
Graduate, Stay, or Go: Mapping the Post-Degree Decisions of International Students in Canada

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Abstract— Using Canada's Postsecondary Student Information System (PSIS) and T1 Family File data (2005 to 2018), this study examines the retention rates of international student graduates in Canada and identifies key factors influencing their decision to remain or leave after graduation. Our longitudinal analysis reveals that international students who complete undergraduate degrees are more likely to stay in Canada compared to those with graduate degrees. Additionally, factors such as graduates' field of study, region of origin, and marital status significantly impact their likelihood of staying. In light of Canada's urgent need for high-skilled immigrants to address labour shortages across multiple sectors, our findings provide valuable insights for policymakers seeking to enhance international student retention strategies.

Keywords— Retention rate, international students, graduate students, undergraduate students, STEM, field of study, PSIS data, tax file.

1 Introduction

In 2022, Statistics Canada reported that there were over a million vacant jobs in Canada, which combined with the low unemployment rate outlined by the Labour Force Survey for May 2022, pointed to a labour shortage in Canada (Statistics Canada 2022). The sectors most affected by labour shortages, like the scientific and technical fields, need skilled and educated workers (Statistics Canada 2022). Compared with new immigrants to Canada, international student graduates are the ideal candidates for these positions as they have received a Canadian education, are proficient in English and/or French, often have local work experience, and have already started to integrate (both socially and economically) into the local culture (IRCC 2016). In 2014, the Government of Canada announced it would work with the provinces and territories, Canadian educational institutions, and other stakeholders to double the size of Canada's international student base from 239,131 in 2011 to over 450,000 by 2022 (Government of Canada 2014). Canada, therefore, has recently been proactively seeking out international students to fill its labour shortages.

But Canada is not alone in identifying international students as potential future workers in its different industries. There is a global competition for international students, as they are often seen as ideal economic immigrants in countries facing skilled labour shortages (Choi, Hou, and Chan 2022). In recent years, the number of international students around the world as well as in Canada has been increasing. According to estimates, there were 2.7 million international students globally in 2005, representing a 61 percent increase since 1999 (Verbik and Lasanowski 2007).

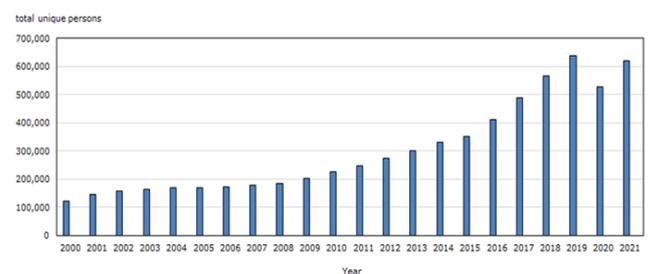


Fig. 1: Study permit holders in Canada with a valid permit on December 31, total individuals, 2000 to 2021. (IRCC, 2021)

In the past decade, Canada has received more international students than most other Western countries. The Canadian Bureau for International Education reported that from 2010 to 2017, there was a 119 percent increase in the number of international students studying in Canada (Esses et al. 2018).

That number has since increased further, reaching 621,600 in 2021 (Choi, Crossman and Hou 2021). Furthermore, the composition of international students in Canada has changed over the years. The share of international students from China and India has increased substantially in recent years, making them the top two sending countries (Choi, Crossman, and Hou 2021). Figure 1 illustrates the growth in the number of international students in Canada, reflecting a consistent increase over the last two decades.

The literature on immigration contains very limited discussion of international students as potential immigrants. There are even fewer studies about international students in Canada (El Masri and Khan 2022). This study contributes to the literature by analyzing factors affecting the retention rates of international student graduates in Canada. The existing literature on this topic has mainly focused on country-specific determinants of migration, such as GDP and unemployment, with very little focus on the individual characteristics that may result in retention. The very few studies that have focused on the retention of international students in Canada are limited to small surveys of these students or cover only a handful of universities (Arthur and Flynn 2011; Esses et al. 2018;). In this study, we focus on determinants particular to individuals, including socio-demographic characteristics and variables related to education, providing further insight into the motivations of international students to stay or to leave. Our study covers all Canadian universities.

The recent interest in foreign graduates as potential Canadian workers has increased the need to understand what factors encourage them to stay after graduation. For example, Esses et al. (2018) interviewed 9,000 international students in Canada and found that 50.6 percent of them planned to apply for permanent residency, and 61 percent planned to work in Canada after graduation. This is in line with the earlier findings of Li (2013). Choi, Crossman, and Hou (2021) found that six of ten international students who were employed during their period of study or after graduation became landed immigrants within ten years of having obtained their first study permit. The study also reported that about three in ten international students who entered Canada in 2000 or later became landed immigrants within ten years. A study by Citizenship and Immigration Canada (now Immigration, Refugees and Citizenship Canada) indicated that 39.5 percent of foreign students transition to foreign worker status, and 15.6 percent transition to permanent resident status (Siddiq et al. 2012). However, we do not know much about the characteristics of those who decide to stay.

In this study, we focus on the individual characteristics of international students in order to fill a gap in the literature and help develop policies that can increase the international student retention rate. The objectives of this study are (1) to explore the retention rates of the various cohorts of international students in Canada and (2) to examine the determinants of international student retention in Canada. This study conducts descriptive and regression analysis at the national level, using the Postsecondary Student Information System (PSIS), merged with the T1 Family File (T1FF) from 2005 to 2018. We report the retention rates for each cohort of international students that arrived between 2005 to 2018. We find that during our study period, the overall retention rate of international students is 65 percent. We conduct both panel

and cross-section regressions. The important predictors of retention in Canada are region of origin, field of study, and marital status. We also observe some cohort-specific heterogeneity in the determinants of international student retention in Canada.

2 Background and Related Literature

Immigrants face challenges integrating into the workforce and an initial wage disadvantage upon arrival (Albert, Glitz, and Llull 2021; Borjas 1985). However, international students may better serve Canada's immigration and economic goals because they hold Canadian educational credentials, which are more valued in the Canadian labour market. Having already lived in Canada, they are also more likely to secure employment and assimilate into society more quickly than foreign-trained immigrants. (Siddiq et al. 2012).

As with studies focused on other international-student-receiving countries (such as Chiswick and Miller 2011; Schaafsma and Sweetman 2001), Hou and Lu (2017) find that immigrants educated in Canada have higher average earnings than immigrants educated elsewhere, both in the short run and the long run. Several studies have shown that there is discrimination against foreign credentials in the Canadian labour market and that labour market experience acquired abroad is often valued less than Canadian work experience (Grant 2005). Some studies have found that not only does foreign labour market experience yield zero return for immigrants (Basilio, Bauer, and Kramer 2017; Schaafsma and Sweetman 2001), but foreign schooling also has zero return (Cohen-Goldner and Eckstein 2008).

Language barriers present an additional hurdle to immigrant assimilation (Basilio, Bauer, and Kramer 2017). Immigrants' earnings only rise after they have gradually acquired knowledge of the language, customs, and nature of the host country's labour market (Chiswick and Miller 2009). Immigrants who are not proficient in any of the nation's official languages often have a harder time integrating into the labour market (Finnie and Meng 2002). International students, however, are expected to know the official language(s) to enroll in higher education, and their language proficiency often improves as their schooling progresses.

