick are also positively affected by international migration. The gravity and the spatial trade models are useful to explain Canadian interprovincial trade. The pooled OLS, fixed effects, 2SLS and SGMM estimators are used in this study. Our results are robust to different estimation methods and alternative measures using both the flow and the stock net migration in Canada's provinces.

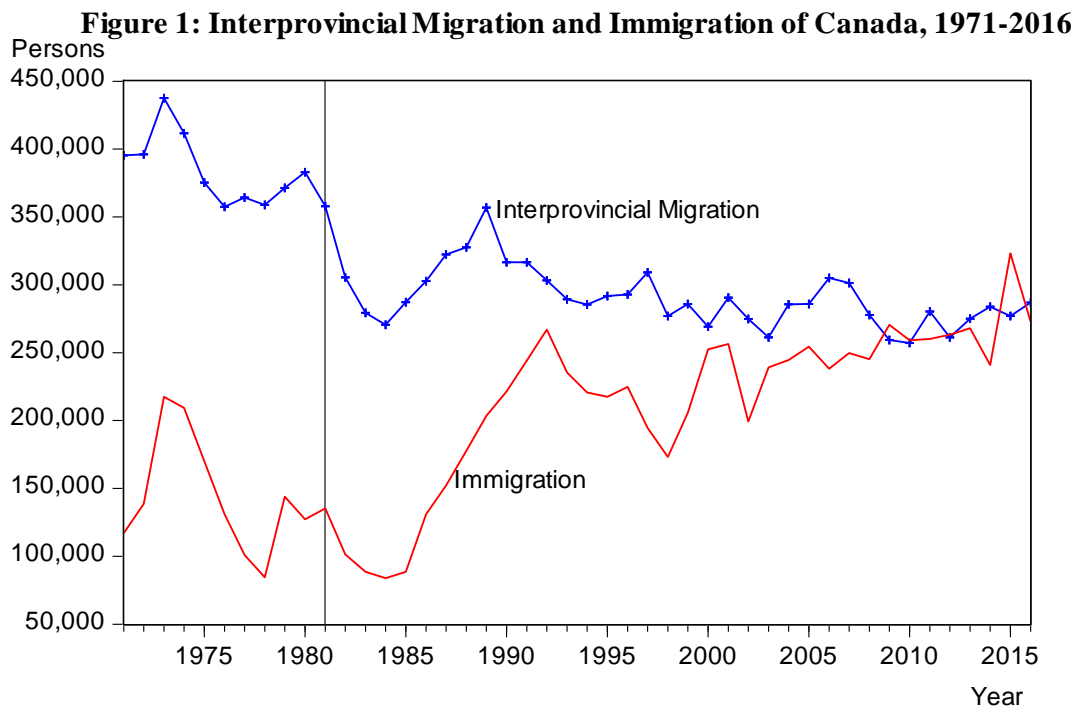
*Keywords: interprovincial migration, international migration, interprovincial trade, gravity model, spatial trade model, endogeneity, IV approach.*

JEL Codes: C33, C36, F16, F22

## 1. Introduction

Canada has been a net immigration country, accepting more migrants per capita than the United States, the United Kingdom, and Europe. Today, migrants represent more than 20 percent (1 in 5 persons) of the total population of Canada (Canadian National Household Survey 2016). This trend is likely to continue in the future because Canada's immigration policy and economic policy are highly integrated with an emphasis on immigration to meet Canada's labour market requirements (Challinor 2011).

Over the past 35 years, on average, approximately two-hundred and ninety-four thousand Canadians moved from one province to another, every year<sup>1</sup>. In addition to interprovincial migration, on average, Canada received approximately two-hundred and twelve thousand foreign immigrants every year. Thus, over 500 thousand migrants each year are migrating in the Canadian economy (Figure 1). The federal and provincial governments of Canada, administer a number of programs to enable the full utilization of immigrants' contributions to the economy.



Significant net migration to a province increases aggregate demand of the province. For example, suppose that a large number of immigrants moved from abroad to Ontario. These immigrants will

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<sup>1</sup> See Table 2 in Appendix.

add to the existing aggregate demand in Ontario. Within Ontario, it may not be able to immediately meet the entire demand of these newcomers. Ontario may import goods and services from other provinces, like Quebec in the short run (maybe in the long run, too). This leads to an increase in imports to Ontario and exports from Quebec. In this circumstance, international migration leads to interprovincial trade. Similarly, if British Columbia (BC) can attract more migrants from other provinces due to higher employment opportunity, migrants will likely move from other provinces to BC. Employment and earnings of migrants in BC would create additional demand for goods and services in the province. This results in trade creation between BC and other provinces.

Unemployment pushes migrants and employment pulls them to an immigration destination. After migration, new immigrants bring information from abroad and reduce the cost of trade between immigrants' home and host countries. A sizable migration, therefore, creates trade between migrants' host and source locations (Rauch and Trindade 2002).

Canada has promoted many policies on a national level to foster free movement of people and trade goods and services within the country. Canadian Free Trade Agreement 2017<sup>2</sup> was an attempt to eliminate existing interprovincial barriers and to avoid the creation of new barriers to trade, investment, and labour mobility. The goal was free movement of persons, goods, services, and investments within Canada. The Canadian Free Trade Agreement (CFTA) reaffirms labour mobility provisions and obligations that were established under the 1995 Agreement on Internal Trade (AIT). If CFTA 2017 becomes successful, i.e., all barriers to free movement of persons and trade would be eliminated, the intra-industry trade as well as imports and exports of goods and services between provinces will be much easier. All provinces may enjoy the benefit of CFTA 2017 and the benefits described in the CFTA 2017 such as increased migration and trade will likely grow faster. If this takes place, the Canadian economy would likely become more vibrant.

Canadian interprovincial migration has attracted renewed attention from economists and policymakers. There are studies about assimilation of immigrants into the Canadian labour market, the impact of immigration on Canadian international trade, but there are no studies that specifically estimated the impact of interprovincial and international migration on interprovincial trade. The impact of labour migration on Canadian interprovincial trade is therefore an important issue to

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<sup>2</sup> CANADIAN FREE TRADE AGREEMENT 2017 (Consolidated Version).

investigate. Specifically, we investigate whether international net migration (net migration in Canadian provinces from abroad) and interprovincial net migration play a significant role in the creation of interprovincial trade. We further test for the relative effectiveness of international and interprovincial net immigration on interprovincial exports and imports. That is, we test whether net migration affects imports more than exports. Finally, we investigate which of the ten Canadian provinces drives the findings from our empirical study.

Sgrignoli, Metulini, Schiavo, and Riccaboni (2015), Iranzo and Peri (2009), Lewer and Hendrick (2009), Lewer (2006), Dunlevy and Hutchinson (1999), and Gould (1994) found that immigration increased trade between the immigrants' host and origin countries. Head and Ries (1998) also found that immigration increased both Canadian imports and exports; however, imports increased three (3) times more than exports. Mundar (2005) found that immigration positively affected imports of both intermediate and finished goods, while it positively affected only exports of finished goods. Genc, Gheasi, Nijkamp and Poot (2011) found that a 10 percent increase in immigration increased the volume of trade by 1.5 percent for heterogeneous goods, although this increase was lower for homogeneous goods. There is little controversy in the literature about the positive effect of immigration on international trade.

Several studies investigated the determinants of interprovincial migration (Day and Winer 2006, Osberg, Helliwell 1996, Newbold 1996, Gordon and Lin 1994, Day 1992, Robinson and Tomes 1982, Laber and Chase 1971, Courchene 1970). However, a limited number of studies estimated the impact of interprovincial migration on macroeconomic variables. Sharpe, Arsenault and Ershov 2007, and Beine, Coulombe and Vermeulen 2014 were the exceptions. Between them, the earlier study estimated the impact of interprovincial migration on output and labour productivity in Canada, while the latter study examined how immigration mitigated the increase in the size of the non-tradable sector in booming regions of Canada. To the best of our knowledge, there is no previous study about the impact of Canadian interprovincial and international immigration on interprovincial trade.

Earlier studies show that immigrants generally bring with them a preference of home country products as well as new information to the host country. Immigrants come with the knowledge of home-country markets, language, and business contacts that can potentially decrease trading transaction costs. Immigration typically increases trade between the host and the source countries

(see, Girma and Yu 2002, Rauch and Trindade 2002, Head and Ries 1998, Gould 1994). Similarly, interprovincial immigration may lead to an increase in interprovincial trade between Canadian provinces. This study addresses the gap in the literature.

