FACTORS AFFECTING INTERPROVINCIAL MIGRATION OF UNIVERSITY-BOUND STUDENTS IN CANADA: EVIDENCE FROM THE POSTSECONDARY STUDENT INFORMATION SYSTEM (PSIS)

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Abstract

This thesis explores the factors influencing interprovincial migration of university-bound students in Canada between 2017 and 2021 using data from the Postsecondary Student Information System (PSIS). Employing both log-log and Poisson gravity models, the study examines geographic, economic, and institutional variables, along with the novel inclusion of cannabis regulation leniency, as a potential social determinant of migration.

The analysis confirms that geographic distance remains a significant deterrent to student migration, with the probability of migration diminishing sharply as the distance between provinces increases. Economic variables reveal counterintuitive patterns. Interestingly, higher GDP per capita in origin provinces correlates with greater out-migration, suggesting wealthier students are more mobile.

A particularly novel aspect of this study is its inclusion of cannabis policy as a factor influencing student migration. Provinces with a higher density of cannabis retail stores per capita demonstrate a marked increase in student migration, suggesting possible lifestyle preferences; however, the minimum legal age for cannabis consumption appears to have a negligible effect.

These findings underscore the multifaceted nature of student migration, combining traditional economic and geographic factors with emerging social dynamics. The study offers valuable insights for policymakers and university administrators, emphasizing the need for targeted interventions that enhance interprovincial mobility, improve institutional competitiveness, and consider the broader social and regulatory landscapes in which students make their decisions.

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Chapter 1: Introduction

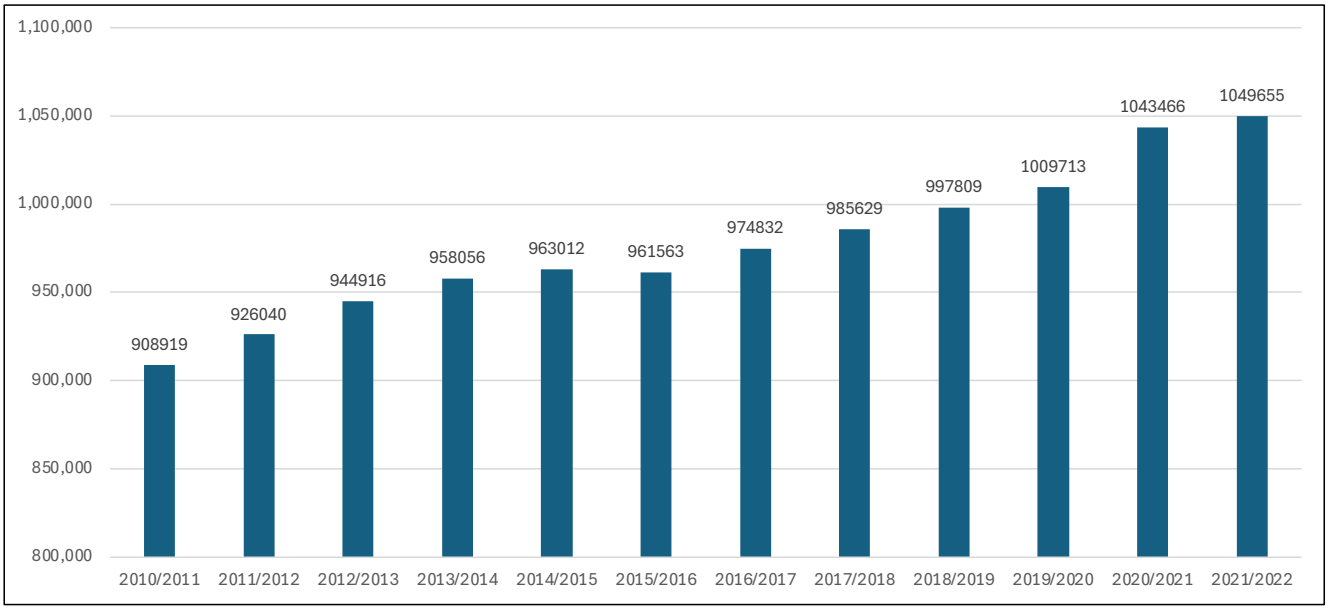
1.1: Background Of the Study

The transition from high school to post-secondary education is a significant milestone for many young people, often involving a move to a new environment. In a country as diverse as Canada, with its unique provincial regulations, this transition could also mean a move to a province with distinct laws and regulations. The interprovincial migration of university-bound students in Canada is a crucial aspect of the national educational landscape. This migration significantly influences the redistribution of human capital across provinces, thereby impacting local economies, labor markets, and the socio-cultural fabric of the regions involved. The Post-secondary Education System Information (PSIS), with its comprehensive dataset, is a powerful tool for analyzing these migration patterns and gaining insights into the factors that influence students' decisions to pursue higher education in different provinces.

As youth transition into adulthood, significant decisions that can affect personal, social, and economic consequences are made. One of these decisions is whether to further post-secondary education after high school and if they should move to a different province for that. By the age of 24, most Canadian youth report to have attended some form of higher education, be it a university, college or apprenticeship program (Berger, 2009).

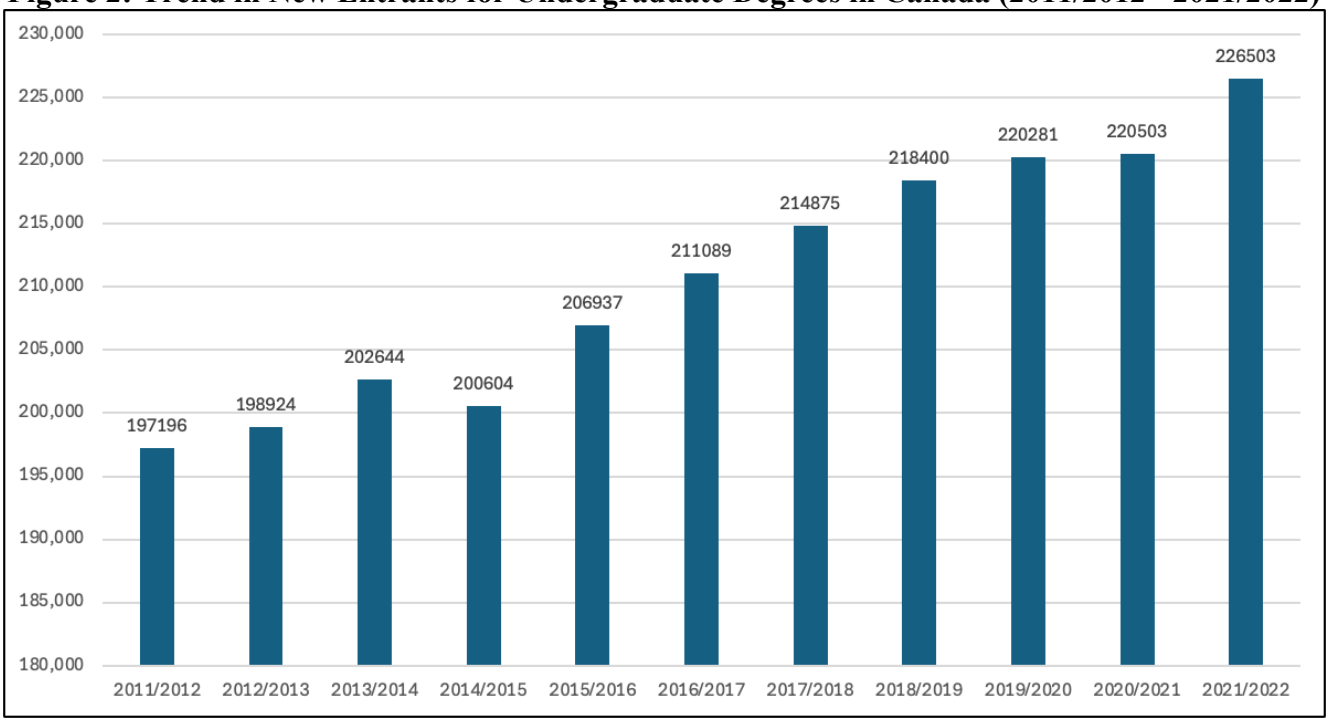
As shown in Figure 1, data from Statistics Canada (2023) reveal that 2,122,860 students were enrolled in post-secondary programs at public institutions across Canada during the 2021/2022 academic year. Among these, 1,049,655 enrolled in bachelor's or equivalent degree programs.

Figure 1: Trend in University Student Enrolment in Canada (2010/2011 - 2021/2022)



Source: Statistics Canada. Table 37-10-0163-01 Postsecondary enrolments, by International Standard Classification of Education, institution type, Classification of Instructional Programs, STEM and BHASE groupings, status of student in Canada, age group and gender

Figure 2: Trend in New Entrants for Undergraduate Degrees in Canada (2011/2012 - 2021/2022)

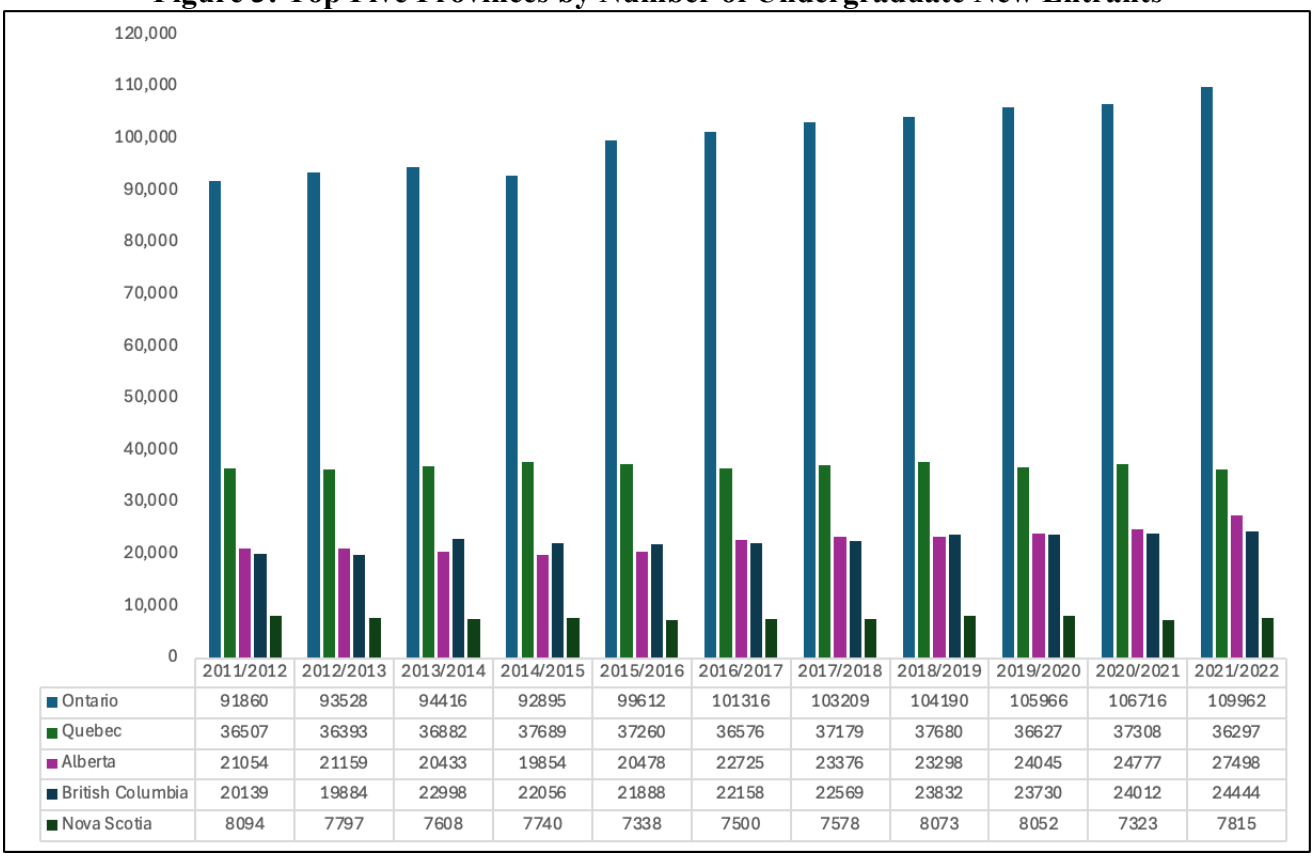


Source: Statistics Canada. Table 37-10-0140-03 Persistence and graduation of undergraduate degree students, within the province or territory of first enrolment, by student characteristics

Figure 2 further details the trend of new entrants who are 15 years old and over, specifically to undergraduate degree programs in Canada.

Whalen and Li (2024) conducted a study on the interprovincial migration of recent graduates aged 20-29 from 2000/01 to 2019/20. They discovered that only two provinces, Alberta (average of 1.4% of the total population) and British Columbia (0.3%), had a cumulative net inflow of individuals within the specified age group. Provinces such as Ontario and Quebec showed no change, while the remaining provinces experienced a net migration outflow.

Figure 3: Top Five Provinces by Number of Undergraduate New Entrants



	2011/2012	2012/2013	2013/2014	2014/2015	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022
Ontario	91860	93528	94416	92895	99612	101316	103209	104190	105966	106716	109962
Quebec	36507	36393	36882	37689	37260	36576	37179	37680	36627	37308	36297
Alberta	21054	21159	20433	19854	20478	22725	23376	23298	24045	24777	27498
British Columbia	20139	19884	22998	22056	21888	22158	22569	23832	23730	24012	24444
Nova Scotia	8094	7797	7608	7740	7338	7500	7578	8073	8052	7323	7815

Source: Statistics Canada. Table 37-10-0140-03 Persistence and graduation of undergraduate degree students, within the province or territory of first enrolment, by student characteristics

Figure 3 shows the top five provinces by number of undergraduate new entrants. The data highlights Ontario's leading role in Canadian higher education, followed by consistent growth in Alberta and British Columbia. Quebec, while having strong numbers, shows some recent decline, and Nova Scotia maintains a smaller but stable student population. These trends could reflect broader

demographic shifts, economic factors, or the impact of provincial education policies. Students often pursue their studies outside their province of origin for various reasons. In 2016/17, Narh and Buzzelli (2022) stated that 113,787 (or 9.6% of all higher education students in their sample in 2016/17) post-secondary students migrated from their province of origin to study elsewhere.

In recent years, there has been growing interest in understanding the determinants of student migration within Canada. Previous studies (Alessandrini, 2018; Andrianov, 2017; Dubois, 2002; Mueller, 2008; Narh & Buzzelli, 2022; Whalen & Li, 2024) have highlighted various factors- including economic conditions, educational opportunities, and institutional characteristics- that influence students' choices.

