

**THE DETERMINANTS OF INTERNATIONAL POST SECONDARY STUDENT
MOBILITY IN CANADA: NATIONAL AND REGIONAL PANEL DATA
ANALYSIS**

by

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Bachelor of Arts in Economics, St. Thomas University, 2017

A Report Submitted in Partial Fulfillment of
the Requirements for the Degree of

Master of Arts

in the Graduate Academic Unit of Economics

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This report is accepted by the
Dean of Graduate Studies

UNIVERSITY OF NEW BRUNSWICK

December, 2022

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ABSTRACT

Given the current need of recruiting immigrants to fill in labour force gaps, international students in Canada have become paramount to immigration policy. The increased need to recruit skilled workers makes it important to know what attracts international students to the country, but most importantly, what makes international students want to stay. This knowledge provides the opportunity to have a more targeted policy approach to retention. For this purpose, we use the Post-Secondary Information Survey and the T1 Family Tax Files data for the years 2005 to 2018 to estimate a logit panel data model which identifies the factors affecting international students' retention in Canada, given characteristics related to their education and socio-demographic factors. We also investigate the causes of internal mobility across Canadian provinces among international students while controlling various individual-specific and macro variables. Our findings will help federal and provincial policymakers shed light on policy formations to improve the retention rate of international students.

DEDICATION

To Fabiana Rosado, for your invaluable support and insights, our partnership during this process made this achievement possible.

To Zach, whose strength and care supported me throughout the entire process. This would not have been possible without you.

To my family, whose dedication and love made me the woman I am today.

ACKNOWLEDGEMENTS

- I would like to thank my supervisors, Dr. Fariba Solati and Dr. Murshed Chowdhury, for their commitment and mentorship during this project. Your unyielding belief in this project inspired me.
- I am also grateful to the rest of the Faculty of Economics at the University of New Brunswick. To Jodi O’Neill, for her administrative support and being the bearer of all good news. Lastly, to the analysts of the RDC, who helped me during this entire project and provided valuable insights.
- This research is funded and supported by the New Brunswick Innovation Foundation- Research Assistantship Initiative (NBIF-RAI).
- Dr. Solati was responsible for project conceptualization, project administration and funding arrangement. Dr. Solati and Dr. Chowdhury were jointly supervising this project and were responsible for the review & editing of this project which is a part of a larger project (Brain drain/gain in Canada).
- The data analysis was conducted at the NB-IRDT housed at the University of New Brunswick, Fredericton.

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List of Abbreviations

Science, Technology, Engineering and Mathematics and Computer Sciences (STEM)

Business, Humanities, Health, Arts, Social Science and Education (BHASE)

Middle East and North Africa (MENA)

East Asia and the Pacific (EAP)

North American Industry Code System (NAICS)

New Brunswick (NB)

Nova Scotia (NS)

Prince Edward Island (PEI)

Newfoundland and Labrador (NL)

British Columbia (BC)

Research and Data Centre (RDC)

Immigration, Refugees and Citizenship Canada (IRCC)

Express Entry (EE)

1. Introduction

Given the current need of recruiting immigrants to fill in labour force gaps, international students in Canada have become paramount to immigration policy. Statistics Canada has reported that there are over a million vacant jobs in Canada, which combined with the low unemployment rate outlined by the Labour Force Survey for May 2022, points to a labour shortage in the country (Statistics Canada, 2022). Some of the sectors that have been most affected by these vacancies and employ skilled workers are health care and social assistance (14% of vacancies), and professional, scientific, and technical services (7.5%) (Statistics Canada, 2022). Hence, there is a need to bring skilled workers to Canada, settle them as permanent residents, and incentivize that they remain in the country long term. International student graduates are the ideal candidates to become permanent residents in Canada; they have received a Canadian education, they are proficient in English and/or French, they often have local work experience, and they have already started to integrate (both socially and economically) into the local culture (Immigration, Refugees and Citizenship Canada, 2017).

The Government of Canada announced its International Education Strategy in 2014. They proposed to 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). In addition, immigration minister Sean Fraser was appointed in 2022 to “expand pathways to Permanent Residence for international students and temporary foreign workers”, as mandated by the House of Commons (Thevenot, 2022). For this reason, exploring the

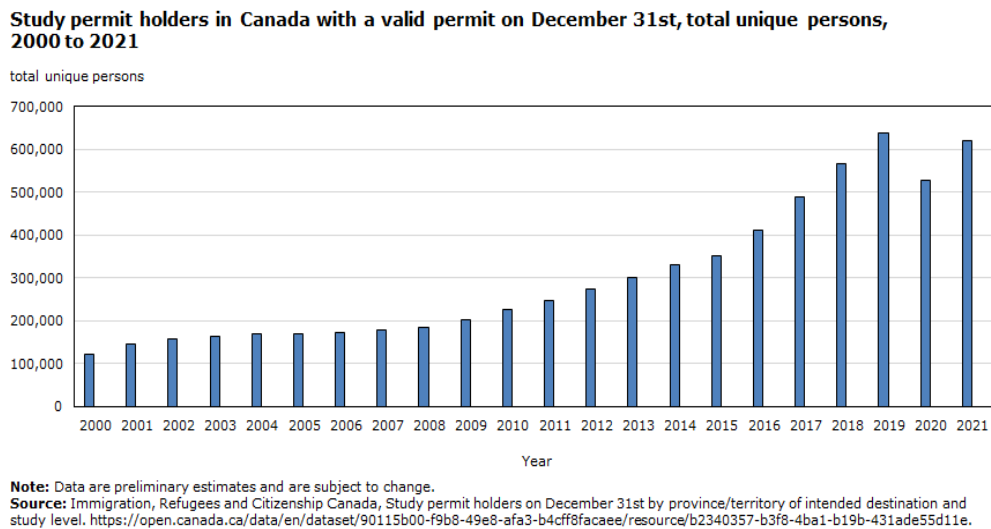
factors which are associated with international student migration (both internationally and within/between Canadian provinces) is essential.

The number of international students around the world and in Canada has increased. According to estimations, in 2005 there were 2.7 million international students around the world, representing a 61 percent increase in enrollments since 1999 (Verbik and Lasanowski, 2005). The United Nations Educational, Scientific, and Cultural Organization (UNESCO) predicted that there would be approximately five million international students in 2020 (Adrian Kershaw Consulting, 2005). In 2019, the OECD (2021) estimated that there were 6.1 million tertiary students worldwide. Canada is one of the Western countries that has received the most international students in recent years. Crossman et al. (2021) argue that the reason for the faster growth concerning the inflow of international students to Canada is likely related to both the less receptive environment in other major Western countries (particularly in the United States), along with the measures adopted by both the Canadian government and educational sector to attract international students. This suggests that Canadian is often perceived as a rather welcoming nation. The Canadian Bureau for International Education (2018) reported that from 2010 to 2017 there was a 119 percent increase in the number of international students studying in Canada. The number of international students has increased further since, reaching 621,600 in 2021 (Crossman et al., 2022).

Figure 1 illustrates the growth in the number of international students in Canada. International students may decide to stay in Canada after graduation, return to their region of origin, or settle in a different country. Crossman et al. (2021), found that in the cohort of 2000, 27% of study permit holders intended to enroll in a college degree, while 20% intended to enroll in a university degree (Bachelor's and above). This numbers

have changed throughout time, so that in the 2019 cohort, 41% of students were enrolled in a college degree, and 27% were enrolled in a university degree. Esses et al. (2018) interviewed 9,000 international students in Canada and found that 50.6 percent of them had plans to apply for permanent residency, and 61.0 percent of them had plans to work in Canada after graduation.

Figure 1. Study Permit Holders in Canada with a Valid Permit on December 31st, Total Unique Persons, 2000 to 2021 (IRCC, 2021)



The composition of international students in Canada has changed over the years. Recently, there has been a decrease in the variety of countries of origin from which international students are from. Crossman et al. (2022) have found that the share of international students from the same seven countries (South Korea, China, Japan, the United States, France, Mexico, and India) increased from 59% in the 2000-to-2004 cohort to 67% in the 2015-to-2019 cohort. These countries are the ones from which most international students come from, with the top two countries in the latest cohort being India and China. Our findings show that the top countries from which international

student graduates come from are China, India, France¹, Iran, and Nigeria, which corroborates findings by Crossman et al. (2022).

Crossman et al. (2021) reported that for the 2015 to 2019 cohort, 55.4 percent of international students were male; 44.6 were female. The share of female students has slightly decreased, as women made up 48.9 percent of international students in the 2000 to 2004 cohort (Crossman et al., 2021). Our findings show that the percentage of male international student graduates is 53 percent; the percentage who are women is 46 percent. No significant changes in these values have transpired over the past two decades. Moreover, there has been an increase in the concentration of students attracted to particular provinces in Canada. For example, Ontario attracted the largest share of international students in the early 2000s, and this attraction grew from 37% in the 2000 to 2004 cohort to 49% in the 2015 to 2019 cohort (Crossman et al., 2022). Lu and Hou (2017), established that most international students resided in Ontario, British Columbia, and Quebec, particularly in the metropolitan areas of Toronto, Vancouver, and Montreal.

Similarly, the concentration of international students in particular fields of study has changed. The share of international students in the field of business, management, and public administration is significant among international university students. It declined from 28% in the 2011 to 2014 cohort to 25% in the 2015 to 2017 cohort, but the corresponding share of business students at the college level expanded from 37% in the 2011 to 2014 cohort to 41% in the 2015 to 2017 cohort (Crossman et al., 2021). The expansion of students in the field of business meant decreases in other fields such as architecture, engineering, visual and performing arts, and communications technologies

¹ The high number of students coming from France is likely because of Quebec.

(Crossman et al., 2021). Our data suggests that the most popular fields of studies throughout the years 2005-2018 were business administration, social sciences, and engineering.

The literature on migration has focused on immigrants in general, and it has been very limited in its analysis of international students, let alone international students in Canada (El Masri, and Khan, 2022). This study contributes to the literature by analyzing the determinants of migration for international student graduates in Canada. Moreover, the existing literature has traditionally focused on country-specific determinants of migration, such as GDP and unemployment, with very little focus on individual characteristics (Finnie, 2000; Coulumbe, 2006). Other studies focused on the retention of international students in Canada are limited to small surveys of international students, constrained to a handful of universities (Ortiz and Choudaha, 2014; Schutz and Richards, 2003; Arthur and Flynn, 2011; Esses et al., 2018).

Our focus on determinants particular to individuals, including socio-demographic characteristics and variables related to education, provides further insight into the motivations of international students. Our study also covers all Canadian universities. Furthermore, the study focuses not only on the retention of international students in Canada but their movements between Canadian provinces after they graduate. We analyzed the motivations behind their decision to change region of residence. The retention of international students in a particular area of Canada is important for regional development. Esses et al. (2018) established that the ability to retain international students as permanent residents and skilled workers is especially critical for regions with a declining labour force because they are a new source of highly skilled labour that can contribute to the regions' growth and prosperity.

The breadth of our study, coupled with the fact that we provide insight that goes further than macroeconomic indicators, means that governments will have more insight when it comes to policy formation. We have filled various gaps in the literature, including addressing the individual characteristics of international students, which play a role in their decision of staying in the country as workers. In addition, by observing international students who attended universities across all of Canada, along with addressing their interprovincial mobility as well as their international mobility, means that we have gone beyond what other studies in the literature have done. Hence, national, and provincial governments will have an opportunity to not only develop policies that address macroeconomic well-being, but also policies that are focused on the individual needs of potential immigrants. In turn, this will provide more opportunities to retain international students in a particular region.