Why people migrate from one province to another is also an important factor when we estimate the impact of migration on trade creation. In an empirical model, it is assumed that a dependent variable will be affected by the explanatory variables. For example, interprovincial trade may be a function of interprovincial migration, among other determinants of trade. However, if interprovincial migration may also be a function of a third variable such as employment opportunity, we must then estimate the impact of the employment opportunity on interprovincial migration before we estimate the impact of interprovincial migration on interprovincial trade. In that case, endogeneity would likely be an issue to address. Many studies show that migration is significantly correlated with macroeconomic factors (see, Edmonston and Lee 2013, Coulombe 2006, Day and Winer 2006, Helliwell 1996, Newbold 1996, Osberg, Gordon and Lin 1994, Day 1992, Robinson and Tomes 1982, Laber and Chase 1971, Courchene 1970). Earlier studies indicate that employment opportunity is one of the important determinants of immigration (see, Osberg, Gordon and Lin 1994, Helliwell 1996, Coulombe 2006, Edmonston and Lee 2013). However, hardly any of the previous studies (Sgrignoli et. al. 2015 is an exception) that have estimated the impact of migration on trade creation have not dealt with the endogeneity issue. This study addresses the endogeneity issue in the empirical model.

The gravity model and the spatial trade model are used to estimate the effect of interprovincial and international migration on interprovincial trade. A balanced panel approach is applied to data of the 10 Canadian provinces from 1981-2016. We apply a number of estimators including pooled OLS (POLS), the fixed effects (FE), the two-stage least square (2SLS) and the system generalized methods of moment (SGMM) in this study.

Test statistics indicate the presence of endogeneity and this requires proper attention. Our preferred estimators are therefore instrumental variable approaches such as 2SLS and SGMM. We estimate the impact of both the flow and the stock of net migration on interprovincial trade.

Estimated results show that net interprovincial (internal) and net international (external) migration increases Canadian interprovincial trade. Internal net migration has more influence than external net migration on increasing interprovincial trade. We also find evidence that net internal and net

external migration positively and significantly affect interprovincial imports of Canada. However, the impact of net internal and net external migration on interprovincial exports is positive but not statistically significant. Province-wise estimated results show that interprovincial trade of Quebec, BC, Saskatchewan, and New Brunswick are positively and significantly affected by interprovincial migration. Among these provinces, all but New Brunswick are positively and significantly affected by net international migration. Estimated results of the net migration stock and the net migration flow are consistent with each other.

Geographical proximity plays a significant role in interprovincial trade. Province-wise spatial factors such as the size of the provincial economy, population, and language also play positive roles in increasing interprovincial trade. The income of the originating province<sup>3</sup> (OP) and of the receiving province (RP) play positive and significant roles in fostering interprovincial trade (hereafter, we will use OP and RP for originating province and receiving province, respectively). A higher RP-to-OP population ratio plays a positive role in interprovincial trade. Common language has a significantly positive effect on interprovincial trade. Both the gravity and the spatial trade model are useful models to explain the interprovincial trade of Canada. Our estimated results are robust to different estimation methods and different measures (stock and flow) for net migration to Canadian provinces.

The rest of the paper is organized as follows. Section 2 gives a brief discussion on Canadian interprovincial migration and trade. Section 3 explains the data, variables and methods. Section 4 explains the empirical models and the estimation methods. Section 5 plots the data and explains empirical models. Section 6 estimates the empirical models and discuss the results, and Section 7 concludes the study.

## **2. Interprovincial migration and trade in Canada: An overview**

Close to 150 years on, Canada has unfinished business left over from Confederation in 1867. The promise of lower internal trade barriers among former independent colonies helped bring these colonies into Confederation to create the Canadian nation-state. In the intervening years, barriers

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<sup>3</sup> For example, Ontario is an originating province (OP) if people immigrate to Ontario from other provinces and emigrate from Ontario to other provinces. In other word, we can say that Ontario is the host province and other provinces are the source provinces of migrants. On the other hand, all other provinces (except Ontario) are the receiving provinces (RP).

to interprovincial trade and economic development were making headlines as late as in 2018 concerning national pipeline construction to the Pacific Ocean and the Atlantic Ocean. Some claim that trade barriers are now higher than ever<sup>4</sup>.

It's not unusual for consumers, workers and business firms to encounter as many roadblocks doing commerce across provincial borders as with international trade to the United States or elsewhere. For example, trying to transport alcohol by a consumer from Quebec to New Brunswick resulted in a case heard by the Supreme Court of Canada in 2018. Tradespeople have difficulties doing similar work at federal government facilities in Ottawa and across the Ottawa River in Gatineau, Quebec due to competing provincial trade license requirements. Restrictions also exist for firms in Ottawa, Ontario bidding on similar federal construction work in Gatineau, Quebec. Many people agree that these barriers to trade and commerce are an imposition of the freedom of Canadians to work anywhere in the country. Why do these barriers to trade continue to exist and what can be done about them is an ongoing public policy debate in Canada<sup>5</sup>.

The economic case for national action is compelling. It makes little sense to have barriers to trade and economic activity between provinces simply because there are no national rules to stop them. If trade barriers are intended to make one province or territory richer by making others poorer, they usually fail and all suffer economically. Protectionist trade policies in the provinces have existed since 1867. The national government has a leading role to ensure that Canada has an open, efficient, predictable and stable domestic market where all Canadians are treated fairly and equally.

Interprovincial migration is the most important component of population growth in some provinces and territories of Canada (Dion and Coulombe 2008, Gunderson 1994). For higher economic growth, all economic resources must be used efficiently. If resources concentrate in few regions of the country, balanced provincial growth throughout the economy will be difficult to attain. An equitable distribution of human and capital resources is therefore required for balanced growth in the economy. However, there are natural and artificial barriers that hinder interprovincial labour migration in Canada. Natural barriers include language and cultural differences, availability and scarcity of natural resources, geographical distance, weather and climate, among others. Artificial

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<sup>4</sup> Gordon Infeld, "Why can't Canada learn to get along? How provincial trade barriers remain a conundrum" Canadian Press, Nov. 28, 2014

<sup>5</sup> Marie-Danielle Smith, "Will Kinder Morgan walk away from the Trans Mountain pipeline expansion?" National Post, May 23, 2018



barriers include non-recognition of professional certifications (such as, medicine, law, accountancy and auditing certifications) by provinces, difference in provincial governments licencing of trades, preferential hiring practices in each province, difference in migration policy, difference in provincial social safety net programs, difference in the education system and employment standard (see, Gunderson 1994 for detail). Besides, provincial differences in wage rates, cost of living, housing price, provincial tax rate, and urbanization play an important role in determining migration within Canada (see, Robinson and Tomes 1982, Helliwell and Verdier, 2001). Canadian interprovincial migration is often very difficult to project because it is extremely volatile over time (Smith 1986).

Interprovincial trade and international trade explain approximately 23 percent and 77 percent of Canada's total trade, respectively (CANSIM data, 2015). 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) (WDI 2018, and CANSIM 2018). According to 2015's data, Canada's interprovincial trade was \$367,884 million, while its provincial import demand from abroad was \$589,855 million, per year. Canada searches for new international trade partners' in Europe and Asia. This initiative involves high transaction and negotiation costs. Rather, Canada could take advantage of a less expensive option. If the country improves its trade relationships among the provinces, it could expand its internal market and increase its GDP. The Standing Senate Committee on Banking, Trade and Commerce agreed with recent estimates suggesting that internal trade barriers reduce Canada's GDP by between \$50 billion and \$130 billion. Elimination of internal trade barriers is expected to increase Canada's GDP ranging between 0.05% and 7.0% (Tkachuk and Day 2016).

It is difficult to list all the trade barriers to interprovincial trade in Canada. However, it is known widely that the provinces have barriers to trade and migration in many forms. For example, not allowing out-of-province doctors to practice, forbidding fish and crab being processed in another province, the export of liquid natural gas, a provincial standard for the length of trucks, a province's decision to buy domestic goods and services, and provincial production subsidies (among others) still hinder Canada's internal trade. Canada has been struggling with the problem of interprovincial trade and migration barriers for quite some time. Several initiatives have been

taken to reduce these barriers. In 1995, the Agreement on Internal Trade (AIT) aimed at eliminating and reducing barriers to free movement of persons, goods & services, and investment within Canada while leaving many interprovincial barriers still in place. When AIT failed, British Columbia and Alberta signed a bilateral agreement called TILMA (Trade, Investment, and Labour Mobility Agreement) in 2006. It was expected that other provinces would take similar initiative. However, other provinces have not followed the lead of TILMA. Later, a Standing Senate Committee on Banking, Trade and Commerce was formed in early 2016 and the committee was asked to examine and report on issues pertaining to internal barriers to trade.