However, there remains a geographical and theoretical gap in the literature regarding the specific dynamics of interprovincial student migration. Regarding the first gap, most migration studies focus on international migration despite the quantitative significance of internal migration. According to King and Skeldon (2010), internal migration is often more important, although this distinction has become blurred. Compared to European countries, the research on internal human capital migration within Canada has not been thoroughly studied. Within the academic or education space, most research on student migration has centered on graduates, international students, or those already in the labor market, with little attention given to high school graduates and first-time college-bound or university-bound entrants.

This thesis asserts that understanding the migration patterns of high school graduates and college/university-bound students is as vital as studying the migration of college/university graduates, international students, or labor market

workers. This focus can provide valuable insights for policymakers, aiding their endeavors to retain and utilize human capital effectively.

1.2: Statement of the Problem

Despite the importance of understanding interprovincial student migration, there are significant gaps in the existing research. Most studies have focused on international migration or the mobility of graduates and labor market participants, with relatively little attention given to the migration patterns of high school graduates entering post-secondary education. Furthermore, there is a lack of comprehensive analysis that integrates economic, geographic, and institutional factors to explain these migration flows within Canada. This gap in knowledge hinders policymakers' ability to effectively manage and support the distribution of human capital across provinces.

Interestingly, this study introduces a novel variable: a leniency index that captures the leniency of cannabis regulation across the provinces using the number of cannabis retail stores per capita and the minimum legal age of cannabis consumption across the provinces. This inclusion is driven by the unique opportunity presented by cannabis legalization in Canada in October 2018. The federal government recommended a minimum legal age (MLA) of 18 years upon legalization but allowed provinces to set higher MLAs. Alberta and Quebec initially set the MLA at 18 years, while all other provinces set it at 19 years. In January 2020, Quebec raised the MLA to 21 years, making Alberta the province with the lowest MLA and Quebec the highest. The number of cannabis retail stores is an innovative addition to the analysis of student migration. By exploring this variable, we aim to understand how lifestyle and social factors influence students' migration decisions beyond traditional economic and educational considerations.

Provinces with more lenient cannabis regulations and a higher density of retail stores may attract students who consider these factors as enhancing their lifestyle. This phenomenon, sometimes referred to as "cannabis migration," suggests that the availability of cannabis can be a significant determinant for some students when choosing their post-secondary destination.

By examining this and other macroeconomic, geographical, and university-related variables, we seek to comprehensively understand the broader social determinants of student mobility.

1.3: Objectives of the Study

The primary objective of this study is to analyze the factors influencing interprovincial migration among university-bound students in Canada using the PSIS data. Specifically, the study aims to:

1. Identify the key determinants of student migration, including economic, geographic, and institutional factors.
2. Examine the impact of distance and other spatial factors on student migration decisions.
3. Examine the impact of geographical factors on student migration decisions.
4. Examine the impact of university factors (such as tuition fees, donations, and grants) on student mobility.
5. Assess the influence of macroeconomic variables such as GDP per capita and changes in the unemployment rate on students' migration patterns.
6. Understand the effect of linguistic differences on students migration flow.
7. Understand the role of regulation leniency, such as the legalization and regulation of recreational cannabis, in shaping student migration decisions.

1.4: Thesis Organization

This thesis has five chapters. The current chapter briefly overviews the interprovincial migration of students in Canada. It also states the research objectives and questions to guide the research. In Chapter Two, the literature review, we review the relevant literature on post-secondary education, as well as theoretical and empirical analysis of migration. Chapter Three discusses the study design, data sources, variables, and the analytical procedures used for model estimation. Results obtained from the estimated models are presented and discussed in Chapter Four. The final chapter briefly concludes with key findings and offers some policy recommendations.

Chapter 2: Literature Review

This chapter discusses relevant conceptual, theoretical, and empirical observations on student migration for post-secondary education. We start by looking at the study of migration, followed by the migration framework and the post-secondary education system in Canada, and finally look at empirical literature regarding the determinants of student migration. Past research has investigated population migration's prevalence and spatial distribution by age, gender, ethnicity, and employment status (Finnie, 2004; Gibbons & Vignoles, 2012; Patiniotis & Holdsworth, 2005). Nevertheless, within the extensive body of research on mobility and migration, there is a notable dearth of studies focusing on the migration of university-bound students entering postsecondary education with fewer Canadian contributions. The goal of this thesis and chapter is to critically assess previous literature and identify gaps, some of which this thesis will seek to address.

2.1: The Study of Migration: Concepts, Methods, and Theory

According to Rees (2009), the set of techniques used in studying human populations is called "demography." Demography encompasses the study of fertility, death, and migration. Given that the main subject under investigation in this thesis is student migration into post-secondary education, it is necessary to clearly understand the concepts and methodological issues in the general field of migration studies.

With the widespread consequences related to migration, both for the individual and the society, policymakers have become increasingly aware of the role of migration within the context of economic growth, social well-being, and urban development. Belfield and Morris (1999) define human mobility as the movement

of people between an origin and destination, which consists of international and internal migration flows (McDonald, 2004). International migration relates to the movement of people across international borders. Internal migration relates to the movement of people within a single country's borders.

One major issue within the study of migration is what connotes the definition of migration. Our primary focus in this thesis refers to student migration within Canada, particularly the choice to migrate for post-secondary education within the different provinces in Canada.

Although there is no set definition of how long someone must stay in a different province or region before being considered a migrant, the United Nations defines a migrant as "*any person who is moving or has moved across an international border or within a State away from his/her habitual place of residence, regardless of: the person's legal status, whether the movement is voluntary or involuntary, what the causes for the movement are, what the length of the stay is*" (International Organization for Migration (IOM), 2024)

With the definition above, a student who leaves his home province (for example, Ontario) and moves to a different province (e.g., Alberta) will be considered a migrant. This is the definition we follow in this thesis.

2.2: Migration Theories and Framework

The research on migration cuts across several disciplines. Some researchers have given a detailed review of migration theories (Arango, 2000; Brettell & Hollifield, 2013; De Haas, 2010); however, the focus of this thesis will be to study some basic concepts and their links to student migration.

(Ravenstein, 1885, 1889) first discussed the laws of migration, which later informed Lees's (1966) work. Lee (1966) suggests that four main factors ultimately

influence migration decisions: push factors from the origin, pull factors of the destination, obstacles faced during migration, and individual characteristics. Considering these factors, individuals may decide to migrate in hopes of a better life. Push factors are the issues in the country of origin that make it more likely for an individual to migrate. On the other hand, pull factors are the aspects of a host country that make it attractive for immigrants to move there.

Tuckman (1970) is generally recognized as the first research on student migration. According to Tuckman (1970), students' interstate migration may be explained by an investment or consumption theory of demand. The investment theory of demand means that students choose to migrate for studies to increase the "present value of the expected stream of benefits" that is gotten from their education. Just like a simple cost-benefit analysis, if a student believes that the net expected benefit from migrating to another state for education will outweigh the cost, such a student will be more likely to migrate. For example, ceteris paribus, lower education costs will experience a higher in-migration of students than states with higher-priced education costs. The consumption theory of demand focuses on utility-derived benefits that push students to migrate. Factors influencing student choice could include weather (climate), culture, the location of the institution, or even the institution's internal environment. If the consumption benefits offered by institutions are all the same, then students will focus on just choosing institutions that are low priced.

The residents of Canada are considered to be a mobile population such that during a single year more than 2 million (13% of the population) move from one house to another, about 4% move within their province of residence, and 1-in-100 move from one province to another (Edmonston, 2011).

We have briefly discussed student migration. Next, we will examine the post-secondary education system in Canada and finally wrap up this chapter by examining empirical studies related to student migration. This will help us identify some of the factors that influence student migration.

2.3: Post-secondary Education in Canada

Post-secondary education refers to the level of education that follows the completion of secondary or high school education. It encompasses a wide range of programs and institutions that provide higher learning opportunities beyond the K-12 schooling system (Kunz & Staub, 2020). The term post-secondary education (PSE) in Canada describes academic, technical, and vocational courses and programs pursued after completing secondary school, and these are offered by colleges, Collèges d'enseignement général et professionnels (CEGEPs), universities, and university colleges. These programs award diplomas, certificates, and undergraduate and graduate degrees to their graduates. After completing high school, students must decide whether to enter the workforce or continue their education after high school. This choice is influenced by various elements, such as the possibility of employment in a booming economy, the perception of PSE participation hurdles, and the distance from a post-secondary institution.

In Canada, the responsibility for education, including post-secondary education, lies with the provincial governments. There is no national or federal government department specifically dedicated to overseeing post-secondary education policy at a national level. However, both levels of government are committed to promoting economic development and reducing disparities in opportunities, which has implications for post-secondary education policy (Kirby, 2007).

According to Statistics Canada (2023), approximately 2.12 million students were enrolled in post-secondary programs in public institutions in Canada in 2021/2022, with total new entrants accounting for about 482,313 (226,503 in undergraduate programs). Close to 80% of youth in Canada obtain their high school diploma between the ages of 18 and 20. Furthermore, 55% within this age group (18 to 20) eventually enroll in post-secondary education (Shaienks & Gluszynski, 2007). In 2019, 73% of young Canadians aged 25 to 34 had attained a postsecondary qualification, rising from 59% in 2000.

Interprovincial mobility refers to the movement of individuals between different provinces or territories within a country. It involves individuals relocating from one province to another, either temporarily or permanently, for various reasons such as employment, education, family, or personal preferences (Bernard et al., 2008). Interprovincial mobility can significantly impact individuals, communities, and the overall economy. It allows individuals to access opportunities that may not be available in their home province, such as better job prospects, educational programs, healthcare facilities, or quality of life. It can also contribute to regional development by bringing in new skills, knowledge, and diversity to different parts of the country (Abella, 2013; Bernard et al., 2008; Finnie, 2001). Interprovincial mobility is particularly relevant in countries like Canada, where each province and territory has its own distinct economy, labor market, and social dynamics (Okonny-Myers et al., 2011). In Canada, for example, individuals may choose to move from provinces with limited economic opportunities to provinces with stronger economies and job markets, such as moving from the Atlantic provinces to Alberta for employment in the oil and gas industry (Yu et al., 2021)

2.4: An Empirical Review of The Factors That Affect Student Migration

We will utilize a comparative approach to gain a more nuanced understanding of the global phenomenon of student migration. We will begin by examining the relevant literature on student mobility trends in various countries besides Canada. This will provide a strong foundation for subsequently analyzing the specific dynamics at play within the Canadian context. A dedicated literature summary will be presented within the appendix section of this thesis, showcasing the key research findings on student migration globally.

Agasisti and Dal Bianco (2007) investigated the determinants of college student migration in Italy, focusing on theoretical considerations and suggesting the importance of university characteristics and socio-economic conditions in geographical areas. The study conducted an empirical analysis using a gravity model, where the distance from the area of residence to the destination (university location) acted as a deterrent. Results confirmed the frictional role of distance while also highlighting the positive impact of factors such as the number of faculties, resources invested in student aid, and socio-economic conditions of the area on university attractiveness.

Sa et al. (2004) investigated the factors influencing regional demand for higher education in the Netherlands, focusing on the spatial considerations of prospective students' university choices. Employing a spatial interaction model, the study analyzed data on high school graduates and their chosen universities, incorporating geographical and non-geographical factors. The results revealed that distance and housing costs deterred student mobility, while amenities offered by the region and urban environment, along with program variety, positively impacted the demand for higher education. Aligning with Tuckman (1970) proposition that either

investment or consumption theories can explain student migration across state lines, Sa et al. discovered that prospective students were primarily driven by consumption motives rather than factors related to future investment. The quality of educational programs played a minor role in their decision-making process. Based on these findings, the study recommended that policymakers prioritize reducing rental costs over further geographical decentralization of universities.

Mustafa et al. (2018) studied high school students' college and university choices in Qatar using a 2015 survey of 1,427 participants. They identified three key factors influencing choices: quality of education, cultural values, and cost. Demographic factors like gender and parental education also played a role. Their findings offered insights for HEIs in Qatar to attract and retain students better. The findings advocated for targeted interventions such as school counseling to support students in making informed choices, particularly for those facing financial constraints. Moreover, the study highlighted the need for greater transparency and accessibility regarding financial aid and scholarships to alleviate cost-related concerns among students.

Agrey and Lampadan (2014) conducted a study with 261 respondents to explore the determinants of students' university choices in central Thailand. They employed in-depth interviews and survey development to ensure content validity. Exploratory factor analysis and chi-square statistical formulation were used to analyze the data. The study found that all five factors - support systems, learning environment, job prospects, sporting facilities, and student life programs - contribute to students' decision-making processes, with modern learning environments and job prospects emerging as powerful predictors.

In the United States, Alm and Winters (2009) identified a critical gap in research on college student migration within the United States. Prior research primarily focused on interstate migration, overlooking the role of intrastate migration patterns. To address this gap, the researchers examined student enrollment patterns within Georgia, explicitly focusing on students attending colleges in their home state. They utilized a gravity model of student migration to analyze the influence of distance on student choice. Data on first-time freshman student flows from 175 public school districts in Georgia to the 33 member institutions of the University System of Georgia (USG) in 2002 were merged with data on school district and institutional characteristics. Their findings revealed a negative correlation between distance and college attendance, with greater distance discouraging students from enrolling in USG institutions. Interestingly, this effect varied by college type. Greater distance to the nearest college significantly decreased the likelihood of enrollment in any USG institution, whereas distance to the nearest university had minimal to no impact on overall USG enrollment.

Cooke and Boyle (2011) investigated the migration patterns of high school graduates to colleges in the United States. Their focus was on the spatial processes underlying these migrations. They utilized the Integrated Postsecondary Education Data System (IPEDS) data to analyze migration flows between 47 states and the District of Columbia. Due to modeling limitations and minimal migration, Alaska, Hawaii, and Wyoming were excluded from the analysis. The research identified several factors that influenced these migration patterns. States with high-quality, competitively priced public universities and those with higher-priced public universities tended to attract more first-year students. Additionally, states with younger populations were more attractive to these graduates. This spatial

perspective highlighted the uneven distribution and arrangement of high school students and colleges across the United States. It further illustrated how structural factors, such as geographic location, could significantly impact migration flows.

