Canadian Journal of Regional Science
Revue canadienne des sciences régionales

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Volume 45, numéro 1, 2022

Soumis : 2021-02-26
Accepté : 2021-05-11

URI : https://id.erudit.org/iderudit/1088300ar
DOI : https://doi.org/10.7202/1088300ar

Aller au sommaire du numéro

Éditeur(s)

Canadian Regional Science Association / Association canadienne des sciences régionales

ISSN

0705-4580 (imprimé)
1925-2218 (numérique)

Découvrir la revue

Citer cet article

Narh, E. D. & Buzzelli, M. (2022). Higher Education Student Migration in Canada: Interprovincial Structure and the Influence of Student Mother Tongue. *Canadian Journal of Regional Science / Revue canadienne des sciences régionales*, *45*(1), 26–37. https://doi.org/10.7202/1088300ar

Résumé de l'article

Approximately ten percent of Canadian higher education students cross provincial boundaries each year to attend college or university. Despite its size and impact, the geography of higher education student migration (HESM) is not well documented in Canada. This paper analyses Statistics Canada's Postsecondary Student Information System (PSIS) for the academic year 2016/17. Interaction matrixes are developed and mapped to analyse both the broad geographical structure of interprovincial HESM and the impact of language, specifically student mother tongue, in shaping migration patterns. In both the overall picture of HESM and that of mother tongue, HESM generates expected patterns as well as important migration variations. Ontario and Quebec anchor the national picture and, together with others, constitute exchanges amongst contiguous provincial clusters. Unique cross-country interprovincial connections are also revealed and migration by mother tongue generates further nuances still. The paper concludes with a discussion of the implications of this work for understanding (i) migration-based integration amongst Canadian provincial higher education systems, and (ii) with further research, the multi-scalar processes and geographies of HESM for institutional and local economic policy makers.

CANADIAN JOURNAL OF REGIONAL SCIENCE
REVUE CANADIENNE DES SCIENCES RÉGIONALES

CANADIAN REGIONAL SCIENCE ASSOCIATION
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HIGHER EDUCATION STUDENT MIGRATION IN CANADA: INTERPROVINCIAL STRUCTURE AND THE INFLUENCE OF STUDENT MOTHER TONGUE

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Soumis : 2021-02-26
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Abstract: Approximately ten percent of Canadian higher education students cross provincial boundaries each year to attend college or university. Despite its size and impact, the geography of higher education student migration (HESM) is not well documented in Canada. This paper analyses Statistics Canada's Postsecondary Student Information System (PSIS) for the academic year 2016/17. Interaction matrixes are developed and mapped to analyse both the broad geographical structure of interprovincial HESM and the impact of language, specifically student mother tongue, in shaping migration patterns. In both the overall picture of HESM and that of mother tongue, HESM generates expected patterns as well as important migration variations. Ontario and Quebec anchor the national picture and, together with others, constitute exchanges amongst contiguous provincial clusters. Unique cross-country interprovincial connections are also revealed and migration by mother tongue generates further nuances still. The paper concludes with a discussion of the implications of this work for understanding (i) migration-based integration amongst Canadian provincial higher education systems, and (ii) with further research, the multi-scalar processes and geographies of HESM for institutional and local economic policy makers.

Keywords: higher education student migration, Canada

INTRODUCTION

Higher education student migration (HESM) creates repeated waves of population movements year over year. These waves, often over great distances, generate multi-scalar social and spatial impacts. For example, higher education leaders are keen to attract and retain students from near and far because they recognise the myriad benefits of population mix at their colleges and universities. Political leaders and policy stakeholders, such as economic development professionals, are also tuned into HESM. They recognise the cultural and economic benefits and potential losses of human capital migration (see Beckstead et al, 2008), especially since HESM can bind higher education to the labour market.

In Canada, about ten percent of higher education students migrate yearly to study outside of their home province (Statistics Canada, 2012). This has particular significance in federalist Canada in which higher education is structured and funded as parallel provincial systems. HESM therefore brings a degree of national integration. The number and proportion of students implicated in HESM is uncertain, however, given the lack of current and reliable research. The present paper examines Canadian HESM by analysing the Postsecondary Student Information System (PSIS), an annual Statistics Canada national survey of students in colleges and universities. Interaction matrixes are developed and mapped to analyse the geographical structure of interprovincial HESM. In addition, a distinctly Canadian sub-theme is examined through the lens of Canadian migration research: the putative impact of language as indicated by student English- or French-mother tongue.

The following section reviews the literature on Canadian HESM in international context, revealing stalled domestic research beyond the mid-1990s. The research methods applied to analysing PSIS at the level of the individual student data record are then discussed prior to turning to the results of Canadian HESM in 2016/17. In both the overall picture of HESM and that of mother tongue, HESM generates expected patterns as well as important migration variations. Ontario and Quebec expectedly anchor the national picture. Together with others, we see a high degree of movements amongst contiguous provinces but also unique cross-country interprovincial connections. Mother tongue variations generate further nuances still. The paper concludes with a discussion of the implications of this work as not only a new window on integration across Canadian provincial higher education systems, but also the processes and geographies of HESM for institutional and local economic policy makers.

LITERATURE REVIEW

The structure and process of higher education student migration (HESM) is fairly well documented in the literature though with only few Canadian contributions. Groat (1964) set the stage with research on US inter-state migration from 1887 to 1958, focusing on socioeconomic, institutional, and spatial factors. He found that the majority of migrants were male, and that migration was driven by the spatially uneven distribution of private universities. Research since has detailed the US experience most, such as migration determinants (e.g., Tuckman, 1970; Abbot & Schmid, 1975; Baryla & Dotterweich, 2001) and patterns (Johns & Viehland, 1989; Fryman, 1990). Contributions from elsewhere, such as the UK (e.g., Faggian et al, 2007; Hoare, 1991; Belfield & Morris, 1999), add further to the literature but Canadian experience is under-developed by comparison.

To begin to build a comprehensive Canadian picture, HESM is framed by the wider migration literature. Migration is selective (Liaw & Rogers, 1999; Bernard et al, 2016) and remakes populations spatially, temporally, and compositionally (Pu et al, 2019; Bernard et al, 2016). Temporally, we may examine "to school migration" as in the present paper (e.g., Abbot & Schmid, 1975; Niedomysl & Fransson, 2014; Day & Grafton, 1998); this primary movement in turn serving as a foundation for analysis of "after school" return or onward migration (Newbold, 2001; Faggian et al, 2007; Newbold, 2017). Burbidge & Finnie (2000) do both in repeated cross sections of a panel/cohort of students in Canada in 1982, 1986 and 1990. They found that students who migrate to attend school prefer nearby provinces, but Nova Scotia and Ontario were the main destinations when farther moves were made. Day & Grafton (1998) used a similar approach to examine migration push and pull factors behind primary/initial moves over the 1972-1997 period. Whereas Day & Grafton (1998) reported that the overall interprovincial student migration rate was between seven and nine percent of higher education students, Burbidge & Finnie (2000) reported between six and seven percent. A more recent report (Statistics Canada, 2012) suggests one in ten higher education students migrate. Direct comparisons are difficult, however, as this rate of movement appears to be lower than US inter-state migration. Groat (1964) found HESM rates of between 20% and 26% for much earlier decades and this was corroborated by Abbott & Schmid (1975) in the early 1960s (26.6%). Notably, the latter also document significant variability by institution type: 16.2% for public universities, 62% for privates and 38.6% for religious denominational universities. More recently, US land-grant universities saw an average 27.86% migration rate in 2005 (Adkisson & Peach, 2008). The present paper offers an avenue for comparison given the relative dearth of Canadian research. Greene & Kirby (2013), for instance, examine distance learners as virtual migrants who do not physically relocate but register from afar for distance studies.