A report of the Standing Senate Committee on Banking, Trade and Commerce of Canada (2016) has stated that 150 years since the Confederation was formed, there remains too many unnecessary regulatory and legislative differences among Canada's provincial jurisdictions. These create "walls" and prevent the free flow of people, goods, services and investments between provinces and territories. These provincial barriers increase the cost of production, business and trade. The committee recommended that the federal government work actively with provincial/territorial governments to ensure and reform the existing rules and policies, and laws and regulations for the free movement of people, goods, services and investment in Canada.

In 2017, the Federal and Provincial governments of Canada signed the Canadian Free Trade Agreement's (CFTA, 2017) to overcome the main barriers in trade and labour migration and to foster economic growth. Over time this may contribute to balanced provincial growth in Canada. The main objectives of the CFTA, 2017 are to reduce and eliminate barriers to the free movement of persons, goods, services, and investments within Canada (see, Article 100). All parties mutually agreed to the principles of ensuring (i) to eliminate existing barriers and avoid new barriers, (ii) non-discriminatory treatment of persons, goods, services, and investments, irrespective of where they originate in Canada, and (iii) to reconcile occupational standards and regulatory measures to provide for the free movement of persons and the removal of barriers to trade and investment within Canada (see, Article 102, CFTA 2017). Canada is now looking forward to seeing the success of CFTA 2017.

### 3. Data, Variables, and Methods

This study applies a balanced panel approach using secondary data from 1981 to 2016 for ten Canadian provinces. Our main data sources are the Statistics Canada (STATCAN) and the Citizenship and Immigration Canada (CIC). The name of the variables, the description about the variables and the respective sources are given in Table 1 (in Appendix). A summary of interprovincial and international migration is given in Table 3 and Table 4. These tables show that Ontario, Quebec, BC and Alberta are the major provinces of interprovincial and international migration. Share of interprovincial migration (between 1981 and 2016) of Ontario, Alberta, BC and Quebec are 24.5%, 22%, 18% and 9.5%, respectively. International immigration shares by province shows that Ontario (50%) is the largest immigration host, followed by Quebec (18%), BC (16%), and Alberta (9%). This indicates that Ontario is the highest migration hub for both internal and external migrants. Alberta is the 2<sup>nd</sup> largest province for internal migration, however it is the 4<sup>th</sup> largest province for international immigration. Quebec is just opposite. It is the 2<sup>nd</sup> largest province for international immigration, but the 4<sup>th</sup> largest province for internal migration. BC is the 3<sup>rd</sup> largest province for both internal migration and international immigration.

Table 3: Average Interprovincial Migration in Canada (1981-2016)

Province	Immigration	Emigration	Net Migration	Provincial Share of Migration (Average, 1981-2016)
Ontario	72,628	69,901	2,727	24.51%
Quebec	22,519	32,954	-10,435	9.54
British Columbia	57,053	45,647	11,406	17.66
Alberta	68,451	57,796	10,655	21.71
Saskatchewan	16,924	21,282	-4,358	6.57
Manitoba	14,536	19,043	-4,507	5.77
Nova Scotia	16,394	17,283	-889	5.79
New Brunswick	11,576	12,726	-1,150	4.18
Newfoundland and Labrador	8,194	11,010	-2,816	3.30
Prince Edward Island	2,777	2,867	-90	0.97

Table 4: Average International Migration to and from the Provinces of Canada (1981-2016)

Province	Immigration	Emigration	Net Migration	Share of immigration (Average, 1981-2016)	Share of Net Migration (Average, 1981-2016)
Ontario	103,373	24,047	79,326	48.95%	50.15%
Quebec	37,078	7,985	29,093	17.56	18.39
British Columbia	34,032	9,393	24,639	16.12	15.58
Alberta	20,553	7,056	13,497	9.73	8.53
Saskatchewan	4,059	877	3,182	1.92	2.01
Manitoba	7,596	1,779	5,817	3.60	3.68
Nova Scotia	2,134	840	1,294	1.01	0.82
New Brunswick	1,214	645	569	0.57	0.36
Newfoundland and Labrador	563	290	273	0.27	0.17
Prince Edward Island	566	87	479	0.27	0.30

There are two main features of Canadian migration: (a) interprovincial migration among Canadian provinces, and (b) international migration to Canadian provinces.

Canadian immigration data (1981 - 2016)<sup>6</sup> shows that interprovincial migration is also significantly higher in the provinces of Ontario, British Columbia, Quebec and Alberta compared to the other provinces of Canada. Average interprovincial immigration (during 1981 - 2016)<sup>2</sup> in Ontario (72,628), Quebec (22,519), British Columbia (57,053), Alberta (68,451), Saskatchewan (16,924), Manitoba (14,536), Nova Scotia (16,394), New Brunswick (11,576), Newfoundland and Labrador (8,194), and Prince Edward Island (2,777) show significant interprovincial migration among Canadian provinces. This indicates that some provinces such as Ontario, BC, Quebec and Alberta are preferable to the migrants over others (see, Table 3).

As with interprovincial migration, immigration in some provinces is significantly higher than in other provinces. On average, international immigration population in Ontario (103,373), Quebec (37,078), British Columbia (34,032) and Alberta (20,553) are significantly higher than other provinces such as, Manitoba (7,596), Saskatchewan (4,059), Nova Scotia (2,134), New Brunswick (1,214), Prince Edward Island (566), and Newfoundland and Labrador (563). Note that net international migration in all provinces of Canada is significantly positive (see Table 4).

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 in our sample period (1981-2016)<sup>2</sup> indicates that Ontario (28%), Quebec (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%). Export data for the same period also shows a similar interprovincial trade pattern. The major exporting provinces 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%).

If we compare (internal or external) migration data with the data on interprovincial trade, there appears to be a link between migration and interprovincial trade. Ontario, Quebec, BC and Alberta

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<sup>6</sup> See Table 2 for detail.

are the major immigration hosts; and these provinces are the top trading provinces in Canada. Among these four major migration hosts, net migration in all provinces except Quebec is positive. Similarly, net interprovincial trade of all provinces is positive except in Quebec. International net migration in Ontario, BC, Alberta, Manitoba and Saskatchewan is positive and higher than other provinces. The international trade balance of these provinces is also positive and higher than other provinces (see, Table 2 in Appendix). Quebec is the only exception that has a negative trade balance despite a positive and large net international migration.

For further evidence and more insight, we estimate the impact of interprovincial and international net migration on interprovincial trade by using several panel estimation methods.

We apply both the gravity model and the spatial trade model<sup>7</sup> for estimation purpose. The gravity model includes the proximity between Canadian provinces while the spatial trade model includes the provincial heterogeneities in trade policies, the rate of inflation, population size, the size of the provincial economy and cultural phenomenon such as language.

The gravity model includes the geographical distance between provinces as an essential variable in addition to other commonly used variables in trade models such as the income of OP and RP and the prices of OP and RP. Gravity is measured by the distance between local and other provinces (average distance from the considered province to all other provinces in kilometers). Interprovincial and international migration are the variables of our interest and these variables are included in both the gravity and spatial trade models. RP's price is the average CPI of all provinces except the OP. The spatial trade model includes some province-specific factors such as the size of the economy, population, culture (proxied by common language). Population is the ratio of RP's population and OP's population. RP's population is the average population of all provinces except the OP's population. The economic size variable is proxied by the GDP of provinces. The size of the RP's economy is the average GDP of all provinces except the OP's GDP. "Common language" is a dichotomous dummy variable for the provinces that have *de facto* official language English and French. The value is 1 if the provincial language is English and French, and zero (0) otherwise.

A graphical analysis is made to visualize the pattern of the data and the correlation between immigration and interprovincial trade. Then, we estimate our empirical models.

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<sup>7</sup> See Anania & McCalla (1991) for detail.

## **Potential Endogeneity and the Estimators**

Previous studies estimated the relationship between migration and trade, and found that immigration leads to trade creation (see, for example, Dunlevy and Hutchinson 1999, Head and Ries 1998, Bergstrand 1985). The migration variable was used as an exogenous variable in these studies without testing whether migration was an exogenous variable in the trade model. We cannot ignore the possibility that migration could be an endogenous variable. Firstly, there are studies that found evidence that macroeconomic factors significantly affect labour migration (see, for example, Edmonston and Lee 2013, Coulombe 2006, Day and Winer 2006, Helliwell 1996, Newbold 1996, Osberg, Gordon and Lin 1994, Day 1992, Robinson and Tomes 1982, Laber and Chase 1971, Courchene 1970). The endogeneity issue must be addressed in a trade model if migration is taken as one of the determinants of trade.