Furthermore, Schaafsma and Sweetman (2001) argue that age at immigration plays an important role. Younger immigrants tend to acculturate more easily, while those who arrive later in life generally receive lower returns on both their foreign work experience and foreign education. Hence, there is a strong argument for prioritizing international students in Canada for immigration, as they are often at their prime working age.

Push and pull factors drive the mobility of skilled immigrants and international students. Push factors are issues in the country of origin that make an individual more likely to emigrate. On the other hand, pull factors are the aspects of a host country that make it attractive to immigrants. In terms of pull factors, Kaushal and Lanati (2019) analyzed migration patterns across more than 190 sending and receiving countries. They found that individuals who move abroad to pursue tertiary education are primarily driven by the rising global demand for tertiary skills. In contrast, the desire

for permanent settlement plays a much smaller role in motivating their decision. Mayda (2010) found evidence that pull factors—such as income opportunities in the destination country—significantly increase immigration rates. In addition, improved labour market outcomes linked to higher education obtained overseas, along with the willingness of host countries to attract skilled labour, are key factors influencing whether individuals choose to study abroad and later migrate (Beine, Noël, and Ragot 2014; Chiswick and Miller 2011). Students in Canada are motivated to remain there due to enhanced job opportunities and a high standard of living (Arthur and Flynn 2011). In general, international students generally flow from lower-income countries to higher per capita income countries (Abbott and Silles 2016).

Like Beine, Docquier, and Schiff (2008), Amirault, De Munnick, and Miller (2016) have found that the relationship between population size and migration is positive and that thick markets and networks are important incentives to migrate to Canada. In addition, quality of education and a safe environment in Canada are among the top reasons for international students to study in Canada and stay after graduation (Li 2013). Furthermore, education level and field of study are variables that the literature suggests are important pull factors. This is often associated with the effects of agglomeration, as a region with a high number of highly educated workers tends to attract even more educated workers to it, increasing its productivity and its attractiveness (Miyagiwa 1991). Demographic characteristics also play a role in the decision to migrate. Among demographic determinants, age (Amirault, De Munnick, and Miller 2016) and gender (Dumont, Martin, and Spielvogel 2007; Sweetman and Warman 2014) have been shown to significantly impact the decision to stay or leave. In a study on Finland, Mathis and Karhunen (2020) found that marriage and the presence of children led to a higher likelihood of an international student graduate staying in Finland. The European Commission also found that establishing ‘roots’—having a family and housing—in a location increased the probability that an individual would stay in that location, regardless of employment.

In this study, we are filling gaps in the literature by examining the determinants of international student retention based on the individual characteristics of immigrants, using a large, Canada-wide dataset on students who completed tertiary education in Canada.

3 Data and Methodology

3.1 Data

This study uses the Postsecondary Student Information System (PSIS), merged with the T1 Family Tax Files (T1FF), as its main source of data. PSIS is a dataset, collected and published by Statistics Canada, that includes detailed information on enrollees and graduates of public Canadian post-secondary institutions (Statistics Canada 2021b). The survey is collected through electronic administrative files kept by the universities, and participation is mandatory (Statistics Canada 2021b). It includes variables accounting for field of study, program and credential type, citizenship, gender, and status of the student in Canada, amongst others. Our project

links this survey to the T1FF using a unique ID assigned to each individual. The data in the tax files cover all those who completed a T1 tax return for the year of reference, or those who received federal child benefits. When complete, the files account for 96 percent of the population (Statistics Canada 2021a). The information provided pertains to the income and demographic information of tax filers.

Since participation in PSIS is mandatory and most individuals file taxes every year, the attrition rate is very low, so the dataset remains representative on a longitudinal and cross-sectional basis. We therefore use PSIS and T1FF as administrative data, with the expectation that they provide a proper representation of the population studied.

The individuals included in this study are international post-secondary student graduates in Canada. The study defines international students as those who held a study permit while they completed their studies. International students are eligible for a work permit after they complete their studies, but we are including in the dataset only those students who had a study permit while they were attending university. The sample is also limited to individuals who have already graduated from their programs. It excludes international students who are still in their programs because their post-graduation employment and location decisions are unknown to us. We have limited the sample to those classified as highly skilled workers—i.e., those who have graduated with at least a bachelor's degree at a Canadian university. Students were sorted by their highest completed degree to avoid double-counting. International student graduates were followed through their tax files from the years 2005 to 2018. The panels show 1,127,595 observations—an unbalanced panel dataset as the number of years varies per individual. The number of individuals tracked is 160,770; each individual is repeated throughout the dataset, and each can be tracked for a minimum of three years to a maximum of 14 years. Individuals who filed taxes for the first time in 2017 and 2018 are not included, because we have not followed them long enough to determine whether they have stayed in Canada. We use panel data to track individuals across time, determining their migration patterns and retention.

3.2 The Econometric Model

Following the existing literature, we estimate the logit model to examine predictive factors for student retention and measure the projected probability of retention for a graduate (Mathies and Karhunen 2020). The model measures the likelihood that an international student will stay in the country as a worker after finishing their studies. The regression equation is as follows:

$$\begin{aligned} \text{stayed}_{it} = & \beta_0 + \beta_1 \text{age}_{it} + \beta_2 \text{agesq}_{it} + \beta_3 \text{studypr}_i + \beta_4 \text{field}_i \\ & + \beta_5 \text{region}_i + \beta_6 \text{level}_i + \beta_7 \text{mst}_{it} + \beta_8 \text{incomecat}_{it} \\ & + \beta_9 \text{sex}_{it} + \varepsilon_{it} \end{aligned} \quad (1)$$

In equation (1) outlined above, the dependent variable is binary (*stayed*) and equals one if the individual i at time t

stayed in Canada after graduation, and zero if they moved abroad after graduation. The independent variables are *age* (at tax filing), *agesq* for age squared, *studypr* for province of study, *field* for field of study, *regions* for region of origin, *level* for program level, *incomecat* for income categories, *mst* for marital status, *child* for number of children, and *sex* for whether an individual is male or female.

The study uses tax files to determine whether an individual settled or moved. If they filed taxes in every consecutive year up to 2018, we classify them as stayed, regardless of the year they started (the last year of data available). Mathies and Karhunen (2021) establish that students must have filed taxes for at least three years to be considered retained. If the data shows that an individual stopped filing taxes, then we determine that they have left Canada. Graduates who stopped and then re-started filing taxes during the study period are included in the analysis. However, we consider only their last period of taxation to determine whether they were retained.

The decision to pool the cohorts together in a single analysis was made to capture overall retention trends for international students across multiple years. This approach ensures a sample size large enough to estimate the effects of key predictors of retention behaviour, such as age, region of origin, field of study, and income. These factors are expected to have consistent effects regardless of the specific year of arrival. Moreover, our approach captures the broader trends that are consistent across cohorts. However, as part of robustness checks, and to further understand cohort-specific effects, we run regressions for each specific cohort separately. Despite losing the number of observations in the cohort-specific model, the findings are expected to largely reflect those of the pooled model. This ensures that the retention patterns we observe are reflective of both shorter- and longer-term retention behaviour.

