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Visa Policy and International Student Migration: Evidence from Canada

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Abstract

This paper examines how visa policy affects international student migration. Using administrative data on community colleges in Canada, we evaluate a reform that introduced a new visa stream - the Student Partners Program (SPP) - with shorter processing times and higher approval rates for student visa applicants able to demonstrate that they have the financial resources and language skills to succeed academically. Using a triple difference estimator, we find that SPP increased student migration from treated countries by 33% relative to what would have occurred without the reform, and that this effect materialized only among students from origin countries suffering from low approval rates. Moreover, we show that higher enrollment was driven in roughly equal proportions by an increase in visa approval rates and the volume of visa applications, suggesting the policy helped reduce statistical discrimination and increased the attractiveness of treated institutions. We also leverage the SPP reform to investigate potential crowding-out effects. While inflows of international students did not reduce the number of domestic students enrolled at Canadian community colleges, the reform helped foreign enrollment outpace domestic enrollment by crowding-in international students from countries that were not eligible to SPP.

Keywords: international migration, students, visa policy, information.

JEL Classification: F22, H52, I23, O15.

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1 Introduction

Student migration has become increasingly relevant in the global competition for talents. According to the OECD, the number of international students enrolled at post-secondary education programs grew from 2 million in 1998 to over 6 million in 2019. For receiving countries, international students are a unique type of migrants, who benefit from a better integration on the labour market than other foreign workers because of their domestic credentials and their experience and language proficiency in the destination country (Schaafsma and Sweetman (2001)).¹ Their role for innovation and the dynamism of host economies is also well documented, particularly in the US (Hunt (2011), Stuen et al. (2012)).² Understanding how destination countries can meet their recruitment targets and what frictions matter in preventing or fostering international student migration is therefore an important policy question.

This paper investigates how origin-specific requirements in the processing of visa applications affect student migration from developing countries. Since the late 2000s, students from fast-developing countries, who represented 70% of OECD foreign enrollment in 2019,³ have suffered from lower approval rates of their study visa applications than applicants from richer countries.⁴ A key factor to explain this gap is the lack of information included in the supporting documentation attached to visa applications, which sometimes fails to remove immigration officers' concerns regarding migration fraud and the intentions of

¹Schaafsma and Sweetman (2001) found that immigrants who have completed their education in Canada and the United States Canada have earnings comparable to those of national students and higher than that of immigrant workers who graduated in their country of origin.

²Immigrants who first enter the USA on a student or trainee visa or a temporary work visa have a large advantage over natives in wages, patenting, commercialising or licensing patents, and publishing (Hunt (2011)), and the contribution of those students to the production of knowledge at American scientific laboratories is statistically comparable to that of natives (Stuen et al. (2012))

³Among them, students from India and China account for more than 31% of all foreign students, and close to half of this total (47%) in the United States alone.

⁴In Canada in 2009, the approval rate for European and American applicants was close to 90%, but stood respectively at 68% and 51% for students from China and India. A similar same pattern was found in Australia and the UK, where the approval rate of study visa applications for students from non-OECD countries was 10 to 20 % lower than for students from developed countries. (Source: Department of Home Affairs (Australia), Home Office (UK)).

prospective students from developing countries.⁵ Low approval rates significantly hamper the ability of destination countries to remain competitive in the race for talent. First, they reduce higher education institutions' (HEI) ability to recruit the most qualified applicants and create unfilled capacities at universities, with potential losses in terms of tuition revenue and student quality. Second, they create administrative hurdles that can act as a deterrent for international students considering education in a foreign country (Beine et al. (2014)), who may prefer to pick an alternative destination.⁶ Over the past 15 years, policy reforms in Australia, France, and Canada suggest that bringing in origin-specific requirements as part of a plan to discourage fraudulent visa applications can be regarded as an effective policy response to address information shortcomings.

Against this backdrop, this paper is the first to investigate how such policies affect the volume of international student migration from developing countries. More specifically, we study the introduction of a new visa stream for international students from India, China, and Vietnam pursuing college education in Canada - the Student Partners Program (SPP) -, whose objective was to reduce immigration officers' bias in the processing of visa applications in order to facilitate the enrollment of foreign students at community colleges. Our contribution is three-fold. First, we evaluate the impact of the Student Partners Program on international enrollment from target countries. Second, we identify and quantify the mechanisms driving this effect. Third, we study the consequences of this policy for domestic enrollment. To inform our empirical analysis, we propose a basic theoretical model to understand how incomplete information affects the processing of visa applications by immigration officers. Our model predicts that SPP should help increase

⁵For instance, governments at destination fear that student visa holders overstay after the expiration date of their visas, that they use it to come to work illegally, or engage in technological or industrial espionage on behalf of their home countries (OECD, 2022). In Canada, study permit applications from India and China were therefore two to four times more likely to be rejected under misrepresentation grounds than those originating from the US or Western European countries between 2015 and 2020 (Source: IRCC).

⁶HEIs in destination countries frequently report difficulties in obtaining visas as a significant barrier to foreign student enrollment. See for instance <https://foreignpolicy.com/2020/07/15/ice-drops-student-visa-threat-but-foreign-students-still-face-hurdles/>

international student enrollment by reducing statistical discrimination and increasing visa approval rate, and that this effect should be larger in origin countries with greater risks of misrepresentation. We test this prediction by estimating the causal impact of SPP on international students from India, China, and Vietnam using data on enrollment and graduates of Canadian public post-secondary institutions between 2003 and 2017. The staggered implementation of SPP provides a quasi-experimental design in which treated institutions and foreign nationalities were made eligible to the program at different points in time. We therefore rely on a triple-difference approach, which eliminates potential institution and origin-specific confounding factors that are either endogenous or cannot be controlled for in standard difference-in-difference models used in the recent literature on international enrollment (Arenas (2021), Amuedo-Dorantes et al. (2019)). More specifically, we estimate the causal effect of SPP by comparing how the enrollment of international students who had access to the SPP stream at participating institutions changed relative to non-participating colleges and students from non-eligible nationalities.