Secondly, if a model with endogeneity problem is estimated by OLS estimator, estimated results would not be unbiased. Moreover, Silva and Tenreyro (2006) show that the parameters of a log-linearized gravity model estimated by OLS lead to bias estimate. Our empirical model is a log-linearized gravity model. Consequently, pooled OLS may not be an unbiased estimator. In addition to the pooled OLS and the fixed effects estimators, we, therefore, apply the System GMM method (SGMM) and the Two-stage Least Square (2SLS) estimator in this study.

In SGMM, endogenous variables are instrumented by internal instruments. However, the employment rate of provinces is used as the instrument for net migration in the two-stage least square (2SLS) model because previous studies indicate that employment opportunity is a significant determinant for immigration (see, Osberg, Gordon and Lin 1994, Helliwell 1996, Coulombe 2006, Edmonston and Lee 2013).

## **4. Graphical discussion, model specification and estimation**

Descriptive statistics (Table 2 in Appendix) and graphical analyses (as follows) give a preliminary view about the structure of the data and the relationship between variables. We plot interprovincial trade against interprovincial and international net immigration. Graphical discussion about the relationship between trade and migration is given as follows.

## **Graphical Analysis**

If in-migration and out-migration occur in the same year, the number of migrants that remain in a province can only be shown by net migration (in-migration minus out-migration). Hence, we construct the net interprovincial migration and the net international migration variables by subtracting emigration from immigration.

We show the relationship between net interprovincial and net international migration, and interprovincial trade in scatter diagrams. The vertical axis of Figure 2 and Figure 3 show the interprovincial trade and the horizontal axis shows net interprovincial migration (Figure 1) and net international migration (Figure 3). Figure 2 shows a positive relationship between net interprovincial migration and interprovincial trade. Figure 3 also shows a positive correlation between net international migration to Canadian provinces and interprovincial trade. Figure 2 and Figure 3 offer an indication that immigration and interprovincial trade are positively related. However, we investigate further to validate that the relationship is a significant one.



Figure 2: Interprovincial net immigration and interprovincial trade

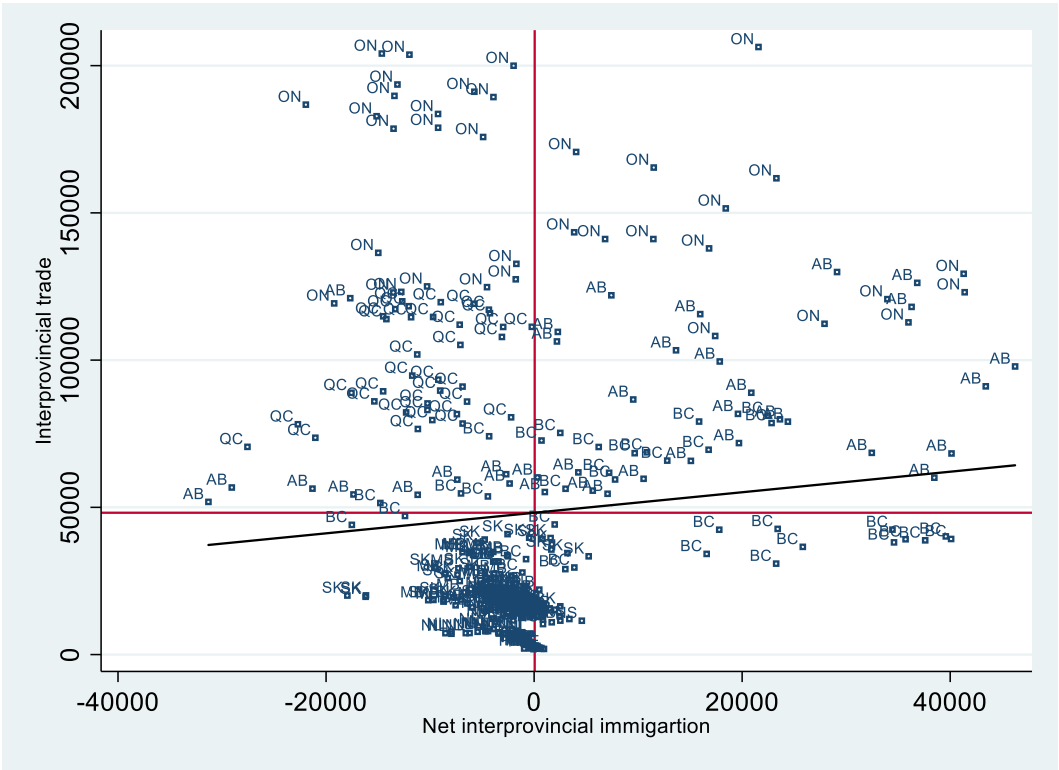
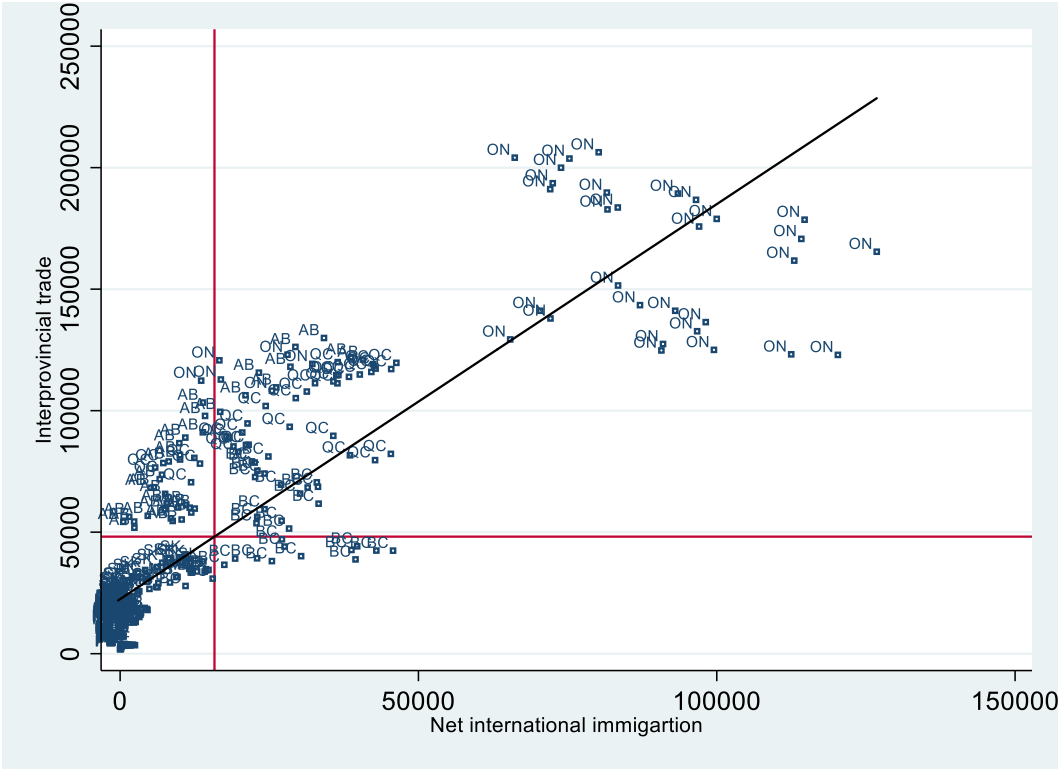


Figure 3: International net migration and interprovincial trade



## Model Specification and Estimation

Anderson and Van Wincoop (2003) predict that bilateral trade flows depend on the relative trade costs, and a well-specified gravity model can address these costs. The gravity model has been recognized as the most influential trade model of international trade analysis. It has been used empirically for analyzing the determinants of bilateral trade flows across countries by a number of previous studies (see, for example, Dunlevy & Hutchinson, 1999, Khadaroo & Seetanah, 2008; Narayan & Nguyen, 2016; Kinuthia, 2017). We apply the gravity model similar to Head and Ries (1998), Dunlevy and Hutchinson (1999), Khadaroo and Seetanah (2008), Narayana and Nguyen (2016) and Kinuthia (2017) who applied the gravity model to estimate the relationship between labour migration and international trade.

When modeling discriminatory trade practices of Canadian provinces and when considering province-specific factors such as provincial population, economic size, language, among others, we not only count for the trade costs (a gravity model) but also consider the spatial aspects of provinces (see, Anania and McCalla 1991). This study applies the “spatial trade model”, in addition to the gravity model. Our spatial factors include provincial economic size, population, and culture (which is proxied by the *de facto* official language). We use proximity as an indicator of gravity and this variable is included in both the gravity and the spatial trade model due to its significance as a control variable.