As a spatial process, HESM has been examined at alternative spatial scales including: international (Hercog & Van de Laar, 2017); sub- or intra-national, such as US inter-state migration (Adkisson & Peach, 2008); local regional studies (Alm & Winters, 2009), including rural-to-urban foci (e.g., Hossain et al, 2019); studies that use more granular metrics such as migrant distance travelled (Turley, 2009; Frenette, 2006). Others have layered the spatial theme with additional considerations such as the distribution of higher education institutions (HEIs) and the characteristics of origins and destinations (Niedomysl & Fransson, 2014; Tuckman, 1970). In addition to their spatial distribution, other studies have considered institutional factors such as tuition fees, HEI quality and prestige, institution type (e.g., private versus public) and program quality (Abbot & Schmid, 1975; Baryla & Dotterweich, 2001; Baryla & Dotterweich, 2006; Greene & Kirby, 2012; Adkisson & Peach, 2008). Greene & Kirby (2013) found that program, course considerations (e.g., reputation) and cost were influential in students' decision to study at a university outside of their home province. The present paper focuses on the interprovincial scale, thus affording an opportunity to update the Canadian picture of HESM and draw international comparisons.

Finally, as suggested by Groat's (1964) early work on gender split, HESM both grows out of and shapes sociodemographic processes (Leppel, 1993). Perhaps the foremost theme to consider in building a current and comprehensive picture of Canadian HESM is language. In Europe, for example, Saarela & Scott (2017) studied migrants from Finland (one group with Finnish mother tongue and another with Swedish mother tongue) to Sweden and found that Finnish-speaking migrants were more likely to return 'home' than Swedish-speaking migrants. In Canada, demographers have shown that language and mother tongue can play a structuring role in youth (Liaw, 1990), immigrant (Newbold, 1996) and elderly (Liaw & Ledent, 1988) migration. For instance, for the period of 1976-1981, Liaw (1990) reported high rates of out-migration of English speakers from Quebec complemented by greater preference for French speakers to migrate to Quebec from other provinces. Liaw & Rogers (1999) attribute these

patterns to cultural and political factors such as the lack of bilingual education in the rest of Canada and Quebec's apparent anti-English/pro-French policies. Could these patterns and processes still be at play today?

HESM is a repeated substantial movement of youth within Canada though exactly how large and varied begs updated research. With this broad context, the potential for language to structure migration bears investigation. Perhaps in Canada as elsewhere, students imagine places and social spaces where they choose to study by linking their language ideologies to destinations (Park & Bae, 2009). Building upon extant migration research, the English-French may be particularly acute in HESM given both Quebec's population size amongst provinces and its large higher education system. The latter is but one system however its size and primarily French colleges and universities surely generate immigration dynamics that bear study. More broadly, because higher education is a provincial responsibility, we may view HESM within Canada as a window on federalism. How HESM unfolds maybe be an important but as yet largely hidden window on national integration of parallel provincial higher education systems (Jones, 1997).

DATA AND METHODS

Data preparation

The analysis is based on the 2016/17 reporting year of the PSIS database, specifically all enrolled domestic undergraduate and graduate students in all Canadian public higher education institutions (HEIs; including CEGEPs in Quebec). PSIS is a census with a repeated cross-sectional design. Statistics Canada creates the PSIS dataset from administrative data provided to it by HEIs across the country. No sampling of the population is done. The data comprises of records of students per institution in each reporting year and captures information of both new entrants and continuing students[1]. Initial steps involved removing records of students registered but not enrolled (e.g., gap year students) and those captured in PSIS but enrolled in upper secondary education (e.g., secondary school students earning tertiary credit). In addition, since the current study is focused on Canadian student interprovincial migration, international students were removed from the data. Finally, about 2.1% of students whose immigration status was not reported were also excluded.

After these initial steps, the PSIS database required filtering and inspection in preparation for analysis. The first step was to rectify multiple entries for the same student, a situation that arises for two reasons: At the data capture moment, students may be enrolled in two or more programmes and thereby entered multiple times in the database. Also, students may be enrolled in both undergraduate and postgraduate programmes in the PSIS reporting year. To resolve this, undergraduate and graduate (Masters, PhD, Post-Doc) entries were separated into two separate files. In each subsequent file, each student's unique identifier (RECORD ID; always constant for the same student) was aggregated to arrive at one entry for each individual student. This step also resolves multiple entries based on registration in more than one programme, doing so by giving precedence to majors (i.e. minors were eliminated). We then merged the separate undergraduate and graduate files into a single dataset. Again, we used the RECORD ID to identify and remove duplicate entries in the merged dataset. This step resolved the double entries (n=6,024) of students enrolled in both undergraduate and graduate programs in the reporting year. This resulted in 3,012 records/students showing enrolment in both undergraduate and graduate programmes. Half (i.e. 1,506) were randomly assigned as undergraduates and the other half as graduate students. In sum, the data cleaning and aggregation ensured the enrolment numbers and the analysis are not inflated by multiple entries but instead capture the individual student data record as the unit of analysis.

Table 1. Descriptive Statistics of Variables

			Number of HEIs	
Variable	**Frequency**	**Percent (%)**	**University**	**College**
Province of origin				
Newfoundland and Labrador	16206	1.3	1	1
Prince Edward Island	4554	0.4	1	1
Nova Scotia	28308	2.3	11	0
New Brunswick	18570	1.5	4	4
Quebec	286032	23.4	16	75
Ontario	495303	40.6	21	25
Manitoba	40770	3.3	7	5
Saskatchewan	32994	2.7	2	8
Alberta	113190	9.3	11	14
British Columbia	149652	12.3	11	14
Yukon Territory	1275	0.1	0	1
Northwest Territories	1146	0.1	0	1
Nunavut	414	0.0	0	1
Missing	31920	2.6	N/A	N/A
Total	1220334	100	85	150
Mother tongue				
English	528669	43.3		
French	240273	19.7		
English and French	339	0.0		
Other Language	102021	8.4		
Missing	349032	28.6		
Total	1220334	100		
Institution attended				
University	1159368	95.0		
College (includes CEGEP*)	60966	5.0		
Total	1220334	100		

Notes. N/A= Not available. *CEGEP is a French acronym that stands for Collège d'enseignement Général et Professionnel, known in English as a general and vocational college.