The objectives of this research are (1) to explore the determinants of international student retention in Canada; and (2) to study the determinants of international student graduates' interprovincial migration. To fill the gap in the literature, we addressed the following research questions:

- What are the characteristics and determinants of international student retention in Canada?
- What are the characteristics and determinants of international student interprovincial mobility?
- What is the retention rate of international students in Canada after graduation?

- At what rate do international students who change province of residence after graduation?

The recent interest placed on foreign graduates to become Canadian workers increases the importance to understand what makes them want to stay in the country. By focusing on their individual characteristics, targeted policy at the national and provincial levels can be developed to increase international student retention. To address these research questions, this study has conducted descriptive and regression analysis at the national and provincial level, using the Post-Secondary Information System (PSIS), merged with the T1 Family Tax from the years 2005 to 2018. We found that out of all international student graduates, 65 percent of them were still in the country in 2018. The biggest predictors of retention in Canada are: region of origin, the field of study, and marital status. In terms of interprovincial mobility, around three percent of all international students changed province after graduation. The biggest determinants for interprovincial mobility include: the local unemployment rate, being a woman, being married, and having children.

2. Literature Review

This section will cover the literature relevant to international students in Canada, the importance of attracting human capital to Canada, and why international students are a preferred type of human capital to retain in Canada. Moreover, the literature on the determinants of migration will be analyzed. Given that the literature on the determinants of migration regarding international students is scarce, I have also included literature on migration patterns for immigrants in general.

2.1 The State of International Students in Canada

Over about two decades, since 2000 onwards, the number of international students in Canada has tripled (Canada Bureau for International Education, 2018). As stated before, the number of international students in Canada has grown to over 600,000. Along with this increase, Canada has seen economic benefits from international students undergoing their degrees in the country. The Immigration, Refugees and Citizenship Canada department of the Government of Canada reported in 2018 that international students in Canada contributed an estimated \$21.6 billion to Canada's gross domestic product (one percent of GDP) (Firang, 2020). Atlantic Canada, one of the most economically disadvantaged regions of the country, has also seen benefits from international students. Siddiq et al. (2012) estimated the initial economic impact of international students was about \$376 million in 2009–2010, including an initial injection of \$175 million of new money to Atlantic Canada. They established that the total economic impact of international students is estimated to be \$565 million in 2009–2010. Therefore, international students spent \$2.64 in Atlantic Canada for every dollar spent by the four provincial governments for their education and health care (Siddiq et al., 2012).

The benefits of international students can go beyond the money they spend in the country. If they decide to stay in Canada, they can make a significant contribution to the labour force as skilled workers. Statistics Canada (2021) reported that about 3 in 10 international students who entered Canada in 2000 or later became landed immigrants within 10 years. A study by Citizenship and Immigration Canada indicates that 39.5% of

foreign students transition to foreign worker status, but only 15.6% transition to permanent resident status (Siddiq et al., 2012). Moreover, Dam, Chan, and Wayland (2018) found that international students represented 2.8% of the total permanent residents admitted to Canada in 2016, which is a 170% drop from 2007. They established that the reason for the reduction is the introduction of the Express Entry program, an immigration program established in 2015 based on a points system, under which fewer international students are successful in obtaining PR after they graduate (Dam, Chan, and Wayland, 2018). Some of the barriers mentioned by the study are low-skill employment restrictions, restrictions to work during their studies, ineligible work experience, having to compete with all other immigrants, and expired post-graduation permits.

A study by Choi, Crossman, and Hou (2017) also found that 6 in 10 international students who were employed during their period of study or after graduation became landed immigrants within 10 years of having obtained their first study permit. In the province of New Brunswick, a study found that 3 years post-graduation, less than one-fourth (24%) of international students are still in the province, though the retention rates for 2015 and 2016 are higher than in previous years (Bhuiyan et al., 2021). Findings show that the increase in retention in the province may be due to the Atlantic Immigration Pilot Program (AIPP) and Atlantic Canada Study and Stay™ – New Brunswick (Bhuiyan et al., 2021). A different study by Boco et al. (2021) suggests that the retention rate of international students in New Brunswick is 60 percent at the end of their graduation year, and 38 percent two years after graduation. Boco et al. (2021) also analyzed the retention rate of apprentices in the province of New Brunswick. They note that the retention rate of apprentices with a Red Seal Certificate is 92 percent after two

years, while non-Red Seal endorsed certificate holders have an average two-year retention rate of 64%. In a study about the retention rates of immigrants in New Brunswick, McDonald, and Miah (2021) found that 81 percent of all immigrants were retained 1 year after landing, and 58.7 percent remain in the province after five years. Emery et al. (2017) suggest that out of all the temporary residents who came to New Brunswick, 64% became permanent residents with an intention of landing in NB; 12% intended to land in Ontario, and 9% intended to land in Quebec

Of the factors incentivizing students to stay, job opportunities and economic prosperity tend to be major factors. For instance, Esses et al. (2018) found that a large percentage of international students have plans to apply for permanent residency (50.6%) and to work in Canada after graduation (61.0%). And, Arthur and Flynn (2011) argue that students are motivated to remain in Canada due to enhanced job opportunities and a high standard of living.

2.2 The importance of attracting Human Capital to Canada

The following section will discuss what human capital is and its relation to long-run economic growth. According to Lucas (1988), human capital enhances productivity of both labour and physical capital, and it can be accumulated through time as knowledge increases through education and training. Investments, such as expenditures on education, training, and medical care, are investments in human capital (Becker, 1994). Society places a high value on education, experience, and on-the-job training, since the presence of human capital in a nation leads to an expansion of scientific and technical knowledge that raises the productivity of labour and other factors of

production (Becker, 1994). One of the main causes of growth in a country is the accumulation of human capital (Galor and Moav 2002; Glaeser et al. 2004). In the modern era of knowledge-based economies, the sustainability of long-run economic growth has become extremely dependent on the availability of highly-skilled human capital (Siddiq et al., 2012).

One of the main avenues through which human capital leads to economic development, in the long-run, is through contributions to innovation (Solow, 1956; Romer, 1986; Lucas 1988). As an example, human capital can increase the number of innovative entrepreneurs and products, thus encouraging economic growth through innovation. Acemoglu and Autor (2012), established that human capital leads to technological progress because individuals with the highest talents make contributions by the use of their human capital if they have the necessary access to educational facilities. In addition, they stated that the workforce in more general terms may affect technology, first, due to the externalities derived from human capital and, second, because human capital alters and increases the incentives to invest more in technological progress. In addition, Schultz (1975) argues that workers are better able to cope with changes in the economic structure and handle new technologies if they have more human capital.

As stated above, heavily investing in education is an investment in human capital. However, in their study of Europe's long-run economic growth in relation to human capital, Diebolt and Hippe (2019) established that medium levels of education (education up to high school diplomas) are not significant which highlights that economic growth in Europe's 'knowledge-driven' economies is boosted by the highest form of educational attainment. This means that the most economic growth comes from

students who have attended university, not only secondary school. In fact, Sterlacchini (2008) found that human capital—in the form of higher education—and a region's knowledge base have a significant and positive impact on economic growth in twelve EU15 countries between 1995 and 2002. There are studies linking the success of Silicon Valley to its proximity to elite universities, pointing out that universities are important in attracting human capital to the local area and in stimulating entrepreneurial talent in the region (Woodward et al., 2006; Huffman and Quigley, 2002). Hence, human capital in the form of university student graduates is very important for long-run economic growth.

The low birth rate and aging population in Canada mean that some skilled labour has to be sourced from abroad. The immigration of educated workers has become paramount in policy-making and economic planning. Skilled immigrants are highly sought after by governments due to their positive effects on economic growth (Siddiq et al., 2012). International students - due to their Canadian post-secondary education - are potential skilled immigrants. International students offer a source of human capital and many countries around the world depend on them to augment economic development (Siddiq et al., 2012). International students have already begun the process to move to Canada, so recruiting them would expedite the process.

Di Giovanni, Levchenko, and Ortega (2015) point out that the long-run impact of observed levels of migration is large and positive for the receiving countries; as an inflow of migrants increases the size of the labour force. In addition, a study conducted by Doquier, Ozden, and Peri (2014) on OECD nations shows that less educated workers also benefitted from their countries receiving international migrants. Canada, Australia, the US, Luxembourg, the UK, and Switzerland, which were among the magnets of international migrants, all experienced positive long-run effects from immigration,

between 1 and 5 percent growth in wages of low-skilled domestic workers. Studies on the European Union have shown consistently positive effects on overall GDP and on per capita GDP of recipient countries of immigrants (Ortega and Peri, 2009; Alesina et al., 2013; Ortega and Peri, 2014; Ozgen, Nijkamp, and Poot, 2009). A meta-study of the empirical literature on the effects of migration on income growth and convergence (Ozgen, Nijkamp, and Poot 2009) finds that the overall effect of net inward migration on growth in real per capita income tends to be positive. Ortega and Peri (2014) used bilateral trade data from the NBER-UN dataset to show there is a robust, positive effect of openness to immigration on long-run income per capita.

The positive effects of immigration are felt more profoundly in the technology sectors. Burns, Andrew, and Mohapatra (2008) find that emigration rates of the highly educated tend to be higher than for the general population of developing countries, in particular scientists, engineers, and medical professionals. They showed that developing countries accounted for three-quarters (approximately 2.5 million) of the 3.3 million immigrant scientists and engineers living in the United States in 2003. A study by Hanson and Liu (2021) showed that the United States has built its strength in high technology in part through its businesses having access to exceptional talent in science, engineering, and mathematics. They showed that immigrants from China, India, and other Asian countries are more likely to specialize in STEM occupations than native-born workers. Moreover, Challeraj, Maskus, and Matoo (2008) have found evidence to support the view that foreign graduate students and skilled immigrants are significant inputs into developing new technologies in the U.S. economy; impacts which are more pronounced within universities and in patents.

Canada has already pursued different policy avenues to recruit human capital from abroad. The Government of Canada long recognized the need for economic migration (IRCC, 2020). The previously mentioned new immigration system, Express Entry (EE), was introduced to Canada in 2015. Along with the new immigration system, the Comprehensive Ranking System (CRS) was created, which is the points-based system Immigration, Refugees, and Citizenship Canada (IRCC) uses to determine a candidate's position in the EE pool (IRCC, 2020). IRCC established that it ranks prospective skilled immigrants by looking at specific factors such as work experience, language ability, education, and other aspects which have previously been shown to be associated with long-term economic success in Canada. In an evaluation of the Express Entry system, the Government of Canada stated that it is an effective filtering mechanism, selecting individuals who have stronger short-term economic performance in Canada, relative to those not chosen (IRCC, 2020).

2.3 Immigrant Assimilation and the Advantage of International Students

Immigrants face challenges with respect to integrating into the workforce, and typically, an initial wage disadvantage upon arrival (Borjas, 1985; Chiswick, 1978; Albert, Glitz, & Llul, 2021). However, international students may be more advantageous to Canadian immigration targets because they do not face the same wage disadvantage as foreign immigrants due to their Canadian experience and better assimilation into Canadian society (Siddiq et al., 2012). The literature shows that immigrants have a wage disadvantage upon arrival to the destination country (Borjas, 1985; Chiswick, 1978; Albert, Glitz, & Llul, 2021). Borjas (1985), used the 1970 and

1980 US censuses to run cross-sectional regressions using OLS and found that it takes white immigrants' earnings 10 to 15 years to converge to that of white, US-born workers, and it takes immigrants from all other races even longer to earn comparable wages. Moreover, Chiswick (1978), using data from the 1970 US Census, found that immigrants earn substantially less upon arrival than US-born individuals with similar characteristics. Friedberg (2000) claims that immigrants to Israel earn approximately one-quarter less than their native counterparts of comparable measured skill levels. Bowlus, Miyairi, & Robinson (2016) studied immigrants in Canada and found that three-quarters of the observed earnings differential between immigrants and Canadians is accounted for by substantial differences in the amount and quality of job offers they receive after arriving to Canada.