The existing literature in international trade commonly applied the following specification for bilateral trade flows (Bergstrand 1985).

$$TF = f(RP, Y, Y^*, D) \quad (1)$$

where  $TF$  stands for trade flow,  $RP$  relative price,  $Y$  for domestic income,  $Y^*$  trade partners income, and  $D$  for distance. Theoretical trade models predict that domestic income will increase imports and foreign income will increase exports. Empirical studies generally found evidence in favour of the theoretical prediction. The relative price of goods and services (foreign price relative to the domestic price of traded goods) also plays a significant role in international trade. If domestic price is lower than the foreign price, the goods and services result in exports, however, if the foreign price is lower than domestic price, imports increase. Hence, a price differential (between home and abroad) leads to trade creation. Specifically, a higher domestic price level increases imports

from other provinces and a higher foreign price level increases exports of the domestic province, and vice versa. Finally, the gravity model states that there will be more trade between countries or provinces if their proximity are closer.

Factor movement (such as labour migration) has a significant role in international trade (Head and Ries 1998, Dunlevy and Hutchinson 1999, Gould 1994, Mundar 2005, Lewer 2006, Lewer and Hendrick 2009, Genc et al. 2011). We cannot ignore the contribution of immigration to commodity trade. Equation (1), therefore, can be re-written as -

$$TF = f(RP, Y, Y^*, D, IMM) \quad (2)$$

where *IMM* stands for net migration.

As mentioned earlier, we must account for the influence of spatial factors in trade. So, we apply spatial trade model including province specific factors.

The level of GDP plays two roles in our empirical models. First, OP's income (GDP of OP) and RP's income (GDP of other provinces) are influential variables for import and export, respectively. Second, the size of the economy (is proxied by the level of provincial GDP) is an important spatial determinant for provincial trade. We, therefore, include OP's GDP and RP's GDP as explanatory variables in both the gravity and the spatial trade models.

In an alternative specification for the spatial trade model, we include *de facto* common language, and the provincial population ratio as spatial factors for interprovincial trade, in addition to the OP's GDP, the RP's GDP and the proximity.

The empirical gravity model (equation 3) and the spatial trade model (equation 4) can be written as follows:

$$\ln EXIM_{it} = \beta_0 + \beta_1 \ln EXIM_{i,t-1} + \beta_2 \ln NM_{it} + \beta_3 \ln Y_{it} + \beta_4 \ln Y_t^* + \beta_5 \ln P_{it} + \beta_5 \ln P_t^* + \beta_6 \ln Dist_{it} + \varepsilon_{it} \quad (3)$$

$$\ln EXIM_{it} = \gamma_0 + \gamma_1 \ln EXIM_{i,t-1} + \gamma_2 \ln NM_{it} + \gamma_3 \ln Y_{it} + \gamma_4 \ln Y_t^* + \gamma_5 \ln P_{it} + \gamma_6 \ln P_t^* + \gamma_7 \ln Dist_{it} + \gamma_8 \ln (Pop^*/Pop)_{it} + \gamma_9 Lcommon + \varepsilon_{it} \quad (4)$$

where *EXIM* stands for trade flow, *ln* for natural logarithm, *i* for OP and \* for RP. *EXIM*<sub>*i,t-1*</sub> is the first lag of interprovincial trade. It is assumed that if two countries have a historical trade

relationship, they are more likely to be engaged in further trade. Thus, we apply the first lag of trade as an explanatory variable in both the gravity and spatial trade model. *NM* stands for net interprovincial and international migration. We apply both the flow and stock of net migration variables in both interprovincial and international trade model. We apply either net interprovincial migration or net international migration in alternative models. *P* stands for price level in the domestic province, *P\** for average price level of other provinces, *Y* for GDP in domestic province, *Y\** for average GDP of other provinces, *Dist* for distance between domestic and other provinces (average distance from the considered province to all other provinces in kilometre) and *Pop\** and *Pop* are population in RP and OP, respectively.

The employment rate is an influential factor in explaining labour movement in an economy. If a province has more employment opportunity, it can attract more labour mobility from other provinces and at the same time from foreign countries. This leads to internal and international migration. Employment opportunity however may not directly affect imports and exports. The employment rate is also an appropriate instrument for net migration. We, therefore, apply the employment rate as an instrument in the 2SLS regression. We also test (a post-estimation) whether there is an endogeneity issue in the empirical model. We cannot reject that there is an endogeneity issue in the empirical model. We, therefore, accept the SGMM and the 2SLS as our main estimators. As internal instruments (lags) are used in the SGMM (which is controversial) and an external instrument, employment rate is used for migration, we prefer the estimated results found from 2SLS.

We also estimate import and export demand functions using the commonly applied gravity model for import and export demands. Import demand function considers the relative price, domestic income and distance as the major explanatory variables. Export demand function includes the relative price, foreign income and distance as the major explanatory variables. We also apply the spatial model to estimate the import and the export demand function.

## 5. Estimated Results

### Granger Causality in Panel Data

We test for Granger causality in panel data using the Dumitrescu & Hurlin (2012) Granger non-causality test statistic. We reject the null hypothesis that net interprovincial ( $Z\text{-bar} = 4.697^{**}$ ) and net international migration ( $Z\text{-bar} = 1.711^{*}$ ) does not Granger-cause net interprovincial trade. These findings suggest a causal relationship between net interprovincial migration and interprovincial trade that flows from net interprovincial migration to interprovincial trade. We also find a causal relationship between net international migration and interprovincial trade that flows in the direction from net international migration to interprovincial trade.

### The gravity model and interprovincial trade flow

We estimate the gravity model (Equation 3) using POLS, FE, 2SLS and SGMM estimators<sup>8</sup>. Estimated results using pooled OLS, fixed effects and 2SLS estimators indicate that net interprovincial migration has a positive and significant impact on interprovincial trade of Canada. The 2SLS and SGMM show that net international migration to Canadian provinces plays a positive and significant role in interprovincial trade flow. Pooled OLS shows a negative impact of net international migration on interprovincial trade. The (post-estimation) test for endogeneity detection shows that endogeneity is an issue in our empirical model, and it should be addressed. The FE estimator can control for cross-section (province) specific factors, however, it is unable to address the endogeneity issue. The 2SLS and SGMM estimators are applied to solve the endogeneity problem. The Sargan test does not support the appropriateness of internal instruments that we used in SGMM. Our preference, therefore, is for the estimated results using 2SLS estimator. Estimated results are given in Table 5 and Table 6.

The 2SLS results indicate that net interprovincial and international migrations are positive and significant determinants for Canadian interprovincial trade. However, net interprovincial migration has more influence than net international migration in interprovincial trade flow. A one percent (1%) increase in net interprovincial migration increases interprovincial trade by about 0.6

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<sup>8</sup> We test for unit root using Levin, Lin and Chu (2002) and Im, Pesaran and Shin (2003) and found that our series are stationary at level.

percent, while a one percent increase in net international migration increases interprovincial trade by approximately 0.2 percent.

Geographical distance is a negative and significant determinant for interprovincial trade. This indicates that as proximity between provinces increases, the trade between provinces falls. These results validate the gravity model as an appropriate model for estimating interprovincial trade. OP's income and RP's income are positive and significant determinants for interprovincial trade. Intuitively, OP's income increases import and RP's income increase export. Jointly provincial incomes increase provincial trade. The price levels (of OP and RP) do not show any systematic and consistent effect on interprovincial trade. History (previous years' trade) of trade plays a positive and significant role in current interprovincial trade of Canada.

Table 5: The Gravity Model and the results of Pooled OLS and the fixed effects estimators

Dependent Variable: <b>Trade Flow</b>	<b>Pooled OLS</b>		<b>Fixed Effects</b>	
	(1)	(2)	(1)	(2)
Lag of trade flow	0.312** (0.026)	0.341** (0.027)	0.137** (0.019)	0.132** (0.021)
Net interprovincial migration	0.086** (0.023)		0.054** (0.017)	
Net international migration		-0.027** (0.010)		0.010 (0.008)
OP income	0.594** (0.025)	0.565** (0.025)	0.669** (0.065)	0.737** (0.064)
RP income <sup>ω</sup>	0.414** (0.075)	0.276** (0.072)	0.435** (0.091)	0.383** (0.090)
OP Price	-0.685** (0.245)	-0.611** (0.249)	0.133 (0.176)	0.065 (0.183)
RP price <sup>φ</sup>	0.414 (0.264)	0.525** (0.265)	-0.384* (0.195)	-0.340* (0.198)
Distance	-0.371** (0.044)	-0.285** (0.038)	Omitted	Omitted
Constant	-0.139 (0.457)	-0.019 (0.461)	-2.452** (0.540)	-2.452** (0.548)
Observation	359	359	359	359
Adj R <sup>2</sup> /overall R <sup>2</sup>	0.99	0.99	0.98	0.99

Note: <sup>φ</sup> we use the average price level of all provinces except the OP's price level, as the RP price variable. <sup>ω</sup>we use the average GDP of all provinces except the OP as the RP's income variable.