The model includes a set of dummy variables that account for the province in which the graduates studied (*studypr*). Provincial fixed effects capture general economic conditions and specific geography, climate, cultural makeup, and other characteristics not otherwise accounted for in other variables (Finnie 2000). This study also controls for age (in linear and quadratic terms: *age* and *agesq*), constructed by subtracting the reference year of taxation from the year of birth. Finnie (2000) argues that age should have a negative effect on migration (as younger populations are usually more mobile) and that moving has increased psychological and economic costs and decreased expected future benefits for older populations.

Marital status (*mst*) and the number of children (*child*) are also controlled for in this study, as they have an impact on the costs and benefits of moving. Marriage and the presence of children often imply a higher moving cost for a family (Finnie 2000). Marital status is categorised as those in a relationship (married or common-law), those who have been previously married (divorced or widowed), or those who are single (never married). The reference category is being in a relationship. In addition, the model controls for earnings (*incomecat*) using categories in line with Mayda (2010). We divide total income before tax into four categories defined by the Canadian census: less than zero, zero to twenty thousand, twenty to fifty thousand, fifty to eighty thousand, and eighty

thousand and above (all in Canadian dollars).¹

Regions of origin are categorised according to the World Bank's (2022) definitions: East Asia and the Pacific (EAP), Europe and Central Asia; Latin America and the Caribbean; the Middle East and North Africa (MENA); North America; South Asia; and Sub-Saharan Africa. Regions of origin (regions) are included because international migration patterns are highly dependent on income differentials between countries of origin and destination, and accounting for region of origin can capture that relationship (Gries, Kraft, and Simon 2016; Zhang and Lucey 2019). The program level (*level*) divides student programs between bachelor's, master's, Ph.D., and other post-secondary programs. Program type (*field*) classifies students according to their subject area, whether it be STEM, social sciences, humanities, or health sciences. Retention rates may vary depending on the fields studied at the university (Demirci 2019).

Following the outline of Hailpern and Visintainer (2003), we interpret the odds ratio and the magnitudes of coefficients. We have also decided to use robust standard errors to account for heteroskedasticity and autocorrelation issues.²

4 Results

4.1 Descriptive Statistics

The number of international student graduates included in our dataset increased from 11,160 in 2005 to 140,880 in 2018 (Table 1). This increase was likely due in part to the strategies the Government of Canada implemented to attract and retain international students, as outlined in their International Student Plan (Government of Canada 2014). Table 1 analyzes the education level of international students per year. In 2005, 58 percent of international students were pursuing an undergraduate degree, while 42 percent were enrolled in a graduate program.³ The proportion of international students with a graduate degree, however, has increased throughout the years, while the proportion of undergraduate students has decreased.

Table 2 describes the percentage of international students living in each province of Canada from 2005 to 2018. In 2005, the province with the highest percentage of international students was Ontario, with 26.5 percent of international students. British Columbia and Alberta were next at 23.6 and 13.2 percent, respectively. The province with the lowest percentage was Prince Edward Island, with 0.5 percent of international students. Since 2005, the percentage

¹Income in this case is total income and can include employment income, self-employment income (such as net business, fishing, or farming income), net rental income, pensions, employment insurance payments, and capital gains and losses. Therefore, income can be less than zero if it includes capital losses or negative business income.

²We decided to use robust standard errors instead of clustered standard errors, which are used when a study has sampled data from a population using clustered sampling and wants to draw a conclusion about the broader population (Abadie et al. 2017). As stated above, the PSIS and T1 Files data are administrative; they were collected by university administrations and participation was mandatory. Therefore, the dataset is appropriately representative of international students (but not the broader population of Canadian citizens and permanent residents who are also students).

³Since we have only counted each student once, this model cannot reflect international undergraduate students who have subsequently decided to pursue a graduate degree.

**TABLE 1: GRADUATED INTERNATIONAL STUDENTS:
PROGRAM TYPE PER YEAR**

Year	Undergraduate		Graduate		Total
	Frequency	Percentage	Frequency	Percentage	Frequency
2005	6,450	57.8%	4,710	42.2%	11,160
2006	9,565	59.0%	6,650	41.0%	16,215
2007	13,870	59.0%	9,640	41.0%	23,505
2008	19,635	58.6%	13,890	41.4%	33,520
2009	24,685	56.9%	18,665	43.1%	43,350
2010	31,280	56.3%	24,290	43.7%	55,570
2011	38,645	55.6%	30,795	44.4%	69,445
2012	45,615	54.6%	37,910	45.4%	83,530
2013	55,665	55.7%	44,275	44.3%	99,940
2014	64,110	53.5%	55,625	46.5%	119,735
2015	73,505	53.7%	63,400	46.3%	136,905
2016	79,985	53.1%	70,535	46.9%	150,520
2017	75,875	52.9%	67,455	47.1%	143,330
2018	75,165	53.4%	65,715	46.6%	140,880
Total	612,110	100%	515,485	100%	1,127,595

of students in Ontario has increased 10 percentage points, reaching 36.2 in 2018. This corroborates the findings of Crossman, Choi, and Hou (2021), who argue that the concentration of international students in Ontario has increased in the past ten years. On the other hand, the percentage of students in British Columbia has decreased through the years, reaching a low of 18.7 percent in 2015 and then going slightly up to 19.1 percent in 2018. In Alberta, the percentage of students decreased steadily until 2018, when it reached 8 percent. Quebec saw the biggest change, rising from 9.1% in 2005 to 20.2% in 2018. By 2018, Quebec had the second-highest number of international students. New Brunswick and Nova Scotia have experienced a comparative loss in the percentage of students, going from 8.6 to 2.3 percent and 10.2 to 5.1 percent, respectively. The percentage of international students attending university in Atlantic Canada was 12 percent on average throughout 2005 to 2018. It decreased throughout the years, starting at 23 percent in 2005 and going down to 10 percent in 2018. This speaks to the increase in the concentration of international students attending university in Ontario, as discussed by Crossman, Choi, and Hou (2021).

Table 3 describes the distribution of regions of origin of international students throughout the years studied. In 2005, most international students (52.2 percent) came from East Asia and the Pacific. The source region with the next highest percentage of international students was Europe and Central Asia, with 11.1 percent of international students in Canada. The region with the lowest percentage of international students in 2005 was Latin America and the Caribbean, with 6.5 percent of international students. Since 2005, the percentage of international students coming from East Asia and the Pacific has decreased to 41.4 percent in 2018. The percentage of international students coming from Europe and Central Asia has remained stable, and the greatest percentage increases have occurred in the student populations from South Asia and Sub-Saharan Africa. The percentage of international students originating from South Asia has increased from 9.1 percent in 2005 to 18 percent in 2018, and the proportion of students from Sub-Saharan Africa has increased from 7.6 percent in 2005 to 10.9 percent in 2018.