Martinez (2021) investigated the factors influencing post-secondary enrollment and migration in Utah. The research employed logistic regression and machine learning techniques to identify key predictors of both enrollment and migration patterns among high school graduates. The study found that graduating from a traditional four-year high school program with a diploma and having a high cumulative GPA were strong positive predictors of post-secondary enrollment. Conversely, factors such as being an English language learner, receiving special education services, or coming from a low-income background significantly decreased the likelihood of enrollment.

The studies reviewed thus far provide valuable insights into the factors shaping student migration patterns across various countries. We observed the influence of university characteristics, socio-economic conditions, distance, program offerings, and cost considerations on student choices in Italy (Agasisti & Dal Bianco, 2007), the Netherlands (Sa et al., 2004), Qatar (Mustafa et al., 2018), Thailand (Agrey & Lampadan, 2014), the United States (Alm & Winters, 2009; Cooke & Boyle, 2011), and Utah (Martinez, 2021).

This comparative approach establishes a strong foundation for analyzing student migration within the Canadian context. By examining the experiences of other countries, we can identify potential similarities and differences in the factors influencing student mobility in Canada. The following section will delve specifically into the existing literature on student migration trends in Canada, drawing upon the insights gleaned from this global perspective.

In Canada, Dubois (2002) used human capital theory to investigate the determinants of post-secondary education enrolment decisions among young Canadians. The study developed a model based on the assumption that high school graduates assess the costs and benefits of different levels of post-secondary education and choose the education option that maximizes the expected net present value. The study identified key determinants of post-secondary participation using a multinomial logit approach and data from the School Leavers Follow-up Survey (1995). Factors such as parental education, financial support, individual abilities, marital status, parental situation, and immigration status significantly influenced university enrolment decisions. For college studies, factors like province of residence, gender, father's education and occupation, and marital status were prominent. Separate analyses by gender revealed differences in the influence of parental socio-economic status on enrolment decisions, with the mother's status affecting young women more and the father's status affecting young men more. The findings underscored the importance of reducing obstacles to post-secondary participation by addressing socio-economic disparities, ensuring necessary competencies among high school graduates, supporting young adults in balancing school aspirations with family responsibilities, and encouraging young men to pursue post-secondary studies while enhancing their awareness of job prospects.

Frenette (2006) investigated the impact of how far a high school graduate lived from a university on their likelihood of attending university right after graduation in Canada. The study also considered whether family income, parental education, and gender played a role. Using data from the Survey of Labour and Income Dynamics (SLID) and a database of Canadian university postal codes, the study calculated the straight-line distance between students' homes and the nearest

university. Students were then categorized into three groups based on distance: within commuting distance (0 to 40 km), possibly out-of-commuting distance (40 to 80 km), and out-of-commuting distance (80 km or more). The findings revealed that students residing beyond 40 kilometers from a university were significantly less likely to attend than those living within 40 kilometers. This trend remained consistent even after controlling for various socio-economic factors. Notably, students from lower-income families and females were particularly disadvantaged by distance.

Mueller (2008) explored the complex decision-making process faced by young Canadians regarding enrollment and completion of post-secondary education (PSE). Financial constraints, family background, and access to information significantly impacted enrollment and completion. The study advocated for targeted financial aid (grants, refundable tax credits) over untargeted subsidies to improve access, especially for low-income students. It also highlighted the importance of non-financial support like early intervention programs and counseling. Additionally, the research called for further investigation into the experiences of non-traditional students and the impact of factors like work on PSE outcomes.

Greene and Kirby (2012) investigated the impact of tuition fees on access and student migration, focusing on Memorial University of Newfoundland in Canada's Atlantic coast. The study aimed to understand the changes in enrollment patterns among Maritime students and why they chose to attend Memorial University. Utilizing a mixed methods approach, including quantitative surveys and qualitative interviews, the researchers examined the enrollment decisions of two groups: migrant students, who relocated to pursue full-time on-campus studies, and

distance students, who remained in their home province and studied via distance education. The findings revealed that Maritime students considered various factors, including cost, university reputation, and program availability when selecting an institution. While perceived cost, particularly tuition fees, played a significant role in decision-making, factors such as university reputation and program availability also influenced students' choices. The study highlighted the importance of maintaining low tuition fees to sustain post-secondary enrollment and ensure an educated workforce. Additionally, it emphasized the need for universities to focus on attributes like reputation and program availability in recruitment efforts to enhance participation and ensure long-term enrollment sustainability.

Andrianov (2017) investigated the influence of macroeconomic factors on student enrollment in Canadian post-secondary institutions. Using data from Statistics Canada spanning 1992 to 2013, the study examined how the unemployment rate, GDP growth, and exchange rate impacted enrollment trends. The research employed the Autoregressive Distributed Lag (ARDL) method and revealed that both GDP growth and the unemployment rate positively affected enrollment in the long run. However, only the unemployment rate showed a statistically significant positive impact in the short run. These findings align with previous research on economic cycles and college enrollment, suggesting that GDP growth per capita is a reliable predictor, following a procyclical pattern (increasing with economic booms).

Alessandrini (2018) examined how adverse labor market conditions, measured by the unemployment rate, impacted post-secondary education (PSE) enrollment in Canada. The study utilized data from the Survey of Labor and Income Dynamics (SLID) spanning 1993-2011. The research revealed that higher unemployment

rates led to increased PSE enrollment, with a shift in educational pathways and student demographics. Furthermore, the study found that during periods of high unemployment, students were more likely to choose university over community college, particularly in provinces heavily reliant on natural resources. Additionally, as unemployment increased, there was a rise in university enrollment among students from educated backgrounds, further reshaping the student body composition.

Narh and Buzzelli (2022) investigated patterns of higher education student migration (HESM) within Canada. They focused on interprovincial migration patterns and the influence of a student's mother tongue. Utilizing data from Statistics Canada's Postsecondary Student Information System (PSIS) for the 2016/17 academic year, the study analyzed the geographic distribution of HESM and the impact of language on migration decisions. The findings identified Ontario and Quebec as key players in HESM, exchanging students and attracting migrants across Canada. Additionally, the presence of higher education institutions (HEIs) significantly influenced migration flows. Provinces with fewer HEIs exhibited higher rates of student outflow, while those with more institutions attracted a larger number of incoming students. The study also explored the influence of student mother tongue on migration patterns, revealing intriguing dynamics. English-speaking students constituted the majority of migrants, whereas French-speaking students demonstrated a higher degree of individual mobility across provinces.

Whalen and Li (2024) examined the link between provincial spending on universities in Canada, educational attainment levels, and interprovincial migration patterns. Despite significant investments in higher education by provincial governments, the study found no clear long-term correlation between higher per-

student spending and increased educational attainment. The study also highlighted the impact of interprovincial migration on provincial investments in education. Some provinces, despite above-average university subsidies, experienced net outflows of young, educated workers to other provinces. This suggests that provincial investments might not necessarily lead to a more educated local workforce if graduates migrate elsewhere after graduation.

As mentioned above, existing literature sheds light on these factors:

Socio-economic factors: Parental education, financial support, and family background significantly influence student choices, particularly regarding university enrollment (Dubois, 2002).

Distance to universities: Similar to global trends, distance plays a significant role in Canada, particularly for students from lower-income families or females (Frenette, 2006).

Financial considerations: Tuition fees and access to financial aid (grants, scholarships) are crucial aspects of student decision-making (Greene & Kirby, 2012; Mueller, 2008).

University reputation and program offerings also play a significant role in attracting students (Greene & Kirby, 2012).

Macroeconomic factors: The unemployment rate and GDP growth can impact enrollment decisions, with higher unemployment leading to increased university enrollment (Andrianov, 2017; Alessandrini, 2018).

Student's mother tongue: With English-speaking students constituting the majority of migrants, but French-speaking students exhibit higher individual mobility across provinces (Narh & Buzzelli, 2022).

Provincial spending on universities: Research by Whalen & Li (2024) challenges the assumption that higher provincial spending directly translates to increased educational attainment. While provinces invest heavily in universities, there is no clear long-term correlation with educational attainment. Additionally, interprovincial migration can impact the effectiveness of these investments, as graduates may migrate to other provinces after graduation (Whalen & Li, 2024).

Chapter 3: Methodology

This chapter describes the study design, data sources, appropriate variables, and analytical procedures for model estimations.

As highlighted in our literature review, we have examined the factors identified by previous studies that encourage students to relocate. Regions attracting human capital trained elsewhere can enhance their competitive standing, even without significant investment in education (Faggian & Franklin, 2014). However, despite extensive research on the factors that draw and retain human capital, two significant gaps persist.

The first is a 'geographical' gap, particularly striking given the diverse policies and locations of Canadian provinces. Most migration studies focus on international migration despite the quantitative significance of internal migration. According to King and Skeldon (2010), internal migration is often more important, although this distinction has become blurred. Moreover, internal human capital migration has been more thoroughly studied in European countries than in Canada.

The second gap is a 'theoretical' one, closely tied to the geographical gap. Most research on human capital and migration within the academic or education space has centered on graduates, international students, or those already in the labor market (Burbidge & Finnie, 2000; Cordova Mosquera, 2022; Finnie, 2004; Kirby, 2021; Okonny-Myers et al., 2011; Perez-Encinas et al., 2021; Serlenga & Shin, 2021), with little attention given to high school graduates and first-time college-bound and university-bound entrants.

This thesis asserts that understanding the migration patterns of new entrants students into higher education institutions is as vital as studying the migration of higher education institution graduates, international students, or labor market

workers. This focus can provide valuable insights for policymakers, aiding their endeavors to retain and utilize human capital effectively.

3.1: The Data

This study will analyze the Postsecondary Student Information System (PSIS) data from the Canadian Research Data Centre Network (CRDCN) as well as external data sourced from publicly available data on the Statistics Canada website. PSIS is a dataset collected and published by Statistics Canada, which includes detailed information on enrollments and graduates of Canadian public post-secondary institutions. The survey is collected through electronic administrative files kept by the universities, and their participation is mandatory. No sampling of the population is done.

For this thesis, our focus on the PSIS data is on first-time university entrants who are Canadian students (this means international students would not be included in our analysis). The analysis is based on the 2016/2017 to 2020/2021 reporting years of the PSIS database. This represents a five-year reporting period. It is worth noting that data during the point of application (application data) would have been preferable because it streamlines our research to a point in time that gives a more current snapshot of the population's characteristics, behaviors, or preferences at the time of application, but it was unavailable. Consequently, enrollment data was utilized for the analysis.

Before discussing our data cleaning process, it's crucial to define the groups in our study: new entrants who are bound for university. Our definition of new entrants aligns with Statistics Canada's approach, identifying them as students enrolled in an academic year who had not been previously enrolled in a program leading to the same educational qualification within the preceding two years of

PSIS data[1]. Since PSIS data includes all enrolled students, we distinguish new entrants by identifying those not previously enrolled in the same type of educational program in the last two years. It should also be noted that the new entrants count is based on program count (i.e., those who have not been enrolled in a similar program or credential type for the last two years) and not student counts. In other words, students who appear for the first time in the data as well as students who may have taken a gap year greater than 2 years and returned to the university are included.

Delving into our data cleaning, the initial step involved removing all international students—only Canadian and permanent resident students were included in the analysis. Students whose immigration statuses were missing (i.e., not stated) were also excluded.

We subsequently concentrated on students aged 15 and over who were registered full-time as of the snapshot dates of September 30 and December 1. This selection aligns with Statistics Canada's definition of new entry cohorts. It is crucial to recognize, however, that this approach tends to exclude a larger proportion of new entrants in colleges compared to universities. Colleges typically have a more continuous intake of students, exhibit greater variation in enrolment periods—particularly for shorter programs offered in winter and spring—and have a higher proportion of part-time students. Using program type and credential type, we focused on students who were looking to get into an undergraduate program and obtain a degree (this includes applied degrees).

[1] Defining cohorts of new entrants: https://www150.statcan.gc.ca/n1/pub/37-20-0001/372000012023006-eng.htm

Based on the above criteria, we examined records from two years prior for each academic year. For instance, to identify the cohort of new entrants in 2017, we reviewed data from 2015 to determine if the students had been enrolled in the same program and credential type two years earlier. New entrants are defined as those who have not been enrolled in either the same program type or credential type in the preceding two years.

With this breakdown, we were able to determine our interprovincial migration flow and the population of students who have migrated between the origin and destination provinces.

This analysis is limited to the ten Canadian provinces. The territories were not included because of the small amount of migration to and from these provinces. The resulting sample of 450 observations represents the number of university-bound students migrating from each of the ten provinces to every other province (10^2-10 interprovincial migration flows after deleting intraprovince moves).

Table 1: Data Description and Data Sources

Variable Name	Variable Description	Source
YEAR	Year	N/A
ORI	Origin Province	N/A
DEST	Destination Province	N/A
DIST	Distance between provinces (logged)	Statistics Canada
ADJ	Adjacency of province. 1 for adjacent provinces and 0 for non-adjacent provinces	N/A
OPOP	Student Population of new entrants at the origin province (logged)	PSIS Dataset
DPOP	Student Population of new entrants at the destination province (logged)	PSIS Dataset
FLOW	Migration Flow	PSIS Dataset

OHEI	Number of universities at the origin province (logged)	PSIS Dataset
DHEI	Number of universities at the destination province (logged)	PSIS Dataset
OTUT	Average Tuition paid by students in the origin province (logged)	Statistics Canada
DTUT	Average Tuition paid by students in the destination province (logged)	Statistics Canada
O_DONATION	Donations and grants received by universities in the origin (logged)	Statistics Canada
D_DONATION	Donations and grants received by universities in the destination (logged)	Statistics Canada
O_GDP	GDP per capita in origin province (logged)	Statistics Canada
D_GDP	GDP per capita in destination province (logged)	Statistics Canada
O_CHGUNEMP	Change in Unemployment for bachelor's degree students in Origin.	Statistics Canada
D_CHGUNEMP	Change in unemployment for bachelor's degree students in Destination.	Statistics Canada
OREM	Remoteness in the origin province (logged)	Statistics Canada
DREM	Remoteness in the destination province (logged)	Statistics Canada
O_MLA	Cannabis consumption minimum legal age in origin (logged)	Statistics Canada
D_MLA	Cannabis consumption minimum legal age in destination (logged)	Statistics Canada
O_CANSTORE	Cannabis retail stores per capita in origin province	Statistics Canada
D_CANSTORE	Cannabis retail stores per capita in destination province	Statistics Canada
OLING	Linguistic factor of provinces. 1 for Quebec and 0 for other provinces in the origin.	N/A
DLING	Linguistic factor of provinces. 1 for Quebec and 0 for other provinces in the destination.	N/A

3.2: The Gravity Model

The gravity model has been widely used in international trade over the last 50 years. Although Tinbergen (1962) is well known to be the first to apply the gravity model in the context of international trade; the history of the gravity model of

migration dates back to Ravenstein (1885) who used the gravity model to study the movement of people from country to country.