Table 6: The Gravity Model and the results of 2SLS and GMM

Dependent Variable: <b>Trade Flow</b>	<b>2SLS</b>		<b>SGMM</b>	
	(1)	(2)	(1)	(2)
Lag of trade flow	0.214** (0.084)	0.249** (0.102)	0.514** (0.045)	0.228** (0.019)
Net interprovincial migration	0.586** (0.132)		0.010 (0.021)	
Net international migration		0.182** (0.046)		0.028** (0.007)
OP income	0.706** (0.078)	0.640** (0.089)	0.394** (0.043)	0.661** (0.018)
RP income <sup>ω</sup>	1.012** (0.201)	0.530** (0.128)	-0.048 (0.086)	0.399** (0.038)
OP Price	-0.624 (0.411)	-1.260** (0.390)	-0.604** (0.158)	-0.786** (0.094)
RP price <sup>φ</sup>	-0.290 (0.433)	0.596* (0.350)	0.871** (0.190)	0.481** (0.103)
Distance	-0.873** (0.152)	-0.291** (0.065)	-0.151** (0.045)	-0.328** (0.017)
Constant	-0.510 (0.667)	-0.453 (0.589)	1.209** (0.344)	-0.089 (0.183)
Observation	359	359	359	359
R <sup>2</sup>	0.98	0.98		
Endogeneity Test	$\chi^2 = 23.475$ (p = 0.000)	$\chi^2 = 37.820$ (p = 0.000)		
Arellano-Bond test:				
AR(1)			z <sub>1</sub> = 0.07 (p=0.944)	z <sub>1</sub> = -1.16 (p=0.246)
AR(2)			z <sub>2</sub> = -0.11 (p=0.911)	z <sub>2</sub> = -0.14 (p=0.890)
Sargan Test (IV):				
Excluding group			$\chi^2 = 22.60$ (p = 1.00)	$\chi^2 = 175.03$ (p = 0.000)
Including group			$\chi^2 = 105.16$ (p = 0.000)	$\chi^2 = 187.79$ (p = 0.000)

Note: “Provincial employment rate” is an instrument for the net interprovincial and the net international migration. Price ratio does not change our results. However, we present the OP’s price and RP’s price variables to show their impact on trade separately.

### **The spatial trade model and interprovincial trade flow**

Discriminatory trade policy and differences between provinces such as language, size of the population, the size of the economy may affect trade between provinces. We, therefore, estimate the spatial trade model (equation 4) using all the estimators. Estimated results are given in Table 7 and Table 8.

A test for endogeneity indicates that the migration variable is endogenous in the interprovincial Canadian trade model. Similar to the gravity model, our preferred estimator is the 2SLS in the spatial trade model.

Estimated results suggest that net interprovincial and net international migration have positive and significant influence on interprovincial trade of Canada. Similar to the gravity model, the spatial trade model also indicates that net interprovincial migration is more influential than net international immigration in determining interprovincial trade in Canada. A one percent (1%) increase in net interprovincial migration increases interprovincial trade by 0.5 percent. However, a one percent (1%) increase in net international migration increases interprovincial trade by approximately 0.13 percent. Thus, our results are consistent using both trade models.

Spatial factors such as population, size of the economy and language play a positive and significant role in interprovincial trade. We find that both OP's and RP's incomes are positive and significant determinants for interprovincial trade. Reciprocal English and French speaking provinces are more likely to be engaged in interprovincial trade (about 11% higher) compared to the provinces that do not have both English and French language. Population plays a significant positive role in interprovincial trade. Proximity is also a highly significant determinant in the spatial trade model. Similar to the gravity model, price levels (of OP and RP) do not have a systematic impact on interprovincial trade. Therefore, we can conclude that both the gravity model and the spatial model of trade are useful to explain the interprovincial trade in Canada.



Table 7: The Spatial Trade Model and the results of pooled OLS and the fixed effects estimators

Dependent Variable: <b>Trade Flow</b>	<b>Pooled OLS</b>		<b>Fixed Effects</b>	
	(1)	(2)	(1)	(2)
Lag of trade flow	0.210** (0.024)	0.225** (0.025)	0.131** (0.019)	0.129** (0.020)
Net interprovincial migration	0.069** (0.020)		0.029 (0.018)	
Net international migration		-0.006 (0.009)		0.002 (0.008)
OP income	0.847** (0.037)	0.837** (0.039)	0.879** (0.092)	0.946** (0.082)
RP income <sup>ω</sup>	427** (0.073)	0.330** (0.071)	0.242** (0.108)	0.180* (0.101)
OP Price	-0.261 (0.046)	-0.246 (0.217)	0.264 (0.179)	0.271 (0.186)
RP price <sup>φ</sup>	-0.227 (0.233)	-0.138 (0.236)	-0.550** (0.199)	-0.566** (0.201)
Distance	-0.444*** (0.042)	-0.380** (0.038)	Omitted	Omitted
English&French <sup>Υ</sup>	0.116** (0.012)	0.115** (0.013)	Omitted	Omitted
Population ratio <sup>ΥΥ</sup> (pop*/pop)	0.174** (0.029)	0.182** (0.030)	0.230** (0.072)	0.273** (0.067)
Constant	-1.440** (0.418)	-1.367** (0.427)	-3.486** (0.624)	-3.670** (0.614)
Observation	359	359	359	359
Adj R <sup>2</sup> /overall R <sup>2</sup>	0.99	0.99	0.98	0.98

Note: <sup>Υ</sup>De facto common official language. <sup>ΥΥ</sup>The ratio of population from all provinces (except OP) and population in OP.

Table 8: The Spatial Trade Model and the results using the 2SLS and GMM estimators

Dependent Variable: <b>Trade Flow</b>	<b>2SLS</b>		<b>SGMM</b>	
	(1)	(2)	(1)	(2)
Lag of trade flow	0.138* (0.074)	0.133 (0.081)	0.350** (0.037)	0.138** (0.018)
Net interprovincial migration	0.500** (0.114)		0.014 (0.016)	
Net international migration		0.134** (0.032)		0.038** (0.006)
OP income	0.881** (0.082)	0.936** (0.089)	0.694** (0.042)	0.924** (0.022)
RP income	0.981** (0.192)	0.545** (0.103)	0.097** (0.069)	0.419** (0.036)
OP Price	-0.269 (0.348)	-0.557** (0.280)	-0.272** (0.120)	-0.320** (0.082)
RP price	0.751* (0.390)	-0.287** (0.284)	0.185 (0.158)	-0.243** (0.096)
Distance	-0.842** (0.126)	-0.391** (0.056)	-0.296** (0.035)	-0.406** (0.016)
English & French	0.109** (0.019)	0.157** (0.020)	0.091** (0.009)	0.137** (0.006)
Population ratio (pop*/pop)	0.118** (0.053)	0.203** (0.035)	0.160 (0.017)	0.197** (0.011)
Constant	-1.705** (0.591)	-2.140** (0.518)	-0.232 (0.309)	-1.594** (0.186)
Observation	359	359	359	359
R <sup>2</sup>	0.99	0.99		
Endogeneity Test <sup>1</sup>	$\chi^2 = 20.39$ (p = 0.000)	$\chi^2 = 24.193$ (p = 0.000)		
Arellano-Bond test:				
AR(1)			z <sub>1</sub> = -0.57 (p=0.570)	z <sub>1</sub> = -2.00 (p=0.046)
AR(2)			z <sub>2</sub> = -0.17 (p=0.864)	z <sub>2</sub> = -0.30 (p=0.762)
Sargan Test (IV):				
Excluding group			$\chi^2 = 31.35$ (p = 0.999)	$\chi^2 = 171.40$ (p = 0.000)
Including group			$\chi^2 = 125.31$ (p = 0.000)	$\chi^2 = 168.32$ (p = 0.000)

Note: <sup>1</sup> The endogeneity test is performed (post-estimation) to determine whether endogenous variables in the model are exogenous. “Provincial employment rate” is an instrument for net interprovincial and international migration.

### **Robustness using the stock of net migrants**

Every year, some people immigrate to a province and some emigrate from that provinces. This leads to either a positive or a negative net migration flow each year. For example, if there is a net (large or small) positive consistent migration flow to a province every year, the province accumulates a large number of net immigrant flow over time. However, if there is an uneven flow of migration to a province, (i.e., there is a significant positive net migration in that province in some years and a significant negative net migration in other years). On a long term average, if even the net migration in both provinces is positive (assume), the impact of net migration will be different in two provinces due to the difference in the constant flow of migrants. The province that has a consistent positive net migration flow is likely to benefit (from positive net migration) more than the province that has unstable migration flow. The stock of migration might be a factor in determining interprovincial trade. We, therefore, construct the cumulative net interprovincial and international migration variable (a stock variable) for all provinces. We estimate the impact of cumulative net migration on interprovincial trade. We apply both the gravity and the spatial trade model as the empirical models. Estimated results are consistent with our previous results in Table 6 and Table 8. Although we applied all the above-mentioned estimators, we present only the results of 2SLS in Table 9 as previously discussed<sup>9</sup>.