Table 4 represents the percentage of international students in each field of study over the observed period. In 2005,

38.3 percent of international students were enrolled in a STEM program; 57 percent were enrolled in a business, humanities, health, arts, social science or education (BHASE) program; and 4.8 percent were enrolled in a program related to medicine. Since then, enrollment in STEM programs has increased steadily, reaching 42.6 percent in 2018. Meanwhile, enrollment in BHASE programs has slightly decreased throughout the years, reaching a low of 55.1 percent in 2018. The percentage of international students enrolled in a program related to medicine has decreased from 4.8 percent in 2005 to 2.4 percent in 2018.

Table 5 describes the international student retention rate, which we define as an international student who filed taxes in Canada for every consecutive year until 2018. If an international student filed taxes in the last year of our study, they qualify as having stayed in Canada. Of the undergraduate international students who filed taxes in 2005, 65.5 percent were still in the country in 2018. Fifty-six percent of international graduate students who filed taxes in 2005 were in Canada in 2018. We note that the closer we got to 2018—and the shorter the length of time a graduated international student had been living in Canada—the higher the retention rate (85 percent and 93.4 percent). This is consistent with other studies, which find that shorter-term retention rates are higher than long-term retention rates (McDonald and Miah 2021).

Furthermore, our results show that international student retention rates varied by program level. Of the international students who completed undergraduate studies in 2005, 65 percent were still in Canada in 2018; of the international students who completed graduate studies in 2005, 56 percent were still in Canada in 2018. We also looked at retention ten years after arrival. We found that 64 percent of the international undergraduate students who were in Canada in 2008 were still in the country ten years later. Fifty-nine percent of the international graduate students who were in Canada in 2008 were still in the country ten years later. Therefore, retention rates are higher for undergraduate students than for graduate students, which is consistent with the fact that individuals with more years of education are more mobile (Frank and Belair 2000).

4.2 Regression Analysis

Table 6 reports the determinants of international student retention in Canada. It highlights the characteristics of international students who choose to stay, relative to those who leave. The base/reference categories in the regressions are chosen to closely reflect studies by Mayda (2010) and Finnie (2000). Age is one of the most important variables influencing the decision to stay in Canada and it is statistically significant. An additional year of life will increase the odds of someone staying in Canada by 41 percent. This is consistent with the literature, which suggests that the most mobile individuals are those who are young (Amirault, De Munnik, and Miller 2016).

The most significant variables—both statistically and economically—are those for region of origin. Our findings reveal that international students who came from Europe and Central Asia are 16 percent less likely to stay than those from East Asia and Pacific (EAP). In a similar vein, inter-

TABLE 2: PERCENTAGE OF INTERNATIONAL STUDENTS LIVING IN EACH PROVINCE

Year	NL	PEI	NS	NB	QC	ON	MB	SK	AB	BC	Total
2005	3.2%	0.5%	10.2%	8.6%	9.1%	26.5%	3.2%	1.8%	13.2%	23.6%	11,160
2006	2.6%	0.4%	8.5%	6.8%	11.0%	30.6%	3.9%	1.8%	12.5%	22.0%	16,215
2007	2.4%	0.3%	7.1%	5.5%	13.6%	32.7%	3.5%	1.8%	11.8%	21.2%	23,505
2008	2.1%	0.3%	6.2%	4.5%	10.5%	30.6%	3.6%	1.9%	10.9%	21.5%	33,520
2009	2.0%	0.3%	5.6%	3.9%	16.1%	34.3%	3.6%	2.1%	10.5%	21.7%	43,350
2010	1.9%	0.3%	5.4%	3.6%	17.5%	34.2%	3.7%	2.1%	10.0%	21.2%	55,570
2011	1.8%	0.3%	5.5%	3.0%	18.2%	34.5%	3.7%	2.2%	9.9%	20.4%	69,445
2012	1.8%	0.3%	5.4%	3.0%	18.4%	35.4%	3.9%	2.5%	9.5%	19.6%	83,530
2013	1.8%	0.3%	5.5%	2.6%	19.6%	35.2%	3.9%	2.9%	9.2%	18.9%	99,940
2014	1.9%	0.4%	5.4%	2.4%	20.1%	35.5%	3.8%	3.0%	8.8%	18.7%	119,735
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2016	1.8%	0.4%	5.2%	2.3%	20.4%	36.2%	3.9%	3.0%	8.1%	18.9%	150,520
2017	1.9%	0.4%	5.1%	2.6%	20.3%	36.0%	3.8%	3.0%	8.1%	19.2%	143,330
2018	1.9%	0.4%	5.1%	2.3%	20.2%	36.2%	3.7%	3.0%	8.0%	19.1%	140,880

TABLE 3: GRADUATED INTERNATIONAL STUDENTS: REGION OF ORIGIN PER YEAR (%)

Year	East Asia & Pacific	Europe & South Asia	Latin America & Caribbean	MENA	North America	South Asia	Sub-Saharan Africa	Total
2005	52.2%	11.1%	6.5%	6.7%	6.9%	9.1%	7.6%	11,160
2006	50.4%	11.0%	6.7%	7.4%	6.7%	9.5%	8.3%	16,215
2007	48.5%	11.4%	6.8%	8.4%	6.7%	10.3%	8.5%	23,505
2008	47.9%	11.6%	6.2%	8.6%	6.4%	10.9%	8.9%	33,520
2009	46.5%	11.7%	6.3%	9.5%	6.2%	11.0%	8.9%	43,350
2010	45.7%	11.5%	5.9%	10.1%	5.6%	12.4%	8.8%	55,570
2011	45.3%	11.5%	5.9%	10.6%	5.4%	12.3%	8.9%	69,445
2012	45.0%	11.7%	5.6%	10.8%	4.8%	13.1%	8.9%	83,530
2013	44.8%	11.7%	5.4%	10.5%	4.3%	13.7%	9.1%	99,940
2014	44.0%	11.7%	5.2%	10.6%	4.0%	15.0%	9.6%	119,735
2015	43.3%	11.7%	5.3%	10.4%	3.7%	15.3%	10.0%	136,905
2016	41.9%	11.5%	5.4%	10.2%	3.5%	16.6%	10.4%	150,520
2017	41.4%	11.4%	5.6%	10.1%	3.2%	17.8%	10.7%	143,330
2018	41.4%	11.2%	5.6%	9.8%	3.0%	18.0%	10.9%	140,880

national students from North America, i.e. the United States, are 37 percent less likely to stay than those from EAP, and those from Latin America and the Caribbean are 22 percent less likely to stay. Students from MENA are 16 percent less likely to stay than those from EAP, but students from South Asia are 14 percent more likely to stay in Canada than those from EAP. Lastly, students whose region of origin was Sub-Saharan Africa are equally as likely to stay as those whose region of origin is EAP (i.e., we cannot reject the null hypothesis concerning differences between these two groups). The region of origin is mostly a push factor, rather than a pull factor, and reflects that international students from more economically well-off regions such as North America and Europe are less likely to stay in Canada than those who come from economically disadvantaged regions. This is in line with Borjas' (1987) wealth-maximization hypothesis, wherein students from less developed countries are more likely to acquire schooling and stay in a foreign country due to large wage differentials between host and source countries. Moreover, Abbott and Silles (2016) argue that students who come from economically disadvantaged countries have the most incentive to study abroad.