We find that on average - across all three nationalities eligible to SPP - the reform increased enrollment of foreign students at institutions participating in the program by 33% in the post-treatment period. In other words, absent SPP, enrollment of Indian, Chinese, and Vietnamese students at Canadian institutions that benefited from the SPP visa stream would have been 33% lower during the years covered in our analysis. Our results further indicate that the program was very successful among Indian and Vietnamese students, respectively increasing enrollment by 105% and 74%, but had virtually no effect on their Chinese counterparts, whose visa approval rates were significantly higher before the reform kicked in. These findings pass several robustness tests controlling for possible selection and substitution biases and experimenting with alternative control groups and estimators.

Next, we explore the mechanisms driving the impact of SPP on student enrollment. We find that the policy increased both the number of visa applications and the approval rates

of these applications, with each channel accounting for roughly 50% of the aggregate effect. This suggests that the reform was not only effective at removing officers' bias towards candidates and reducing statistical discrimination, but also managed to increase the relative attractiveness of participating colleges with respect to non-treated, comparable institutions.

Finally, we leverage the SPP reform to test the potential crowding-out of native and non-treated international students. To do so, we address the usual endogeneity concerns associated with time-varying and institution-specific unobservable characteristics - which are likely to affect both foreign and native students - by instrumenting the number of international students with the SPP reform. While inflows of international students did not reduce the number of domestic students enrolled at Canadian community colleges, our findings indicate that a 10% increase in international students led to a 0,6% reduction in the share of domestic students, suggesting that foreign enrollment grew faster than domestic enrollment between 2003 and 2017. We further show that this growth was fueled by the crowding-in of international students from countries non-eligible to SPP after the reform was implemented, perhaps as a result of cross-subsidization where treated institutions expanded their hosting capacities through the additional tuition revenue from SPP students. (on the cross-subsidization hypothesis, see Shih (2017) and Machin and Murphy (2017)).

The rest of the paper is organized as follows. Section 2 presents the related literature. Section 3 describes the historical and institutional context of the SPP reform. Section 4 introduces the theoretical framework. Section 5 discusses the methodology and describes the data used in the empirical analysis. Section 6 contains a discussion of the findings, including several robustness checks, and Section 7 concludes.

2 Related Literature

In a context where developed economies compete to attract an increasingly high number of foreign students, a large literature has explored the drivers of international student mobility. Among studies featuring gravity models with multiple origin and destination countries, Perkins and Neumayer (2014), Beine et al. (2014), Abbott and Silles (2016), Bessey (2012) and Lanati and Thiele (2020) use country-level data to investigate the role of determinants such as geographic factors, networks, quality of university, political freedom, GDP per capita at origin and destination, fees and foreign aid projects in post-secondary education. Other papers focusing on specific destinations include Dreher and Poutvaara (2008) and Rosenzweig (2008), which highlight the importance of networks and skill premium, respectively, in attracting foreign students to the United States. Using university-level data, Beine et al. (2020) and Ragot et al. (2017) study the effect of tuition fees on student migration in Italy and the UK, showing that universities charging higher fees have fewer international students.

The economic literature has devoted less attention to the role of migration policy changes as a driver of international student mobility. In the American context, Kato and Sparber (2013) and Shih (2016) have shown that reducing the number of work visas available for foreign-born workers discourages high-ability international students from pursuing education in the United States. Amuedo-Dorantes et al. (2019) show that the 2008 Optional Practical Training reform extending the time period during which international students in the United States are allowed to temporarily work on their student visas to complement their education for STEM graduates raised student visa arrivers' relative propensity to major in STEM. Expanding the scope of the analysis, Amuedo-Dorantes et al. (2020) found that the 2008 OPT reform and consecutive extensions raised matriculation of international students in bachelor's and master's programs. In contrast, we are not aware of any published work studying the effect of changes in student visa or work policy on

international student migration outside of the US. To the best of our knowledge, our paper is therefore one of the first to study the effect of a policy reform targeting student migration on international student enrollment in a non-American context. Within this literature, Ragot and Beine (2022)'s work in progress on Campus France documents that the introduction of a new visa application procedure facilitating the application process of international students led to a global increase of inflows of foreign students. Arenas (2021) shows that lifting the requirement to take the Spanish end-of-high-school exam for foreign students had a positive impact on the quality and quantity of international student migration in Spain. Our paper adds to this literature by exploring whether and how the quality of information on study visa applicants affects the quantity of international student migration and documents how the consequences of this policy vary across students' country of origin with the risk of misrepresentation.

Our exploration of crowding-out is related to Shih (2017) and Machin and Murphy (2017), who document the crowding-in of US students by international students as a consequence of cross-subsidization, where the high net tuition payments from foreign students help subsidizing the cost of enrolling additional local students. In contrast, Borjas (2007) found a strong negative correlation between the number of foreign students enrolled at a particular US university and the number of white native men in that university's graduate program, pointing to a crowding-out effect which is particularly strong at the most elite institutions.