Immigrants who have acquired their education from abroad come to Canada as skilled workers, yet their earnings do not often reflect their education and experience. Basilio, Bauer, & Kramer (2017) state that "human capital obtained from the origin country may not be equivalent to human capital obtained in the host country due to limited transferability of skills and imperfect compatibility of home and host country labour markets" (p.255). They ascertain that wage differentials are due to the lesser value attached to foreign human capital. Chiswick (2011), using the 2000 US Census, found that an additional year of education for US-born workers raises earnings more substantially than for foreign-born individuals with similar characteristics. The explanation behind the smaller return on foreign education is the country-specific aspects of the knowledge acquired in school, a lower equality of foreign schooling, or the poorer information it provides employers who use schooling as a screen (Chiswick, 2011). Schaafsma and Sweetman (2002) found that the return to education varies with

age at immigration, as younger immigrants receive more education in their host country which has higher returns. Schmidt (1997) establishes that the earnings differential between German-born workers and immigrants is explained by the difference in educational endowment. Friedman (2000) found that in Israel the return to education obtained abroad is higher for immigrants from Europe and the Western Hemisphere than for immigrants from Asia and Africa. Eckstein and Weiss (2004) argue that in Israel, the returns that immigrants receive for their imported school experience are initially zero or negative, they rise with time but never reach the prices obtained by natives. Bowlus, Miyairi, & Robinson's (2016) study on immigrants in Canada concluded that immigrant earnings are lowered by their smaller returns to education. The smaller returns are caused not only by a lack of recognition of foreign credentials, but also by the real differences in the quality of education and its "fit" with labour market requirements in Canada (Bowlus, Miyairi, & Robinson, 2016). In particular, Sweetman (2004) found that the countries from which credentials are most discounted are the ones where literacy and numeracy test scores are the lowest. Grant (2005) also show that there is discrimination against foreign credentials in the Canadian labour market.

In addition, labour market experience acquired abroad is often valued less than Canadian work experience. In their analysis of immigrant assimilation, Basilio, Bauer, & Kramer (2017) found that foreign labour market experience yields virtually zero returns for immigrants. On a similar note, Chiswick (1978) found that the effect of a year of preimmigration labour market experience is lower for foreign-born (especially those from non- English speaking countries) than a year of experience for the domestic-born. Schaafsma and Sweetman (2002) found that there is virtually no return to foreign work experience in the host country, and Friedberg (2000) suggest that the national origin of

an individual's labour market experience is a crucial determinant of their value in the labour market – i.e., human capital is not perfectly transferable across countries. Finally, Cohen-Goldner & Eckstein (2008) found that imported schooling and experience have zero return conditional on the local accumulated human capital of immigrants.

Furthermore, language barriers present an additional difficulty to the assimilation of immigrants. Basilio, Bauer, & Kramer (2017) claimed that immigrants have higher returns to education and work experience in their host countries because each additional year of experience allows them to gain language proficiency and local knowledge. Similarly, Chiswick (1978; 2009) found that immigrants' earnings only rise after they have been gradually acquiring knowledge of the language, customs, and nature of the US labour market. Studies that have compared the cognitive skills of immigrants versus Canadian-born based on test scores for literacy, numeracy, and problem-solving, showed that the lower scores from immigrants are mostly due to differences in language proficiency (Bonikowska et al. 2007; Finnie and Meng 2002). Thus, immigrants who are not proficient in either of the official languages often have a harder time integrating into the labour market.

However, the difficulty of integrating workers can be mitigated with additional time in the host country, which is why focusing on international students can be advantageous as they have spent more time in the host country and have Canadian credentials. Duleep and Regets (1999) argue that as immigrants acquire local human capital the earnings gap is narrowed. For this reason, there is a higher likelihood that immigrants will invest in their skills in the host country and undertake investment beyond that which facilitates the transfer of previously learned skills (Duleep and

Regets, 1999). On a similar note, Bratsberg and Ragan (2002) claim that immigrants in the U.S. who acquire local schooling have higher earnings and a higher return to their education, even when accounting for English proficiency. Schoeni (1999) found that the returns to education for US immigrants with US schooling are substantially higher than for those who only have foreign schooling.

Kossoudji (1989) argues that assimilation may not be a matter of how long an immigrant has been in the country; rather it depends on whether their schooling was completed before arriving to their destination country, as immigrants who arrive before schooling is completed are likely to gain higher wages with experience in the U.S. and to emulate domestic job mobility. Schaafsma and Sweetman (2002) argue that age at immigration matters, as those who arrive later in life endure, on average, lower returns to both foreign labour experience and foreign education; and the young acculturate more easily. Hence, an argument can be built for prioritizing international students in Canada for immigration purposes. Hawthorne (2008) argues for an emphasis on international students in immigration policy, stating that “facilitating immigrants obtaining a Canadian credential may also help, not only because of the high value of the Canadian credential that immigrants receive but also because it serves an important signal to verify the quality of their foreign education” (p. 41). He presents Australia as an example of a country that seeks “onshore” international student applicants who have obtained a degree in Australia. Hou and Lu (2017) showed that Canadian-educated immigrants on average had higher earnings than foreign-educated immigrants both in the short run and in the long run.

2.4 Determinants of Migration

The mobility of skilled immigrants is driven by push and pull factors. Push factors are the issues in the country of origin that make it more likely for an individual to emigrate. On the other hand, pull factors are the aspects of a host country that make it attractive for immigrants to move there. The following section will address the push and pull factors that drive the mobility of international students.

Kaushal and Lanati (2019) analyzed over 190 sending and receiving countries and found that individuals moving abroad to pursue a tertiary education are motivated more so by the rising demand to acquire global tertiary skills and much less by the desire to migrate for permanent settlement. In addition, they found that students from high-income countries expect a higher return to education in an English-speaking country, because of the perceived quality of the institutions and the larger amounts of top 200 universities (Kaushal and Lanati, 2019).

Furthermore, Mayda (2010) has found evidence that pull factors, such as income opportunities in the destination country, significantly increase the size of emigration rates. However, she also found that the push factors, such as income in the origin country, are insignificant. In addition, she uncovered that migration flows increase when the destination country has less restrictive immigration policies (Mayda, 2010). Aziz et al (2022) found that migration between OECD countries happens due to differences in institutional quality; with the role of political institutions playing a bigger role than that of economic institutions.

The desire of students to expand their knowledge of other societies and to improve their language skills, particularly English, has proven to be an important motivator to study abroad (Kahanec and Kralikova, 2011). In addition, opportunities for

improved labour market outcomes from higher education overseas; and the willingness of host countries to attract skilled labour are important determinants of immigration for studies (Chiswick and Miller, 2011; Beine et al., 2014). Student mobility has also been driven by the overall growth in higher education worldwide, particularly among high-income economies, and the perceived value of enrolling at prestigious institutions (Perkins and Neumayer, 2014).

Beine et al. (2014) found that migration costs, as proxied by physical distance, are found to have a statistically significant and negative effect on international student mobility. They also found that a common language and the presence of a strong network of migrants in the country of destination positively influence international student migrant flows, while higher living costs deter potential student migrants. Abbott and Silles (2016) found that for non-high-income countries, the results indicate that much of the flow of international students is attributable to higher per capita income in destination countries. For high-income countries, the ratio of per capita GDP between countries of destination and origin is not statistically significant. These results are consistent with the hypothesis that the benefits of migration for students who originate from poorer countries are higher than for wealthier countries and therefore that those from economically disadvantaged countries have the most incentive to study abroad (Abbott and Silles, 2016).

The decision to immigrate is often influenced by the desirable characteristics of the destination country. Chen and Rosenthal (2008) found that in the United States, regardless of marital status, highly educated households move toward places with higher-quality business environments. In addition, they found that individuals over the age of 50 move away from business environments and toward places with more

consumer amenities. Burns & Sanket (2008) found that the quality of living conditions and research facilities in high-income countries, as well as the density of research networks and the size of the pre-existing diaspora, are factors that attract immigrants. Marfouk (2007) argues that the difference in living standards between regions is what determines the decision to migrate.

In addition, population size plays a big role in migration. Beine et al. (2008) proved that a region with a larger population attracts more qualified workers. Amirault, De Munnik, & Miller (2016), when studying interprovincial migration in Canada, found that the relationship between population size and migration is positive. Thus, they concluded that thick markets and networks are important incentives to migrate to Canada. Migration patterns in Canada show that people migrate from rural and small regions to large population centres (Amirault, De Munnick, & Miller, 2016). Coulumbe (2006) established that there is a positive relationship between migration and human capital in Canadian provinces, stating that a rich province with high amounts of skilled workers, will attract even more skilled workers. In addition, Finnie (2000) found that mobility rates are inversely related to the size of the province, reflecting general economic conditions.

The literature suggests that the push and pull factors for migration are mostly economical; and people move mostly for better employment prospects and higher wages (Zhang & Lucey, 2019; Etzo, 2018; Gries, Kraft, & Simon, 2016). Zhang & Lucey (2019) found that economically advanced regions tend to be recipients of tertiary graduates, and less developed regions lose their highly educated workers. Income inequality in the country of origin decreases the ability to immigrate for low and medium-skilled individuals since it increases their liquidity constraints (Cooray and

Schneider, 2016). Poprawe (2015) found that income level and returns to education are factors that influence higher rates of healthcare professionals' emigration. Docquier and Iftikhar (2019) found that among Sub-Saharan African countries, those with low productivity differentials in the information sector suffer more from "brain drain". Moreover, people with higher income levels are more mobile because they have the economic capability to move (Cooray & Schneider, 2016).

The determinants of inter-provincial migration are not dissimilar to those of international migration. Similarly, income is one of the strongest factors in the migration of skilled professionals. In fact, within-country migration is more sensitive to income differentials than international migration (Barro and Sala-i-Martin 1991; Braun, 1993). When studying inter-provincial migration in China, Gries, and Simon (2016) found that migrants seem to move to regions with higher inequality which may promise well-paid jobs and urban privileges. A study on inter-regional migration in Italy found that the per capita GDP is the main economic determinant of migration flows, as well as the infrastructure's endowment level (Etzo, 2018).

Income also plays a role in the push factors of interprovincial migration, as Gries and Simon (2016) found that urban poverty is a counter-pull factor in China. Etzo (2018), found that the impact of per capita GDP on migration flows is stronger on the sending region; thus, low-income levels are a stronger push factor than they would be a pull factor. Other studies also suggest that differences in unemployment rates between provinces in Canada are what causes out-migration (Coulumbe, 2006; Finnie 2000).

Education level and field of study are variables that the literature suggests have an impact on the decision to migrate. 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 the productivity of the region and furthering the attractive power (Miyagiwa, 1991). A study by Machine, Salvanes, & Pelkonen (2012) suggests that an additional year of education can significantly increase the likelihood of regional mobility. Studies on internal migration in Canada show that interprovincial migrants are 1.5 times more likely to have a university education than the non-migrant population (Amirault, De Munnick, & Miller, 2016; Coulumbe, 2006). Demirci (2019) found that STEM graduates in the United States have a higher retention rate at the bachelor's and master's levels compared to graduates in humanities and social sciences. Furthermore, the location in which an individual decides to conduct their studies is also an important determinant in their decision to migrate after graduation. Including variables for the province of study is important because there is evidence that out-of-state college attendance is positively associated with out-migration after graduation (Sipra, 2014).