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<sup>9</sup> See, Section 4 for details.

Table 9: Cumulative net interprovincial and net international migration.

Dependent Variable: <b>Trade Flow</b>	<b>2SLS</b>			
	(1)	(2)	(3)	(4)
Lag of trade flow	0.222** (0.088)	0.167** (.072)	0.350*** (0.120)	0.132 (0.081)
Net cumulative interprovincial migration	0.687*** (0.125)	0.393*** (0.065)		
Net cumulative international migration			0.285*** (0.081)	0.134*** (0.032)
OP income	0.715*** (0.082)	1.001*** (0.088)	0.526*** (0.102)	0.936*** (0.089)
RP income	1.192*** (0.205)	0.722*** (0.108)	0.451*** (0.114)	0.545*** (0.103)
OP Price	-0.435 (0.350)	-0.106 (0.237)	-0.440 (0.416)	-0.557* (0.280)
RP price	-0.677 (0.405)	-0.809*** (0.279)	-0.048 (0.447)	-0.287 (0.284)
Distance	-0.929** (0.146)	-0.815*** (0.103)	-0.275*** (0.081)	-0.391*** (0.056)
English & French		0.089*** (0.015)		0.157*** (0.020)
Population ratio (pop*/pop)		0.277** (0.036)		0.203*** (0.035)
Constant	-1.460** (0.615)	-1.805*** (0.425)	-0.266 (0.665)	-2.140*** (0.518)
Observation	359	359	359	359
R <sup>2</sup>	0.985	0.99	0.975	0.99
Endogeneity Test	$\chi^2 = 23.71$ (p = 0.000)	$\chi^2 = 18.49$ (p = 0.000)	$\chi^2 = 52.52$ (p = 0.000)	$\chi^2 = 24.19$ (p = 0.000)

### Interprovincial Import and Export

We estimate interprovincial import and export models using 2SLS estimator. The key indicators of an import demand function are the price ratio and domestic income. In our empirical model, we include net migration, proximity and lag of import as the determinants of provincial import, in addition to the key indicators (such as price ratio and OP's income) of the import demand function. We apply RP's income, price ratio, net migration, proximity and lag of export as the potential determinants of interprovincial export.

Table 10: Estimated results of interprovincial import and export models using 2SLS.

Variable	Import				Export			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lag dependent	0.431*** (0.105)	0.352** (0.088)	0.467*** (0.076)	0.392*** (0.103)	0.979*** (0.010)	0.974*** (0.013)	0.982*** (0.009)	0.965*** (0.018)
Net interprovincial migration	0.465*** (0.117)				0.193 (0.141)			
Net international migration		0.103*** (0.022)				0.062 (.045)		
Net cumulative interprovincial migration			0.108*** (0.019)				0.210 (0.148)	
Net cumulative international migration				0.198*** (0.049)				0.111 (0.082)
OP income	0.418*** (0.080)	0.477*** (0.066)	0.327*** (0.058)	0.428*** (0.076)				
RP income <sup>1</sup>					0.171*** (0.062)	0.080 (0.051)	0.176*** (0.064)	0.100** (0.047)
Price ratio	-0.117 (0.386)	0.168 (.279)	-0.349 (0.228)	-0.282 (0.313)	1.007 (0.719)	1.202 (0.792)	0.948 (0.695)	0.918 (0.709)
Distance	-0.341*** (.093)	0.002 (0.028)	-0.170*** (0.033)	-0.010*** (0.034)	-0.194 (0.129)	-0.024 (0.072)	-0.189 (0.123)	-0.043** (0.071)
Constant	3.617** (0. .829)	0. .884*** (0. .273)	1.516*** (0.250)	1.081*** (0.335)	-0.286 (0.690)	-0.588 (0.564)	-0.391 (0.608)	--0.612 (0.563)
Observation	359	359	359	359	359	359	359	359
R <sup>2</sup>	0.98	0.99	0.99	0.98	0.97	0.97	0.97	0.97

Estimated results indicate that net migration is a positive and significant determinant of interprovincial import (see, Table 10). Both the flow and stock of net migration significantly influence interprovincial import. The coefficient of net migration is positive but insignificant in the interprovincial export model. This suggests that net interprovincial migration can significantly influence interprovincial imports, but it does not significantly affect interprovincial exports. Note, interprovincial imports of one province resembles the exports of other provinces. Out of 10 Canadian provinces, imports of a province is a cumulative sum that come from all other provinces (9 provinces), however, exports of a province go to each of 9 others provinces separately. A significant net migration can increase the demand for imports of a province significantly due to higher demand for goods and services. However, exports of that provinces depends on the demand for export separately that come from all other provinces. d This may be an explanation for an insignificant effect of net migration on exports.

### Estimated results by province

We estimate the impact of net internal and net external migration on provincial trade by province. We have 36 observations available for each province which is an adequate sample size for estimation purpose. We estimate province-specific models to find which provinces drive the results of panel estimation. Estimated results indicate that the key provinces that drive our panel results are Quebec, British Columbia, Saskatchewan and New Brunswick (see, Table 11). The impact of net internal and external migration is positive and significant in these provinces. Among major provinces, Ontario shows an insignificant effect of net migration on trade. Firstly, Ontario's in-migration and out-migration on average are about equal. There might be an offsetting effect of migration on interprovincial trade for Ontario. Secondly, when an economy experiences very similar types of shocks, repeatedly, it may internally develop the capacity to absorb further shocks. Historically, Ontario has been the highest recipient of in-migrants and out-migrants. At the same time, a sizable population of Ontario emigrates to other provinces every year (see, Table 2 in Appendix). The net migration in Ontario, therefore, may not significantly influence its interprovincial trade.

Table 11: Estimated result by province (Gravity Model)

Provinces (Dependent = Trade Flow)	2SLS	
	Net interprovincial migration	Net international migration
Ontario	-0.242 (0.220)	-0.458 (0.721)
Quebec	294** (0.098)	0.237** (0.058)
British Columbia	0.056** (0.022)	0.053* (0.028)
Alberta	-0.093* (0.049)	-0.608 (0.813)
Saskatchewan	0.371** (0.166)	0.113** (0.027)
Manitoba	1.487 (3.959)	0.496 (0.597)
Nova Scotia	3.956 (30.437)	-0.081 (0.082)
New Brunswick	0.624* (0.339)	-0.173* (0.093)
Newfoundland and Labrador	0.106 (0.067)	0.225 (0.267)
Prince Edward Island	-0.299 (0.439)	0.124 (0.376)

New Brunswick shows a significant positive effect of net internal migration on interprovincial trade, however, the impact of net external migration on interprovincial trade is negative. The

negative impact of international net migration on interprovincial trade of New Brunswick may be explained as follows. We find that more people are migrating out of the province than are migrating into the province. On average, the net international migration in New Brunswick is positive (+569); however, net interprovincial migration is negative (-1,150). If we count for both the internal and external net migration, we find that net (overall) migration is negative in New Brunswick. Moreover, on average, international trade of New Brunswick is higher (\$18,311 million) than its interprovincial trade (\$17,422 million). It is possible that net international migrations contribute to less interprovincial trade but more international trade. Its proximity to the New England States and its two largest industrial firms (Irving Companies and McCain Foods) are export-oriented. Moreover, they import a large amount of oil mainly from Saudi Arabia.

Unexpectedly, we find the impact of net internal migration on Alberta's interprovincial trade is negative. On average, Alberta's international trade (\$101,237 million) is much higher than internal trade (\$80,302 million). During 1981-2016, international trade of Alberta was growing, on average, at about 6 percent rate every year (see Figure 4). It appears from Figure 4 that international trade was growing faster than interprovincial trade. Perhaps interprovincial migrants to Alberta contribute more to international trade than interprovincial trade. However, estimating international trade model is beyond the scope of this study.