This paper is also related to the literature on the discrimination of immigrant applicants based on their origin country (for a review of the discrimination literature in economics, see Bohren et al. (2019)). Using data on applications for immigrant permanent labor certification evaluated, Rissing and Castilla (2014) show that labor certification approvals differ significantly depending on immigrants' foreign citizenship, even after controlling for key factors. Hersch (2008) found that immigrants with the lightest skin color earn on

average 17% more than comparable immigrants with the darkest skin color in the US. Conducting a field experiment with thirteen thousand resumes, Oreopoulos (2011) finds substantial discrimination across a variety of occupations towards applicants with foreign experience or those with Indian, Pakistani, Chinese, and Greek names compared with English names. In a similar experiment, studying race in the labor market by sending fictitious resumes, Bertrand and Mullainathan (2004) found that White names receive 50 percent more callbacks for interviews.

Because the success of policies targeting international students largely depends, at least from the host countries' point of view, on whether or not these students remain at destination after graduation, our paper is also related to the sizable literature exploring the characteristics of international students on the labour market. Dreher and Poutvaara (2011) show that the stock of foreign students is an important predictor of subsequent migration. Beine et al. (2023) provides evidence on the transition rate of foreign graduates into the local labour market in the US following the reform of the Optional Practical Training work permit for STEM graduates, shedding light on the capacity of destination countries to retain international students. Their results, although specific to the US context, highlight the potential of migration policy reforms to attract and retain foreign talents in host countries. Hunt (2011) describes how immigrants who first entered the US on a student or trainee visa perform better than natives in wages and patenting once on the labour market, while Stuen et al. (2012) discuss the contribution of international students to the dynamism and innovation of American companies.

Finally, this paper is related to the literature exploring the effects of migration policy on foreign labour employment. Antecol et al. (2003) show that Australian and Canadian immigrants have higher levels of English fluency, education and income than US immigrants. Mayda et al. (2018) demonstrates that cap restrictions on H-1B visas in the US significantly reduced the hiring of new workers in for-profit firms relative to what would

have occurred in an unconstrained environment. Kerr and Lincoln (2010) find that immigrants' contribution in the US is driving the increase in employment and invention in the field of science and engineering following higher admissions of foreign workers holding H-1B visas.

3 The Student Partners Program

3.1 Historical background

Since the late 1990s, Citizenship and Immigration Canada (CIC, now IRCC) has transformed Canada's immigration system to strengthen its status as a welcoming destination for foreign talents. In 2010, the number of international students entering Canada had nearly doubled since 2000,⁷ with this upward trend expected to continue and intensify over the next decade. In this context, CICan and Canadian Community colleges renewed their efforts to attract international students to come and study in Canada.⁸ These campaigns to improve international student recruitment however came up against the low rates of acceptance of student visa applications. In practice, visa officers had doubts about applicants' financial sustainability and migration abuse - international migrants gaining access to Canada by pretending to be a student -, which made it challenging to decide whether a college-bound applicant was a genuine (or bona fide) student. Moreover, it was difficult to verify supporting documentation and obtain feedback on whether individuals who were issued study permits were actually making their way to the classroom. This problem was particularly salient for Indian nationals, a large number of which unsuccessfully applied

⁷Source: Statistics Canada.

⁸CICan is a national association formed in 1972 to represent the interests of Public Post-Secondary institutions of Applied Learning and Applied Research, which include Community Colleges, Univ. Colleges, Cégeps, Institutes of Technology (Polytechnics), Institutes, Universities. CICan member institutions offer three main types of educational programs. One, 2 and 3 year diplomas designed to train technicians, mid-level managers and service providers, as well as applied degrees equivalent to University Bachelor Degrees but with an applied focus in a particular field. Third, Post graduate certificates focused on current industry practices which provide hands-on professional experience and lead to higher employability of graduates.

for a visa to enroll into specialized trade-based diploma and post graduate diploma programs at community colleges in Canada. As a result, the average study permit approval rate for college-bound Indian students was 34 % in 2008.

In response, CICan and IRCC launched the Student Partnership Program in April 2009 as a joint pilot project in India. The main objective was to address information frictions inherent to the risk of misrepresentation by correcting officers' bias towards Indian students, and increase the number of visas issued to study at Canadian Community Colleges as a result.⁹ SPP was initially only open to Indian nationals in 20 participating colleges, but considering how successful it turned out to be - the approval rate of visa applications to participating members increased from 34 to 75% and the number of visa issued from 1,503 to 4,243 between 2009 and 2010 -,¹⁰ the project was extended to 39 institutions and a dedicated stream for Chinese students was created in 2010. Over the following eight years, several colleges joined the Indian and / or the Chinese stream of the program. In 2016, CICan and IRCC implemented a similar program in Vietnam, a then rapidly developing market, known as the Canada Express Study (CES) program.¹¹ The SPP ended in the transition to the Study Direct Stream in 2018, with respectively 46, 53 and 55 colleges then participating in the Indian, Chinese and Vietnamese programs (see Figure 1). The SDS effectively made the SPP visa stream available to all educational institutions designated by their respective province to host international students in China, India, Vietnam and the Philippines. Since 2018, students from those countries applying to virtually any post-secondary institutions can therefore benefit from faster visa processing