Demographic characteristics also play a role in the decision to migrate. Age is a variable that has often been studied in relation to migrants. Lucas (2001) found that the current value of a given income differential flow was higher for younger people due to their longer lifespan, resulting in an attraction to migrate, which decreases as individual ages. Amirault, De Munnick, & Miller (2016) found that interprovincial migrants in Canada are 1.5 times more likely to be younger than non-migrants. Moreover, Coulumbe (2006) establishes that the most sizable outmigration in Canada occurs from the 18-24 age group and that people 44 years and older leave at much smaller rates. In addition, gender often plays a role in the decision to migrate as well. Dumont et al. (2007) showed that migrants from low-income countries are more likely to be female.

Marital status and presence of children are also variables that play a role in migration. 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 of retention regardless of employment.

Country-specific characteristics are often factors that contribute to the push of individuals out of their country of origin. Corruption is one of the main push factors found in the literature. Cooray and Schneider’s (2016) results indicate that as corruption increases, the emigration rate of high-skilled persons also increases. On a similar note, when comparing countries in Africa, Poprawe (2015) found that the most corrupt countries exhibit the highest physician emigration rates.

As previously mentioned, the literature on international students’ retention and migration patterns after graduation is scant in Canada (El Masri and Kant, 2022). Most of the literature is only focused on the movement of immigrants and the general population of Canada (Finnie, 2000; Coulumbe, 2006). The patterns of migration of international students are also explained only by macroeconomic variables, and not by individual characteristics (Abbott and Silles, 2016). The other studies done on retention are small surveys done on a handful of universities, and they cannot be used to study migration patterns in Canada as a whole (Esses et al., 2018, Arthur and Flynn, 2011). We are filling gaps in the literature by studying the determinants of retention of international students based on individual characteristics of immigrants, using a large Canada-wide dataset on students who completed tertiary education.

3. Data and Methodology

3.1 The Data

This study uses the Post-Secondary Information System (PSIS), merged with the T1 Family Tax Files, as the main source of data. PSIS is a dataset collected and published by Statistics Canada, which includes detailed information on enrollments and graduates of Canadian public post-secondary institutions (Statistics Canada, 2021). The survey was collected through electronic administrative files kept by the universities, and their participation is mandatory (Statistics Canada, 2021). It includes variables that account for fields of study, program and credential type, citizenship, gender, and status of the student in Canada, amongst others. This project has undertaken the linking of the survey to the T1 Family Files using a unique ID assigned to each individual. The data in the tax files cover all persons who completed a T1 tax return for the year of reference or who received Federal child benefits, and it is extracted from administrative files. When complete, the files account for 96 percent of the population (Statistics Canada, 2021). 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. Hence the use of PSIS and T1FF, as administrative data, should perform properly in its representativeness.

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. After international students complete their

studies, they are eligible for a work permit, but we are including in the dataset those students who had a study permit while they were attending university. The sample was also limited to individuals who have already graduated from their program. The study excludes international students undergoing their program because their employment and location decisions are unknown to us. We have limited the sample to people 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 make sure not to count students twice. The international student graduates are 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 they 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 were not included, because we have not followed them for long enough to determine whether they stayed in Canada or not, or whether they moved provincially. We use panel data to track individuals across time, allowing me to determine their migration patterns and retention.

3.2 The Econometric Models

This section of the report discusses the nature of the panel data logit models, as well as the design and purpose of the dependent and independent variables.

3.2.1 Model 1: Panel Logit Model on International Student Retention

The first model used in this research was conceived by Mathis and Karhunen (2020) in their paper "Do they stay or go? Analysis of international students in Finland".

They used a logit model to examine predictive factors for students' retention and measure the projected probability of retention for an average college student. In other words, the model measures the likelihood that an international student stays in the country as a worker after finishing their studies. The regression equation is as follows:

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

In Equation one which was outlined above, we can see the dependent variable that is binary (*stayed*) which equals one if the individual stayed in Canada after graduation, and zero if they moved abroad after graduation. The independent variables are *age*, *agesq* which stands for age squared, *studypr* which means province of study, *field* which stands for field of study, *regions* which means region of origin, *level* stands for program level, *incomecat* means income categories, *mst* is marital status, *child* is number of children, and *sex* stands for whether an individual is male or female.

\The study determined whether they settled or moved using their tax files. If they filed taxes on every consecutive year until 2018, we classify them as stayed. Regardless of the year they started, they have to have filed taxes every year until 2018, which is the last data-year available. The paper by Mathis and Karhunen (2020) establishes that for us to be able to consider a student as retained, they must have filed taxes for at least three years. If the data reflects that an individual stopped filing taxes, then we determine they have left Canada. Graduates who have missing years in between taxation years would be counted in the study but only their last period of taxation would be taken into account to determine whether they were retained or not.

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*) and is constructed by subtracting the reference year of taxation from the year of birth. The literature argues that age should have a negative effect on migration, as the younger population is usually more mobile (Finnie, 2000; Lucas, 2001). Finnie (2000) argues that the older population has increased psychological and economic costs and decreased expected future benefits of moving.

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 categorized as those: in a relationship (married or common law), who have been previously married (divorced or widowed), or single (never married). The reference category is being in a relationship. In addition, the model controls for earnings (*incomecat*) using categories, as done by Mayda (2010). We have divided total income before tax into four categories as 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.²

² Income in this case is total income and can include things like employment income, self-employment income (such as net business, fishing, or farming income), net rental income, pension, and employment insurance payments, and capital gains and losses. Therefore, income can be less than zero if it includes capital losses or negative business income.

The regions of origin are categorized according to the World Bank's definitions (World Bank, 2022). Regions are divided into East Asia and Pacific, Latin America and the Caribbean, Middle East and North Africa, Central Asia and Europe, and Sub Saharan Africa. Regions of origin (regions) are included because international migration patterns are highly dependent on income differentials among countries of origin and destination, and accounting for the region of origin can capture that relationship (Zhang & Lucey, 2019; Etzo, 2018; Gries, Kraft, & Simon, 2016). 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, and Humanities, or Health Sciences. The retention rates could vary depending on the fields taken at the university (Demirci 2019).

3.2.2. Model 2: The Interprovincial Migration of International Student Graduates in Canada

The second model was derived by Finnie (2000) in his paper Who Moves? He analyses the interprovincial mobility of Canadians using a logit model, with a dependent variable equal to one if an individual has changed residence in the last year. The dataset used in his study was the Longitudinal Administrative Database (LAD), which also had access to the tax files of Canadians. Hence, he could determine with fair certainty the movements of interprovincial migrants based on where they filed their taxes. This study uses a similar approach, to determine the likelihood that an international student will change province of residence after they graduate. As a result, we get an understanding of migration patterns both in and out of Canada and within Canadian provinces.

$$moved_{it} = \beta_0 + \beta_1 age_{it} + \beta_2 agesq_{it} + \beta_3 prres_i + \beta_4 naics_i + \beta_5 regions_i + \beta_6 level_i + \beta_7 mst_{it} + \beta_8 GDPpc_{it} + \beta_9 sex_{it} + \beta_{10} unemp_{it} + \beta_{11} pop_{it} + \beta_{12} child_{it} + \beta_{13} T_t + \varepsilon_{it} \quad (2).$$

The variables *age*, *agesq*, *regions*, *level*, *mst*, *sex*, and *child* are the same ones as in Equation 1. The new variables in equation 2 are *prres* which stands for province of residence, *naics* which stands for job industry, *GDPpc* which means GDP per capita, *unemp* which means unemployment rate, *pop* which stands for population size, and *T* which are year dummies.

In similar fashion, this logit model employs a binary variable (*moved*) equal to one if an individual has changed their province of residence between taxation years. The T1 family tax files allow us to determine in which province an individual has filed their taxes, thus we can track their movements based on the location of their taxes. We decided to use the province of taxation (*prres*) instead of the self-reported province of residence because we are more interested in the economic contributions of that individual. The study also considers international student graduates who have stayed in Canada for at least three years after graduation, to establish with certainty that they have been retained in the country.

As with the previous specification, age is included in both linear and quadratic term (*agesq*) to capture a non-linear relationship with the dependent variable. As stated above, the literature suggests that as an individual ages, it is less likely they will move (Finnie, 2000; Lucas, 2001). Additionally, the study also controls for marital status (*msr*) and the presence of children (*child*). Being married and a parent is argued to increase the costs of moving, while potentially amplifying the benefits of staying (Finnie, 2000).

The model includes a series of labour market variables to reflect local labour market conditions, gathered from data published by Statistics Canada (2022). The variables for GDP per capita, population, and unemployment rate have been added as logarithms. The benefits of using a logarithm are that it narrows a variable's range, especially for large monetary values, and makes the estimation more accurate (Wooldridge, 2013). The unemployment rate (unemp) for each province has been included to capture local labour market opportunities (Finnie, 2000). Fegugrlia et al. (2014) also controlled for the unemployment rate in their model, arguing that it captures the difference between destination and origin states in terms of labour market dynamics. A high unemployment rate in a region often results in significant out-migration (Cheng and Yang, 1998). In addition, we have included the provinces' GDP per capita (gdppc) and population (pop) variables as also used by Fegugrlia et al. (2014). They argued that the level of GDP per capita³ in the year before a worker's mobility captures differences in living standards, influencing the decision to migrate (Fegugrlia et al., 2014; Marfouk, 2007). Moreover, the population variable was added under the hypothesis that larger population centres attract more skilled workers (Fegugrlia et al., 2014; Beine et al., 2008).

Unlike Finnie, we have included additional individual characteristics that have been argued to determine the likelihood of migration. The model controls for education level (level) and region of origin (regions). Since our study is focused specifically on highly skilled individuals, it is important to determine the education level of each graduate. The level of education is a determinant in the decision to migrate, as more

³ An alternative to GDP per capita could be the growth rate of GDP per capita, which was not used as we are following the model outlined by Finnie (2000) and Freguglia (2014) as closely as possible.

educated individuals are more mobile (Miyagiwa, 1998; Machine, Salvanes, & Pelkonen 2012). Furthermore, we are focusing on international student graduates, whose attitude towards migration, along with certain individual characteristics, are likely determined by their country of origin (e.g., the impact of cultural factors) (Bhugra and Becker, 2005). Variables that account for the sector (naics) in which the international student is employed are also included. Fegugrli et al. (2014) included sector dummies to identify those sectors that were more liable to lose their skilled labour force. They argued that some sectors are more vulnerable to international competition for workers (Fegugrli et al., 2014; Golgher, 2001). We would like to study whether this applies to international students as well since their field of employment might be related to whether they decide to move.

In addition, we decided to use logit model, instead of probit or linear probability models, since it is the method used by Freguglia et al. (2014), as well as the only method that allowed for odds ratios to be ran. We opted to use odds ratios to interpret the magnitudes of coefficients⁴. The interpretation of odds ratios that we used was the one outlined in the Stata Journal by Hailpern and Visintainer (2003). The model we used was random effects, which was chosen instead of fixed effects since the nature of the majority of our variables is time invariant.