In this thesis, we will employ the gravity model to analyze the flow of students from the province where they were prior to enrolling in a university (province of origin) to the province where they first attended university (province of study/destination).

The choice to attend college is spatial, and students' enrollment decisions are partly determined by how enrollment opportunities are distributed in relation to their high school location (Cooke & Boyle, 2011). If a student resides near a variety of enrollment options, they will be more inclined to apply to and attend nearby colleges (i.e., colleges in the American sense), while those in areas with limited options are less likely to apply and more likely to attend colleges farther away. A student's decision to migrate from a state is not solely dependent on that state's attributes but is also affected by the opportunities available in other states and their geographical proximity to the student's home state Cooke and Boyle (2011).

The gravity model is particularly suitable for this analysis as it captures the degree of interaction or movement of individuals between two places, for example, to model the flow of students from their province of origin (home province) to their province of study (HEI destination) as is the case in this thesis. In general terms, the gravity model operates on several key assumptions. Firstly, the interaction between two locations, is directly proportional to the product of the sizes of the origin and destination locations. Secondly, the interaction is inversely proportional to the distance between the two locations. This reflects the idea that greater distances present higher costs, both financial and non-financial, thus reducing the likelihood of migration. These assumptions are useful as they can be used to

provide estimates on the impact of distance on these student flows as well as to consider the impact of a range of important push and pull factors.

The models used in this research were inspired by the work of Narh & Buzzelli (2022), Alm and Winters (2009) , as well as Cooke & Boyle (2011). In its most basic form, the gravity model can be mathematically represented as:

Equation 3.1:

$$M_{ij} = A_{ij} P_i^{\alpha} P_j^{\beta} d_{ij}^{\gamma}$$

where.

M_{ij} refers to the migration flow of students from location *i* to *j.*

P_i refers to the total student population at origin *i;*

P_j represents the student population at destination *j*,

d_{ij} is the distance between provinces *i* and *j,* and it is assumed to be inverse with migration flow;

$A_{ij} = \prod_k (z_{kij}^{\gamma k})$ is a multiplicative shift term that allows for the inclusion of K variables measuring province of origin and province of study "push" and "pull" factors (z_{kij}), respectively, that influence migration.

α, β, γ are parameters to be estimated. α and β are expected to be positive, indicating that both larger origin and destination populations are associated with increased migration flows. Larger populations at the origin create more potential migrants, while larger populations at the destination increase the attractiveness of that province as a place to study. This model will be expounded on soon to reflect the variables to be analyzed in this thesis.

The traditional approach to estimating this equation consists in taking logs of both sides, leading to a log-log model of the form:

Equation 3.2

$$\ln(M_{ij}) = \ln(A) + \alpha \ln(P_i) + \beta \ln(P_j) - \gamma \ln(d_{ij}) + \theta_1(X_i) + \theta_2(X_j) + \theta_3(Z_{ij}) + \epsilon_{ij}$$

In this extended model:

$\ln(M_{ij})$ represents the natural logarithm of the migration flow from origin *i* to destination *j*.

$\ln(P_i)$ is the natural logarithm of the student population at the origin.

$\ln(P_j)$ is the natural logarithm of the student population at the destination.

$\ln(d_{ij})$ is the natural logarithm of the distance between the origin and destination.

X_i is the characteristics of the origin, such as the unemployment rate or the number of higher education institutions.

X_j is the characteristics of the destination, such as tuition fees.

Z_{ij} represents bilateral factors like border adjacency.

The expected signs of the coefficients are:

α, β: positive, indicating that larger populations at the origin and destination increase migration flows.

γ: negative, reflecting the deterrent effect of distance on migration.

θ_1, θ_2: These signs depend on the specific characteristics but generally, favorable economic and institutional conditions at the destination (e.g., lower tuition fees, higher donations and grants) are expected to positively influence migration.

θ_3: positive, as provinces that are adjacent to each other typically have higher migration flows due to lower costs and barriers associated with moving.

While the log-log gravity model is a popular approach to migration, the dependent variable (which in our case is FLOW) is transformed to ensure that the

predicted migration is positive. However, when the migration flow (FLOW) is equal to zero, these observations are simply dropped from the estimation sample when transformed into a logarithmic form, except a small positive number is usually added (in this thesis, we add 1 to the FLOW variable, i.e., log_FLOW = log_(FLOW+1). The problem with the zeroes becomes more pronounced as the migration data becomes disaggregated. Hence, the Poisson and binomial regression have become popular for modeling the migration flow when there are counts or zeros present.

Given that our migration flow looks at the counts of new-entrant students moving from province *i* to province *j*, and there will be zeros, some low and high values, the Poisson model will also be used in addition to the log-log model for this thesis. This is not a new approach in the study of migration or student migration see- (Cooke & Boyle, 2011; Cullinan & Duggan, 2016; Flowerdew & Aitkin, 1982; Silva & Tenreyro, 2006). A similar method used in trade flows is to apply the Poisson pseudo-maximum likelihood (PPML) estimator (Silva & Tenreyro, 2006), For this thesis, we use the standard Poisson model.

The Poisson gravity model can be expressed econometrically as:

Equation 3.3

$$M_{ij} = \exp[\ln(A) + \alpha \ln(P_i) + \beta \ln(P_j) - \gamma \ln(d_{ij}) + \theta_1(X_i) + \theta_2(X_j) + \theta_3(Z_{ij})]\, \epsilon_{ij}$$

Unlike the log-log model, the Poisson model treats the dependent variable as a count of non-negative integers. This means that the chance of observing a zero outcome decreases when the expected values are low.

We will now discuss the variables used in this thesis to capture the complexity of student migration.

3.3: Study Variable

Dependent Variable

Our dependent variable is the flow of first-year university-bound students from their province of origin (*i*) to the province of destination (*j*), labeled as "FLOW" The data is sourced from the PSIS dataset.

Independent Variable

Next, we will examine four groups of origin-specific and destination-specific factors: the geographical factors (GEO), the socioeconomic factors (ECO), the university characteristics (UNI), and the regulation leniency characteristics (LEN). Thus, our interprovincial gravity model takes the following form.

Equation 3.4*:*

$$M_{ij} = f\left(SPAT_{ij}, ORIG_{GEOi}, DEST_{GEOj}, ORIG_{ECOi}, DEST_{ECOj}, ORIG_{UNIi}, DEST_{UNIj}, , ORIG_{LINGi}, DEST_{LINGj}, ORIG_{LENi}, DEST_{LENj}\right)$$

1. Spatial Factors

- **Distance** (DIST)**:** Migration flow decreases with increasing distance between location (Agasisti & Dal Bianco, 2007; Alm & Winters, 2009; Baryla Jr & Dotterweich, 2001; Cooke & Boyle, 2011; Cullinan & Duggan, 2016; Faggian & Franklin, 2014; Fenske, 1972; Frenette, 2006; Martinez, 2021; McHugh & Morgan, 1984; Narh & Buzzelli, 2022; Sa et al., 2004; Tuckman, 1970). In this thesis, distance is calculated by using the Statistics Canada Digital Boundary Files, specifically the 2021 Census boundary file. The digital boundary files provide accurate geographic boundaries for all provinces and territories in Canada, which are essential for calculating inter-provincial distances. The process of calculating the distances between provinces involved several steps, including obtaining the shapefile, reading the data, calculating centroids, computing distances using the Haversine formula, creating a

distance matrix, and merging this information with the migration data. Distance is measured in meters (before taking logs).

- **Remoteness Index (OREM & DREM):** In his seminal work, Krugman (1995) argued that bilateral distance alone is insufficient to fully capture the dynamics of trade flows within the gravity model. This limitation led to the introduction of the Multilateral Resistance Term (MRT), which acknowledges that trade between two regions is influenced not only by their bilateral distance but also by their relative remoteness from other trading partners. A key challenge in applying the gravity model is that MRTs are not directly observable, posing a significant hurdle for researchers and policymakers alike. Baldwin and Taglioni (2006) highlight the significance of properly controlling for MRTs, labeling the omission of these factors in empirical studies as the "Gold Medal Mistake." To address this challenge, a proxy for MRT can be constructed using the remoteness index, which is a function of bilateral distances (in our case, distances between provinces) and the Gross Domestic Products (GDPs) of the regions involved (Baier & Bergstrand, 2009; Head, 2003; Head & Mayer, 2014; Wei, 1996). The remoteness index is vital because it measures each importer and exporter (in our case, origin and destination) set of alternatives. For example, if the destination province has numerous nearby alternatives, the destination will have a low remoteness index and a lower inflow of students from each province source. In accordance with the literature, the estimates of the remoteness index should be positive as it confirms that provinces that are more remote or isolated from the rest of the world tend to trade more with each other. The remoteness index for both origin and destination are logged. **Remoteness Index** = $\sum_l \boldsymbol{D_{lj}} / \boldsymbol{M_l}$

- **Adjacency** (ADJ)**:** While distance provides a straightforward approximation of spatial separation, it may not fully capture the influence of regional proximity on migration flows. To address this, our model includes a dummy variable called 'adjacency' similar to the approach used by Cooke and Boyle (2011) in the United States. This variable is set to 1 if a pair of provinces are adjacent and 0 otherwise.

2. **Geographic Factors**

It is important to note that all geographic factors are log-transformed.

- **Origin and Destination Student Population** (OPOP & DPOP): The populations of students in the origin and destination provinces are logged to linearize the relationships and manage the wide range of values across provinces. We hypothesized a positive coefficient for the student population in the origin and destination given that larger provinces are expected to send more students to higher education since a larger population typically means a larger pool of potential students. In the same light, larger institutions in the destination will attract more students.
- **Number of Universities** (OHEI & DHEI): We included the number of higher education institutions (universities) in each province as a geographic variable. A greater number of universities in the destination province increases its attractiveness, positively impacting migration flows.

3. **University Factors**

All university factors in origin and destination are logged.

- **Tuition Fees** (OTUT & DTUT): Drawing from the research of Dubois (2002); Mueller (2008); Whalen and Li (2024) about the importance of financial aid

as a determinant for post-secondary enrollment, we utilize data from Statistics Canada (2024), which offers comprehensive records of university revenues categorized by source. This data is particularly pertinent as it reflects provincial subsidies allocated to support domestic student enrolment, thereby aligning closely with our focus on domestic students. Higher tuition fees in the origin province, can push students from considering studying in the province.

- **Donations and Grants** (O_DONATIONS & D_DONATIONS)**:** We use donations and grants as a proxy for scholarships given that there were no readily available data on scholarships between provinces. Donations and grants tend to have an indirect impact; they often enhance the quality of facilities, research opportunities, and overall educational experience, which can make a university more appealing (Whalen & Li, 2024).

4. Macroeconomic Variables

- **GDP Per Capita** (O_GDP & D_GDP): GDP per capita serves as an indicator of the economic well-being and standard of living of a region's residents. The data for GDP per capita is derived from two sources provided by Statistics Canada: the annual provincial and territorial gross domestic product (GDP) based on expenditure (in millions of dollars) and the annual population estimates for the years 2017 to 2021. Andrianov (2017) suggests that higher GDP per capita positively influences student enrollment in Canadian post-secondary education. Additionally, research by Cooke and Boyle (2011) indicates a positive relationship between per capita income in the origin state and the rate of out-migration, implying that students from wealthier regions (provinces, in our case) are more likely to migrate out of state for higher education. For this thesis, our a priori expectation is a positive relationship for

O_GDP and a negative relationship for D_GDP. Both O_GDP and D_GDP are logged transformed.

- **Unemployment Rate** (O_CHGUNEMP & D_CHGUNEMP)**:** The unemployment rate indicates the percentage of the labor force that is unemployed and actively seeking employment. We look at the change in unemployment rate year in year. Research by Cooke and Boyle (2011) indicates a negative relationship between the change in the unemployment rate in the destination state and the rate of in-migration. This suggests that regions with decreasing unemployment rates are more likely to attract students. This finding is important when examining the impact of macroeconomic factors on Canadian student enrollment.

5. Leniency Factors

- **Cannabis Retail Stores & Cannabis Consumption Minimum Legal Age (MLA)**: Finally, we look at the number of cannabis retail stores per capita as well as the minimum legal age for consumption and its effect on the inter-provincial migration of students. Canada legalized cannabis consumption for non-medical purposes in October 2018, making it the second country in the world to legalize the sale, possession, and consumption of cannabis for non-medical use. One of the goals of the legalization was to eliminate the purchase of cannabis in illegal avenues. The federal government recommended that the minimum legal age (MLA) be 18 years after legalization. However, provinces were allowed to choose higher MLAs. Alberta and Quebec chose the MLA of 18 years, while other provinces increased the MLA to 19 years. In January 2020, Quebec revised its MLA to 21 years. Thus, this makes Alberta the province with the lowest MLA to date and Quebec with the highest.

In a newspaper article by Gunelius (2020), the phenomenon of people moving to states or areas where cannabis is allowed for either medicinal or recreational use is known as the "cannabis migration." Gunelius also reported that freedom was one of the catalysts motivating “marijuana migrants.” For example, before Quebec raised its minimum legal age for cannabis to 21, Miller (2017), a correspondent for the Ottawa Sun, explored the possibility of 18-year-olds from Ottawa, Ontario, being motivated to travel to Gatineau (a city in Quebec next to Ottawa) to consume cannabis. This investigation stemmed from the existing incentive for these individuals to journey to Quebec for drinking purposes, given that province's lower legal drinking age. Could Alberta be experiencing a similar effect, making it a destination of choice for students seeking a more lenient regulatory landscape? By including the number of cannabis retail stores and the minimum legal age in the gravity model, this study aims to quantify the impact of cannabis availability on inter-provincial student migration.

6. **Linguistics Factors**

Linguistic Factor as an Origin Characteristic (OLING): when examining the linguistic factor from the origin perspective, it serves as an indicator of how likely students from a linguistically distinct province, such as Quebec, are to migrate to other provinces. By coding Quebec as 1 and other provinces as 0, we can assess whether students from a French-speaking origin are more or less likely to leave their home province.

Linguistic Factor as a Destination Characteristic (DLING): conversely, in the destination province, we similarly introduce a linguistic factor, coded as 1 for Quebec (a French-dominant province) and 0 for other provinces. The

assumption is that provinces with distinct linguistic profiles influence migration flows by affecting how students perceive their ability to integrate, both academically and socially, into the destination province. The a-priori expectation is that if the coefficient on the linguistic factor is negative and statistically significant, this would suggest that language serves as a barrier for students from non-French-speaking provinces, reducing the likelihood of migration to French-speaking destinations such as Quebec.