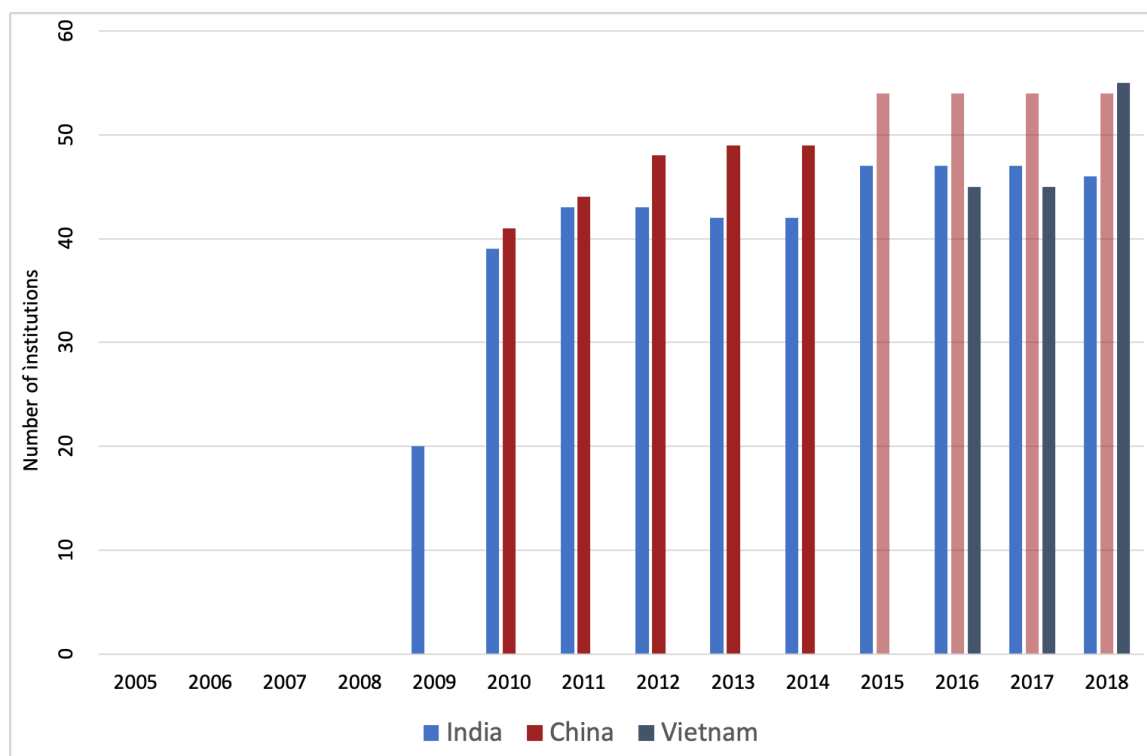
⁹Other popular destination countries have implemented policy reforms similar to SPP around the late 2000s. Besides Canada, France launched Campus France, a new visa application platform facilitating the application process of international students, in 2007, and the Australian Government strengthened integrity measures in certain parts of the student program caseload to counter fraud and ensure that students had sufficient funds to live and study in Australia in 2009.

¹⁰Source: CIC statistics. Cohorts for year 2009 includes September 2009 cohort and January 2010 cohort.

¹¹Vietnamese students did not formally have access to SPP but to the Canadian Express Study Program, which was very similar and whose objective was, like SPP, to facilitate visa processing for Vietnamese students wishing to study at participating colleges in Canada.

times by demonstrating upfront that they have the financial resources and language skills to succeed academically in Canada.¹²

Figure 1: SPP rollout (2005-2018)



Notes: The vertical bars indicate the number of institutions participating in the SPP program between 2003 and 2018 for each country of origin. From 2015 onwards, the lighter bars for China correspond to the period when SPP was effectively available for Chinese students at all post-secondary institutions through the implementation of the SDS.

3.2 Eligibility and details of the program

With the introduction of SPP, students planning to pursue studies in Canada could apply to any college participating to the program through either the regular or the SPP stream. In practice, SPP applicants from India, China, and Vietnam needed to provide additional documents and certifications proving their intentions, but could also hope for a faster

¹²It is worth stressing that while officially launched in India, Vietnam and the Philippines in 2018 (and later extended to other countries), the SDS originally started in China in 2015 as a pilot program with similar criteria to SPP but open to any post-secondary education program eligible for the post-graduate work permit program (PGWPP). In our empirical analysis, we therefore consider SPP to be available to all Chinese students applying to post-secondary institutions in Canada from 2015 onward - see section 5.2.

turnaround and more positive outcomes by signalling their intentions more clearly. In particular, there were two major additions to the regular application kit in order to be considered for the SPP stream.

Language proficiency, long used by visa officers as a critical factor in determining whether an applicant is a genuine student, had to be demonstrated through IELTS scores. The required IELTS score was respectively set at 6.0, 5.5, and 5.0 for the Indian, Chinese, and Vietnamese streams. Second, applicants had to provide a copy of receipts by SPP institution for tuition payment, and demonstrate they had the financial resources to live and study in Canada. Up until 2012, a copy of an educational loan covering at least 80% of tuition, living and travel expenses for one academic year was enough for the Indian SPP. However, because fraudulent banking documents were easy to obtain and extremely difficult to verify in China and India, IRCC and CICan then set up the Guaranteed Investment Certificate (GIC) with selected financial institutions in these countries to ensure students could easily demonstrate proof of funds.

For CICan member institutions, admission into the program worked through voluntary participation, although the final decision to admit any new colleges into the SPP rested with visa offices in partnering countries, in consultation with CICan. In exchange, in order to ensure program integrity and minimize migration violations, institutions selected to participate were supposed to comply with reporting mechanisms providing regular systematic feedback on student enrollment and attendance.

4 Conceptual framework

In this section, we propose a basic theoretical model to understand the benefits of *information* in the processing of visa applications. More specifically, we study how increasing the level of information available to immigration officers can help increase student enrollment by reducing statistical discrimination. We then apply this framework to the specific

case of SPP.