Endogeneity due to reverse causality is possible. For example, the model argues that better wages can lead to an increase in migration to the region, and low wages can

⁴ Both logit models are represented using odds ratios instead of average marginal effects. This decision was made based on the processing power of the computers at the RDC laboratory. Our first decision was to use marginal effects, which is more commonly used in the literature. However, marginal effects in our second regression took over a week to process, due to the processing power available to the computer. The laboratory resets their computer every weekend, so we could not let the program run for longer.

cause higher rates of emigration. However, the immigrant flows can affect the wages in the host and source countries. To address such endogeneity, Mayda (2010) suggested relating the dependent variable in the current period to the lagged values of (log) GDP per worker and income. The same concern can be applicable to unemployment and population size, which is why the model includes lagged values for these variables as well. Mayda (2010) argues that while it would be impossible to say that these values are exogenous, it is possible to argue that they are predetermined, in the sense that immigrant inflows—and other unidentified factors in the error term—can only affect contemporaneous and future wages.

We have also decided to use robust standard errors on both models to account for heteroskedasticity and autocorrelation issues⁵.

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. This points to the fact that there was a 12.6 percent increase in the number of international students who stayed in Canada after graduation⁶. As previously noted, this increase was likely in part due 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

⁵ We decided to use robust standard errors instead of clustered standard errors, which are used when you have sampled data from a population using clustered sampling, and want to say something about the broader population (Abadie et al., 2017; McKenzie, 2017). As we stated above, the PSIS and T1 Files data is administrative, it was collected by the universities' administrations and its participation is mandatory. Therefore, the dataset is appropriately representative of international students, and we are referring to the population of international students only, not the broader population of students in Canada (Canadian citizens and permanent residents).

⁶ This number includes international student graduates and those who have filed taxes only.

analyzes the education level of international students per year. In 2005, 58 percent of international students were pursuing an undergraduate degree, while 42 percent of international students were enrolled in a graduate program. The number of international students doing an undergraduate degree rises to 59 percent during the years 2006 to 2008. Since then, the proportion of graduate students started to increase steadily, until 2017, when it peaked at 47 percent of international students⁷. At this time, the proportion of international students undergoing an undergraduate degree was at its lowest at 53 percent. Therefore, the proportion of international students with a graduate degree has increased throughout the years, while the proportion of undergraduate students has decreased. Hence, there appears to be a convergence concerning the proportion of international students pursuing each level of university education.

Table 2 describes the percentage of international students living in each province of Canada through the years 2005-2018. In the year 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. During that year, the province with the lowest percentage was Prince Edward Island, with 0.5 percent of international students. Since 2005, the percentage of students in Ontario has increased 10 percentage points, reaching 36.2 in 2018. This corroborates the Crossman, Choi, Lu, & Hou (2022) finding, which argued 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

⁷ Since we have only counted each student once, this cannot reflect international undergraduate students who subsequently decided to pursue a graduate degree.

Alberta, the percentage of students decreased steadily until 2018, when it reached 8 percent. The province which experienced the largest percentage change is Quebec, which started at 9.1 percent in 2005, reaching 20.2 percent in 2018; thus, becoming the province with the second most 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 from 10.2 to 5.1 percent, respectively. The percentage of international students attending university in Atlantic Canada was 12 percent on average throughout the years 2005-2018. It has 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 et al. (2021).

Table 3 describes the distribution of regions of origin of international students throughout the years. In 2005, the region from which most international students came was East Asia and the Pacific, which encompassed 52.2 percent of international students. It was followed by Europe and Central Asia, which made up 11.1 percent of international students. 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, reaching 41.4 percent in 2018. The percentage of international students coming from Europe and Central Asia has remained stable throughout the years, 11.2 percent of international students were from the region in 2018. The proportion of international students coming from Latin America and the Caribbean decreased, reaching 5.2 percent at its lowest point in 2014. After that it slightly went up, reaching 5.6 percent in 2018. The biggest percentage increases occurred in South Asia

and Sub-Saharan Africa. The percentage of international students originating from South Asia increased from 9.1 percent in 2005 to 18 percent in 2018. The proportion of students from Sub-Saharan Africa increased from 7.6 percent in 2005 to 10.9 in 2018. Similarly, the number of students from MENA countries increased from 6.7 percent to 9.8 percent, while the number of students from North America decreased from 6.9 percent to 3 percent. This information is congruent with data from Crossman, Choi, Lu, & Hou (2022), who established that most international students come from South Korea, China, and Japan.

Table 1. International Student Graduates' Program Type per Year

Year	Undergraduate		Graduate and Other		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	53,735	53.8%	46,210	46.2%	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

Table 2. International Student Graduates' Province of Study per Year (%)

Year	Newfoundland	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia
2005	3.2%	0.5%	10.2%	8.6%	9.1%	26.5%	3.2%	1.8%	13.2%	23.6%
2006	2.6%	0.4%	8.5%	6.8%	11.0%	30.6%	3.9%	1.8%	12.5%	22.0%
2007	2.4%	0.3%	7.1%	5.5%	13.6%	32.7%	3.5%	1.8%	11.8%	21.2%
2008	2.1%	0.3%	6.2%	4.5%	15.0%	33.9%	3.6%	1.9%	10.9%	21.5%
2009	2.0%	0.3%	5.6%	3.9%	16.1%	34.3%	3.6%	2.1%	10.5%	21.7%
2010	1.9%	0.3%	5.4%	3.4%	17.5%	34.2%	3.7%	2.3%	10.0%	21.2%
2011	1.8%	0.3%	5.5%	3.0%	18.2%	34.5%	3.7%	2.7%	9.9%	20.4%
2012	1.8%	0.3%	5.4%	2.9%	19.0%	34.9%	3.7%	2.9%	9.5%	19.6%
2013	1.8%	0.3%	5.5%	2.6%	19.6%	35.2%	3.9%	2.9%	9.2%	18.9%
2014	1.9%	0.4%	5.4%	2.4%	20.1%	35.5%	3.8%	3.1%	8.8%	18.7%
2015	1.8%	0.4%	5.3%	2.3%	20.2%	36.0%	3.9%	3.0%	8.4%	18.7%
2016	1.8%	0.4%	5.2%	2.3%	20.4%	36.2%	3.7%	3.0%	8.0%	19.1%
2017	1.9%	0.4%	5.1%	2.3%	20.3%	36.0%	3.8%	3.0%	8.1%	19.2%
2018	1.9%	0.4%	5.1%	2.3%	20.2%	36.2%	3.7%	3.0%	8.0%	19.1%

Table 3. International Student Graduates' Province of Study per Year (frequency)

Year	Newfoundland	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
2005	360	55	1,140	965	1,015	2,960	355	195	1,480	2,635	11,160
2006	420	65	1,380	1,105	1,785	4,960	625	285	2,020	3,570	16,215
2007	565	80	1,665	1,300	3,200	7,685	830	415	2,780	4,985	23,505
2008	710	110	2,080	1,500	5,035	11,365	1,205	635	3,665	7,220	33,520
2009	850	145	2,420	1,680	6,980	14,855	1,555	895	4,565	9,410	43,350
2010	1,040	170	3,005	1,895	9,725	19,015	2,070	1,305	5,540	11,800	55,570
2011	1,235	210	3,790	2,105	12,665	23,980	2,570	1,840	6,855	14,190	69,445
2012	1,530	255	4,545	2,385	15,870	29,120	3,095	2,415	7,920	16,400	83,530
2013	1,840	325	5,465	2,570	19,625	35,155	3,905	2,945	9,190	18,925	99,940
2014	2,265	455	6,425	2,915	24,055	42,505	4,585	3,655	10,505	22,370	119,735
2015	2,510	540	7,190	3,205	27,660	49,320	5,385	4,080	11,450	25,565	136,905
2016	2,740	600	7,785	3,425	30,720	54,430	5,615	4,465	12,020	28,715	150,520
2017	2,670	570	7,320	3,325	29,085	51,630	5,410	4,295	11,555	27,465	143,330
2018	2,620	560	7,175	3,310	28,460	51,040	5,185	4,230	11,340	26,960	140,880

Table 4. International Student Graduates' Region of Origin per year (%)

Year	East Asia and Pacific	Europe and South Asia	Latin America and the Caribbean	Middle East and North Africa	North America	South Asia	Sub Saharan Africa
2005	52.2%	11.1%	6.5%	6.7%	6.9%	9.1%	7.6%
2006	50.4%	11.0%	6.7%	7.4%	6.7%	9.5%	8.3%
2007	48.5%	11.4%	6.8%	8.4%	6.7%	9.6%	8.5%
2008	47.9%	11.6%	6.6%	8.6%	6.4%	10.0%	8.9%
2009	46.5%	11.7%	6.3%	9.5%	6.2%	10.9%	8.9%
2010	45.7%	11.6%	6.2%	10.1%	5.8%	11.8%	8.8%
2011	45.3%	11.5%	5.9%	10.6%	5.4%	12.3%	8.9%
2012	45.0%	11.7%	5.6%	10.8%	4.8%	13.1%	8.9%
2013	44.8%	11.7%	5.3%	10.6%	4.4%	14.0%	9.1%
2014	44.0%	11.7%	5.2%	10.6%	4.0%	15.0%	9.6%
2015	43.3%	11.7%	5.3%	10.2%	3.7%	15.8%	10.0%
2016	41.9%	11.7%	5.5%	10.0%	3.4%	17.2%	10.4%
2017	41.4%	11.4%	5.6%	10.0%	3.2%	17.8%	10.7%
2018	41.4%	11.2%	5.6%	9.8%	3.0%	18.0%	10.9%

Table 5. International Student Graduates' Regions of Origin per Year (frequency)

	East Asia and Pacific	Europe and South Asia	Latin America and the Caribbean	Middle East and North Africa	North America	South Asia	Sub Saharan Africa	Total
2005	5,820	1,240	725	745	770	1,015	845	11,160
2006	8,170	1,780	1,090	1,200	1,085	1,550	1,345	16,215
2007	11,410	2,680	1,600	1,975	1,585	2,250	2,005	23,505
2008	16,050	3,880	2,210	2,880	2,155	3,365	2,980	33,520
2009	20,180	5,080	2,710	4,120	2,675	4,745	3,840	43,350
2010	25,370	6,470	3,435	5,610	3,225	6,555	4,905	55,570
2011	31,450	8,000	4,120	7,375	3,755	8,570	6,170	69,445
2012	37,595	9,740	4,710	9,040	4,025	10,960	7,455	83,530
2013	44,820	11,675	5,330	10,575	4,420	14,025	9,100	99,940
2014	52,730	13,955	6,215	12,640	4,760	17,965	11,470	119,735
2015	59,245	16,065	7,220	13,975	5,015	21,695	13,685	136,905
2016	63,075	17,580	8,215	15,025	5,065	25,910	15,650	150,520
2017	59,275	16,335	8,000	14,325	4,575	25,490	15,335	143,330
2018	58,345	15,745	7,895	13,870	4,275	25,375	15,380	140,880
Total	493,535	130,225	63,475	113,350	47,380	169,470	110,155	1,127,595

Table 7 represents the percentage of international students in each field of study over the observed time period. In the year 2005, 38.3 percent of international students were enrolled in a STEM program, while 57 percent were enrolled in a Business, Humanities, Health, Arts, Social Science and 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 6. International Student Graduates' Field of Studies per Year

Year	STEM		Social Science and Humanities		Medical Field		Total
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	
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	56.7%	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%	66,135	55.2%	3,015	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	42.5%	78,935	55.1%	3,425	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 8 describes the international student retention rate, which we have defined 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 are under the category of staying in Canada. Out of all the international student graduates who filed taxes in 2005, 61 percent remained in the country in 2018. We can see that the closer we get to 2018, and the shorter the time an international student graduate has been living in Canada, the retention rate increases for both groups. This is consistent with other studies, which find that the retention rates for a shorter number of years are higher than long-term retention rates (Okony-Myers, 2010; McDonald et al., 2021). Furthermore, our results show that the retention of international students varied by program level. Out of the international students who completed undergraduate studies in 2005, 65 percent of them were still in Canada in 2018. Moreover, out of the international students who completed graduate studies in 2005, 56 percent were still in Canada in 2018. We have also looked at retention after 10 years of arrival. We found that out of international students who were in Canada in 2008 and received an undergraduate degree, 64 percent of them were still in the country after 10 years. 59 percent of the 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 mobile⁸ (Frank & Belair, 2000).