As shown in Table 1, the resulting dataset sums to just over 1.22 million students in 2016/17. As the Table shows, the province of origin variable captures the number and percent of students at their 'home' province. About 2.6% of the cases of the province of origin variable are missing (i.e. not recorded). Also missing are some cases in the mother tongue variable (28.6%). Removal of the missing values for the province of origin variable (pairwise deletion) reduces the sample to about 1.19 million students: the final total sample for the analysis of interprovincial flows. Further pairwise deletion as a result of missing values in the mother tongue variable occurs in the subsequent cross-tabulated data. The results in the flow matrixes were rounded to multiples of 3 as required by Statistics Canada's vetting rules for usage of PSIS.

Calculating migration

This section details the calculations used to derive the out-migration, in-migration and exchange of migrants among provinces and

1 For more information, see https://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=5017.

territories. The origins and destinations are represented by i_n and j_n respectively in the flow matrix (see Table 2 and 3, results). The sum of students at the origins is denoted by Σi_n and in the destinations by Σj_n. The interaction between $i_n j_n$ is the non-migrant students who studied in their own respective provinces.

The out-migration or the number of students who left their 'home' province of origin to study elsewhere is calculated by the formula:

$$O_n = \Sigma i_n - i_n j_n$$

The percentage of the out-migrant students at each origin is presented in the column labelled $L\%O_n$ in Table 2. To calculate the out-migrant students from each origin as a ratio of the total out-migrant students nationwide, we use the formula:

$$L\%O_n = \Sigma i_n - \frac{\Sigma i_n - i_n j_n}{\Sigma ij} \text{ x } 100$$

where Σij is the grand total of out-migrating students

For instance, referring to Table 2, the number and percentage of Newfoundland and Labrador students who out-migrated to study elsewhere in 2016/17 are 2,277 and 14.1%, respectively. And this number represents 2.0% of the total out-migrating students nationwide.

The in-migration or the number of students who entered each destination province/territory to study is calculated by the formula:

$$I_n = \Sigma j_n - i_n j_n$$

As well, the percentage of in-migrant students who studied at each destination is represented in the row labelled $L\%I_n$ in Table 2. To calculate the in-migrant students to each destination as a ratio of the total in-migrant students nationwide, we use the formula:

$$N\%I_n = \frac{\Sigma i_n - i_n j_n}{\Sigma ij} \text{ x } 100$$

where Σij is the grand total of in-migrating students

For instance, the number and percentage of students who migrated to Newfoundland and Labrador in 2016/17 to study are 3,393 and 19.6%, respectively. And this number represents 3.0% of the total in-migrating students nationwide.

With the above migration flows tabulated, we can then turn to net migration: the exchange of student migrants among origins and destinations. The number of net migrants is calculated using the formula:

$$N_n = \Sigma j_n - \Sigma i_n$$

The percentage of net migration represents the relative percentage change at the origin, and it is presented in the row labelled $\%\ N_n$ in Table 2.

For example, referring to Table 2, Newfoundland and Labrador received a net positive migration of 1,116 students in 2016/17, representing a 6.9% gain over the total number of students in the province.

Before turning to a full discussion of the results, we add a final concept here: net migration efficiency. As defined by Fryman (1990: 91), net migration efficiency is the ratio of the number of students gained or lost by each province/territory to the overall number of student migrants entering of leaving. Net migration efficiency is calculated by:

$$NE_n = \frac{\Sigma j_n - i\Sigma_n}{\Sigma j_n + \Sigma i_n - 2(i_n j_n)} \text{ x } 100$$

Following the worked example of Newfoundland and Labrador, the net migration efficiency is 19.7%. The following section discusses the picture that emerges from these methods and explores further substantive themes highlighted in Table1.

Migration and mother tongue

The mother tongue variable shown in Table 1 is categorized into the three (3) main groups of English, French and Bilingual (English and French) as well as Other languages (immigrant/minority languages). This analysis focuses on monolingual English-only and French-only students. As shown in Table 1, 28.6% of cases for the mother tongue variable were missing/unreported in the PSIS sample. It bears noting Prince Edward Island (PEI), Alberta (AB) and Yukon territory (YK) did not report the mother tongue of students who studied there, numbering 3,456, 112,062 and 537 students respectively (including migrants and non-migrants, as shown in Table 2). One also sees many missing cases from Newfoundland and Labrador (NL), Nunavut and Northwest territory (NT) when comparing the Table 2 and 3 totals. In effect, the analysis of migration by student mother tongue captured in Table 3 represents the out-migration of students from all provinces and territories and in migration for all but PEI, AB and YK. Caution is needed when interpreting the flows for NL.

Analysis of the influence of mother tongue begins with a dedicated flow matrix (results Table 3) as well as statistical z-test analysis to compare the overall flow matrix and that of mother tongue specifically (i.e. comparison with Tables 2). The z-test analysis for the out-migration of students investigates the onset of the migration process to compare the movements as captured in Table 2 and Table 3 as well as that conditioned by mother tongue. The proportion of out-migrating English and French mother tongue students was hypothesised as statistically no different than the overall outmigration of students across the provinces (null H_{0E} and H_{0F}, respectively). In addition, the proportion of out-migrating English mother tongue students is hypothesised as statistically no different than the proportion of out-migrating French mother tongue students (i.e. comparing English and French mother tongue migrants directly within Table 3; H_{0EF}). Exceedance of the critical z-value by the calculated z-score at a significance level of 5% (α=0.05) would confirm significant departure from these null hypotheses. A test of significance (p-values) for the z-scores were obtained and interpreted.

Finally, location quotient (LQ) analysis examines the spatial distribution or concentration of in-migrating English and French mother tongue students at the provinces of study as compared with the national average. Using the LQ to examine in-migration provides the extent to which migrants are over- or under-represented in their chosen province of study as compared with the national rate once the migration process is complete. The location quotient is given by the formula:

$$LQ = \frac{I_n / \Sigma j_n}{\Sigma ji / \Sigma i_n j_n}$$

where I_n is the number of in-migrants at each province, Σj_n is the sum of students at each province, Σji is the total number of in-migrant student and $\Sigma i_n j_n$ is the grand total of students in the resulting sample.

The location quotient calculation was based on Table 3 and values for the respective in-migration of English and French mother tongue students were used accordingly. For example, the concentration of English mother tongue students who arrived in Nova Scotia to study there is 3.4 times more than the national average of English mother tongue students who in-migrated to provinces for their studies.