We start from a baseline scenario where student visa applications are submitted through a unique, hereafter referred to as *regular* stream. Visa streams are characterized by the level of information $I \in [\underline{I}, \bar{I}]$ they require from each applicant and make available to visa officers when reviewing applications, with $I = \underline{I}$ for applications submitted through the *regular* stream. We normalize the volume of study visa applications to 1. For a given country of origin, the risk associated with migration abuse and misrepresentation is negatively correlated with the share $s \in [0, 1]$ of bona fide students in the total number of applications processed by immigration officers. In the absence of complete information, this share reflects officers' prior about the intentions of study permit applicants originating from a specific country.¹³

Officers' decision to approve or reject applications then depends on their prior s and the level of information I at their disposal. They approve visa applications at rate $\rho(s, I) \in [0, 1]$, where ρ is a C^2 function increasing in the level of information I required from applicants and the prior s on the share of bona fide students: $\frac{d\rho(s, I)}{ds} \geq 0$, and $\frac{d\rho(s, I)}{dI} \geq 0$. On the one hand, information helps applicants convince visa officers of their intentions and increase their chances to obtain a visa. On the other hand, as outlined in the introduction, risks of migration abuse from non-OECD origin countries are associated with lower visa approval rates. A greater s therefore corresponds to a lower risk, i.e a lower share of bogus applicants with no intention to study among those applying for a study visa. From a policy perspective, this implies lower statistical discrimination and higher approval rates. We assume moreover that s and I are substitutes: $\frac{d^2\rho(s, I)}{dI ds} = \frac{d^2\rho(s, I)}{ds dI} \leq 0$.

When more information is available to visa officers, the prior about the share of bona fide applicants applying for study permits becomes less important in their decision to accept

¹³Bona fide (resp. bogus) students are applicants who intend (resp. pretend but do not actually intend) to come to their destination country for the purpose of studying. In many countries, this risk is assessed ex-post based on several indicators, such as the rate of student visa holders becoming unlawful non-citizens or violating visa restrictions, the rate of visa refusals due to a fraud, or the number of visa applications for international protection.

or reject applications. In other words, when applicants' intentions become more transparent, prior s matters less, and vice versa.¹⁴ Incidentally, we assume that $\forall I \in [\underline{I}, \bar{I}]$, $\rho(0, I) = 0$ and $\rho(1, I) = 1$, which imply that if visa officers believe there are no genuine (resp. fraudulent) applicants, they will systematically reject (resp. accept) applications regardless of the information at their disposal. Finally, we set $\frac{d^2\rho(s, I)}{d^2s} > 0$, such that with the regular stream, the share of approved applications is never higher than visa officers' prior about the share of genuine applicants s . In economic terms, this can be interpreted as government's risk aversion regarding illegal immigration.

Let b denote the net benefit (potential earnings after graduation and cost of study) that an applicant obtains from studying at destination and $c(I)$ increasing in I the cost of providing information I for genuine applicants, with $c(\underline{I}) = 0$ for simplicity. It is then straightforward that a student will prefer to use any visa stream I and pay cost $c(I)$ if and only if $b\rho(s, I) - c(I) > b\rho(s, \underline{I})$, i.e if the expected benefit from providing information I is greater than that of applying through the regular stream. This participation constraint is equivalent to

$$b(\rho(s, I) - \rho(s, \underline{I})) > c(I) \tag{1}$$

In what follows, we assume that applicants' participation constraint is satisfied.

With only the regular visa stream \underline{I} in place, immigration officers have a hard time distinguishing between bona fide and bogus individual applicants because information \underline{I} at their disposal fails to provide a clear signal about their intentions. The government therefore wishes to increase the level of information available to visa officers from $I = \underline{I}$ to $I > \underline{I}$ by introducing a new visa stream - hereafter referred to as policy I -, improving

¹⁴In this regard, note that if officers could perfectly observe applicants' intentions through the information provided in their application, their belief s about the share of genuine applications would become totally irrelevant.

their ability to tell bona fide study permit applications from bogus ones.

Let $\Delta(s, I) = s(\rho(s, I) - \rho(s, \underline{I}))$ be the change in international student enrollment when the government implements policy I , where international student enrollment $\rho(s, I)s$ is the product of the rate at which student visa applications are accepted by visa officers multiplied by the share of genuine students among applicants. $\Delta(s, I)$ is trivially increasing in I , from which comes immediately that the government sets the level of information in the new visa stream I such that the participation constraint (1) is binding, and the government's choice I^* is implicitly defined by the following equality:

$$b(\rho(s, I^*) - \rho(s, \underline{I})) = c(I^*) \quad (2)$$

Proposition 1: $\frac{dI^*}{ds} \leq 0$ Government's optimal policy - level of information - I^* is decreasing in the share of bona fide applicants s .