⁸ We know that students are more mobile, but we have no data which can tell us where they are going to.

Table 7. International Student Retention: International Student Graduates who filed Taxes in the Year of Reference and 2018

Years	Not in Canada in 2018		In Canada in 2018		Total
	Count	Percentage	Count	Percentage	
2005	4285	38.5%	6850	61.5%	11135
2006	6185	38.2%	9995	61.8%	16180
2007	9000	38.4%	14450	61.6%	23450
2008	12815	38.3%	20625	61.7%	33440
2009	15335	35.5%	27900	64.5%	43235
2010	18255	32.9%	37180	67.1%	55435
2011	20945	30.2%	48325	69.8%	69265
2012	22650	27.2%	60650	72.8%	83300
2013	23815	23.9%	75845	76.1%	99660
2014	24845	20.8%	94525	79.2%	119370
2015	23610	17.3%	112840	82.7%	136445
2016	20045	13.4%	129920	86.6%	149970
2017	11120	7.8%	131715	92.2%	142835
Total	212905		911210		1124110

Table 8. International Student Retention: International Student Graduates who filed Taxes in the Year of Reference and 2018

Years	Undergraduate				Total
	Not in Canada in 2018		In Canada in 2018		
	Count	Percentage	Count	Percentage	
2005	2060	34.5%	2625	65.5%	4685
2006	2855	34.8%	3760	65.2%	6615
2007	4090	35.4%	5490	64.6%	9580
2008	5710	36.2%	8095	63.8%	13805
2009	6995	33.8%	11555	66.2%	18550
2010	8155	32.3%	16000	67.7%	24155
2011	9380	29.9%	21240	70.1%	30620
2012	10130	27.5%	27555	72.5%	37685
2013	10595	24.6%	35330	75.4%	45925
2014	10810	21.9%	44450	78.1%	55260
2015	9855	18.7%	53090	81.3%	62940
2016	8045	15.0%	61940	85.0%	69985

2017	4450	8.8%	62510	91.2%	66960
Total	93130		418870		512000
	Graduate				
Years	Not in Canada in 2018		In Canada in 2018		Total
2005	2225	44.0%	4225	56.0%	6450
2006	3330	43.1%	6235	56.9%	9565
2007	4910	42.7%	8960	57.3%	13870
2008	7105	41.4%	12530	58.6%	19635
2009	8340	37.7%	16345	62.3%	24685
2010	10100	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

Table 10 shows the percentage of international students who have changed their province of residence throughout the years. Starting in 2006, we know that 3 percent of international students changed their province of residence. In the years after, the number of international students moving decreased, until it reached a low of 2.3 percent in 2008. The percentage increased steadily in the years that followed, with only a small decrease in 2015, until it reached the highest number in 2018, of 3.7 percent of international students changing their province of residence.

Table 9. International Student Graduates who Moved Provinces Within Canada per Year

Years	Did not Move		Moved		Total
2006	15730	97.0%	485	3.0%	16215
2007	22850	97.2%	655	2.8%	23505
2008	32745	97.7%	775	2.3%	33520

2009	42275	97.5%	1075	2.5%	43350
2010	54185	97.5%	1385	2.5%	55570
2011	67590	97.3%	1855	2.7%	69445
2012	81105	97.1%	2425	2.9%	83530
2013	96965	97.0%	2975	3.0%	99940
2014	115845	96.8%	3885	3.2%	119735
2015	132945	97.1%	3955	2.9%	136905
2016	145990	97.0%	4525	3.0%	150520
2017	138265	96.5%	5060	3.5%	143330
2018	135725	96.3%	5155	3.7%	140880
Total	1093380		34215		1127595

4.2 Regression Analysis

4.2.1 Model 1

The first model, displayed in Table 11, estimated the determinants of international student retention in Canada, that is, what are the characteristics of international students who choose to stay, relative to those who leave? The base/reference categories in the regressions were chosen to closely reflect the studies done by Mayda (2010) and Finnie (2000). Age is one of the most influential variables in the decision of staying in Canada, and it is statistically significant at conventional levels. An additional year of age will increase the odds of someone staying in Canada by 41%. This is consistent with the literature which suggests that the most mobile individuals are those who are young (Lucas, 2001; Amirault, De Munnick, & Miller, 2016).

The most significant variables both statistically and economically are the variables for regions of origin. The category that was left out is East Asia and the Pacific (EAP). International students who came from Europe and Central Asia have 16% lower

odds to stay than those from EAP. In a similar vein, international students from North America are 37% less likely to stay than those from EAP. Among those from Latin America and the Caribbean, are 22% less likely to stay. MENA international students' odds are 16% those of EAP. Students coming from South Asia are 14% more likely to stay in Canada than those coming from EAP. Lastly, students whose region of origin was Sub-Saharan Africa have the same odds 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 than a pull factor. As mentioned above, students who come from economically disadvantaged countries have the most incentive to study abroad (Abbott and Silles, 2016). In addition, economically advanced regions receive more tertiary graduates, and the more economically disadvantaged a region is, the higher skilled workers they lose (Poprawe, 2015; Docquier and Iftikhar, 2019). Therefore, it makes sense that our results reflect that international students who come from more economically well-off regions such as North America and Europe are less likely to stay in Canada compared to those from economically disadvantaged regions.

In terms of program type/level, results suggest that those who completed a graduate degree have lower odds to stay in Canada, their odds are 25% less those who completed an undergraduate degree. This was statistically significant at the 1 percent level. According to the literature, an additional year of education increases the likelihood to migrate; our results are congruent with previous studies (Machine, Salvanes, & Pelkonen, 2012; Amirault, De Munnick, & Miller, 2016; Coulumbe, 2006). The regression also controlled for field of study. We find that the variables for the field of study are statistically significant at the 1 percent level and that students who underwent a

medical degree are 40% less likely to stay in Canada than those who took STEM. In addition, international students who took a BHASE-related field have a decrease in the odds to stay in Canada than those who took STEM, their odds are 3% less those of STEM students. Notably, STEM graduates being more likely to stay reflects other papers which show higher retention rates for this subgroup (Demirci, 2019).

Family life-related variables were also taken into account. The number of children influences an international student's decision to remain in Canada. This variable was highly statistically significant, at the one percent level. The results suggest that for each additional child, an international student is 3% 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 at the one percent level. The reference category was less than 25,000 dollars in income. We found that those who earn 25,000 to 50,000 dollars have 85% higher odds to stay in Canada than those in the base category. Additionally, international students who have earned 50,000 to 80,000 dollars have an increase in the odds to stay than those with a very low income, their odds are 126% those than the reference category. Finally, graduates who earned more than 80,000 dollars have higher odds to stay than those who had a low income, they are 181% more likely to stay. This means that earning more money usually leads to a person deciding to stay. This is consistent with the literature, as the decision to immigrate is tied to the desire for better-paid jobs—or a higher GDP per capita (Gries and Simon, 2016; Etzo, 2018; Zhang & Lucey, 2019). Hence, international students who have found economic success in Canada are not likely to leave. The respondent's gender also

matters, being statistically significant at the one percent level. That is women have higher odds to stay in Canada than men, women's odds are 22% more those of men. In a similar vein, Dumont et al. (2007) showed that migrants are more likely to be female.

Moreover, we found that students who went to university in PEI had 12% higher odds to stay in Canada than those who studied in Ontario, significant at the 5 percent level. Graduates from universities in Newfoundland are 24% less likely to stay compared to those in Ontario. International students who went to NS had reduced odds stay in Canada than those who went to Ontario, their odds were 26% those of Ontario. Students in NB were 47% less likely to stay in Canada compared to the base category. Students in Quebec had 7% higher odds to stay than those who studied in Ontario. Studying in Manitoba had no effect on the odds to stay compared to the base category. Studying in Saskatchewan was associated with an international student being 8% less likely to stay in Canada. Alberta was associated with international students being 34% less likely to stay in Canada compared to Ontario. Studying in BC meant students' odds to stay were reduced compared to the base category, BC student's odds were 10% less those of Ontario. 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 et al., 2021).

Table 12 shows the same regression as table 11, but split up into each year of the study. There is a cross-sectional regression for the years 2005 to 2018. The cross-sectional regressions reflect the same relationships between variables as the panel data regressions, further confirming our findings.

Table 10. The Determinants of Retention of International Student Graduates in Canada (Odds ratio following the logistic regressions)

N=1,127,597	
Variables	Odds Ratio
Age	1.41*** (0.000)
Age Squared	0.99*** (0.000)
Province of Study (Base: Ontario)	
Newfoundland	0.76*** (0.000)
PEI	1.12** (0.019)
NS	0.74*** (0.000)
NB	0.53*** (0.000)
Quebec	1.07*** (0.000)
Manitoba	1.00 (0.773)
Saskatchewan	0.92*** (0.000)
Alberta	0.66*** (0.000)
BC	0.90*** (0.000)
Field of Studies (Base: STEM)	
BHASE	0.97*** (0.000)
Medical Field	0.60*** (0.000)
Regions of Origin	
Europe and Central Asia	0.84*** (0.000)
Latin America and the 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)
Program Level (Base: Undergraduate)	
Graduate	0.75*** (0.000)
Other	1.21** (0.002)
Marital Status (Base: Married and Common Law)	
Widowed, divorced, separated	0.98 (0.412)
Single	1.04*** (0.000)
Number of Children	1.03*** (0.000)
Income Categories (Base: Less than 25,000)	
25,000-50,000	1.85*** (0.000)
50,000-80,000	2.26*** (0.000)
80,000+	2.81*** (0.000)

Sex (Base: Male)	
Female	1.22*** (0.000)
Constant	0.00*** (0.000)
<p>*p<0.10; ** p<0.05, ***p<0.01 **Numbers in parenthesis are standard errors.</p>	

Table 11. The Determinants of Retention of International Student Graduates in Canada per year (Odds ratio following the logistic regressions)