RESULTS

Interprovincial HESM in Canada, 2016/17

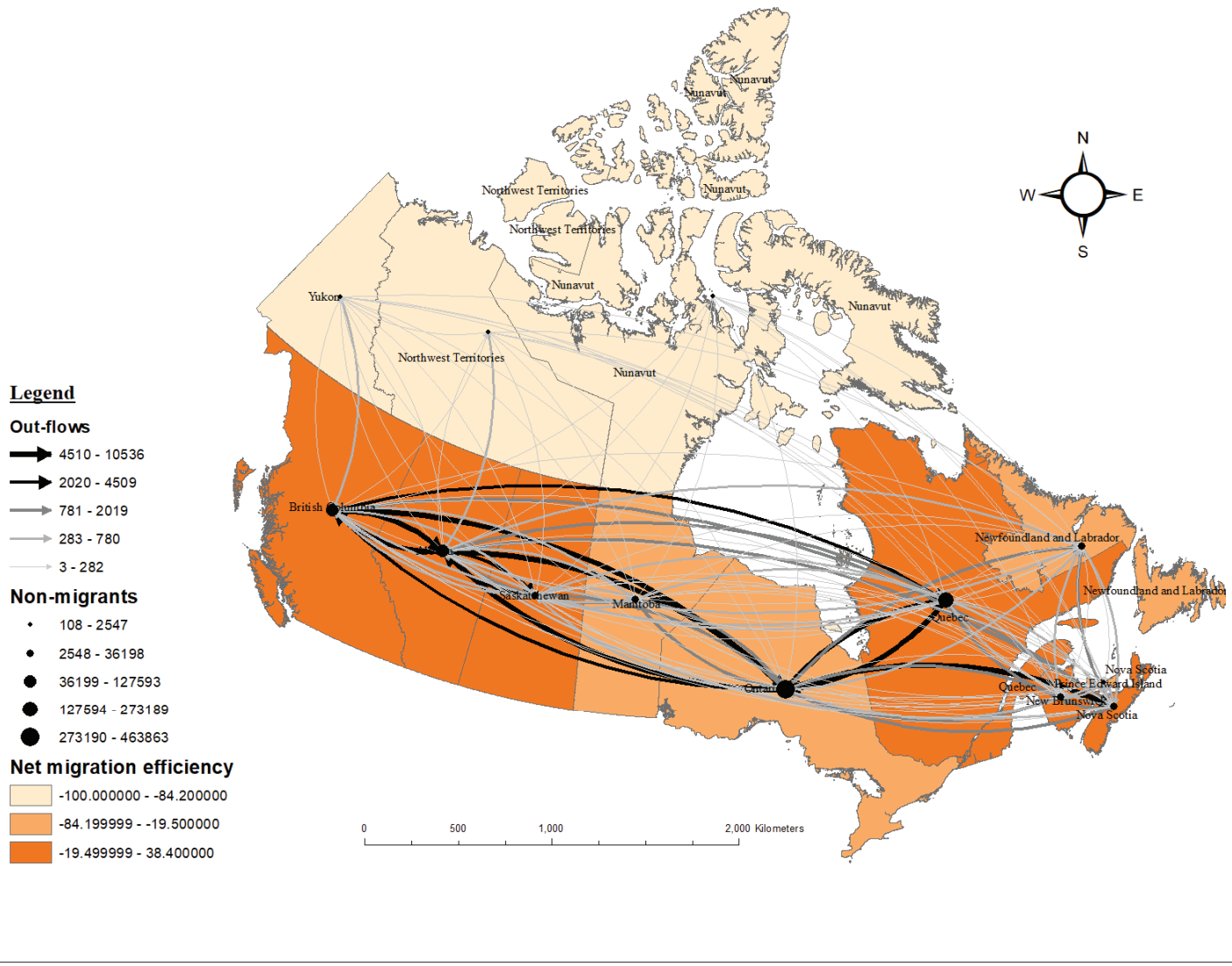
The interprovincial migration of students can be characterized by both expected patterns and important divergences. Overall, 113,787 higher education students crossed provincial boundaries to attend university or college in 2016/17, representing 9.6% of all students in the sector. This share of students confirms Statistics Canada's (2012) rate of interprovincial student migrants although the absolute number here is smaller owing to the focus solely on domestic students (i.e. excluding international students) as well as the data cleaning steps described earlier.

As shown in Table 2, the overall matrix displays notable patterns and variations in the out-migration and in-migration rates. The very highest rates belong to the territories (Yukon, Northwest territory and Nunavut) because of the small student numbers and a lack of HEIs in the Canadian North (see Table 1). Among the provinces, out-migration ranges from 4.5% in Quebec to 44.1% in Prince Edward Island. Mirroring this to an extent is the range of in-migration rates from 5.8% in Quebec to 39.8% in Nova Scotia. The overall matrix reveals an expected 'regionalised' pattern of movements amongst contiguous or nearby provinces, both in the Atlantic and the West. In general, there are three groups of migration flows: first, the territories, as noted above. Second, the Atlantic and Western provinces exhibit middling out-migration rates. Third, low out-flows in Quebec and Ontario which may be partly explained by the presence of more HEIs.

Following this latter observation, another notable pattern in the overall flow matrix is the number of students in Ontario and Quebec, the largest provinces by student numbers and driving interprovincial flows with the lowest in- and out-migration rates. Following Liaw's (1990) assertions about the role of language in Canadian migration, this may explain why the smaller student populations of Alberta and British Columbia exhibit numerically higher outflows than Quebec. To help frame these patterns, the magnitude of the number of students leaving or entering each province/territory is calculated as the ratio of total provincials flows to the national total. Table 2 shows unique cases again, such as the territories and provinces with few HEIs (e.g., Prince Edward Island). Overall, Ontario and Quebec drive the national picture and, together with Alberta and British Columbia, exhibit a high degree of student 'trading.'

The national share of migration mimics the regionalised pattern of flows noted above, but inversely so: the territories show expectedly low rates given their small numbers. The Atlantic and Western provinces (except Alberta), are middling in the proportion of migrants.

Figure 1. Flow Map of Overall Interprovincial Higher Education Student Out-migration in Canada, 2016



Finally, whereas Ontario and Quebec exhibit low rates relative to their resident populations, they (along with British Columbia) constitute the lion's share of absolute student movements in the country. For instance, in NL, a relatively high number of students went farther afield to Ontario and Alberta as opposed to nearby provinces. The same pattern is observed for British Columbia's flows to neighbouring Alberta vis-à-vis Ontario in the east (see Figure 1).

National and regional trends are constituted by the experiences of individual provinces, some of which exhibit surprising net migrations as shown in Table 2. As suggested above, for example, the small number of HEIs in Prince Edward Island leads to a net loss of students whereas Nova Scotia and NL gained 28.4% and 6.9% of their respective totals. In fact, Nova Scotia exhibited the highest net in-migration with entrants from nearby Atlantic provinces as well as more distant origins. Ontario and Quebec also gained positive net migrations of 0.7% and 1.4% respectively; again, small shares given their size. Ontario's net migration was balanced but was exceeded in this respect by Saskatchewan with almost the same number of entrants as out-migrants in 2016/17. Among the larger provinces, British Columbia had the greatest net loss of students suggesting unmet demand by its HEI capacity. Beneath these broad national trends, then, are some highly variable individual provincial experiences.

Finally, net migration efficiency situates the net flows in the context of the extant size of the student population in each province. By this measure, for example, we see an amplification of the net gains and losses amongst the Atlantic provinces. Once again PEI's small number of HEIs explains its leading (-37.7%) negative net migration efficiency. All western provinces saw net efficiency losses, especially Manitoba (-22.5%) and British Columbia (-23.8%). As signalled earlier, these patterns are driven by the size and perhaps also the central locations of Ontario and Quebec. Notably, Quebec led in with a nine-fold rise in net migration efficiency. If Quebec's French language attenuates outflows, net migration efficiency corroborates the point while also revealing its imbalance with a strong inward draw of students from near and far.