## 6. Conclusion

The purpose of this study is to estimate the effect of net interprovincial and net international migration on interprovincial trade of Canada. We apply both the gravity and the spatial trade models. We apply several estimators such as pooled OLS, the fixed effects, the generalized methods of moment and the two-stage least square for comparison purpose. Due to the potential existence of endogeneity in our empirical model, we preferred the SGMM and the 2SLS estimators. However, the Sargan test did not support the appropriateness of internal instruments that we used in SGMM. Our preference, therefore, is to use the 2SLS estimator. Note that the results from pooled OLS and the fixed effect are similar to what we find in the 2SLS. Estimated results indicate that both net interprovincial and net international migration positively affect interprovincial trade. The results show the influence of net interprovincial migration to be higher than the influence of net international migration on interprovincial trade. A one percent increase in net interprovincial immigration increases interprovincial trade by more than half a percent. However, a one percent increase in net international immigration increases the interprovincial trade by about 0.2 percent only. Net internal and net external migration positively affect the interprovincial imports and exports. However, the effect on exports is not statistically significant. We use both the stock and flow of migration. The estimated results are consistent with each other.

We find that both the gravity model and the spatial trade model are useful to explain Canadian interprovincial trade. Proximity is found to be a negative determinant for interprovincial trade. As the distance between provinces increase, trade between provinces fall.

We also use province-specific factors such as population, size of the economies and common language as the determinants for interprovincial trade. Estimated results show that province-specific factors are significant determinants for interprovincial trade in Canada. Interprovincial trade flows are higher between provinces that speak both English and French. The ratio of provincial population plays a significant role in determining interprovincial trade.

Province-wise estimates indicate that Quebec, British Columbia, Saskatchewan, and New Brunswick are positively and significantly affected by net interprovincial migration. All but New Brunswick are positively and significantly affected by international migration.



Our results are robust to different estimation methods (such as pooled OLS, the fixed effects, and the two-stage least square) and alternative measures using both the flow and the stock of net internal and external migration in Canada's provinces.

It is clear from our estimation that both interprovincial and international migration significantly increase Canadian interprovincial trade. If the Canadian Free Trade Agreement, 2017 can effectively reduce interprovincial barriers of migration and trade, the labour mobility and trade between provinces would be much higher than before, and the economy would grow much faster than current growth rate. The Standing Senate Committee of Banking, Trade and Commerce (2016) believes that elimination of internal trade barriers would increase Canada's GDP ranging between 0.05% and 7.0% (Tkachuk and Day 2016).

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## APPENDICES

**Table 1: Variable, description and data source**

Variable	Description	Data source
Provincial import	Interprovincial imports; expenditure-based, 2007 (chained) annual (Canadian dollars x 1,000,000)	Statistics Canada
Provincial export	Interprovincial exports; expenditure-based, 2007 (chained) annual (Canadian dollars x 1,000,000)	Statistics Canada
International import	International Imports; expenditure-based, 2007 (chained) annual (Canadian dollars x 1,000,000)	Statistics Canada
International Export	International Exports; expenditure-based, 2007 (chained) annual (Canadian dollars x 1,000,000)	Statistics Canada
Provincial in-migration	Interprovincial In-Migrants, annual (persons)	Statistics Canada
Provincial out-migration	Interprovincial Out-Migrants, annual (persons)	Statistics Canada
International immigration	International Immigration; Canada, provinces and territories, annual (persons)	Statistics Canada/CIC
International emigration	International Emigration; Canada, provinces and territories, annual (persons)	Statistics Canada/CIC
Provincial Income	Gross domestic product, expenditure-based, provincial and territorial, annual (dollars x 1,000,000) Chained (2007) dollars	Statistics Canada
Provincial price level	Consumer Price Index, annual (2002=100)	CANSIM
Population	Estimates of population, Canada, provinces and territories, annual (persons)	CANSIM
Distance	Distance between provinces	GlobalFeed.com <sup>Y</sup> (Distance calculator Canada)
English & French	Dummy for de facto common language	

<sup>Y</sup>[https://distancecalculator.globefeed.com/Canada\\_Distance\\_Calculator.asp](https://distancecalculator.globefeed.com/Canada_Distance_Calculator.asp)

**Table 2: Descriptive Statistics (provincial data, 1981 - 2016)**

Variable	Mean	SD	Min	Max
<b>Ontario</b>				
Provincial Import (million)	66810.14	14781.36	44374	92062
Provincial Export (million)	88618.31	17154.69	63813	116018
In-migration (persons)	72628	12823	56690	105002
Out-migration (persons)	69901	10332	52942	98420
International import (million)	153683.1	68559.65	43392	255722
International Export (million)	157871.5	66852.88	49670	244860
Immigration in province (persons)	103373	29592	40121	148654
Emigration from province (persons)	24047	3901	16620	29849
<b>Quebec</b>				
Provincial Import (million)	48280.97	8189.056	33485	60151
Provincial Export (million)	49603.39	8426.72	37051	63095
In-migration (persons)	22519	2695	18392	28849
Out-migration (persons)	32954	5285	23880	47561
International import (million)	69975.67	31559.58	20852	115675
International Export (million)	67415.69	25961.04	28230	98763
Immigration in province (persons)	37078	12517	14698	55050
Emigration from province (persons)	7985	1441	5117	10650
<b>British Columbia</b>				
Provincial Import (million)	30673.42	8037.336	18261	43762
Provincial Export (million)	20761.94	8936.422	9607	37372
In-migration (persons)	57053	11829	41901	79204
Out-migration (persons)	45647	5955	37632	64009
International import (million)	31890.06	16165.56	8953	59112
International Export (million)	38323.22	11055.23	18975	57426
Immigration in province (persons)	34032	10847	12256	52025
Emigration from province (persons)	9393	2594	5668	13231
<b>Alberta</b>				
Provincial Import (million)	38473.92	13816.98	21591	66955
Provincial Export (million)	41828.03	11529.46	28487	62954
In-migration (persons)	68451	16109	39938	102406
Out-migration (persons)	57796	9650	42003	80213
International import (million)	36294.5	24845.67	9845	82565
International Export (million)	64942.64	32208.27	17967	121661
Immigration in province (persons)	20553	10526	8989	49214
Emigration from province (persons)	7056	1096	4753	9201
<b>Saskatchewan</b>				
Provincial Import (million)	15475.97	4785.913	9951	24667
Provincial Export (million)	10946.61	3566.744	5723	16235
In-migration (persons)	16924	2203	13228	22067
Out-migration (persons)	21282	4243	15124	32939
International import (million)	8821.806	5599.335	2631	20634
International Export (million)	15943.19	5907.739	7014	25259
Immigration in province (persons)	4059	3765	1572	14859
Emigration from province (persons)	877	196	483	1441

**Manitoba**

Provincial Import (million)	13232.39	4009.232	8060	19385
Provincial Export (million)	10906.89	3143.702	6848	15847
In-migration (persons)	14536	2757	10295	21020
Out-migration (persons)	19043	3289	13608	26963
International import (million)	9042.528	4806.487	2538	17137
International Export (million)	10297.03	4886.625	3295	16829
Immigration in province (persons)	7596	4490	3004	16826
Emigration from province (persons)	1779	251	1353	2430

**Nova Scotia**

Provincial Import (million)	9440.61	1400.629	7048	11945
Provincial Export (million)	5785.19	1331.766	3308	7518
In-migration (persons)	16394	1627	13687	20257
Out-migration (persons)	17283	1522	14190	20828
International import (million)	7399.389	2959.474	2840	11361
International Export (million)	5200.333	1840.591	2322	7663
Immigration in province (persons)	2134	951	833	5483
Emigration from province (persons)	840	237	430	1245

**New Brunswick**

Provincial Import (million)	9416.639	1939.112	6283	13592
Provincial Export (million)	8006.056	1623.323	4681	10703
In-migration (persons)	11576	1379	9676	14874
Out-migration (persons)	12726	1424	10127	17615
International import (million)	9575.92	4372.95	2902	16470
International Export (million)	8735.11	3361.19	3699	13083
Immigration in province (persons)	1214	879	554	4675
Emigration from province (persons)	645	210	343	1060

**Newfoundland and Labrador**

Provincial Import (million)	6332.694	1026.852	5079	8269
Provincial Export (million)	4325.278	2562.791	1726	8674
In-migration (persons)	8194	1172	5810	10224
Out-migration (persons)	11010	2335	7419	15485
International import (million)	5101.472	3207.08	1289	12284
International Export (million)	7401.083	2655.773	3935	12628
Immigration in province (persons)	563	217	274	1189
Emigration from province (persons)	290	87	184	511

**Prince Edward Island**

Provincial Import (million)	1802.583	407.6202	1117	2401
Provincial Export (million)	959.5278	216.8464	665	1347
In-migration (persons)	2777	311	2202	3482
Out-migration (persons)	2867	483	1925	4216
International import (million)	668.8333	392.7962	170	1378
International Export (million)	674.3333	340.7011	196	1140
Immigration in province (persons)	566	699	107	2593
Emigration from province (persons)	87	29	33	155

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\* 10 provinces

Figure 4: Interprovincial and International Trade of Alberta (1981-2016)