This comes immediately from differentiating both sides of (2) with respect to s and observing that the *informational* value of prior s decreases with the level of information I available to visa officers (recall that $\frac{d^2\rho(s, I)}{dsdI} \leq 0$). The LHS of (2) is decreasing in s , while the RHS of (2) remains invariant, which gives $\frac{dI^*}{ds} \leq 0$. When the share of genuine applicants s increases, the relative benefit from using the new visa stream instead of the regular stream for genuine applicants decreases because the positive effect of additional information on approval rates is lower. Incidentally, the level of information applicants are willing to provide and the cost $c(I^*)$ they are willing to pay are also decreasing in s . This proposition is in line with the streamlining of visa processes in recent years (Gopal (2016)): In major destination countries, supporting documents for visa applications require greater information from prospective applicants from low and middle-income countries, and in particular from countries regarded as posing a serious risk of migration fraud. At the same time, designing visa processes tailored to each origin country is challenging due to

a variety of practical and diplomatic reasons. Instead, in Australia, France, Canada, or the UK, these processes - including SPP - categorize origin countries into broader groups based on the perceived risk of fraud associated with student migration.¹⁵

From a policy perspective, it is therefore interesting to understand how the impact of a new visa stream on international student enrollment depends on the share of bona fide applicants at origin. Recall that $\Delta(s, I) = s(\rho(s, I) - \rho(s, \underline{I}))$, from which we obtain $\frac{\Delta(s, I)}{ds} = \frac{d\rho(s, I)}{dI} + s \frac{d^2\rho(s, I)}{dI ds}$. The first term of this expression $\frac{d\rho(s, I)}{dI}$ is positive and captures the increase in the extensive margin, i.e the additional share of genuine students able to signal their type and obtain a study permit through the new visa stream, when s increases. The second term $s \frac{d^2\rho(s, I)}{dI ds}$ is negative and captures the decrease in the intensive margin, i.e the lower signalling value of additional information ($\frac{d^2\rho(s, I)}{dI ds} < 0$), when s increases.

Turning our attention to SPP, we can now investigate how student enrollment changed in India and China after the introduction of the reform. While we are not able to directly observe the share s_i and s_c of bona fide applicants from India and China, respectively, around the time SPP was implemented, we have information on visa approval rates, which can be regarded as a proxy for the rates $\rho(s_i, \underline{I})$ and $\rho(s_c, \underline{I})$ at which visa officers accepted applications through the regular stream prior to the reform. Approval rates for college-bound applicants from India and China differed markedly during the year that preceded the introduction of the SPP stream in these countries. In India, only 34% of applicants had their study permit approved by Canadian immigration services in 2008. In contrast, this rate stood at 66% in China in 2009.¹⁶ Because $\rho(s_i, \underline{I}) < \rho(s_c, \underline{I})$, it comes immedi-

¹⁵There are multiple reasons for this. First, crafting customized visa procedures for each country would require extensive resources to verify documents, conduct background checks, and assess the authenticity of information. At the same time, countries facing common challenges like fraudulent documents, identity theft, or visa overstays can be treated uniformly, streamlining the process of identifying potential fraud. Second, individualized visa processes might lead to diplomatic tensions if countries perceive their citizens as being disproportionately targeted. Categorization helps mitigate this by treating countries with similar migration risk profiles in a consistent manner, reducing the likelihood of diplomatic strains. Information sharing across countries and the prevention of fraudulent patterns can also explain why destination countries prefer to categorize countries based on risk profiles.

¹⁶Several reasons can explain relatively higher approval rates for Chinese students. First, changes in the Chinese visa licensing for prospective students made studying abroad considerably easier for self-funded

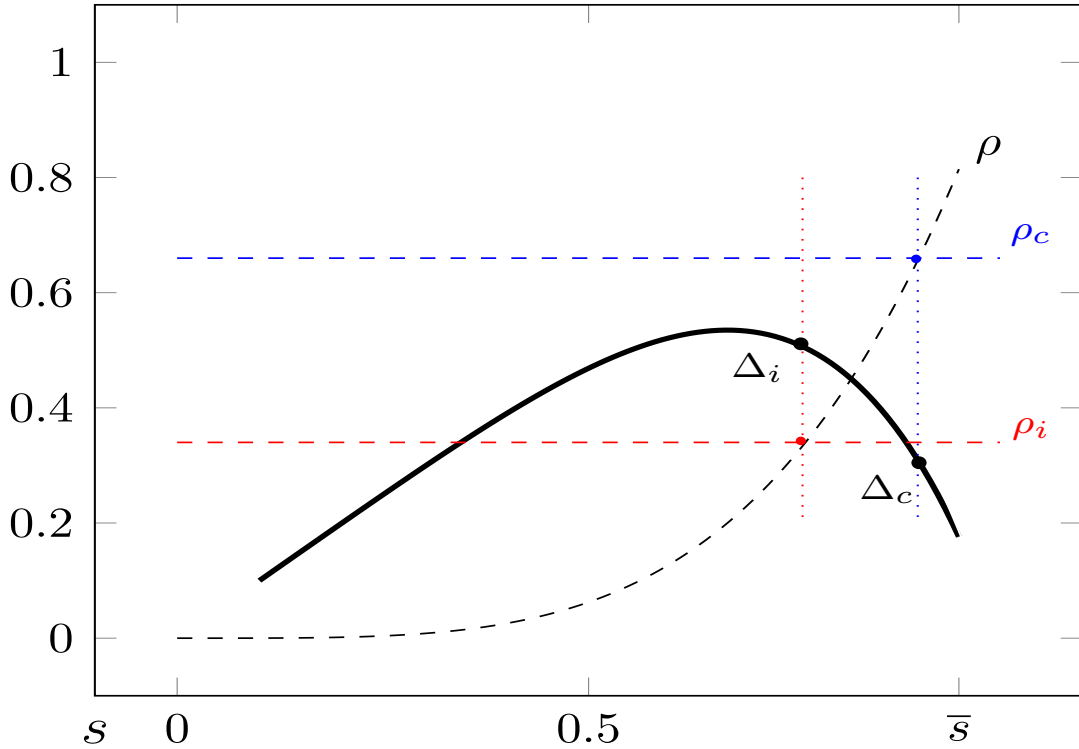
ately that $s_i < s_c$ - officers' prior about the share of bona fide applicants was lower in India than in China, and the impact of the policy on the extensive and intensive margins should be respectively more positive and more negative in China than in India. At the same time, $s_i < s_c$ gives us $\frac{d\rho(s_i, I)}{dI} > \frac{d\rho(s_c, I)}{dI}$ - the value of additional information for visa officers was larger when reviewing the application of Indian students. The aggregate effect of SPP on enrollment was therefore greater in India if its impact on approval rates was significantly larger in India than in China: $\frac{d\rho(s_i, I)}{dI} > \frac{s_c}{s_i} \frac{d\rho(s_c, I)}{dI}$.