Thus we can summarise the overall migration matrix in Table 1 as revealing (i) a dearth of absolute movements for the territories in Canada's North, (ii) an expected pattern of flows amongst contiguous provinces, (iii) regional clusters constituted by 'local' movements, and (iv) a national picture anchored around the large numbers of Ontario and Quebec, two provinces that also represented the greatest draw of students from across the country.

Figure 2. Flow Map of Overall Interprovincial Higher Education Student In-migration in Canada, 2016

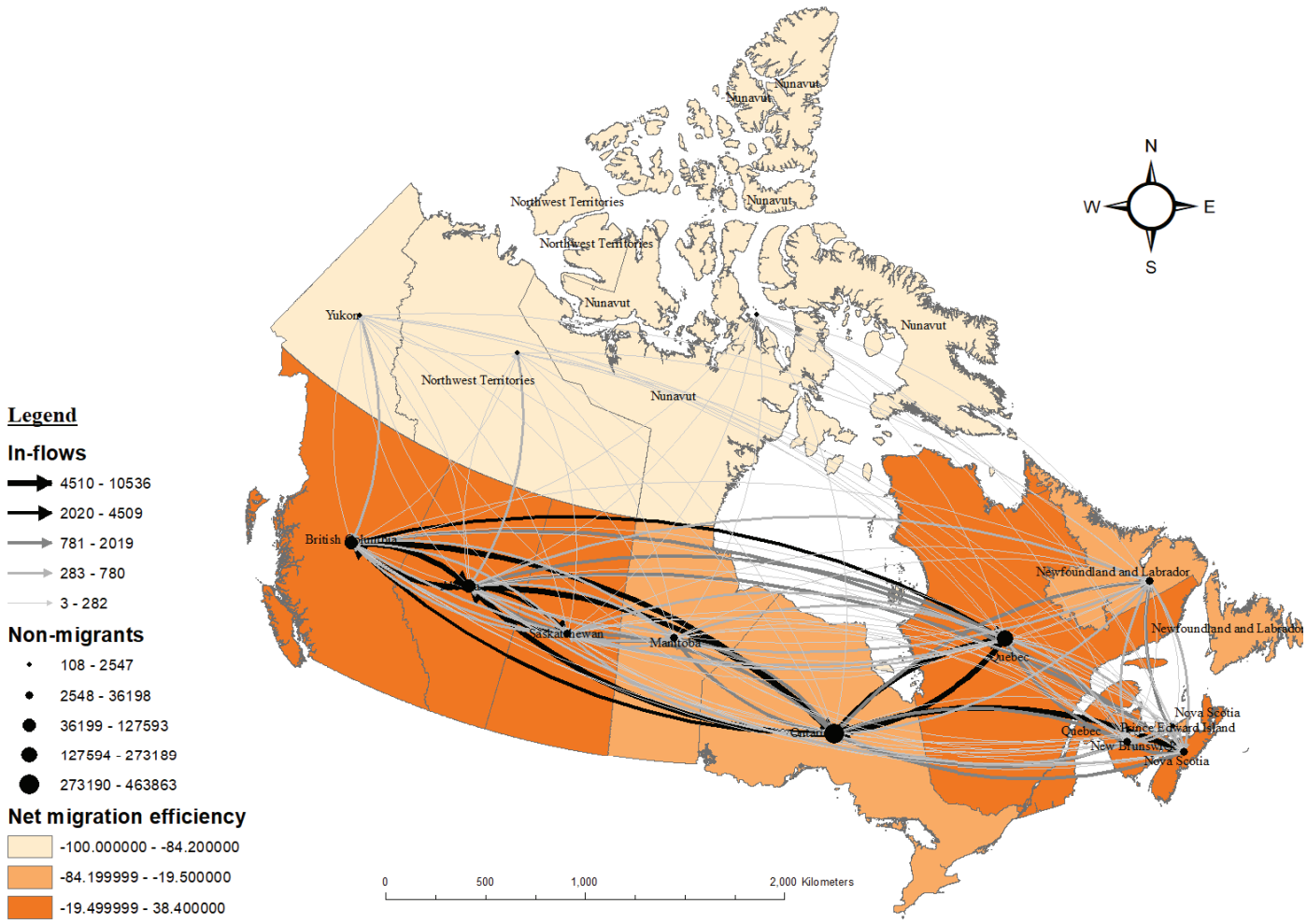


Table 2. Interprovincial Flow Matrix of Higher Education Student Migration in Canada, 2016/17

		Province of Study (Destination)																
		NFL	PEI	NS	NB	QU	ON	MA	SK	AB	BC	YK	NT	NU	Total	Out-migrants	L% of out-migrants**	N% of out-migrants+
		j_1	j_2	j_3	j_4	j_5	j_6	j_7	j_8	j_9	j_{10}	j_{11}	j_{12}	j_{13}	$\sum i_n$	O_n	$\%LO_n$	$\%NO_n$
Province of Origin	NFL	i_1	13929*	45	780	156	159	600	78	18	333	111	0	0	0	16206	2277	14.1	2.0
	PEI	i_2	129	2547*	780	444	102	381	15	12	87	57	0	0	0	4554	2007	44.1	1.8
	NS	i_3	1035	312	21873*	1476	609	2019	147	57	516	267	0	0	0	28308	6435	22.7	5.7
	NB	i_4	393	240	2391	12570*	909	1554	45	42	282	147	0	0	0	18570	6000	32.3	5.3
	QU	i_5	126	30	513	453	273189*	10524	102	54	495	546	0	0	0	286032	12843	4.5	11.3
	ON	i_6	1011	165	6816	930	9843	463863*	1071	636	6459	4509	3	0	0	495303	31440	6.3	27.6
	MA	i_7	60	12	213	60	378	1725	36198*	573	996	552	0	0	0	40770	4572	11.2	4.0
	SK	i_8	60	15	249	45	345	1056	366	27915*	2253	690	3	0	0	32994	5079	15.4	4.5
	AB	i_9	312	51	1527	270	1302	6159	570	2544	94266*	6150	33	3	0	113190	18924	16.7	16.6
	BC	i_{10}	222	30	1068	183	3033	10536	450	753	5778	127593*	9	0	0	149652	22059	14.7	19.4
	YK	i_{11}	9	0	63	3	39	126	9	81	165	312	468*	0	0	1275	807	63.3	0.7
	NT	i_{12}	18	0	45	12	24	126	21	144	402	222	24	108*	0	1146	1038	90.6	0.9
	NU	i_{13}	18	9	21	6	9	69	21	93	30	33	0	0	108*	414	306	73.9	0.3
	Total	$\sum j_n$	17322	3456	36336	16611	289941	498735	39093	32919	112062	141183	537	111	108	1188417	113787	9.6	100
	In-migrants	I_n	3393	909	14463	4041	16752	34872	2895	5004	17796	13590	69	3	0	113787			
	L% of in-migrants***	$\%LI_n$	19.6	26.3	39.8	24.3	5.8	7.0	7.4	15.2	15.9	9.6	12.8	2.7	0.0	9.6			
	N% of in-migrants+	$\%NI_n$	3.0	0.8	12.7	3.6	14.7	30.6	2.5	4.4	15.6	11.9	0.1	0.0	0.0	100			
	Net migration	N_n	1116	-1098	8028	-1959	3909	3432	-1677	-75	-1128	-8469	-738	-1035	-306	N/A			
	% of net migration++	$\%N_n$	6.9	-24.1	28.4	-10.5	1.4	0.7	-4.1	-0.2	-1.0	-5.7	-57.9	-90.3	-73.9	N/A			
	Net migration efficiency+++	NE_n	19.7	-37.7	38.4	-19.5	13.2	5.2	-22.5	-0.7	-3.1	-23.8	-84.2	-99.4	-100.0	N/A			