In terms of program type/level, the results suggest that those who complete a graduate degree are 25 percent less likely to stay in Canada than those who complete an undergraduate degree. According to the literature, an additional year of education increases the likelihood of migration; our results are congruent with previous studies (Amirault, De Munnick, and Miller 2016; Machin, Salvanes, and Pelkonen 2012). The regression also controlled for field of study. We find that the variables for field of study are statistically significant and that students who studied medicine are 40 percent less likely to stay in Canada than those who

took STEM. This is in line with existing literature, such as Mathews et al. (2021), which found that the proportion of visa trainees⁴ remaining in Canada has decreased significantly over time. Watanabe et al. (2008) also indicate that Canada struggles with retaining its trained physicians including both Canadian citizens and International graduates. In addition, our study has found that international students who took a BHASE-related field are 3 percent less likely to stay in Canada than those who took STEM. Notably, our finding regarding STEM graduates being more likely to stay reflects other papers showing higher retention rates for this subgroup (Demirci 2019).

Variables related to family life were also taken into account. The number of children an international student has influences their decision to remain in Canada. The results suggest that for each additional child, an international student is 3 percent more likely to stay in Canada. This result is consistent with the literature, as Mathis and Karhunen (2020) found that the presence of children led to a higher likelihood of an international student graduate staying in Finland.

Income categories are statistically significant as well. The reference category was less than CA\$25,000 in income. We found that those who earn \$25,000 to \$50,000 are 85 percent more likely to stay in Canada than those in the base category. Additionally, international students who earn \$50,000 to \$80,000 are more likely to stay than those with a very low income; their odds are 126 percent those of the reference category. Finally, graduates who earn more than \$80,000 are 181 percent more likely to stay than the base category. This means that earning more money usually leads to a person deciding to stay. This is consistent with the literature,

⁴Visa trainees refer to international medical graduates who come to Canada to complete postgraduate medical education on a temporary visa.

TABLE 4: GRADUATED INTERNATIONAL STUDENTS: FIELD OF STUDY PER YEAR

Year	STEM		Social Science and Humanities		Medical Fields		Total
	Freq.	%	Freq.	%	Freq.	%	
2005	4,270	38.3%	6,355	57.0%	535	4.8%	11,160
2006	6,470	39.9%	9,040	55.8%	700	4.3%	16,215
2007	9,450	40.2%	13,130	55.9%	925	3.9%	23,505
2008	13,350	39.8%	19,025	56.8%	1,145	3.4%	33,520
2009	17,375	40.1%	24,590	56.7%	1,385	3.2%	43,350
2010	22,410	40.3%	31,525	56.9%	1,635	2.9%	55,570
2011	28,345	40.8%	39,135	56.4%	1,965	2.8%	69,445
2012	34,615	41.4%	46,705	55.9%	2,210	2.6%	83,530
2013	41,865	41.9%	55,530	55.6%	2,550	2.6%	99,940
2014	50,585	42.2%	66,155	55.3%	3,000	2.5%	119,735
2015	57,820	42.2%	75,720	55.3%	3,360	2.5%	136,905
2016	63,595	42.2%	83,385	55.4%	3,540	2.4%	150,520
2017	60,970	42.6%	78,240	55.1%	3,420	2.4%	143,330
2018	59,980	42.6%	77,580	55.1%	3,320	2.4%	140,880
Total	471,095	100%	626,795	100%	29,705	100%	1,127,595

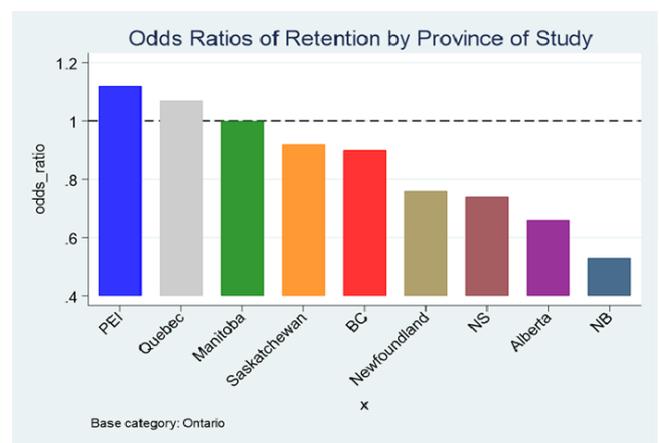
TABLE 5: INTERNATIONAL STUDENT RETENTION: STUDENTS WHO FILED TAXES IN THE YEAR OF REFERENCE AND 2018

Undergraduate Students			
Year	Not in Canada in 2018	In Canada in 2018	Total
2005	2060 (34.5%)	2625 (65.5%)	4685
2006	2855 (34.8%)	3760 (65.2%)	6615
2007	4095 (35.4%)	5490 (64.6%)	9580
2008	5710 (36.2%)	8095 (63.8%)	13805
2009	6940 (37.5%)	11555 (62.5%)	18500
2010	8155 (32.3%)	16000 (67.7%)	24155
2011	9060 (29.9%)	21240 (70.1%)	30620
2012	10130 (27.5%)	27355 (72.5%)	37685
2013	10595 (23.1%)	35330 (76.9%)	45925
2014	10815 (21.9%)	44430 (78.1%)	55240
2015	9910 (18.7%)	53900 (81.3%)	63810
2016	8045 (15.0%)	61940 (85.0%)	69985
2017	4450 (8.2%)	62150 (91.8%)	66960
Total	93130	418870	512000

Graduate Students			
Year	Not in Canada in 2018	In Canada in 2018	Total
2005	2225 (44.0%)	2825 (56.0%)	6450
2006	3330 (34.5%)	6235 (65.5%)	9650
2007	4910 (42.7%)	8960 (57.3%)	13870
2008	7015 (41.7%)	12390 (58.3%)	19505
2009	8340 (37.7%)	16345 (62.3%)	24685
2010	10110 (33.8%)	21180 (66.2%)	31280
2011	11565 (30.6%)	27085 (69.4%)	38645
2012	12520 (26.9%)	33095 (73.1%)	45615
2013	13220 (23.1%)	40515 (76.9%)	53735
2014	14035 (19.6%)	50075 (80.4%)	64110
2015	13755 (15.7%)	59750 (84.3%)	73505
2016	12000 (11.5%)	67980 (88.5%)	79985
2017	6670 (6.6%)	69205 (93.4%)	75875
Total	119775	492340	612110

as the decision to immigrate is tied to the desire for better-paid jobs—or a higher GDP per capita (Gries, Kraft, and Simon 2016; Zhang and Lucey 2019). Hence, international students who have found economic success in Canada are not likely to leave. The respondent's gender also matters. In line with the literature (Dumont, Martin, and Spielvogel 2007), women graduate students have higher odds of staying after graduation than men do.

Moreover, we found that students who went to university in PEI are 12 percent more likely to stay in Canada than those who studied in Ontario. Graduates from universities in Newfoundland are 24 percent less likely to stay compared to those in Ontario. International students in NS and NB are less likely to stay in Canada compared to those who graduate in Ontario. However, students in Quebec are 7 percent more


Fig. 2: Odds Ratios of References by Province of Study

likely to stay than those who studied in Ontario. Studying in Manitoba has no effect on the odds to stay compared to the base category. Studying in Saskatchewan, Alberta, and BC is associated with a lower likelihood of staying in Canada, compared to Ontario. Compared with all provinces, NB has the lowest likelihood for staying in Canada, as 47 percent of its international graduates leave (Figure 2). The variation in outcome is due to the difference in popularity among provinces, and these findings confirm that Ontario is the most popular province for international students (Crossman, Choi, and Hou 2021).