Table 2: *A priori* Expectations

Variable	Expected Relationship
Dependent Variable	
FLOW	Dependent variable
Spatial Factors	
Distance (log_DIST)	Negative
Adjacency (ADJ)	Positive
Remoteness origin (log_O_REM)	Positive
Remoteness destination (log_D_REM)	Positive
Geographic Factors	
Origin Student Population (log_OPOP)	Positive
Destination Student Population (log_DPOP)	Positive
Number of Universities (log_OHEI)	Negative
Number of Universities (log_DHEI)	Positive
University Factors	
Tuition Fees (log_OTUT)	Positive
Tuition Fees (log_DTUT)	Negative

Donations and Grants (log_O_DONATIONS)	Negative
Donations and Grants (log_D_DONATIONS)	Positive
Macroeconomic Factors	
GDP Per Capita (log_O_GDP)	Negative
GDP Per Capita (log_D_GDP)	Positive
Unemployment Rate (O_CHGUNEMP)	Positive
Unemployment Rate (D_CHGUNEMP)	Negative
Leniency Factors	
Cannabis Consumption MLA (log_O_MLA)	Positive
Cannabis Consumption MLA (log_D_MLA)	Negative
Cannabis Retail Store Per Capita (O_CANSTORE)	Negative
Cannabis Retail Store Per Capita (D_CANSTORE)	Positive
Linguistics Factors	
Language factor in the origin (OLING)	Negative
Language factor in the destination (DLING)	Negative

Chapter 4: Empirical Results

This chapter presents and discusses the results of the multivariate regressions that address the research objectives. The results will be presented in two main parts. Section 4.1 primarily looks at the summary statistics of the factors we will be estimating. Section 4.2 looks at the log-log (log-normal) gravity model and slowly builds up the model by adding each factor simultaneously to be able to study the change and movements in the coefficients. Section 4.3 looks at the Poisson gravity model, an extension of the log-log model, and discusses the regression result.

4.1: Descriptive Statistics

Before we move to the regression results, we will briefly present and discuss the characteristics of the dataset used in examining the migration patterns of university-bound students across Canadian provinces. The dataset consists of 450 observations, capturing a range of variables central to analyzing student migration flows from 2017 to 2021. The following section provides a detailed interpretation of these variables, both in their raw and log-transformed forms, offering insights into the central tendencies, dispersion, and distributional characteristics that will inform the subsequent econometric analysis.

Table 3: Summary Statistics

Variables in their raw form.					
	Mean	Var	S.Dev	Skewness	Kurtosis
DIST	2024333	1.51E+12	1229392	0.3114	1.8935
ADJ	0.1777778	0.1464984	0.3827511	1.6856	3.8412
OPOP	24541.74	9.82E+08	31334.42	1.8954	5.5828
DPOP	24541.74	1.01E+09	31799.85	1.9485	5.7382
FLOW	248.8333	230733	480.3468	2.9622	11.6185
OHEI	11.04	165.7668	12.87504	2.0598	6.233
DHEI	11.04	165.7668	12.87504	2.0598	6.233
OTUT	5968.26	3577403	1891.402	-0.408	1.9337
DTUT	5968.26	3577403	1891.402	-0.408	1.9337
O_DONATION	410327.7	3.01E+11	548764.8	1.8686	5.5143
D_DONATION	410327.7	3.01E+11	548764.8	1.8686	5.5143
O_CHGUNEMP	0.0005096	8.75E-06	0.0029588	1.0999	3.9402
D_CHGUNEMP	0.0005096	8.75E-06	0.0029588	1.0999	3.9402
O_GDP	56565.24	9.77E+07	9886.627	0.6346	2.4318
D_GDP	56562.48	9.78E+07	9889.547	0.6339	2.4309
OREM	0.0004522	8.67E-08	0.0002944	0.5622	1.9098
DREM	0.0004522	8.67E-08	0.0002944	0.5622	1.9098
O_MLA	15.16	57.86298	7.606772	-1.4814	3.2273
D_MLA	15.16	57.86298	7.606772	-1.4814	3.2273
O_CANSTORE	0.39	1.39	1.170163	3.4335	13.9436
D_CANSTORE	0.404	1.49	1.221739	3.378085	13.51407

OLING	0.1	0 .0902004	0.3003339	2.6667	8.1111
DLING	0.1	0 .0902004	0.3003339	2.6667	8.1111
Variables in their log-transformed form.					
	Mean	Var	S.Dev	Skewness	Kurtosis
ADJ	0.1778	0.1465	0.3828	1.6856	3.8412
log_DIST	14.2644	0.6586	0.8115	-0.9531	3.5973
log_OPOP	9.3597	1.6388	1.2801	0.0179	2.258
log_DPOP	9.3499	1.6878	1.2991	-0.0701	2.4291
log_OHEI	1.8177	1.2973	1.139	-0.1617	2.3942
log_DHEI	1.8177	1.2973	1.139	-0.1617	2.3942
log_OTUT	8.6328	0.1369	0.37	-0.7852	2.2457
log_DTUT	8.6328	0.1369	0.37	-0.7852	2.2457
log_O_DONATION	12.0427	2.0897	1.4456	-0.2046	2.5772
log_D_DONATION	12.0427	2.0897	1.4456	-0.2046	2.5772
log_O_GDP	10.9286	0.0287	0.1694	0.3899	2.0765
log_D_GDP	10.9285	0.0287	0.1695	0.3892	2.0758
log_FLOW	4.1638	3.0374	1.7428	0.0075	2.566
Log_O_CHGUNEMP	0.00051	8.75E-06	0.0030	1.1036	0.9641
Log_D_CHGUNEMP	0.00051	8.75E-06	0.0030	1.1036	0.9641
log_OREM	-7.9336	0.4892	0.6994	0.0314	1.5014
log_DREM	-7.9336	0.4892	0.6994	0.0314	1.5014
log_O_MLA	2.3942	1.437	1.1987	-1.4982	3.2477
log_D_MLA	2.3942	1.437	1.1987	-1.4982	3.2477

O_CANSTORE	0.39	1.39	1.170163	3.4335	13.9436
D_CANSTORE	0.404	1.49	1.221739	3.378085	13.51407
OLING	0.1	0 .0902004	0.3003339	2.6667	8.1111
DLING	0.1	0 .0902004	0.3003339	2.6667	8.1111

The variable representing the distance between provinces (DIST) has a mean of approximately 2,024,333 meters, with a standard deviation of 1,229,392 meters. This substantial variability underscores the geographic diversity among Canadian provinces, where some pairs are in close proximity while vast distances separate others. The distribution of this variable is moderately skewed to the right (skewness of 0.3114) and exhibits a kurtosis of 1.8935, suggesting a flatter distribution than the normal curve. The log transformation (log_DIST) effectively reduces the skewness to -0.9531 and brings the kurtosis closer to the normal range (3.5973), which aligns with the expectations of a more symmetric distribution of distances after transformation. This adjustment is critical for the subsequent regression analysis, where a normal distribution of residuals is preferred.

Migration flow (FLOW) is a key dependent variable in this study, representing the number of students moving between provinces. The mean migration flow stands at 248 students, with a wide standard deviation of 480, indicating significant disparities in student movement between different province pairs. The distribution is highly right-skewed (skewness of 2.9622) with a kurtosis of 11.6185, indicating a heavy-tailed distribution. Such a distribution suggests that while most province pairs experience modest student exchanges, a few pairs witness exceptionally high flows. After applying a log transformation (log_FLOW), the skewness is nearly neutralized (0.0075), and the kurtosis is reduced to 2.566, resulting in a distribution that better conforms to the assumptions of linear regression models. This transformation mitigates the impact of extreme values, allowing for more reliable statistical inference.

The populations of new entrants at both origin (OPOP) and destination (DPOP) provinces exhibit similar statistical profiles, with means of approximately 24,542

students and standard deviations of around 31,000. Both variables display positive skewness (around 1.9) and kurtosis values above 5, indicating that a few provinces have significantly larger populations of new entrants compared to the majority. Such skewness and kurtosis suggest that these variables could disproportionately influence the migration patterns if left untransformed. The log transformations of these variables (log_OPOP and log_DPOP) effectively reduce skewness to near zero and bring kurtosis closer to 2.25, thereby normalizing the distribution. This adjustment is essential, as it ensures that the model will not be unduly influenced by outliers, leading to more stable and interpretable coefficients.

The number of higher education institutions (HEIs) in both origin (OHEI) and destination (DHEI) provinces shows a mean of 11.04, with a notable standard deviation of 12.87. The positive skewness (2.0598) and high kurtosis (6.233) indicate that while most provinces host a moderate number of HEIs, a few have significantly more, likely reflecting the presence of major educational hubs. The log-transformed variables (log_OHEI and log_DHEI) present a more normalized distribution with skewness near zero and kurtosis around 2.4, making them better suited for regression analysis. This transformation facilitates the interpretation of how the presence of HEIs influences student migration.

The number of cannabis stores per capita in both origin (O_CANSTORE) and destination (D_CANSTORE) are not logged.

The summary statistics provide a comprehensive overview of the variables central to understanding student migration flows in Canada. The high variability and skewness observed in several key variables underscore the importance of log transformations to ensure the validity of the regression models. These transformations normalize the distributions and enhance the interpretability of the

results, allowing for more accurate insights into the factors driving student migration between provinces. The careful examination of these statistics lays a solid foundation for the subsequent econometric analysis, where these variables will be tested for their influence on migration patterns, ultimately contributing to a deeper understanding of the dynamics at play in student mobility across Canada.

4.2: Regression Analysis

4.2.1 The Log-Log Gravity Model

Tables 4 through 6 present different variations of a log-log gravity model. Table 4 does not incorporate robust standard errors, and at a 10% significance level, the results suggest the presence of heteroskedasticity. Table 5 addresses this issue by re-estimating the model using robust standard errors. While the coefficients and statistical significance remain the same, the standard errors there is a change in the standard errors (i.e., they increase or decrease). In Table 6, the remoteness variable is included to assess its impact on the model. The base/reference categories in the regressions were chosen to closely reflect the study done by Narh and Buzzelli (2022).

The gravity model, which is widely used in migration and trade studies, posits that the interaction between two regions is inversely proportional to the distance between them. This foundational concept has been tested and validated across various empirical contexts, including the movement of students between provinces (Agasisti & Dal Bianco, 2007; Alm & Winters, 2009; Baryla Jr & Dotterweich, 2001; Cooke & Boyle, 2011; Cullinan & Duggan, 2016; Faggian & Franklin, 2014; Fenske, 1972; Frenette, 2006; Martinez, 2021; McHugh & Morgan, 1984; Narh & Buzzelli, 2022; Sa et al., 2004; Tuckman, 1970). According to the gravity model, the distance between the origin and destination provinces should have a negative

relationship with the flow of students. This expectation is grounded in the idea that greater physical separation imposes higher costs- both monetary and non-monetary- on students and their families. These costs include travel expenses, the psychological burden of being far from home, and potential logistical challenges related to moving and settling in a new province. Thus, we expect the coefficient on the distance variable (log_DIST) to be negative across all models. In examining the role of distance across the three log-log gravity models, the coefficient is negative and statistically significant at the 1% level. This strong negative relationship confirms that, as expected, longer distances between provinces significantly reduce the likelihood of student migration. The magnitude of -1.101 (see Tables 4-6, est1) indicates that for every 1% increase in the distance between two provinces, the flow of students between province *i* and *j* decreases by approximately 1.1%. The slight decrease in the coefficient's magnitude as more variables are introduced suggests that while distance is a dominant factor, its impact is complemented and moderated by other determinants such as adjacency, remoteness and institutional factors.

Within the framework of the gravity model, population size is analogous to the "mass" in Newton's law of gravitation—larger populations at either end of the migration flow are expected to generate greater interaction, or in this case, student migration. In Tables 4-6, the origin and destination population are positively and significantly associated with migration flows, consistent with a priori expectations and previous research (Cooke & Boyle, 2011; McHugh & Morgan, 1984). The coefficient for the origin population (log_OPOP) is 0.743 is while the coefficient of the destination population (log_DPOP) is 0.779. Specifically, a 1% increase in the origin student population is associated with a 0.743% increase in migration

flow, while a similar increase in the destination population is associated with a 0.779% increase in migration flow.

At this junction, we have established that the basic tenets of the gravity model (distance and population) hold in our regression analysis. We will go further to add other variables we believe act as a factor in affecting student migration both in the origin and the destination.

The number of higher education institutions (HEIs) in both the origin and destination provinces is a critical factor in understanding student migration patterns within Canada. HEIs play a pivotal role in shaping the educational landscape, influencing both the supply and demand for higher education. The number of HEIs majorly serves as a pull factor- a larger number of HEIs in the destination province could attract more students, offering a broader array of programs, better facilities, and more opportunities for networking and career development. In the second specification of the models (est2), where the number of universities in the destination province (log_DHEI) is introduced, we observe a notable change in the significance and magnitude of related variables. Specifically, the coefficient for the destination student population (log_DPOP) becomes smaller and statistically insignificant (0.779 vs 0.122). This shift suggests a positive correlation between log_DHEI and log_DPOP, indicating that the explanatory power of the log_DPOP is absorbed by the number of HEIs in the destination. Economically, this is plausible, as larger populations and a higher number of HEIs are often correlated; provinces with more HEIs tend to host larger student populations, and vice versa. This inclusion of log_DHEI indicates that it is not merely the size of the student population at the destination that draws students but also the educational infrastructure supporting that population—the number of HEIs.

From a theoretical standpoint, an increase in the number of HEIs in the origin province is expected to reduce student outflows. The rationale behind this expectation is that a greater variety of institutions and programs available locally should decrease students' need to seek educational opportunities elsewhere. Beginning with model est3, the coefficient for the number of HEIs at the origin (log_OHEI) is positive and statistically significant (0.297, $p < 0.05$). This positive relationship continues in est4, where the coefficient remains positive and significant. At the same time, the population in the origin (log_OPOP) decreases slightly in magnitude (from 0.743 to 0.740) but remains significant, indicating that while population size at the origin still drives migration, it is being partially absorbed by the addition of log_OHEI. The persistence of significance for both variables suggests that larger populations and more HEIs in the origin province are positively correlated, yet this combination is associated with increased student out-migration, contrary to theoretical expectations.