Suppose $\rho(s, I) = s^{a-I}$, with $a > 1$, $\underline{I} = 0$ and $\bar{I} = a$, and let I_{spp} denote the level of information required from SPP applicants. Figure 2 below represents the approval rate in the regular visa stream $\rho(s, 0)$ and the corresponding change in student enrollment after SPP was introduced $\Delta(s, I_{spp})$ as a function of s , where we have set the level of information about applicants in the SPP stream $I_{spp} = a$ (such that the SPP visa stream allowed applicants to be granted study visas with probability 1) and $a = 4$ for graphical purposes.¹⁷ The red and blue dashed lines correspond to the approval rates of Indian and Chinese students in the regular stream, respectively, $\rho_i = 0,34$ and $\rho_c = 0,66$, from which we obtain the effect of SPP on student enrollment, represented by points Δ_i and Δ_c .

Chinese students at the end of the 1990s, whose number substantially increased from 1999 (see Machin and Murphy (2017) for a discussion). In addition, many Chinese students rely on consulting agencies to build their application. These professional third-parties plausibly led to higher approval rates for Chinese students because of their role in providing clearer and more accurate information to visa officers.

¹⁷Our simulations show that relaxing these assumptions and using different parameter values for a and $I_{spp} < 1$ would leave our analytical conclusions virtually unchanged. $\bar{s} \in [0, 1)$ corresponds to the threshold value s defined implicitly by $b(\rho(\bar{s}, I_{spp}) - \rho(\bar{s}, 0)) = c(I)$ and above which the the participation constraint of applicants is binding and they no longer choose to enter the SPP stream.

Figure 2: Enrollment response function



Based on this simulation, we expect that the SPP visa stream was more successful at increasing international student enrollment in India than in China ($\Delta_i > \Delta_c$). Incidentally, this implies it had a significantly larger impact on the approval rates of prospective applicants from India ($\frac{d\rho(s_i, I)}{dI} \gg \frac{d\rho(s_c, I)}{dI}$).

In the next section of the paper, we evaluate empirically the causal impact of SPP on international student enrollment and approval rates, and check whether this effect varied across India, China, and Vietnam, where the average study visa approval rate stood at 45% before the SPP roll out in 2016. Before we do, it is important to recognize that we only model here part of the supply side of international students' decision and that the consequences of SPP on enrollment could also be moderated by other supply and demand side factors. For instance, the reform could have led to unintended effects whereby the composition and volume of applications changed after the opening of the SPP stream. In particular, it is possible that prospective students who were not considering applying

to SPP colleges before the reform chose to do so after it was implemented, leading to cross-institution substitution as well as larger spillover effects driven by an increase in the attractiveness of treated colleges with respect to other institutions in Canada and abroad. On the demand side, we are also unable to assess the extent to which institutions met or adjusted their international student quotas before and in reaction to the reform, with potential direct implications for international enrollment. Although these effects are not captured by the model, our empirical analysis examines possible substitution biases and investigates various supply-side channels driving the effect of SPP.

5 Data, Methodology and Descriptive Evidence

This section presents the data and the methodology used to estimate the causal impact of the SPP reform on foreign student enrollment in Canadian colleges.

5.1 Data

The key dependent variable used in the empirical analysis is the number of international students enrolled in a given year at Canadian institutions from a specific country of origin over the period 2003-2017. The main source of data is the Post-Secondary Student Information System (PSIS) from the Canadian National Statistical Office (Statistics Canada), which contains detailed information on enrollment and graduates of Canadian public post-secondary institutions. Enrollment counts are based on the number of students enrolled at a given institution in the fall - the exact date varying across institutions between September 30 and December 1.¹⁸ For some institutions, enrollment data is missing from the PSIS data set and we choose to replace them with the number of approved study permit applications, also obtained from IRCC. We discuss the potential implications of this

¹⁸During the time period under investigation (2003 - 2017), a handful of colleges, both treated and non-treated, merged or split from their parent institution. When this happened, we have recreated panel data for the whole period by summing enrollment counts across merged institutions. Missing data for a maximum of 2 consecutive years were handled using linear interpolation.

choice in section 7.1.2 and Table 15 of the Appendix.¹⁹ Information about institutions participating in SPP has been collected from CICan and online archives of the Canadian Government.²⁰ The list of participating institutions and date of entry into the program can be found in Tables 10 and 11, and 12. The baseline sample includes international students from 195 countries of origin that are listed in Table 14.