Table 7 shows the same regression as Table 6, split up into each year of the study. There is a cross-sectional regression for the years 2006 to 2015. Although the findings across years are not directly comparable—due to differences in the number of observations and individual characteristics—many of the independent variables in the cross-sectional regressions show similar patterns to those in the panel data regressions. This consistency further strengthens the validity of our results. For example, our findings of lower odds of graduate student retention in Canada in the panel regression are also reflected in cross-sections. Analogously, the retention rate for female students remains high across the years when compared to their male counterparts.

The difference in findings across years and between the panel and cross-sectional analyses may indicate variations in sample size and heterogeneity over time for different cohorts.

TABLE 6: THE DETERMINANTS OF RETENTION OF GRADUATED INTERNATIONAL STUDENTS IN CANADA (ODDS RATIOS FROM LOGISTIC REGRESSION)

Variable	Odds Ratio (p-value)
<i>Demographic</i>	
Age	1.41*** (0.000)
Age Squared	0.99*** (0.000)
<i>Province of Study (Base: Ontario)</i>	
Newfoundland	0.76*** (0.000)
PEI	1.12** (0.019)
Nova Scotia	0.74*** (0.000)
New Brunswick	0.53*** (0.000)
Quebec	1.07*** (0.000)
Manitoba	1.00 (0.773)
Saskatchewan	0.92*** (0.000)
Alberta	0.66*** (0.000)
British Columbia	0.90*** (0.000)
<i>Field of Study (Base: STEM)</i>	
Social Science and Humanities (BHASE)	0.97*** (0.000)
Medical Fields	0.60*** (0.000)
<i>Region of Origin (Base: East Asia and Pacific)</i>	
Europe and Central Asia	0.84*** (0.000)
Latin America and Caribbean	0.78*** (0.000)
Middle East and North Africa	0.84*** (0.000)
North America	0.63*** (0.000)
South Asia	1.14*** (0.000)
Sub-Saharan Africa	1.00 (0.894)
<i>Program Level (Base: Undergraduate)</i>	
Graduate	0.75*** (0.000)
Other	1.21*** (0.002)
<i>Marital Status (Base: Married/Common-Law)</i>	
Widowed, Divorced, Separated	0.98 (0.412)
Single	1.04*** (0.000)
Number of Children	1.03*** (0.000)
<i>Income Category (Base: Less than \$25,000)</i>	
\$25,000–\$50,000	1.55*** (0.000)
\$50,000–\$80,000	2.26*** (0.000)
Above \$80,000	2.81*** (0.000)
<i>Sex (Base: Male)</i>	
Female	1.22*** (0.000)
Constant	0.00*** (0.000)

$N = 1,127,597$

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses.

While the panel regression reflects that students from most regions except South Asia and Sub-Saharan Africa have a lower retention rate than those from EAP, our cross-section analysis shows that students from Europe and Central Asia have mixed outcomes over the years. Moreover, in most cases, students from Latin America and MENA have higher retention rates than those from EAP. The retention rate for North America has always been low compared to the base region. Due to Canada's lower tuition fees and expenses, it is likely that students from the United States come to Canada for tertiary education and leave upon graduation. For the program of study, our findings suggest that the retention of medical graduates compared to BHASE graduates declines over time. Our finding is echoed in studies examining physician migration patterns, such as Watanabe et al. (2008) and Freeman et al. (2016), who report persistent patterns of physician out-migration from Canada—particularly to the United States. Their study emphasizes that many Canadian-trained physicians, including international graduates, leave over time, often seeking better opportunities abroad. Watanabe et al. (2008) indicate that approximately 80 percent

of Canadian trained physicians who leave Canada choose the United States as their primary destination. Factors such as economic incentives and favorable immigration policies in the U.S. contribute to the migration of Canadian-trained physicians (Watanabe et al, 2008). Their study emphasizes that many Canadian-trained physicians, including international graduates, leave over time, often seeking better opportunities abroad. The BHASE students have mixed outcomes over the years.

5 Conclusion

Given Canada's large labour shortage and increasingly ageing population, international students have become an increasingly attractive source of highly skilled workers. However, it is important to not only attract international students to Canada, but also to retain them permanently as workers. For this reason, this paper focuses on finding the determinants of international student retention in Canada. We used data from the PSIS, merged with the T1FF, to run a logit panel data regression. Our sample was comprised of students who held a study permit between 2005 and 2018, and we only considered individuals who were studying for a bachelor's degree or higher. We used variables such as age, region of origin, province of study, program type and level, and several socio-demographic factors to examine the characteristics of those who stay and those who leave Canada after graduation.

We found that there are more undergraduate students staying than graduate students (those pursuing a master's degree or a Ph.D.), but the gap between these groups has decreased through the years. Moreover, we found that Ontario is the most popular region for international students, and the percentage of students who choose to attend university there has increased. EAP has been the most popular source region from which international students come. The percentage and number of students coming from South Asia and Sub-Saharan Africa have increased in recent years, while the percentage of students coming from Latin America, the Caribbean, and North America has declined.

The most significant variables we discovered are those related to the regions of origin. Students from South Asia and Sub-Saharan Africa are more likely to stay in Canada than those who come from EAP. Furthermore, students studying STEM are more likely to stay than those in BHASE programs, and international graduate students are less likely to stay in Canada than undergraduate students.

Our study has important policy implications. As noted, the biggest factor determining whether an individual stays in Canada is their region of origin. In particular, individuals from South Asia and Sub-Saharan Africa are much more likely to stay in Canada than those from EAP. However, our descriptive statistics show that most international students come from EAP, and a large portion come from Europe and Central Asia. For this reason, the government should conduct further research on the reasons why people from certain regions are leaving. In addition, they should encourage universities to recruit from a wider variety of regions to increase the regional diversity of their international student population.