Variables	2006	2007	2008	2009	2010	2011
Age	0.88 *** (0.000)	0.88***(0.000)	0.89*** (0.000)	0.94*** (0.000)	1.00 (0.900)	1.02* (0.072)
Age Squared	1.00***(0.000)	1.00***(0.000)	1.00*** (0.000)	1.00*** (0.003)	1.00 (0.521)	1.00** (0.017)
Province of Study (Base: Newfoundland)						
NF	1.87***(0.000)	2.08***(0.000)	2.01***(0.000)	1.80***(0.000)	1.45***(0.000)	1.42***(0.000)
PEI	0.63 (0.154)	1.19 (0.599)	1.61* (0.092)	1.64** (0.041)	1.29 (0.231)	1.37 (0.127)
NS	1.50*** (0.000)	1.70***(0.000)	1.80***(0.000)	1.58***(0.000)	1.39***(0.000)	1.33***(0.000)
NB	1.61 *** (0.000)	1.76*** (0.000)	1.95***(0.000)	1.84***(0.000)	1.52***(0.000)	1.48***(0.000)
Quebec	1.08 (0.391)	1.16** (0.026)	1.28***(0.000)	1.39***(0.000)	1.32***(0.000)	1.28*** (0.000)
Manitoba	1.55*** (0.001)	1.51***(0.000)	1.66***(0.000)	1.52***(0.000)	1.38***(0.000)	1.27***(0.000)
Saskatchewan	2.67*** (0.000)	2.57***(0.000)	2.86***(0.000)	2.14***(0.000)	1.70***(0.000)	1.53***(0.000)
Alberta	1.84*** (0.000)	1.71***(0.000)	1.73***(0.000)	1.61***(0.000)	1.46***(0.000)	1.38***(0.000)
BC	1.67*** (0.000)	1.53***(0.000)	1.56***(0.000)	1.42***(0.000)	1.28***(0.000)	1.29***(0.000)
Field of Studies (Base: STEM)						
BHASE	1.17*** (0.001)	1.06 (0.145)	1.00 (0.964)	1.03 (0.301)	1.05** (0.047)	1.06** (0.010)
Medical Field	2.04***(0.000)	2.14*** (0.000)	1.65*** (0.000)	1.47*** (0.000)	1.34*** (0.000)	1.25*** (0.001)
Regions of Origin						
Europe and Central Asia	1.14*(0.078)	1.12* (0.073)	0.93 (0.230)	0.90** (0.020)	0.90***(0.007)	0.85*** (0.000)

Latin America and the Caribbean	1.14 (0.171)	1.13 (0.114)	1.22*** (0.002)	1.20*** (0.001)	1.17*** (0.002)	1.11** (0.027)
Middle East and North Africa	1.23**(0.027)	1.19** (0.021)	1.20*** (0.002)	1.23*** (0.000)	1.26*** (0.000)	1.17*** (0.000)
North America	0.71***(0.000)	0.61*** (0.000)	0.54*** (0.000)	0.50*** (0.000)	0.47*** (0.000)	0.46*** (0.000)
South Asia	1.75***(0.000)	1.55*** (0.000)	1.62*** (0.000)	1.68*** (0.000)	1.90*** (0.000)	1.93*** (0.000)
Sub Saharan Africa	1.76***(0.000)	1.87*** (0.000)	2.07*** (0.000)	1.91*** (0.000)	1.97*** (0.000)	1.90*** (0.000)
Program Level (Base: Undergraduate)						
Graduate	0.65***(0.000)	0.68*** (0.000)	0.74*** (0.000)	0.75*** (0.000)	0.75*** (0.000)	0.79*** (0.000)
Other	1.44 (0.535)	1.14 (0.779)	1.45 (0.298)	0.75 (0.268)	1.03 (0.901)	1.50 (0.121)
Marital Status (Base: Married and Common Law)						
Widowed, divorced, separated	1.41*(0.085)	1.06 (0.722)	1.08 (0.595)	1.05 (0.663)	1.13 (0.274)	1.06 (0.606)
Single	0.69***(0.000)	0.74*** (0.000)	0.75*** (0.000)	0.71*** (0.000)	0.68*** (0.000)	0.70*** (0.000)
Number of Children	1.19***(0.000)	1.20*** (0.000)	1.14*** (0.000)	1.13*** (0.000)	1.10*** (0.000)	1.05*** (0.000)
Income Categories (Base: Less than 25,000)						
25,000-50,000	1.29***(0.003)	1.68*** (0.000)	2.08*** (0.000)	1.86*** (0.000)	1.78*** (0.000)	1.88*** (0.000)
50,000-80,000	2.52***(0.000)	3.13*** (0.000)	2.47*** (0.000)	2.05*** (0.000)	1.97*** (0.000)	2.11*** (0.000)
80,000+	1.99**(0.032)	2.44*** (0.001)	2.31*** (0.000)	2.35*** (0.000)	1.90*** (0.000)	1.93*** (0.000)
Sex (Base: Male)						
Female	1.12**(0.032)	1.12***(0.005)	1.11*** (0.002)	1.14*** (0.000)	1.13*** (0.000)	1.10*** (0.000)
Table 6. Odds Ratio, Likelihood of an international student leaving Canada per year						
Variables	2012	2013	2014	2015	2016	2017

Age	1.01 (0.263)	1.01 (0.612)	1.01 (0.302)	1.03*** (0.002)	1.06*** (0.000)	1.11*** (0.000)
Age Squared	1.00 (0.150)	1.00 (0.288)	1.00 (0.142)	1.00*** (0.001)	1.00*** (0.000)	1.00*** (0.000)
Province of Study (Base: Ontario)						
NL	1.35***(0.000)	1.37*** (0.000)	1.31*** (0.000)	1.42*** (0.000)	1.31*** (0.001)	1.19* (0.053)
PEI	1.03 (0.852)	0.97 (0.830)	1.09 (0.562)	0.87 (0.311)	1.23 (0.161)	1.30 (0.128)
NS	1.10** (0.043)	1.01 (0.758)	0.96 (0.339)	0.92** (0.040)	0.93 (0.109)	1.00 (0.937)
NB	1.23*** (0.001)	1.22*** (0.002)	1.22*** (0.003)	1.13** (0.074)	1.24*** (0.004)	1.29*** (0.006)
Quebec	1.19***(0.000)	1.14*** (0.000)	1.07** (0.013)	1.08*** (0.007)	1.07** (0.020)	1.05 (0.134)
Manitoba	1.20***(0.001)	1.15*** (0.007)	1.14*** (0.008)	1.08 (0.100)	1.05 (0.346)	1.06 (0.310)
Saskatchewan	1.41***(0.000)	1.38*** (0.000)	1.24*** (0.000)	1.21*** (0.001)	1.31*** (0.000)	1.18 (0.018)
Alberta	1.31***(0.000)	1.18*** (0.000)	1.13*** (0.000)	1.09** (0.012)	1.09** (0.024)	1.05 (0.291)
BC	1.22***(0.000)	1.26*** (0.000)	1.17*** (0.000)	1.19*** (0.000)	1.20*** (0.000)	1.18*** (0.000)
Field of Studies (Base: STEM)						
BHASE	1.04* (0.062)	1.02 (0.270)	1.02 (0.314)	1.01 (0.682)	1.00 (0.884)	0.96 (0.104)
Medical Field	1.14** (0.039)	1.04 (0.519)	1.00 (0.951)	1.01 (0.874)	1.00 (0.917)	0.94 (0.436)
Regions of Origin						
Europe and Central Asia	0.81*** (0.000)	0.83*** (0.000)	0.86*** (0.000)	0.82*** (0.000)	0.86*** (0.000)	0.97 (0.405)
Latin America and the Caribbean	1.09* (0.057)	1.11** (0.019)	1.16*** (0.001)	1.24*** (0.000)	1.41*** (0.000)	1.39*** (0.000)
Middle East and North Africa	1.14*** (0.000)	1.12*** (0.001)	1.15*** (0.000)	1.12*** (0.001)	1.14*** (0.001)	1.04 (0.330)
North America	0.44*** (0.000)	0.45*** (0.000)	0.44*** (0.000)	0.44*** (0.000)	0.51*** (0.000)	0.59*** (0.000)
South Asia	1.96*** (0.000)	1.85*** (0.000)	1.84*** (0.000)	1.99*** (0.000)	2.04*** (0.000)	1.88*** (0.000)
Sub Saharan Africa	1.88*** (0.000)	1.91*** (0.000)	1.96*** (0.000)	2.05*** (0.000)	2.04*** (0.000)	1.87*** (0.000)
Program Level (Base: Undergraduate)						

Graduate	0.82*** (0.000)	0.86*** (0.000)	0.89*** (0.000)	0.92*** (0.000)	0.94*** (0.004)	1.01 (0.627)
Other	1.29 (0.254)	1.16 (0.431)	1.03 (0.870)	0.79 (0.125)	0.76** (0.059)	0.95 (0.753)
Marital Status (Base: Married and Common Law)						
Widowed, divorced, separated	0.87 (0.125)	0.78*** (0.005)	0.87 (0.113)	0.83** (0.027)	0.67*** (0.000)	0.56*** (0.000)
Single	0.67*** (0.000)	0.63*** (0.000)	0.60*** (0.000)	0.59*** (0.000)	0.54*** (0.000)	0.47*** (0.000)
Number of Children	1.02* (0.073)	1.04*** (0.005)	1.04*** (0.001)	1.06*** (0.000)	1.04*** (0.000)	1.08*** (0.000)
Income Categories (Base: Less than 25,000)						
25,000-50,000	1.99*** (0.000)	2.07*** (0.000)	2.00*** (0.000)	1.92*** (0.000)	1.87*** (0.000)	1.81*** (0.000)
50,000-80,000	2.20*** (0.000)	2.36*** (0.000)	2.33*** (0.000)	2.28*** (0.000)	2.37*** (0.000)	2.12*** (0.000)
80,000+	1.79*** (0.000)	1.82*** (0.000)	1.72*** (0.000)	1.96*** (0.000)	2.07*** (0.000)	2.11*** (0.000)
Sex (Base: Male)						
Female	1.09*** (0.000)	1.10*** (0.000)	1.12*** (0.000)	1.13*** (0.000)	1.13*** (0.000)	1.14*** (0.000)
*p<0.10; **p<0.05, ***p<0.01 **Numbers in parenthesis are standard errors.						

4.2.2 Model 2

In this section, we analyze the regression results of the second model, the likelihood of an international student changing province of residence, shown in Table 13. The model controlled for the state of the economy in each province from the years 2005 to 2018. All of these were statistically significant at the one percent level. The unemployment rate in each province was the one with the highest coefficient. An increase in the unemployment rate of one percent means an international student is 50% more likely of changing their province of residence. Studies that compared provinces in Canada, found that differences in unemployment rates are what causes out-migration (Coulumbe, 2006; Finnie, 2000). Moreover, a one percent increase in the GDP per capita will decrease the odds of an international student moving provinces, making students 98% less likely to move. This means that the motivations behind the interprovincial migration of international students are slightly motivated by the province's level of per capita production. The migration patterns of international students reflect those of immigrants in general, which studies have found to migrate to places with better wages (Zhang & Lucey, 2019; Etzo, 2018; Gries, Kraft, & Simon, 2016). A one percent increase in the size of the population reflects a 79% decrease in the odds of international students changing provinces. Studies on migration in Canada have found that people gravitate towards places with a higher population (Amirault, De Munnick, & Miller, 2016; Finnie, 2000). Serlenga and Shin (2021) also found that people are more likely to move to regions with a pre-existing network of migrants. Therefore, our finding is consistent, as international students who live in areas with large populations are less likely to move.

A one-year increase in age means an international student has increased odds of moving, they are 11% more likely to move. Women are predicted to have a decrease in the odds to move than men, women's odds are 9% those of men, which reflects the increased mobility of female migrants (Dumont et al., 2007). Being unmarried (single, divorced, widowed) increases the odds of an international student moving by 30% compared to someone who is married or in a common-law relationship. If an international student has one additional child, they are predicted to have a decreased probability of moving, they are 15% less likely to move. Families in Canada have been shown to be reluctant to move, as establishing roots in the destination region increased the probability of retention (Mathis and Karhunen, 2020). This means that international student graduates in Canada are less likely to move once they have established a family and/or had children.