Notes. N/A= Not available.
*Non-migrant students or number of students who stayed and studied in their province of origin.
** Expressed as a proportion of the number of out-migrant students over the total number of students at the province of origin.
*** Expressed as a proportion of the number of in-migrant students over the total number of students at the province of study.
+ Expressed as the proportion of out-migrants/in-migrants in each province/territory over the grand sum out-migrants/in-migrants.
++ Expressed as the proportion of the net migration over the total number of students at the province of origin.
+++ Expressed as the proportion of the net migration over the sum of in-migrant and out-migrant students at each province.

HESM and mother tongue

Following Newbold (1996), mother tongue signals cultural similarity and may condition migration. Liaw & Rogers (1999) take this further and point to the political and cultural factors that stem the flow of migrants to and from Quebec. This influence may be particularly acute in Quebec given not only its unique French first language but also its HEI system size. Quebec experienced a small net positive gain (1.4%) of students in 2016/17 yet a high net migration efficiency (13.2%) trailing only Nova Scotia and NL. This is an early indication of the subtle but impactful role played by language in HESM.

The first observation evident in Table 3 is that 47,706 (9.2%) of English-mother tongue students migrated across provincial boundaries to attend college or university. By contrast, only 9,216 (3.9%) French speakers did so. The full range of English speaker out-migration rates resemble the overall patterns of Table 2, such as the low outflow from Ontario (3.1%), however notable exceptions exist: for example, only 12.7% of Quebec's English speakers left to study elsewhere; much lower than most other provinces. Equally interesting is that 29.6% of Quebec's English-speaking students in-migrated, nearly matched by New Brunswick (29.2%) and exceeded only by Nova Scotia (30.8%). Examination of French speaker migration patterns again yields both familiar patterns and surprising insights. Out-migration from Quebec (2.7%) is low however relatively few French speakers left Ontario (11.2%) as well. And yet, New Brunswick (11.1%) and especially Quebec (1.1%) saw the lowest in-migration rates of French speakers; the latter despite its predominance of French-first HEIs. In general, while English speakers drive the national picture, the percentage of French mother tongue departures was consistently higher amongst provinces except Quebec itself. In other words, English mother tongue migrants dominate the flows while individual French speakers are more likely to be movers.

This takes us to a subtle but important observation about the impact of mother tongue migration amongst provinces: that even though English speakers constitute the bulk of movements, these tend to be more uniformly distributed. When provinces 'trade' their French speakers, however, they tend to lose students. Notably, Quebec exemplifies this with its net migration efficiency noted above turning to a net loss of French students (-1.6% in Table 3) as suggested by Liaw & Rogers (1999). Except for Ontario, all other reporting provinces saw losses of French speaking migrants. It is noteworthy that only Ontario (35.9%) saw a net positive French speaker migration; the lion's share coming from bordering Quebec, in fact. The imbalance of French speaker migration is a defining feature of the structure of HESM in Canada; operating within national flows that are predominantly English.

Table 3. Interprovincial Flow Matrix of Higher Education Student Migration by Mother Tongue in Canada, 2016/17

Province of Origin			Province of Study (Destination) NFL	NS	NB	QU	ON	MA	SK	BC	NT	NU	Total	Out-migrants	L% of out-migrants*	Net migration	% of net migration+
			j_1 ENG (FR)	j_3 ENG (FR)	j_4 ENG (FR)	j_5 ENG (FR)	j_6 ENG (FR)	j_7 ENG (FR)	j_8 ENG (FR)	j_{10} ENG (FR)	j_{12} ENG (FR)	j_{13} ENG (FR)	$\sum i_n$ ENG (FR)	O_n ENG (FR)	$\%LO_n$ ENG (FR)	N_n ENG (FR)	$\%N_n$ ENG (FR)
	NFL	i_1	24 (0)	459 (0)	153 (0)	141 (9)	528 (0)	9 (0)	6 (0)	54 (0)	0 (0)	0 (0)	1374 (9)	1350 (9)	98.3 (100.0)	-1344 (-9)	-97.8 (-100.0)
	PEI	i_2	0 (0)	363 (0)	399 (27)	72 (9)	270 (3)	0 (3)	0 (0)	21 (0)	0 (0)	0 (0)	1125 (42)	1125 (42)	100.0# (100.0)#	-1125 (-42)	-100.0 (-100.0)
	NS	i_3	0 (0)	12747 (84)	1323 (78)	516 (45)	1707 (63)	6 (15)	18 (0)	102 (0)	0 (0)	0 (0)	16419 (285)	3672 (201)	22.4 (70.5)	2004 (-132)	12.2 (-46.3)
	NB	i_4	0 (0)	1113 (27)	8064 (3735)	258 (597)	843 (393)	3 (3)	6 (3)	48 (6)	0 (0)	0 (0)	10335 (4764)	2271 (1029)	22.0 (21.6)	1053 (-561)	10.2 (-11.8)
	QU	i_5	0 (0)	207 (27)	132 (285)	28158 (210294)	3534 (5367)	6 (21)	9 (6)	198 (42)	0 (0)	0 (0)	32244 (216042)	4086 (5748)	12.7 (2.7)	7773 (-3372)	24.1 (-1.6)
	ON	i_6	6 (0)	2337 (12)	798 (57)	7155 (1347)	371481 (11511)	123 (18)	168 (6)	1152 (9)	0 (0)	0 (0)	383220 (12960)	11739 (1449)	3.1 (11.2)	9189 (4656)	2.4 (35.9)
	MA	i_7	0 (0)	78 (0)	48 (9)	279 (48)	1329 (69)	4635 (216)	174 (3)	174 (0)	0 (0)	0 (0)	6717 (345)	2082 (129)	31.0 (37.4)	-1638 (-18)	-24.4 (-5.2)
	SK	i_8	0 (0)	78 (0)	42 (0)	258 (42)	771 (30)	126 (15)	10848 (66)	231 (0)	0 (0)	0 (0)	12354 (153)	1506 (87)	12.2 (56.9)	-366 (-63)	-3.0 (-41.2)
	AB	i_9	0 (0)	678 (3)	240 (9)	960 (138)	4698 (105)	102 (15)	447 (6)	2109 (6)	3 (0)	0 (0)	9237 (282)	9237 (282)	100.0# (100.0)#	-9237 (-282)	-100.0 (-100.0)
	BC	i_{10}	0 (0)	297 (0)	168 (3)	2181 (120)	6996 (60)	63 (21)	126 (0)	36975 (162)	0 (0)	0 (0)	46806 (366)	9831 (204)	21.0 (55.7)	-5505 (-141)	-11.8 (-38.5)
	YK	i_{11}	0 (0)	33 (0)	3 (0)	27 (9)	102 (9)	3 (0)	48 (0)	114 (0)	0 (0)	0 (0)	330 (18)	330 (18)	100.0#ä (100.0)#	-330 (-18)	-100.0 (-100.0)
	NT	i_{12}	0 (0)	21 (0)	12 (0)	9 (6)	99 (6)	3 (0)	87 (0)	105 (0)	105 (0)	0 (0)	441 (12)	336 (12)	76.2 (100.0)	-333 (-12)	-75.5 (-100.0)
	NU	i_{13}	0 (0)	12 (0)	6 (0)	3 (6)	51 (0)	0 (0)	51 (0)	18 (0)	0 (0)	27 (0)	168 (6)	141 (6)	83.9 (100.0)	-141 (-6)	-83.9 (-100.0)
	Total	$\sum j_n$	30 (0)	18423 (153)	11388 (4203)	40017 (212670)	392409 (17616)	5079 (327)	11988 (90)	41301 (225)	108 (0)	27 (0)	520770 (235284)	47706 (9216)	9.2 (3.9)	N/A (N/A)	N/A (N/A)
	In-migrants	I_n	6 (0)	5676 (69)	3324 (468)	11859 (2376)	20928 (6105)	444 (111)	1140 (24)	4326 (63)	3 (0)	0 (0)	47706 (9216)				
	L% of in-migrants**	$\%LI_n$	20.0 (N/A)	30.8 (45.1)	29.2 (11.1)	29.6 (1.1)	5.3 (34.7)	8.7 (33.9)	9.5 (26.7)	10.5 (28.0)	2.8 (N/A)	0.0 (N/A)	9.2 (3.9)				