**TABLE 7: THE DETERMINANTS OF GRADUATED INTERNATIONAL STUDENT RETENTION IN CANADA PER YEAR
(ODDS RATIOS FOLLOWING THE LOGISTIC REGRESSIONS)**

Variable	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Age	0.88*** (0.000)	0.89*** (0.000)	0.94*** (0.000)	1.02 (0.900)	1.01 (0.072)	1.01 (0.263)	1.01 (0.162)	1.01 (0.288)	1.01 (0.142)	1.03*** (0.002)
Age Squared	1.00*** (0.000)	1.00*** (0.000)	1.00*** (0.000)	1.00 (0.521)	1.00 (0.017)	1.00 (0.150)	1.00 (0.158)	1.00 (0.089)	1.00 (0.144)	1.00*** (0.001)
<i>Province of Study (Base: Ontario)</i>										
NF	1.87*** (0.000)	2.00*** (0.000)	2.01*** (0.000)	1.45*** (0.000)	1.42*** (0.000)	1.35*** (0.000)	1.37*** (0.000)	1.31*** (0.000)	1.31*** (0.000)	1.42*** (0.000)
PEI	0.63 (0.559)	1.19 (0.091)	1.61* (0.048)	1.64** (0.000)	1.29 (0.231)	1.37 (0.103)	1.03 (0.562)	0.97 (0.311)	1.09 (0.253)	0.87 (0.384)
NS	0.60*** (0.000)	0.70*** (0.000)	0.58*** (0.000)	1.04 (0.700)	0.96 (0.000)	0.96** (0.043)	0.92** (0.000)	0.96** (0.040)	0.97 (0.460)	0.94** (0.018)
NB	0.44*** (0.000)	0.38*** (0.000)	0.55*** (0.000)	0.96 (0.000)	0.91 (0.000)	1.48*** (0.000)	1.22*** (0.000)	1.11** (0.032)	1.09** (0.040)	1.12*** (0.000)
<i>Field of Study (Base: STEM)</i>										
BHASE	1.17*** (0.000)	1.06 (0.145)	1.00 (0.964)	1.03 (0.301)	1.04 (0.047)	1.01 (0.100)	1.02 (0.062)	1.02 (0.270)	1.02 (0.314)	1.01 (0.682)
<i>Program Level, Region of Origin, Marital Status, Income, etc.</i>										
Female	1.22*** (0.032)	1.12*** (0.005)	1.11*** (0.002)	1.14*** (0.000)	1.13*** (0.000)	1.10*** (0.000)	1.09*** (0.000)	1.10*** (0.000)	1.12*** (0.000)	1.13*** (0.000)

*p<0.10, **p<0.05, ***p<0.01. Numbers in parentheses are p-values.

Encouraging more diversity in student recruitment is a positive start, but students should also have incentives to stay. Immigrants who find an already-established community of their ethnicity or culture are more likely to stay in their destination country (Burns and Mohapatra 2008). In this vein, efforts can be made to establish communities of immigrants. Local immigrant organizations can serve as meeting grounds for newcomers. Universities can organize gatherings for those from the same source region, whether international students or permanent residents. They can also establish peer mentor programs, pairing a temporary resident with a longtime resident from the same culture or religion to build relationships. Fostering a community mindset for newcomers from regions that have less representation can go a long way in influencing international students in deciding to stay. These networks will probably come easily for populations who have a high number of immigrants from certain regions, but the international students who are more likely to stay come from underrepresented regions that might not necessarily have established communities in different Canadian locations.

Similarly, universities can be encouraged to recruit more diversely, not only in terms of regions, but also in terms of gender and field of study. Our findings show that women are more likely to stay in Canada after the conclusion of their studies. Hence, woman-specific opportunities such as scholarships, bursaries, and internships could be increased. In addition, universities can be encouraged to give priority to women in financial aid. Universities can also use similar strategies for students in BHASE programs, since STEM students are more likely to stay in Canada after graduation. Policymakers can also explore why students who have studied BHASE are not doing as well, create opportunities for these groups, and promote more vibrant economic integration for all.

Finally, government policy can place a bigger emphasis

on family reunification for international students. When international students decide to immigrate, they can only bring along a spouse and their children. Other than the parents' and grandparents' lottery, which offers no actual guarantee of reunification, there are no other opportunities for family reunification. However, a family presence and a stronger network of people from the same region can be an incentive for an individual to stay in Canada. The Canadian government can offer sponsorship programs, such as those in the USA, to provide family reunification, enabling students to sponsor their parents and siblings with certainty, and not with a lottery.

Lastly, it is important to acknowledge this study's limitations. First and most important is the fact that we only have information from the people who remained in Canada. As soon as students leave the country, we have no further data. Future studies could include surveys that follow students for several years after they have left the country. Second, while our pooled and cohort-specific analyses provide granular insights, further disaggregation by different time horizons, such as three-year, five-year, and seven-year retention behaviour, could enrich our understanding, and we suggest this for future research. Third, the visa status of some students may have changed over time, which is likely to have some impacts on their retention behaviour. Unfortunately, our dataset doesn't allow us to capture such changes. Fifth, endogeneity of the regressors could be an issue in terms of the precision of the outcomes. For example, the decision to stay could influence the number of children. Unfortunately, the dataset doesn't provide any possible instruments to address such endogeneity. Finally, future research should look at the long-term outcomes of international students after they have successfully transitioned into permanent residency, and the barriers in the transition process from international student to permanent resident.

6 Disclosure Statement

- **Ethics approval and consent to participate:** Not applicable.
- **Consent for publication:** Not applicable.
- **Availability of data and materials:** The data used in this research is from Statistics Canada's confidential Research Data Centre (RDC) housed at the University of New Brunswick. As per Statistics Canada's policy, the datasets used in our research are strictly confidential and cannot be released. Researchers must work on the dataset physically at the centre, and only approved outputs are released following a thorough vetting process. Therefore, we do not have the right to share the datasets.
- **Competing interests:** None.
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References