We also wanted to explore how the regions of origin impacted the likelihood of a student moving. We found that originating from Europe or Central Asia made no impact on the decision to move compared to students from EAP. There is an 10% increase in the odds of a student from Latin America and the Caribbean moving than one from EAP. Being from MENA increases the odds international students moving, they are 35% more likely to move compared to being from EAP. North Americans have a decrease in the odds of moving, they are 12% less likely to move than students from EAP. South Asians have 1.70 higher odds to change provinces than people from EAP. Students from Sub-Saharan Africa have higher odds of moving, their odds are 48% those from EAP. Often, region-specific, and culture-specific characteristics can shape the attitudes toward moving (Burns & Sanket, 2008). Moreover, the groups that move the most are those who are underrepresented in immigrant communities. Immigrants from Europe or Asia

would have an easier time finding immigrants from the same region in any community, so they are less likely to move. Other immigrants from underrepresented regions might need to move to find a community they identify with. The role of networks, a cluster of migrants of the same origin residing in the destination, plays a very important role in the migration decisions of an immigrant. A pre-existing network can make an immigrant more likely to move to a certain region, as it provides informational and financial support to newcomers and lowers the cost of assimilation (Beine and Parsons, 2015; Beine et al., 2019; Serlenga, and Shin, 2021).

In terms of education, we analyze the effect program level had on the decision to move. We found that graduate students have higher odds to change provinces, they are 38% more likely than undergraduate students. As Mayda (2010) did, we estimated the effects that industry types had on the likelihood of changing province of residence. Most of these categories are either statistically insignificant or have coefficients close to zero, pointing to the fact that industry might have very little effect on the decision to move.

When compared to the omitted category of Ontario, international students living in most provinces are associated with a lower probability of moving and are statistically significant at the one percent level. These findings align with the mobility patterns found by Finnie (2000) in Canada, who determined that even after controlling for the provincial unemployment rate and individuals' earnings levels, rates of out-migration varied to a significant degree by province.

Table 12. Odds Ratio, The likelihood of an international student graduate moving between Canadian provinces

N=1,127,597

Variables	Odds Ratio
Unemployment Rate	1.50*** (0.000)
Population Size	0.21*** (0.000)
GDP per Capita	0.02*** (0.000)
Age	1.11*** (0.000)
Age Squared	1.00*** (0.000)
Sex (Base: Male)	
Female	0.91*** (0.000)
Region of Origin	
Europe and Central Asia	1.03 (0.278)
Latin America and the Caribbean	1.10*** (0.004)
Middle East and North Africa	1.35*** (0.000)
North America	0.88*** (0.03)
South Asia	1.70*** (0.000)
Sub Saharan Africa	1.48*** (0.000)
Program Level (Base: Undergraduate)	
Graduate	1.38*** (0.000)
Other	1.08 (0.676)
Marital Status (Base: Married and Common Law)	
Widowed, divorced, separated	1.30*** (0.000)
Single	1.27*** (0.000)
Number of Children	0.85*** (0.000)
NAICS Code (Base: Agriculture, Forestry, Fishing and Hunting)	
Mining, Utilities, and Construction	1.02 (0.876)
Manufacturing	0.97 (0.806)
Retail, Warehouse and Transportation	0.87 (0.202)
Professional, Scientific, Management, and Administrative Services	0.90 (0.315)
Education, Health Care and Social Services	0.54*** (0.000)
Arts, Entertainment, Accommodation Services	0.72*** (0.003)
Other Services	0.74** (0.012)
Public Administration	0.75** (0.011)
Not Stated	0.96 (0.744)
Province of Residence	
PEI	0.00*** (0.000)
NS	0.01*** (0.000)
NB	0.01*** (0.000)

Quebec	0.15*** (0.000)
Newfoundland	0.01*** (0.000)
Manitoba	0.02*** (0.000)
Saskatchewan	0.13*** (0.000)
Alberta	1.39*** (0.000)
BC	0.25*** (0.000)
Northwest Territories	0.02*** (0.008)
Yukon	0.08*** (0.000)
Nunavut	0.02*** (0.000)
Year Dummies	
2006	0.39*** (0.000)
2007	0.42*** (0.000)
2008	0.43*** (0.000)
2009	0.59*** (0.000)
2010	0.40*** (0.000)
2011	0.54*** (0.000)
2012	0.67*** (0.000)
2013	0.74*** (0.000)
2014	0.88*** (0.000)
2015	0.84*** (0.000)
2016	0.79*** (0.000)
2017	0.78*** (0.000)
Complete	0.91 (0.002)
Constant	0.00*** (0.000)

*p<0.10; ** p<0.05, ***p<0.01
**Numbers in parenthesis are standard errors

5. Conclusion

To conclude, this report explores the determinants of international student retention in Canada. Given the large labour shortage and aging population that the country is facing, international students have become an increasingly attractive source of highly skilled workers. However, it is not only important to attract international students to Canada, but they should be permanently retained as workers as well. For this reason, this paper focuses on finding the determinants of international student retention in

Canada. We used data from the Post-Secondary Information Survey, which was merged with the Tax Family Files, to run a logic panel data regression. Our sample was comprised of students who held a study permit during their studies between the years 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 variables.

We conducted several descriptive statistics to show the characteristics of international students in Canada. We found that there are more undergraduate students than students pursuing a master's degree or a Ph.D., but the gap between them has been reduced through the years. Moreover, we found that Ontario is the most popular region among international students, and the percentage of students who choose to attend university there has only increased. Quebec has had a surge of popularity in recent years, while attendance in BC or Atlantic Canada has decreased throughout the years. In terms of regions of origin, we found that EAP has been the most popular 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 and the Caribbean, and North America has declined. Finally, the field of study that has the most international students is BHASE. However, STEM has had an uptake in popularity in recent years.

In terms of regression results, the most significant variables we had are those related to the regions of origin. We found that students from South Asia and Sub-Saharan Africa are more likely to stay in Canada than those who come from EAP. Furthermore, we found that the older an international student graduate is, the more likely they are to stay in Canada.

The regression also took into account variables related to the studies taken by foreign students. We found that students taking programs in STEM are more likely to stay than those in BHASE. When taking into account program level, we found that graduate international students are less likely to stay in Canada compared to undergraduate students. While our results suggest that age has a positive relationship with the decision to stay, we also found that age squared is a significant variable in the regression, which suggests a nonlinear relationship between age and the decision to stay. Therefore, an increase in age and an increase in the level of education both may be related to an increase in the likelihood to stay. We found that the province of studies is insignificant when it comes to the decision to stay in Canada. Concerning family life, we found that the individuals most likely to stay in Canada are married, have children, and are female.

Regarding interprovincial mobility, we found that the most significant variables were those related to unemployment. An increase in the unemployment rate makes international students 1.5 times more likely to change provinces in Canada. In addition to unemployment, population size also has a big impact on the decision to move. An increase in the size of the population makes an international student less likely to move. Lastly, being a woman, being married, and having children make it less likely to change province of residence.

Here we discuss policy recommendations based on the results of the project. According to the regression results, the biggest factor that would determine whether an individual stays in Canada or not is their region of origin. In particular, individuals who come from South Asia and Sub-Saharan Africa are much more likely to stay in Canada than those who come from East Asia and the Pacific. However, our descriptive statistics

show that most international students come from EAP, and a large portion comes 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 increase the diversity in their regions of recruitment and go to a wider variety of regions for recruitment purposes in addition to the ones that they already go to. Advertisements for Canadian schools can be increased in more regions of the world, there can be an increase in the Canadian university fairs hosted in the regions, as well as an increase in networking with local schools. The diversification of recruitment might make it so that we can get a more diverse student population and increase integration in Canada across all regions of origin. The diversification of recruitment will not conflict with the universities' quality and high standard targets in education and research, since even if universities try to recruit from a wider array of countries, they would still have minimum entry requirements and the Canadian government requires language testing to provide study permits. In addition, by attending universities in Canada students will be trained in Canadian standards for research methods.

Encouraging more diversity in student recruitment can be a start but providing incentives for students to want to stay can also be done. Immigrants who find an already established community of their race or culture are more likely to stay in the destination country (Burns and Sanket, 2006). In addition to recruiting a more diverse student population, efforts can be made to establish communities of immigrants in certain regions. Local immigrant organizations can serve as meeting grounds for newcomers with people who have already immigrated to the country. Region-specific gatherings and activities can be introduced between university students and successful permanent

residents. Peer mentor-type programs can also be created, which pair a temporary resident with a longtime resident from the same culture or religion to establish a mentor-type relationship or even a friendship. Fostering a community mindset for newcomers from the regions that have less representation due to their low numbers can go a long way in influencing international students to decide 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 would not necessarily have an established community.

In a similar vein to the aforementioned policy initiative, universities can be encouraged to recruit more diversely not only in terms of regions but also in terms of gender and field of studies. Our findings show that women are more likely to stay in Canada after the conclusion of their studies. Hence, women-specific opportunities such as scholarships, bursaries, and internships can be increased. In addition, universities can be encouraged to give priority to women in terms of their financial aid. If they encounter two candidates with the same qualifications, universities can be encouraged to prioritize women with their scholarships. Similar strategies can also be utilized in terms of field of studies since STEM students are more likely to stay in Canada after graduation. This would also be aligned with the priorities the government has in terms of bridging the labour gaps, as there are abundant job openings for STEM workers. Policymakers can also look into why students who took BHASE programs are not doing as well, create opportunities for these groups, and promote a vibrant economic integration for all.

Finally, a bigger emphasis on family reunification can be made for international students. When international students decide to immigrate, they can only bring along a spouse or their children. Other than the Parents and Grandparents lottery, which offers

no actual guarantee that you can be reunited with your family, there are no other opportunities for family reunification; even though that a family presence and a thicker network of people from the region can prove to be an incentive to stay in Canada. Further programs can be offered to provide family reunification, such as in the United States where you could sponsor your parents and siblings with certainty, not only with a lottery.

In terms of interprovincial mobility, policy recommendations can also be made for provinces that wish to retain their international students. As we argued above, it is important for regions with a declining labour force to increase their retention of international students, because these regions can rely on a new source of highly skilled labour that is able to contribute to the regions' growth and prosperity (Esses et al., 2018). Since the unemployment rate is so significant, it suggests that international students are very interested in having access to job opportunities. In this case, it would be important to have employment support to help international students be proficient at applying for jobs, to give them Canadian experience during their studies to have better prospects after graduation, and to help them network. These initiatives will help international students find employment opportunities after graduation, and also be aware that such opportunities exist. Moreover, employment programs for newcomers and international students can go a long way toward retaining international students in the province, as it shows them that they can be successful in the region and gives them strategies to do so. Exclusive opportunities for them can increase their desire to stay in the same province.

Lastly, it is important to acknowledge the fact that this study has several limitations. Most importantly is the fact that we only have information from the people

who remained in Canada, as soon as they leave the country, we have no further data. This makes it so that other variables like GDP, unemployment rates, and population size from the country where they decided to move to after Canada cannot be included. For future research, studies can be done with surveys that followed students for several years after they have left the country. Moreover, the study can be expanded to include more years than the ones in this study. Additional statistics have been estimated⁹ and are available upon request.

Furthermore, for future research, it would be important to look at the long-term outcomes of international students after they have successfully transitioned into permanent residency. In addition, future studies can do further research into the barriers that exist to the successful transition of international students to permanent residents. In addition, future studies can look into health care services and their quality across Canadian provinces, and how that impacts mobility within Canada.

⁹ e.g. five major source countries and their changes overtime, the distribution of women's regions of origin, the distribution of regions of origin of women who stayed in Canada, the three major fields of study, and the province of residence of graduates of New Brunswick and Atlantic Canadian institutions. They have not been included in this study due to time limit issues related to the RDC.

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