Notes. N/A= Not available. ENG= English and FR= French.
* Expressed as a proportion of the number of out-migrants by mother tongue (i.e. English or French) over the respective total number of students at the province of origin.
** Expressed as a proportion of the number of in-migrants by mother tongue (i.e. English or French) over the respective total number of students at the province of study.
+ Expressed as the proportion of the net migration by mother tongue (i.e. English or French) over the respective total number of students at the province of origin.
# The 100% out-migration does not imply that all the students moved since the mother tongue of students (including non-migrants) at these provinces were unreported .

The onset of the migration process was investigated using the z-test analysis of the out-migration of students among the provinces. Statistical z-test comparison between the proportion of out-migrating English students and the proportion of total outmigration (i.e. Table 3 versus Table 2) is significant for all provinces but Nova Scotia (Table 4). Out-migration of French mother tongue students is also significantly different from the national picture. In addition, out-migration of English mother tongue students is significantly different from their French counterparts in all provinces except New Brunswick (*p= 0.30153*). Turning to the LQ analysis of in-migrating students, we find substantial gains of both English and French mother tongue students in NS and NB as compared with the national average in 2016/17. Quebec gained English in-migrants but lost French speakers as noted earlier. Every province from Ontario westward (excepting Alberta, which did not report on mother tongue) had substantial gains of French speakers in 2016/17. Thus, the results in Table 4 highlight further nuances within the overall picture of HESM in Canada though the reader should note the small numbers associated with some of the flows that can generate varying LQ values.

CONCLUSIONS AND DISCUSSION

Although Canadian research lags that of other countries, this paper begins to fill in the picture of higher education student migration. Through comparison with prior Canadian research, HESM appears to have risen from 6-7% of students in the 1980s and 1990s (Burbidge & Finnie, 2000) to one in ten students more recently (Statistics Canada, 2012). The present paper also adds new dimensions to the Canadian interprovincial picture. Flows between contiguous

Table 4. Statistical Z-test and Location Quotient of Provincial Migration Comparison by Mother Tongue, 2016/17**

Province*	Z-score			r ***	P-value			LQ English	LQ French
	ENG	FR	ENG-FR		ENG	FR	ENG-FR		
Nova Scotia	0.90	19.02	19.10	0.307	0.36812	< .00001	< .00001	3.4	11.5
New Brunswick	18.64	14.37	0.52	0.009	< .00001	< .00001	0.60306	3.2	2.8
Quebec	62.07	33.99	85.98	0.867	< .00001	< .00001	< .00001	3.2	0.3
Ontario	70.62	22.08	50.66	0.441	< .00001	< .00001	< .00001	0.6	8.8
Manitoba	43.28	15.22	2.50	0.053	< .00001	< .00001	0.01241	1.0	8.7
Saskatchewan	8.62	14.11	16.47	0.413	< .00001	< .00001	< .00001	1.0	6.8
British Columbia	32.07	22.04	16.17	0.161	< .00001	< .00001	< .00001	1.1	7.1

Notes. ENG= Comparison of English mother tongue out-migration (in Table 3) to overall out-migration (in Table 2). FR= Comparison of French mother tongue out-migration (in Table 3) to overall out-migration (in Table 2). ENG-FR= Comparison of English to French mother tongue outmigration (in Table 3) *AB, PEI and YK did not report mother tongue of students who studied there. Also, NFL, NU and NT were excluded because of missing cases and small numbers arising from the data preparation discussed. **Statistical Z-test analysis (critical Z-value (α= 0.05) = 1.96, significant p-values (<0.05) are highlighted in bold) and location quotient analysis (LQ>1: high concentration, LQ = 1: equal concentration and LQ < 1: low concentration compared to national average). ***r is the effect size for only the comparison between English and French mother tongue students in Table 3 (r=0.20: small, r= 0.50: medium, r= 0.80: large).

provinces is greatest and underpins regional clusters such as the apparent Atlantic bloc. At the same time, Ontario and Quebec define the national picture of higher education enrolments and migrations, exchanging students not only between each other but also drawing migrants heavily from across the country. Not surprisingly, the number of HEIs appears to be related to high rates of provincial student outflows (few HEIs) and inflows (many HEIs). Within the Atlantic regional cluster, for example, the presence of about 11 universities in Nova Scotia compared to four in New Brunswick and one each in Newfoundland and Labrador and PEI likely explains the flows observed. In particular, there is evidence that suggests students may be drawn out of Newfoundland and Labrador due to program considerations such as graduate studies or specialized program availability and by kinship relations that reach across provincial boundaries (Delisle, 2013).