- Abadie, Alberto, Susan Athey, Guido W. Imbens, and Jeffrey Wooldridge. 2017. *When should you adjust standard errors for clustering?* NBER Working Paper 24003. National Bureau of Economic Research, Cambridge, MA.
- Abbott, Andrew, and Mary Sillies. 2016. "Determinants of international student migration." *The World Economy* 39 (5): 621–635.
- Albert, Cristoph, Albrecht Glitz, and Joan Llull. 2021. "Labour market competition and the assimilation of immigrants." CESifo Working Paper 9231. CESifo, Munich, Germany.
- Amirault, David, Daniel de Munnik, and Sarah Miller. 2016. "What drags and drives mobility? Explaining Canada's aggregate migration patterns." *The Canadian Journal of Economics* 49 (3): 1035–1056.
- Arthur, Nancy, and Sarah Flynn. 2011. "Career development influences of international students who pursue permanent immigration to Canada." *International Journal of Educational and Vocational Guidance* 11: 221–237.
- Basilio, Leilanie, Thomas K. Bauer, and Anica Kramer. 2017. "Transferability of human capital and immigrant assimilation: An analysis for Germany." *Labour* 31 (3): 245–264.
- Beine, Michel, Frédéric Docquier, and Maurice Schiff. 2008. "Brain drain and its determinants: A major issue for small states." IZA Discussion Paper 3398. Institute for the Study of Labour, Bonn, Germany.
- Beine, Michel, Romain Noël, and Lionel Ragot. 2014. "Determinants of the international mobility of students." *Economics of Education Review* 41: 40–54.
- Borjas, George J. 1985. "Assimilation, changes in cohort quality, and the earnings of immigrants." *Journal of Labour Economics* 3 (4): 463–489.
- Borjas, George J. 1987. "Self-selection and the earnings of immigrants." NBER Working Paper 2248. National Bureau of Economic Research, Cambridge, MA.
- Burns, Andrew, and Sanket Mohapatra. 2008. "International migration and technological progress." *Migration and Development Brief* 4. World Bank.
- Chiswick, Barry R., and Paul W. Miller. 2009. "Earnings and occupational attainment among immigrants." *Industrial Relations: A Journal of Economy and Society* 48 (3): 454–465.
- Chiswick, Barry R., and Paul W. Miller. 2011. "Educational mismatch: Are highly-skilled immigrants really working in high-skilled jobs, and what price do they pay if they are not?" In *High-skilled immigration in a globalised labour market*, edited by Barry R. Chiswick, 109–154. Washington, DC: American Enterprise Institute Press.
- Choi, Youjin, Eden Crossman, and Feng Hou. 2021. *International students as a source of labour supply: Transition to permanent residency*. Statistics Canada.
- Choi, Youjin, Feng Hou, and Ping Ching Winnie Chan. 2022. "Early earnings trajectories of international students after graduation from postsecondary programs: Evidence from Canadian administrative data." *Education Economics* 31 (4): 510–530.
- Cohen-Goldner, Sarit, and Zvi Eckstein. 2008. "Labour mobility of immigrants: Training, experience, language, and opportunities." *International Economic Review* 49 (3): 837–872.
- Crossman, Eden, Youjin Choi, and Feng Hou. 2021. *International students as a source of labour supply: The growing number of international students and their changing sociodemographic characteristics*. Statistics Canada.
- Demirci, Murat. 2019. "Transition of international science, technology, engineering, and mathematics students to the U.S. labour market: The role of visa policy." *Economic Inquiry* 57 (3): 1367–1391.
- Dumont, Jean-Cristophe, John P. Martin, and Gilles Spielvogel. 2007. "Women on the move: The neglected gender dimension of the brain drain." IZA Discussion Paper 2920. Institute for the Study of Labour, Bonn, Germany.
- El Masri, Amira, and Noah Khan. 2022. *International students' lived experiences: A review of the literature*. Centre for Global Education and Internationalization.
- Esses, Victoria, Alina Sutter, Alejandro Ortiz, Ning Luo, Jean Cui, and Lisa Deacon. 2018. *Retaining international students in Canada post-graduation: Understanding the motivations and drivers of the decision to stay*. Canadian Bureau for International Education.
- Finnie, Ross. 2000. "From school to work: The evolution of early labour market outcomes of Canadian postsecondary graduates." *Canadian Public Policy* 26 (2): 197–224.
- Finnie, Ross, and Ronald Meng. 2002. "Minorities, cognitive skills and incomes of Canadians." *Canadian Public Policy/Analyse de politiques* 28 (2): 257–273.
- Frank, Jeffrey, and Eric Bélair. 2000. "Pathways to the United States: Graduates from the class of '95." *Education Quarterly Review* 6 (3): 36–44.
- Freeman, Thomas R., Stephen Petterson, Sean Finnegan, and Andrew Bazemore. 2016. "Shifting Tides in the Emigration Patterns of Cana-

- dian Physicians to the United States: A Cross-Sectional Secondary Data Analysis." *BMC Health Services Research* 16: 678.
- Government of Canada. 2014. *Canada's international education strategy: Harnessing our knowledge to drive innovation and prosperity*. Department of Foreign Affairs, Trade and Development.
- Grant, Peter R. 2005. *The devaluation of immigrants' foreign credentials: The psychological impact of this barrier to integration into Canadian society*. Prairie Centre of Excellence for Research on Immigration and Integration.
- Gries, Thomas, Manfred Kraft, and Manuel Simon. 2016. "Explaining inter-provincial migration in China." *Papers in Regional Science* 95 (4): 709–731.
- Hailpern, Susan M., and Paul F. Visintainer. 2003. "Odds ratios and logistic regression: Further examples of their use and interpretation." *The Stata Journal* 3 (3): 213–225.
- Hou, Feng, and Yuqian Lu. 2017. "International students, immigration and earnings growth: The effect of a pre-immigration host-country university education." *IZA Journal of Development and Migration* 7 (5): 1–24.
- Immigration, Refugees and Citizenship Canada (IRCC). 2016. *Evaluation of the Canadian Experience Class: Performance – Effectiveness*.
- Immigration, Refugees and Citizenship Canada (IRCC). 2021. *Temporary Residents: Study Permit Holders – Monthly IRCC Updates*.
- Kaushal, Neeraj, and Mauro Lanati. 2019. "International student mobility: Growth and dispersion." *NBER Working Paper* 25921. National Bureau of Economic Research, Cambridge, MA.
- Machin, Stephen, Kjell G. Salvanes, and Panu Pelkonen. 2012. "Education and mobility." *Journal of the European Economic Association* 10 (2): 417–450.
- Mathews, Maria, Dania Koudieh, Yanqing Yi, Lindsay Hedden, Emily Gard Marshall, Asoka Samarasena, Geoff Barnum, and Ivy Bourgeault. 2021. "Retention of Visa-Trainee Post-Graduate Residents in Canada: A Retrospective Cohort Study." *Human Resources for Health* 19: 98.
- Mathies, Charles, and Hannu Karhunen. 2020. "Do they stay or go? Analysis of international students in Finland." *Globalisation, Societies and Education* 19 (3): 298–310.
- Mayda, Anna M. 2010. "International migration: A panel data analysis on the determination of bilateral flows." *Journal of Population Economics* 23 (4): 1249–1274.
- McDonald, Ted, and Pablo Miah. 2021. *Immigrant retention in New Brunswick: An analysis using linked federal-provincial administrative data*. Fredericton, NB: New Brunswick Institute for Research, Data and Training.
- Miyagiwa, Kaz. 1991. "Scale economies in education and the brain drain problem." *International Economic Review* 32 (3): 743–759.
- Schaafsma, Joseph, and Arthur Sweetman. 2001. "Immigrant earnings: Age at immigration matters." *Canadian Journal of Economics* 34 (4): 1066–1099.
- Siddiq, Fazley, Warren Nethercote, Jeannette Lye, and Judy Baroni. 2012. "The economic impact of international students in Atlantic Canada." *International Advances in Economic Research* 18: 239–240.
- Statistics Canada. 2021a. *Annual income estimates for census families and individuals (T1 Family File)*.
- Statistics Canada. 2021b. *Postsecondary Student Information System (PSIS)*.
- Statistics Canada. 2022. *Payroll employment, earnings and hours, and job vacancies, May 2022*.
- Sweetman, Arthur, and Casey Warman. 2014. "Former temporary foreign workers and international students as sources of permanent immigration." *Canadian Public Policy* 40 (4).
- Thurber, Andrea D., and David L. Wright. 2009. "Physician brain drain from Canada: What is known and what remains to be learned." *Open Medicine* 3 (3): e91–e97.
- Verbik, Line, and Veronica Lasanowski. 2007. "International student mobility: Patterns and trends." *World Education News and Reviews* 20 (10): 1–16.
- Watanabe, Mamoru, Melanie Comeau, and Lynda Buske. 2008. "Analysis of international migration patterns affecting physician supply in Canada." *Healthcare Policy* 3 (4): e129–e138.
- World Bank. 2022. *World Bank country and lending groups*.
- Zhang, Qiantao A., and Brian M. Lucey. 2019. "Globalisation, the mobility of skilled workers, and economic growth: Constructing a novel brain drain/gain index for European countries." *Journal of the Knowledge Economy* 10 (4): 1620–1642.