While the positive relationship between log_OHEI and migration flows may seem counterintuitive at first glance, it could be due to reasons such as selective outmigration, competitive academic environment, and mismatch in program needs. It's also important to compare this with the role of HEIs in the destination province. The coefficient for log_DHEI is significantly larger and strongly significant (0.824***) than that of log_OHEI (0.297**) in est3. This suggests that while the number of HEIs at the origin may influence migration, the pull of HEIs at the destination is much stronger. The large positive coefficient for log_DHEI indicates that provinces with more HEIs are much more effective in attracting students from other provinces than origin provinces are in retaining their own students.

In the study of student migration patterns, both geographic proximity and the relative distance between provinces play crucial roles. The variables ADJ (adjacency) and log_DIST (distance) capture these factors in the gravity model, and help us understand how physical closeness and the perceived cost of moving influence the decisions of university-bound students in Canada. Adjacency, defined as whether two provinces share a common border, is positive and statistically significant coefficient across Tables 4-6, est4 through est7 (est4: 0.416**, est5: 0.325**, est6: 0.329**, est7: 0.363**), which highlights the importance of geographic proximity in facilitating migration. The positive coefficients indicate that students are more likely to migrate to a neighboring province than to a non-adjacent one. This result aligns with the theoretical expectations of the gravity model, where the interaction between two regions is greater when they are geographically closer. Adjacency reduces both the monetary and psychological costs associated with migration, making it easier for students to consider moving to a neighboring province. Interestingly, as adjacency is introduced and remains significant in the models, the magnitude of the distance coefficient slightly decreases (e.g., from -1.101 in est1 to -0.916 in est4). This pattern suggests that while both factors are critical, their effects are complementary rather than substitutive.

In gravity model 3 (Table 6), we introduce the remoteness indexes which is used to control for multilateral resistance. The remoteness index in the origin (O_REM) is positive (0.628***) and significant, while the remoteness index in the destination (D_REM) is negative (-0.301***) and also statistically significant. Firstly, we see that the effect on distance after the addition of the remoteness index are stronger than when the remoteness index wasn't added (see Table 6) est4 (-

0.916) vs. est5 (-0.967). This result suggests that the result from prior estimates did not account for multilateral resistances and were indeed biased (omitted variable bias) as suggested Anderson & Van Wincoop (2003). The coefficient and statistical significance for the origin (0.628***) and destination (-0.301***) confirm that provinces that are more remote/isolated from the rest of the world will tend to see students leave, while the more remote the destination, the less likely they are to be there.

The university-related factors in this analysis include tuition fees and donations in both the origin and destination provinces. In gravity model 3, the positive and statistically significant coefficients for log_OTUT across models est6 (1.209***) and est7 (1.087***) indicate that higher tuition fees in the origin province are associated with increased student migration flows, meaning when tuition fees rise in a student's home province, they are more likely to seek educational opportunities elsewhere. This finding aligns with economic theory, which posits that higher costs can incentivize individuals to explore more cost-effective or value-driven options outside their home province. It may also suggest that provinces with high tuition fees experience greater outflows of students unless they offer exceptional educational value that justifies the cost. Interestingly, the relationship between tuition fees in the destination province (log_DTUT) and student migration flows deviates from expectations. Contrary to the hypothesis that higher tuition fees in the destination would deter student inflows, the coefficients for log_DTUT are positive and statistically significant across all model— est6 (0.848***) and est7 (0.806**). This finding suggests that institutions with higher tuition fees may also offer higher quality education or better amenities, which could attract students despite the higher costs. If this holds

true, the perceived quality of education may outweigh the influence of price, leading to a positive relationship between tuition fees in the destination province and student migration. This finding is consistent with the literature, including studies by Mixon (1992) and Baryla Jr and Dotterweich (2001), which also explore the impact of tuition fees on student enrollment and migration.

Regarding donations and grants, which can serve as proxies for scholarships, the findings are somewhat unexpected. The coefficient for donations in the origin province (log_O_DONATIONS) is statistically significant, but the positive relationship in all specifications is contrary to expectation. In the same light, the coefficient for log_D_DONATION is positive but not consistently significant across all level. This suggests that even though higher donations at destination universities might have some positive impact on attracting students, this effect is not as strong or consistent as other factors, such as tuition fees. One possible interpretation is that while donations help improve the quality and offerings of universities at the destination, students may weigh other factors more heavily when deciding whether to migrate.

In gravity model, Table 2, the results indicate that GDP per capita, both in the origin and destination provinces, significantly influences student migration. However, the impact of GDP per capita in the origin province does not align with *a priori* expectations. Specifically, the positive and statistically significant coefficients for log_O_GDP in models est7 (1.443***) and est8 (0.758*) suggest that higher GDP per capita in the origin province is associated with increased outmigration of students. This finding may imply that individuals from wealthier provinces, *ceteris paribus*, are more inclined to attend universities outside their province of origin, a trend supported by similar research findings, such as those of

McHugh and Morgan (1984). The positive relationship between log_O_GDP and student migration is further emphasized by its interaction with destination tuition fees (which is positive and significant). Higher GDP per capita in wealthier provinces may indicate that families are less sensitive to tuition costs, enabling them to send their children to institutions with higher tuition fees in other provinces. Conversely, the coefficient for log_D_GDP is positive and aligns with traditional economic expectations, indicating that higher GDP per capita in the destination province attracts more students. This suggests that economic prosperity in the destination province, reflected in higher GDP per capita, enhances its appeal as a study destination.

The coefficients for the change in the unemployment rate (O_CHGUNEMP and D_CHGUNEMP) in both origin and destination provinces are statistically insignificant, suggesting that it is the economic capacity to migrate and the focus on just going to study rather than the employment prospects at the origin or destination that primarily drives student migration. In gravity model 3, where the remoteness variable is introduced, both macroeconomic factors (i.e., GDP per capita and the change in unemployment rate) lose statistical significance. This suggests that these factors have little to no effect on migration flows when remoteness is accounted for. This finding is consistent with the work of Faggian and Franklin (2014), Berck et al. (2016)'s in western countries and Liu et al. (2017)'s in China, which found that students do not place significant weight on provincial economic conditions (unemployment rate in their context) when choosing where to study. It could also be that students may not be as sensitive to short-term changes in macroeconomic factors when making long-term decisions about their education.

Finally, we examine the leniency index and linguistics factor. For the leniency index, we start by analyzing the number of cannabis retail stores per capita in both the origin and destination provinces, as well as the minimum legal age (MLA) for cannabis consumption. It is hypothesized that more lenient provinces, characterized by a higher number of cannabis outlets and lower MLAs, would attract more students compared to less lenient provinces. The results show that in Table 5, the number of cannabis retail stores per capita in the destination (D_CANSTORE) province is statistically significant (0.084*). This aligns with our expectations, indicating that provinces with a higher concentration of cannabis retail stores are more attractive to students. The statistical significance of D_CANSTORE in comparison to O_CANSTORE (0.084* vs. 1.168) suggests that the presence of cannabis outlets acts more as a pull factor for destination provinces than as a push factor from the origin. On the contrary, in Table 6, the coefficients for both the number of cannabis retail stores per capita in both the origin and destination provinces, as well as the minimum legal age at both the origin (log_O_MLA) and destination (log_D_MLA) are statistically insignificant, implying that this factor does not play a significant role in student migration decisions within this context.

For the linguistics factor, across all three tables (Table 4 to 6), the results show a consistent and statistically significant negative impact of linguistic factors on student migration, both at the origin and destination levels. The negative signs on both DLING and OLING confirm that language barriers act as a significant deterrent to student mobility in Canada. In Table 4, the coefficient for OLING is -1.522***, which implies that for every 1% increase in the linguistic difference between a French-speaking origin province (e.g., Quebec) and a potential English-

speaking destination, the probability of migration decreases by 1.52%. This reflects a strong home bias among French-speaking students, particularly those from Quebec, who are less inclined to migrate to English-speaking provinces due to linguistic barriers. In the same vein, the coefficient for DLING is -1.161***, indicating that for every 1% increase in the linguistic difference between the student's home province and a French-speaking destination province, there is a 1.16% decrease in the likelihood of migration to that province. This suggests that language barriers are a significant deterrent for students from English-speaking provinces when considering migration to French-speaking provinces such as Quebec. In Table 6, the coefficient for DLING increases to -1.593***, suggesting an even stronger deterrent effect of language at the destination level. The coefficient for OLING in Table 6 is -1.404***, slightly lower than in previous tables but still highly significant.

Table 4: Log-Log Model 1 (no remoteness or robust standard errors used)

	est1	est2	est3	est4	est5	est6	est7
log_DIST	-1.101*** [0.0586]	-1.058*** [0.0565]	-1.037*** [0.0566]	-0.916*** [0.0709]	-0.991*** [0.0660]	-0.991*** [0.0655]	-1.026*** [0.0600]
log_OPOP	0.743*** [0.0371]	0.740*** [0.0355]	0.490*** [0.1008]	0.473*** [0.1002]	0.409* [0.1955]	0.097 [0.2122]	-0.238 [0.2020]
log_DPOP	0.779*** [0.0365]	0.122 [0.1072]	0.091 [0.1072]	0.084 [0.1064]	0.342 [0.1978]	0.502* [0.2150]	0.557** [0.2045]
log_DHEI		0.788*** [0.1216]	0.824*** [0.1215]	0.807*** [0.1208]	0.530*** [0.1592]	0.032 [0.2418]	0.163 [0.2439]
log_OHEI			0.297** [0.1125]	0.291** [0.1117]	-0.685*** [0.1483]	-0.048 [0.2283]	0.266 [0.2305]
ADJ				0.416** [0.1477]	0.325* [0.1365]	0.329* [0.1351]	0.363* [0.1234]
log_OTUT					1.628*** [0.1781]	1.132*** [0.2213]	0.107 [0.2807]
log_DTUT					0.362* [0.1779]	0.781*** [0.2240]	0.099 [0.2816]
log_O_DONATION					0.798*** [0.1728]	0.535** [0.1882]	0.315 [0.1978]

	est1	est2	est3	est4	est5	est6	est7
log_D_DONATION					-0.018 [0.1613]	0.257 [0.1820]	0.241 [0.1893]
log_O_GDP						1.443*** [0.4124]	0.758 [0.4018]
log_D_GDP						-1.077** [0.4085]	-1.718*** [0.3978]
O_CHGUNEMP						7.552 [17.0088]	12.334 [16.3111]
D_CHGUNEMP						-19.137 [17.1299]	-27.006 [16.3592]
O_CANSTORE							-0.018 [0.0384]
D_CANSTORE							0.084* [0.0368]
log_O_MLA							1.168 [1.1136]
log_D_MLA							-1.205 [1.1133]

	est1	est2	est3	est4	est5	est6	est7
OLING							-1.522*** [0.2166]
DLING							-1.161*** [0.2140]
_cons	5.628*** [0.8951]	9.758*** [1.0678]	11.486*** [1.2460]	9.940*** [1.3530]	-15.078*** [3.5057]	-17.380*** [4.4740]	12.873* [5.6822]
r2	0.6804	0.7079	0.7125	0.7175	0.764	0.775	0.8153
r2_a	0.6782	0.7053	0.7092	0.7137	0.7586	0.7677	0.8067
aic	1270.7064	1232.1484	1227.1187	1221.1416	1148.1984	1134.7927	1057.8234
bic	1287.1433	1252.6946	1251.7742	1249.9064	1193.4001	1196.4314	1144.1176
Breusch-Pagan/Cook-Weisberg test for heteroskedasticity			chi2(1) = 0.87 Prob > chi2 = 0.3515				

Source: Author's computation

Standard errors in brackets * p<0.05, ** p<0.01, *** p<0.001

At 10% p-value we reject the null hypothesis. In the next model, we address the presence of heteroskedasticity by considering the robust standard errors.

Table 5: Log-Log Model 2 (robust standard errors used)

	est1	est2	est3	est4	est5	est6	est7
log_DIST	-1.101*** [0.0508]	-1.058*** [0.0490]	-1.037*** [0.0497]	-0.916*** [0.0632]	-0.991*** [0.0579]	-0.991*** [0.0578]	-1.026*** [0.0516]
log_OPOP	0.743*** [0.0366]	0.740*** [0.0350]	0.490*** [0.0987]	0.473*** [0.0984]	0.409* [0.1908]	0.097 [0.2103]	-0.238 [0.1906]
log_DPOP	0.779*** [0.0317]	0.122 [0.1140]	0.091 [0.1126]	0.084 [0.1116]	0.342 [0.1746]	0.502** [0.1713]	0.557** [0.1629]
log_DHEI		0.788*** [0.1366]	0.824*** [0.1334]	0.807*** [0.1320]	0.530** [0.1806]	0.032 [0.2217]	0.163 [0.2495]
log_OHEI			0.297** [0.1071]	0.291** [0.1059]	-0.685*** [0.1458]	-0.048 [0.2183]	0.266 [0.2217]
ADJ				0.416** [0.1270]	0.325** [0.1164]	0.329** [0.1151]	0.363* [0.1232]
log_OTUT					1.628*** [0.1824]	1.132*** [0.2203]	0.107 [0.2652]
log_DTUT					0.362 [0.2049]	0.781*** [0.2213]	0.099 [0.3335]

	est1	est2	est3	est4	est5	est6	est7
log_O_DONATION					0.798*** [0.1720]	0.535** [0.1843]	0.315 [0.1915]
log_D_DONATION					-0.018 [0.1535]	0.257 [0.1604]	0.241 [0.1817]
log_O_GDP						1.443*** [0.3595]	0.758 [0.3840]
log_D_GDP						-1.077*** [0.3221]	-1.718*** [0.3515]
O_CHGUNEMP						7.552 [16.6899]	12.334 [16.5090]
D_CHGUNEMP						-19.137 [15.1713]	-27.006 [14.7703]
O_CANSTORE							-0.018 [0.0384]
D_CANSTORE							0.084* [0.0335]
log_O_MLA							1.168 [1.1591]

	est1	est2	est3	est4	est5	est6	est7
log_D_MLA							-1.205 [1.1596]
OLING							-1.522*** [0.2140]
DLING							-1.161*** [0.2642]
_cons	5.628*** [0.8951]	9.758*** [1.0678]	11.486*** [1.2460]	9.940*** [1.3530]	-15.078*** [3.5057]	-17.380*** [4.4740]	12.873* [5.6822]
r2	0.6804	0.7079	0.7125	0.7175	0.764	0.775	0.8153
r2_a	0.6782	0.7053	0.7092	0.7137	0.7586	0.7677	0.8067
aic	1270.7064	1232.1484	1227.1187	1221.1416	1148.1984	1134.7927	1057.8234
bic	1287.1433	1252.6946	1251.7742	1249.9064	1193.4001	1196.4314	1144.1176