Following Liaw's (1990) suggestion that language and culture play a structuring role in youth migration in Canada, the present paper also explores the influence of mother tongue. What is revealed is compelling: English mother tongue students make up the majority of migrants, yet their French speaking counterparts were more mobile on an individual basis. In comparison with overall flows, Ontario and Quebec again define the national picture yet we also see that when provinces 'trade' French mother tongue students it is nearly always at a loss. Most notably, this is true of Quebec. In 2016/17, Ontario alone benefitted from a net positive flow of French mother tongue students and did so largely at Quebec's expense.

Broadening the picture, this research sets the stage for further inquiry into the departure and destination choice processes of HESMs. HESM is often about students' choice of where and which HEIs to attend. The uneven spatial distribution of HEIs across Canada implies students in some provinces have fewer options than their counterparts in other parts of the country. Also, students are more likely to attend a college or university closer to 'home' than travel long distances (Frenette, 2006). In this context, a preliminary multivariate analysis (Table 5) is added here to suggest avenues for future research. Using a gravity model approach, in which province/territory centroids are the flow points, distance and the origin student population (model 1) negatively impact (i.e. reduces) migration flows while destination population positively affects flows. This initial specification fits the classic gravity model rationale. As expected, the distance decay effect continues when incorporating the number of HEIs in a province (model 2); a 10% increase in the number of HEIs at destinations increases in-flows but only by 0.06%. Further, when mother tongue is included (model 3), the coefficient of distance remains negative. Specifically, a 10% increase in distance reduces overall migration flows by 4% and being a French mother tongue student is associated with approximately a 51% decrease in the migration flows. In addition, a 10% increase in the number of HEIs at the destination increases in-flows by 2%. Thus, in this full model 3, the addition of student mother tongue amplifies the effect of the number of HEIs at destination though we remind the reader that this preliminary analysis is only meant to be exploratory and suggestive because it relies on the use of provincial centroids that may be greatly removed from the locations of HEIs and their regions. Further research can examine in more detail the relative impact of distance, number of HEIs, and student mother tongue using more specific geographical locations (in place of provincial centroids).

Others have shown that demographic, socio-economic, geographic/environmental, and institutional factors are surely also at play (Tuckman, 1970; Frenette, 2006; Mixon & Hsing, 1994; Leppel, 1993). For example, one such sociodemographic factor is family background (e.g., income and parental education) which has been found to influence student's participation in postsecondary education in Canada (Corak et al, 2003; Finnie, 2012; Finnie et al, 2004; Finnie et al, 2005). Further texturing the picture presented here is the availability of different programmes of study within and amongst provinces and their HEIs (Baryla & Dotterweich, 2001). Interest in STEM-based streaming (Means et al, 2016) and programme offerings (Simon et al, 2015) plausibly generate patterns beneath the broad picture. Indeed we may take this further by examining the intersection of gender and migration as Groat (1964) did initially but also ask such questions as: how does gender interact with alternative programmes (availability, competitiveness, prestige) to generate interprovincial flows (Abbott & Schmid, 1975; Heybach & Pickup, 2017)? Do women migrate farther, for instance, in 'reaching' for STEM-based education?

Another area of policy interest and future study ties HESM to the discourse on higher education and economic development. HESM and institutional mix will be of interest to those concerned with the development of human capital, particularly the role of HEIs in attracting and retaining talent. HEIs not only develop local populations (Scott, 2006; Brockliss, 2000) but also draw (potential) talent beyond local regions and provinces (Florida, 2014; Lewis & Donald, 2010). However, migration is not necessarily a permanent move for some students, as evidenced in the return and onward migration literature (Newbold, 2001; Faggian et al, 2007). After graduation, migrants may take advantage of their investment in human capital and either stay in the destinations they earned their degrees, move elsewhere, or return to their place of origin for work (Venhorst et

Table 5. Log-log Regression Results of the Gravity Model of HESM

Model/Predictors	b	Std. Error	z-value	p-value	R^2	AIC
Model 1					0.323	117041.47
Intercept	5.599	0.006	930.374	< .001		
Log of OHES	-19.570	0.152	-128.834	< .001		
Log of DHES	20.021	0.151	132.152	< .001		
Log of distance	-0.402	0.005	-74.349	< .001		
Model 2					0.332	115535.11
Intercept	5.584	0.006	925.730	< .001		
Log of OHES	-16.559	0.149	-110.860	< .001		
Log of DHES	17.002	0.149	113.889	< .001		
Log of distance	-0.408	0.005	-75.472	< .001		
Log of HEI	0.006	1.562e-4	40.268	< .001		
Model 3					0.350	112453.09
Intercept	5.480	0.007	836.627	< .001		
Log of OHES	-11.942	0.174	-68.770	< .001		
Log of DHES	12.333	0.174	70.946	< .001		
Log of distance	-0.424	0.005	-79.100	< .001		
Log of HEI	0.247	0.005	49.306	< .001		
Mother tongue* (ref: English)	-0.710	0.013	-53.066	< .001		

Notes. The outcome variable is the log migration flows, b = regression coefficient and N = 132. OHES= Origin student population. DHES= Destination student population. HEI= Number of HEIs at destinations.
*Log transformation of categorical variable is inadmissible.

al., 2011). Retaining student migrants should therefore be of interest to regions if they are to take advantage of HESM for economic development. As exemplified by mother tongue, HESM can diversify local populations and thus augment labour pools (Bramwell & Wolfe, 2008). Institutional and system administrators (i.e. provincial ministries responsible for higher education) will be keenly interested in the 'trading' of migrating talent, particularly as policy aspires to greater impact by the higher education sector (Eastman et al, 2018).

Finally, as signalled in this discussion, migration processes occur at alternative spatial scales. While the provincial scale provides a helpful initial frame to such issues as the broad structure of migration and role of mother tongue, future research and policy consideration would benefit from greater granularity. To be sure, interprovincial migration is a necessary lens given the provincial responsibility for higher education delivery. Interprovincial HESM offers a unique window on the operation of Canadian federalism for it significantly and repeatedly binds systems falling within provincial jurisdiction. That said, regional and local policymakers would be equally interested in the relative attraction and retentions of HESMs. For instance, of interest to both provincial and local research users and decision-makers is the extent to which the most successful universities and their host regions across Canada compete for the best students. Do the largest urban centres and their universities represent the best chances for economic growth and development in the unfurling knowledge and information economy? Does this leave smaller centres and their institutions behind or do they nevertheless hedge against regional decline? Within provinces too, decision-makers may be as interested in rural-to-urban impacts of HESM attraction and retention. Does having the most competitive institutions represent a double-edged sword by which rural students must migrate to other regions or provinces to find a seat? Scenarios like these create policy paradoxes in which the goals of economic development push for ever greater university success and prestige but may run counter to goals of higher education accessibility for some within-province students.

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ACKNOWLEDGMENT

"This research was supported by funds to the Canadian Research Data Centre Network (CRDCN) from the Social Science and Humanities research Council (SSHRC), the Canadian Institute for Health Research (CIHR), the Canadian Foundation for Innovation (CFI) and Statistics Canada."

"Although the research and analysis are based on data from Statistics Canada, the opinions expressed do not represent the views of Statistics Canada or the Canadian Research Data Centre Network (CRDCN)."