Source: Author's computation
Standard errors in brackets * p<0.05, ** p<0.01, *** p<0.001

Table 6: Log-Log Model 3 (Remoteness index and Robust standard errors used)

	est1	est2	est3	est4	est5	est6	est7	est8
log_DIST	-1.101*** [0.0508]	-1.058*** [0.0490]	-1.037*** [0.0497]	-0.916*** [0.0632]	-0.967*** [0.0522]	-0.970*** [0.0529]	-0.967*** [0.0532]	-0.955*** [0.0465]
log_OPOP	0.743*** [0.0366]	0.740*** [0.0350]	0.490*** [0.0987]	0.473*** [0.0984]	-0.054 [0.1235]	-0.039 [0.2173]	-0.113 [0.2261]	-0.122 [0.1951]
log_DPOP	0.779*** [0.0317]	0.122 [0.1140]	0.091 [0.1126]	0.084 [0.1116]	0.337** [0.1228]	0.671*** [0.1574]	0.611*** [0.1671]	0.725*** [0.1543]
log_DHEI		0.788*** [0.1366]	0.824*** [0.1334]	0.807*** [0.1320]	0.618*** [0.1296]	-0.043 [0.1779]	0.04 [0.2085]	0.367 [0.2184]
log_OHEI			0.297** [0.1071]	0.291** [0.1059]	0.690*** [0.1241]	-0.163 [0.1756]	0.011 [0.2107]	0.239 [0.2143]
ADJ				0.416** [0.1270]	0.347** [0.1102]	0.367*** [0.1040]	0.365*** [0.1037]	0.471*** [0.1157]
log_OREM1					0.628*** [0.0786]	0.404*** [0.0787]	0.340*** [0.0946]	0.131 [0.1021]
log_DREM1					-0.301*** [0.0739]	-0.458*** [0.0704]	-0.489*** [0.0926]	-0.681*** [0.0961]
log_OTUT						1.209*** [0.1890]	1.087*** [0.2110]	0.19 [0.2853]

	est1	est2	est3	est4	est5	est6	est7	est8
log_DTUT						0.848*** [0.1915]	0.806*** [0.2093]	-0.257 [0.2827]
log_O_DONATION						0.691*** [0.1783]	0.618** [0.1894]	0.405* [0.1940]
log_D_DONATION						0.236 [0.1397]	0.226 [0.1559]	0.06* [0.1653]
log_O_GDP							0.589 [0.4081]	0.4 [0.4189]
log_D_GDP							0.26 [0.3945]	-0.031 [0.3881]
O_CHGUNEMP							-1.873 [15.4456]	5.644 [15.0280]
D_CHGUNEMP							-6.754 [16.1773]	-7.586 [15.6861]
O_CANSTORE								0.006 [0.0328]
D_CANSTORE								0.038 [0.0319]

	est1	est2	est3	est4	est5	est6	est7	est8
log_O_MLA								0.518 [1.0789]
log_D_MLA								-0.55 [1.0788]
OLING								-1.404*** [0.2357]
DLING								-1.593*** [0.2364]
_cons	5.628*** [0.8240]	9.758*** [0.8945]	11.486*** [1.0604]	9.940*** [1.0039]	15.468*** [1.7210]	-16.962*** [4.0311]	-23.815*** [6.5350]	-5.045 [6.7767]
r2	0.6804	0.7079	0.7125	0.7175	0.7628	0.7933	0.7947	0.8377
r2_a	0.6782	0.7053	0.7092	0.7137	0.7585	0.7876	0.7871	0.8293
aic	1270.7064	1232.1484	1227.1187	1221.1416	1146.5831	1092.6277	1097.6141	1003.8765
bic	1287.1433	1252.6946	1251.7742	1249.9064	1183.5663	1146.0479	1167.4713	1098.3891

Source: Author's computation
Standard errors in brackets * p<0.05, ** p<0.01, *** p<0.001

4.2.2 The Poisson Gravity Model

The results from the Poisson regression models, presented in Table 7, provide insights into the factors influencing student migration flows for post-secondary education within Canada. Unlike the log-log models, the Poisson regression does not require a logarithmic transformation of the dependent variable (FLOW). This approach is particularly advantageous when dealing with zero flows, as it avoids the potential biases introduced by adding a small positive constant to observations with a value of zero (i.e., no migration flows between the origin and destination). The interpretation of the coefficients for the Poisson regression is different than that the log-log because unlike the log-log where the coefficients are elasticities, the Poisson coefficients are interpreted as semi-elasticities.

Distance continues to exhibit a negative and statistically significant relationship with student migration across all specifications (est1 to est8), consistent with expectations. For instance, the coefficient for log_DIST in est1 is -0.859***. This can be interpreted as a semi-elasticity, where a 1% increase in distance results in an approximate 57.6% decrease in expected migration flows, calculated as exp(-0.859) ≈ 0.424 which translates to a 57.6% reduction (1 - 0.424) * 100%.

The coefficients for log_OPOP (student population at the origin) and log_DPOP (student population at the destination) are positive and significant in the initial models but become negative and insignificant as additional variables are introduced. Specifically, log_OPOP is positive and significant in est1 (0.745***) and est2 (0.783***), but this effect diminishes in later models, indicating that the student population's influence is contingent on other factors such as the number of HEIs, tuition, and donations. Similarly, log_DPOP shows a similar pattern, where it initially positively influences migration but loses significance as the model

becomes more complex. This suggests that while a larger student population at both origin and destination may initially drive migration through network effects or greater opportunities, other factors play a more critical role as they are introduced.

In its most basic form, the Poisson gravity model regression has produced the results that matches its assumption on distance and population.

The log_DHEI (number of HEIs in the destination province) consistently shows a strong positive and significant relationship with student migration across most models (see est2 to est7). This indicates that the presence of more HEIs in a destination province is a robust pull factor, attracting students from other provinces. The strong positive coefficient for log_DHEI (1.260***) highlights the importance of educational infrastructure in influencing migration decisions. In est2, when log_DHEI is added, we see a significant drop in the coefficient and statistical significance of log_DPOP (from 0.803*** to -0.226) suggesting a positive correlation between log_DHEI and log_DPOP. As the number of HEIs in a destination province increases, it likely reflects or even drives a larger student population and vice versa, reinforcing the province's appeal as a destination for education. The log_DHEI goes on (see est2 – est7) to be strongly positive and significant across all models, suggesting that a higher number of HEIs in the destination province is a strong pull factor for attracting students. The number of HEIs in origin is statistically insignificant across all estimates except for when the remoteness index is added, but even then, the statistical significance is shortlived. This goes to reemphasize that the pull of HEIs at the destination is much stronger. The large positive coefficient for log_DHEI indicates that provinces with more HEIs are much more effective in attracting students from other provinces than origin provinces are in retaining their own students.

Unlike the log-log model, where adjacency is positive and statistically significant across models for the Poisson, the adjacency variable is positive but insignificant across all models.

We introduce the remoteness indexes, which are used to control for multilateral resistance. The remoteness index in the origin (O_REM) is positive (0.814***) and significant while the remoteness index in the destination is (D_REM) is negative (-0.018) and statistically insignificant. The positive remoteness in the origin province is supported by literature because as remoteness increases, regions tend to trade more among themselves, or in our case, the flow increases more. We also see that the effect on distance after the addition of the remoteness index are stronger than when the remoteness index wasn't added (See table 7) est4 (-0.827) vs. est5 (-0.996). This result suggests that, indeed, the result from prior estimates did not account for multilateral resistances and were indeed biased (omitted variable bias), as suggested by Anderson & Van Wincoop (2003).

The variables associated with university factors include tuition fees in both origin and destination, as well as donations and grants in the origin are positive and statistically significant coefficients. This relationship is similar to what we had in the log-log model and we hold the same rationale like we had in the log-log gravity model.

All the macroeconomic variables are statistically insignificant meaning that the they have little to no effect on the migration flow. This is consistent with work by researchers such as Faggian and Franklin (2014) and Berck et al. (2016)'s in western countries and Liu et al. (2017)'s work in China, who looked at the effect of macroeconomics variables on student migration. As mentioned earlier, it could also be that students may not be as sensitive to short-term changes in

macroeconomic factors like GDP and unemployment rates when making decisions about where to pursue their education.

Finally, we consider both the leniency index and linguistic factors. For the leniency index, we look at the number of cannabis stores in the origin and destination and the minimum legal age for consumption. All the variables are statistically insignificant. In the same view, the linguistic factors in the origin and destination are statistically insignificant although they follow the a-prior coefficient sign.

Table 7: Poisson Gravity Model

	est1	est2	est3	est4	est5	est6	est7	est8
FLOW								
log_DIST	-0.859*** [0.1041]	-0.842*** [0.0957]	-0.837*** [0.0953]	-0.827*** [0.0866]	-0.996*** [0.0791]	-0.907*** [0.0775]	-0.946*** [0.0733]	-0.951*** [0.0720]
log_OPOP	0.745*** [0.0369]	0.783*** [0.0328]	0.649*** [0.1056]	0.645*** [0.1077]	-0.083 [0.1338]	-0.363 [0.3801]	-0.414 [0.3746]	-0.472 [0.4192]
log_DPOP	0.803*** [0.0470]	-0.226 [0.1677]	-0.231 [0.1664]	-0.236 [0.1605]	-0.482** [0.1631]	0.307 [0.2881]	0.396 [0.2552]	0.373 [0.2764]
log_DHEI		1.260*** [0.2093]	1.273*** [0.2091]	1.276*** [0.2040]	1.603*** [0.2021]	0.953** [0.3072]	0.758* [0.3234]	0.624 [0.3328]
log_OHEI			0.161 [0.1218]	0.162 [0.1215]	0.988*** [0.1475]	0.319 [0.2549]	0.269 [0.2785]	0.1 [0.2797]
ADJ				0.015 [0.1295]	0.002 [0.1318]	0.191 [0.1243]	0.16 [0.1249]	0.178 [0.1235]
log_OREM1					0.814*** [0.0885]	0.650*** [0.1082]	0.715*** [0.1330]	0.676*** [0.1320]
log_DREM1					-0.018 [0.0873]	-0.162 [0.1153]	-0.003 [0.1596]	-0.069 [0.1751]
log_OTUT						0.784*** [0.2217]	0.841*** [0.2425]	0.870* [0.4291]

	est1	est2	est3	est4	est5	est6	est7	est8
log_DTUT						0.556** [0.2091]	0.711** [0.2310]	0.728 [0.3747]
log_O_DONATION						0.753* [0.3501]	0.843* [0.3417]	1.050* [0.3978]
log_D_DONATION						-0.245 [0.2607]	-0.168 [0.2590]	-0.032 [0.2923]
log_O_GDP							-0.292 [0.5034]	-0.352 [0.4974]
log_D_GDP							-1.018 [0.5747]	-0.997 [0.5831]
O_CHGUNEMP							-10.7 [22.5804]	-9.743 [22.6911]
D_CHGUNEMP							-10.033 [25.2643]	-7.307 [25.5666]
O_CANSTORE								0.011 [0.0454]
D_CANSTORE								0.074 [0.0436]
log_O_MLA								-0.444 [0.8842]

	est1	est2	est3	est4	est5	est6	est7	est8
log_D_MLA								0.389 [0.8888]
OLING								-0.143 [0.3569]
DLING								-0.165 [0.3474]
_cons	2.404 [1.6454]	9.022*** [1.4262]	9.936*** [1.6156]	9.869*** [1.5979]	25.361*** [2.3103]	1.58 [6.3958]	14.478 [9.7070]	11.067 [9.5744]
pseudo-R-squared	0.7001	0.7433	0.7442	0.7442	0.8059	0.8212	0.8244	0.827
chi-squared	1139.485	1141.257	1295.32	1345.824	2068.322	2692.703	2697.295	2781.98
log_likelihood	-36759.72	-31464.04	-31355.5	-31354.36	-23782.29	-21912.3	-21520.04	-21166.19
aic	73527.44	62938.08	62723.01	62722.72	47582.58	43850.61	43074.08	42378.38
bic	73543.88	62958.63	62747.66	62751.49	47619.56	43904.03	43143.93	42472.89

Source: Author's computation
Standard errors in brackets * p<0.05, ** p<0.01, *** p<0.001

Chapter 5: Conclusion

This thesis examines the factors that influence student migration, particularly university-bound new entrants. We focused on students aged 15 and above and used data from the Post-Secondary Information System (PSIS) spanning the years 2017 to 2021. In this work, we have estimated both a log-log and a Poisson gravity model in which the decision to migrate is a joint decision based on different characteristics, from the spatial variables to the origin and destination characteristics.

This final chapter contains three main parts. It begins with a highlight of key findings, suggest policy recommendations for consideration by key stakeholders and concludes with some significant limitations and delimitations of this study.

5.1: Summary of Key Findings

One of the central findings of this research is the significant role of geographic distance in shaping migration flows. The negative coefficients associated with distance in both the log-log and Poisson models reaffirm the well-established understanding that distance acts as a substantial barrier to migration. The farther the destination province from the student's home province, the less likely the student is to migrate there. This relationship is consistent across different specifications of the model, underscoring the robustness of distance as a deterrent in student migration decisions. The findings align with traditional gravity model predictions and are reflective of the increased costs and logistical challenges associated with long-distance migration. The introduction of adjacency as a variable further reinforces this point (statistically significant across all log-log models and insignificant in the Poisson model), with students showing a higher propensity to migrate to neighboring provinces. These findings are consistent with

the theoretical expectations of the gravity model, where the interaction between two regions is inversely proportional to the distance between them and positively influenced by geographic proximity.

In addition to distance, the size of the student population at both the origin and destination provinces emerges as a critical determinant of migration flows. Provinces with larger student populations tend to experience higher out-migration, perhaps due to the competitive nature of local educational markets and the desire for students to seek diverse opportunities elsewhere. Conversely, provinces with larger student populations at the destination attract more students, suggesting that these regions offer a more vibrant and supportive environment for higher education. This dynamic highlights the importance of both push and pull factors in shaping migration patterns, where the availability of peers and educational resources in both the origin and destination provinces play a crucial role.

The number of HEIs in the destination province also plays a pivotal role in attracting students, as indicated by the positive coefficients in the model. We observe a notable change in the significance and magnitude of the coefficient for the destination student population (log_DPOP) which becomes smaller and statistically insignificant when the log_DHEI is included in the model. This shift suggests a positive correlation between log_DHEI and log_DPOP, indicating that these two variables are closely related in how they influence student migration.

From a theoretical standpoint, an increase in the number of higher education institutions (HEIs) in the origin province is expected to reduce student outflows. However, the empirical evidence from the regression models challenges this assumption. The outcome suggests that, contrary to theoretical expectations, an increase in the number of HEIs in the origin province is associated with an increase

in student migration flows (outflows). While the positive relationship between log_OHEI and migration flows may seem counterintuitive at first glance, it could be due to reasons such as selective outmigration and mismatch in program needs. It's also important to compare this with the role of HEIs in the destination province.

Economic factors, such as GDP per capita and unemployment rates, present a complex influence on student migration patterns. The analysis reveals that higher GDP per capita in the origin province is paradoxically associated with increased outmigration. This counterintuitive finding suggests that students from wealthier provinces may be more inclined to seek educational opportunities outside their home province, possibly due to greater financial resources that allow them to afford higher tuition fees or the perceived prestige of institutions in other provinces.

In contrast, the GDP per capita in the destination province positively influences student inflows, aligning with traditional economic expectations that wealthier regions are more attractive due to better living standards and potential career opportunities. However, the impact of changes in unemployment rates is less clear, with these factors becoming statistically insignificant when remoteness and other variables are accounted for. This suggests that short-term economic conditions may not be as influential in long-term decisions regarding higher education.

The analysis confirms that higher tuition fees in the origin province push students to seek education elsewhere, reinforcing the role of financial considerations in migration decisions. However, the relationship between tuition fees in the destination province and student inflows is more nuanced. Contrary to expectations, higher tuition fees at the destination are associated with increased student migration, suggesting that students may perceive higher fees as indicative of better quality education, thereby choosing to migrate despite the cost.

Donations and grants, used as proxies for scholarships, also play a significant role, though their impact varies. While higher donations at the origin are unexpectedly associated with increased outflows, the influence of donations at the destination is positive but less consistent. This suggests that while financial support enhances the appeal of institutions, other factors, such as tuition fees and the perceived quality of education, may have a more pronounced effect on migration decisions.

A novel aspect of this study is the exploration of cannabis regulation as a factor influencing student migration. The findings indicate that provinces with a higher number of cannabis retail stores per capita are more attractive to students, supporting the hypothesis that lifestyle and social factors, such as the availability of cannabis, play a role in migration decisions. However, the minimum legal age for cannabis consumption does not appear to have a significant impact, suggesting that while the presence of retail outlets is influential, the legal age restrictions may not be as critical in students' migration choices.

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5.2: Policy Recommendation

The findings from these models have clear policy implications. Policymakers aiming to increase student mobility across provinces might consider strategies to mitigate the perceived and actual costs associated with long-distance moves. This could include enhanced financial aid for relocation expenses, improved inter-provincial transportation networks, or targeted information campaigns that highlight the benefits of attending institutions further from home. Understanding that distance remains a significant barrier, despite other mitigating factors, allows for more focused interventions aimed at encouraging student mobility.

The evolving significance of the HEI variables in the context of these broader factors carries important implications for policymakers and educational institutions. The initial significance of the HEI variables underscores the need for provinces to invest in expanding and enhancing their higher education infrastructure to both retain local students and attract those from other provinces. However, as the models demonstrate, simply increasing the number of HEIs may not be sufficient.

Provinces must also consider the quality of these institutions, the financial support they offer, and the broader economic environment in which they operate. Investments in educational infrastructure should be complemented by policies that enhance the economic attractiveness of the province, such as job creation, economic development initiatives, and support for innovation and research. Additionally, ensuring that institutions are well-funded through donations and grants can help maintain their competitiveness and appeal to students.

For provinces with fewer HEIs, the focus may be on creating specialized institutions or programs that can differentiate them from other regions, offering unique value propositions that attract students despite a smaller number of institutions.

Given the dual role of origin and destination factors in influencing student migration, there is a clear need for enhanced collaboration between provinces. Inter-provincial agreements on tuition reciprocity, shared scholarship programs, and joint investments in educational infrastructure could create a more balanced and equitable higher education landscape across Canada.

Futhermore, the introduction of the remoteness index in this study highlights the challenges faced by more isolated provinces in attracting (and perhaps also)

retaining students. Remoteness reduces the attractiveness of a province as a destination for students, making it imperative for policymakers to address these challenges through targeted interventions. Policies aimed at reducing the perceived and actual remoteness of certain provinces could include investments in transportation infrastructure, digital connectivity, and regional marketing campaigns that highlight the unique advantages of studying in these areas. By enhancing connectivity and promoting the benefits of less populous regions, provinces can mitigate the disadvantages associated with remoteness and improve their ability to attract students.

These results for the linguistic factor in the log-log gravity model carry important policy implications. If the goal is to encourage greater interprovincial mobility among students, particularly between English- and French-speaking provinces, there is a need for targeted interventions that mitigate the language barrier. This could include expanded language education programs, bilingual support services, and initiatives aimed at fostering greater cultural integration between provinces. By addressing these barriers, policymakers and educational institutions can help promote a more fluid movement of students across provincial boundaries, thereby reducing the regional concentration of human capital.

Finally, this opens a discussion ground for provinces to consider a unified stance on cannabis consumption leniency. I also believe that beyond mere policy adjustments, it sets the stage for a riveting scholarly discourse, inviting researchers and policymakers to delve into the intricate interplay of cannabis legislation and student decision-making.

5.3: Limitations and Delimitation of Study

While this thesis contributes to existing literature on the factors that affect post-secondary enrollment and interprovincial migration amongst students, there are some limitations and delimitations of this study. It is important to note that the PSIS data is a confidential administrative data and can only be accessed through select Research Data Center.

The first limitation to our study was the low response rate for the variable "STUDYPR," representing the province of study, for Quebec and Saskatchewan. Several attempts were made to deduce what the province of study could be. For example, we tried to use the variable "PPOSTAL," which represents the "Postal code of permanent address" for students within the PSIS database; however, the "PPOSTAL" also had a low response rate for select provinces like Ontario, which would have created a myriad of problem in our analysis. Due to this, we worked with the data present while looking at the model fit to ensure unbiased result.

Secondly, we looked at a short time span (between 2019 and 2021) after the legalization of cannabis for recreational purposes. Although these were the only available data after legalization. It will be great to see further study down the line examining other more recent years of postsecondary enrollment.

Thirdly, among the two year of study post-legalization, one of the years (2020) was plagued by the COVID-19 pandemic, which definitely would have affected all provinces differently and how student migration might have been recorded in the PSIS for that time period.

Finally, In the context of gravity models, the concept of remoteness has been widely employed as a proxy for multilateral resistance terms (MRTs). These models, which are often used to analyze trade flows, migration patterns, and other

forms of regional interaction, rely heavily on the assumption that not only the direct relationship between two regions matters but also their respective relationships with other regions. The remoteness index, designed to quantify how "isolated" a region is from others, has been a popular tool for this purpose. However, despite its utility, the use of the remoteness index as a proxy for MRTs presents several significant drawbacks that can compromise the accuracy and robustness of gravity models. One of the primary drawbacks of using the remoteness index is its tendency to oversimplify the concept of multilateral resistance. Traditional remoteness indices often reduce this complex phenomenon to a single metric based on GDP-weighted average distances or similar measures. While these indices provide a convenient way to incorporate the idea of isolation into gravity models, they fail to capture the full complexity of multilateral resistance. Multilateral resistance is not just about distance or economic size; it also encompasses trade barriers, cultural differences, and other factors that influence the ease or difficulty of interactions between regions. By focusing solely on distance and GDP, remoteness indices may overlook these critical factors, leading to incomplete or inaccurate analyses. Another critical issue with remoteness indices is their potential to place excessive weight on small economies. Consequently, regions that are geographically distant from small economies might appear more remote than they actually are in a meaningful economic sense. This distortion can lead to misleading conclusions, particularly in studies where small regions play a critical role. In conclusion, while remoteness indices offer a convenient way to incorporate the concept of isolation into gravity models, their use as proxies for multilateral resistance terms comes with significant drawbacks that should be noted.

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APPENDIX

Summary of Literatures

Authors (Year)	Focus	Location/ Scope	Methodology	Main Findings
Frenette (2006)	Influence of geographic distance on university participation.	Canada, high school graduates and university	Used data from the Survey of Labour and Income Dynamics (SLID) and a database of Canadian university postal codes.	Students living farther from universities were less likely to attend shortly after high school graduation. The effect was more pronounced for students from lower-income families and females. However, the study emphasized correlation over causation and the need for further research.
Agasisti and Dal Bianco (2007)	Determinants of college student migration	Italy	Employed a gravity model to analyse the impact of distance from residence to university, alongside other factors such as number of faculties and student aid.	Distance acted as a deterrent to student migration, while factors like the number of faculties and amount of student aid positively influenced university attractiveness.
Sa, Florax, and Rietveld (2004)	Determinants of regional demand for higher education.	Netherlands	Used a spatial interaction model to analyze data on high school graduates and university destinations.	Distance and rental costs deterred student mobility, while urban amenities and program diversity positively influenced education demand. Students were primarily motivated by consumption rather than investment reasons.
Alm and Winters (2009)	Intrastate migration patterns of college students.	Georgia, USA, examining student migration within the state	Analyzed first-time freshman student flows from public school districts to institutions within the University System of Georgia (USG) using a gravity model.	Greater distance discouraged students from attending in-state colleges, with variations across different college types. Distance influenced choice between colleges and universities within the USG.

Authors (Year)	Focus	Location/ Scope	Methodology	Main Findings
Whalen and Li (2024)	Provincial spending on universities in Canada and its impact on educational attainment and interprovincial migration patterns.	Canada, examining provincial spending and its outcomes	Analyzed provincial spending data and migration patterns.	No consistent correlation between higher spending and increased educational attainment. Some provinces with high spending experienced net outflows of educated workers, suggesting provincial investments may not lead to a more educated workforce if graduates migrate elsewhere.
Narh and Buzzelli (2022)	Higher education student migration in Canada, with a focus on interprovincial structures and language influence.	Canada, analyzing student migration patterns and language impact.	Used Statistics Canada's Postsecondary Student Information System (PSIS) data to map migration patterns and analyze language influence.	Ontario and Quebec were central players in student migration, with the presence of higher education institutions significantly influencing migration flows. English-speaking students constituted the majority of migrants, while French-speaking students exhibited higher individual mobility.
Greene and Kirby (2012)	Impact of tuition fees on access and student migration, focusing on Memorial University of Newfoundland.	Canada, particularly Memorial University and student migration patterns.	Mixed methods approach including surveys and interviews.	Perceived cost, university reputation, and program availability influenced student enrolment decisions. Low tuition fees were crucial for sustaining enrolment levels, alongside reputation and program availability
Cooke and Boyle (2011)	Migration of high school graduates to college in the United States, with a focus on spatial processes.	United States, analysing interstate migration patterns.	Utilized data from the Integrated Postsecondary Education Data System to model migration flows.	States with higher quality and competitively priced public universities tended to attract more college freshmen. Structural factors like geographic location impacted migration flows, with policy interventions like lowering costs and establishing scholarships potentially influencing migration patterns.

Authors (Year)	Focus	Location/ Scope	Methodology	Main Findings
Andrianov (2017)	Influence of macroeconomic factors on student enrollment in Canadian post-secondary institutions.	Canada, exploring enrolment determinants.	Used data from Statistics Canada and employed the Autoregressive Distributed Lag (ARDL) method	GDP growth and unemployment positively impacted enrolment, with gender-specific effects observed.
Alessandrini (2018)	Impact of adverse labour market conditions on post-secondary education enrolment in Canada.	Canada, examining enrolment trends.	Used Survey of Labor and Income Dynamics (SLID) data.	Rising unemployment increased university enrollment, exacerbating educational inequality.
Zambre-Rehbein (2018)	Determinants of college enrolment.	Germany, examining various factors influencing enrolment.	Conducted three separate studies employing different methodologies.	Information provision impacted enrolment intentions, compressing secondary schooling decreased immediate university enrolment, and gender differences existed in earnings expectations.
Dubois (2002)	Determinants of post-secondary education enrolment decisions among young Canadians.	Canada, examining factors influencing university and college enrolment.	Used multinomial logit approach and data from the School Leavers Follow-up Survey (1995).	Factors such as parental education, financial support, individual abilities, and immigration status significantly influenced university and college enrolment decisions. Gender-specific differences were observed in the influence of parental socio-economic status.
Mueller (2008)	Factors influencing post-secondary education enrolment and completion in Canada.	Canada, exploring complexities of enrolment decisions	Discussed role of government financing options and reviewed research on student aid.	Emphasized importance of targeted aid like grants and loans for low-income students, concerns about increasing use of merit-based aid, and need for early intervention programs and information services.
Lang (2009)	Factors influencing choice between community. colleges and universities	Ontario, Canada, examining articulation within	Utilized longitudinal surveys and interviews with students, parents, and guidance counsellors.	Conventional articulation did not significantly affect transfer rates. Program offerings in colleges and universities

Authors (Year)	Focus	Location/ Scope	Methodology	Main Findings
	among secondary school students.	post-secondary education system.		influenced transfer rates more significantly.
Mustafa, Sellami, Elmaghraby, and Al-Qassass (2018)	Factors influencing high school students' college and university choices in Qatar.	Qatar, examining quality of education, cultural values, and cost as key factors.	Conducted qualitative survey of 1,427 participants.	Quality of education, cultural values, and cost were key factors influencing choices. Demographic factors like gender and parental education also played a role.
Agrey and Lampadan (2014)	Determinants of students' university choices in central Thailand.	Central Thailand, exploring factors influencing university decisions.	In-depth interviews and survey development, exploratory factor analysis.	Identified five significant factors influencing decision-making: support systems, learning environment, job prospects, sporting facilities, and student life programs.
Cordova Mosquera (2022)	Determinants of international student mobility and retention in Canada.	Canada, examining factors affecting international student retention and mobility across provinces.	Used logit panel data model with Post-Secondary Information System and T1 Family Tax Files data.	Factors like region of origin, gender, and field of study significantly influenced international student retention rates. Policies promoting family reunification and employment support were recommended.
Martinez (2021)	Factors influencing post-secondary enrolment and migration in Utah.	Utah, exploring predictors of enrolment and migration patterns among high school graduates.	Used logistic regression and machine learning.	Graduating from traditional four-year high school program with high GPA strongly predicted post-secondary enrolment. Migration within Utah was influenced by factors like chosen institution and ACT composite scores.

Source: Author's compilation.