5.2 Methodology and Design

Correctly estimating the impact of the reform on international student enrollment is challenging, not least because SPP is one of several policies implemented simultaneously by the Canadian government to attract foreign talents at the time of the reform.²¹

Our identification strategy relies on a triple difference design taking advantage of the implementation of the SPP reform for a selected group of treated institutions and eligible nationalities. In this context, we deem the triple-difference approach as superior with respect to a standard diff-in-diff design with only two dimensions of variation in the treatment that is commonly employed in the literature (e.g. Arenas (2021), Amuedo-Dorantes et al. (2019)). Specifically, the triple-difference method eliminates all potential institution and origin specific confounding factors that are either endogenous or cannot be easily controlled for in a double-diff model because data are not readily available (Berck

¹⁹Applications data were used for the following institutions: Booth University College, Columbia College, Canadore College, Cambrian College, Centennial College, Conestoga College, Confederation College, Douglas College, Georgian College, Lambton College, Loyalist College, Mohawk College, Red River College, Sault College, St. Lawrence College, University College of the North.

²⁰Source: www.canadainternational.gc.ca, accessed in September 2021. These archived web pages contain the list of SPP institutions in China and India for every year since the launch of the pilot program in 2008. Data about the CES program (SPP equivalent) in Vietnam was obtained directly from CICan. The final list of SPP institutions for all three nationalities has been reviewed and approved by CICAN officials.

²¹In 2008, the Canada Experience Class stream allowed skilled foreign workers or foreign graduates of Canadian higher education institutions to apply for permanent residency without having to leave the country. At the same time, IRCC extended the Post-Graduation Work Permit (PGWP) rules for international students who want to work in Canada after graduation to three years and eliminated the requirement for job offer or offer of employment in a particular field of study. In 2015, the Express Entry system was launched in order to improve the management of Canadian permanent residence applications for filling labour gaps.

and Villas-Boas (2016), Olden and Møen (2022)). In the empirical setup, we therefore fit a model exploiting all three dimensions of variation in the data, namely post-secondary institution j , country of origin of students i and time t . The model takes the following form:

$$N_{ijt} = \exp[\alpha_{jt} + \alpha_{it} + \alpha_{ji} + \beta Pol_{ijt} + e_{ijt}] \quad (3)$$

where N_{ijt} is the number of students enrolled in post-secondary institution j from country i in year t . Pol_{ijt} is the treatment indicator. It takes the value of 1 when foreign students of nationality i – namely India, China and Vietnam - are enrolled in a post-secondary institution j where a dedicated SPP visa stream is opened as of year t , and 0 otherwise. Recall that the SDS, a visa stream similar to SPP, was implemented as a pilot program in China in 2015 (see section 3.1). For this reason, we consider that the SPP stream effectively available ($Pol = 1$) to Chinese students enrolled at any post-secondary institution from 2015 onward.²² α_{jt} , α_{it} and α_{ji} are institution-year, origin-year and institution-origin high-dimensional fixed effects, respectively. These cross fixed effects capture all the unobserved factors that may confound the impact of SPP on student enrollment and enable to better identify our parameter of interest β . All institution specific characteristics such as size, tuition fees, cost of living, quality and language (English or French) potentially related to the enrollment of foreign students are absorbed by the α_{jt} term; all the dyadic pre-existing specific connections - such as exchange programs - between Canadian colleges and students' country of origin are captured by institution-origin pair dummies α_{ji} , while origin-year fixed effects α_{it} account for every factor at the origin, such as quality of education, living conditions, business cycle. To account for serial correlation in student migration decisions within college-origin dyads, standard errors are clustered

²²In a robustness test (Table 16), we restrict our sample to the period prior to 2015 where only a fraction of institutions were participating in SPP for Chinese students. The results are in line with our baseline estimates.

at college-origin pair level. Equation 3 can be seen as the equivalent of a structural (or 3-way) gravity model with high dimensional fixed effects applied to international student mobility (see for instance Larch et al. (2019), Ragot and Beine (2022) and Beine et al. (2014)). In line with existing applications of the gravity model of migration (e.g. Beine et al. (2014), Beine et al. (2020) and Beine and Parsons (2015)), we estimate Equation 3 using Poisson Pseudo-Maximum Likelihood (PPML). The choice of using PPML as our preferred estimator is justified by two main considerations. First, the share of zeros in our dependent variable is approximately 63% in the baseline model, which is definitely large enough to bias the results of standard log-linear fixed effect models (see Silva and Tenreyro (2006) and Silva and Tenreyro (2011)). Second, PPML remains consistent in presence of heteroscedasticity and does not require statistical independence of the error term.²³

Causal inference in a difference-in-difference exercise requires that the control group represents an appropriate counterfactual for international student enrollment in the absence of SPP. More specifically, it must be that control, non-treated institutions are sufficiently similar to colleges where SPP was implemented. Against this backdrop, we include in our baseline counterfactual all post-secondary Canadian colleges or institutes that did not participate in the SPP program but whose educational provision is similar to that of treated community colleges. These institutions, both CICan and non-CICan members, include Canadian Community Colleges, University Colleges, Cégeps, and Institutes of Technology (Polytechnics) offering applied learning, research programs and diplomas. In order to obtain a suitable control group that can be matched against treated institutions in terms of size and student composition, we also include international enrollment at Canadian

²³In a simulation exercise Ciani and Fisher (2019) showed that in a difference-in-differences setting with a continuous outcome it is preferable to estimate a Poisson Pseudo Maximum Likelihood over running OLS on the log-linearised model because the former does not require statistical independence of the error term. As a robustness test in Table 17 in the Appendix we estimate the baseline model with OLS - by (i) first excluding the zeros and (ii) then by specifying the dependent variable specified in Inverse Hyperbolic Sine (IHS) to deal with the zero values - and found similar estimates in line with the conclusions of this paper.

universities in programs of study that are comparable to community college education. More specifically, we include post-secondary undergraduate international enrollment (i.e. lower than the Masters degree) at Canadian universities that rank lower than 800 or are absent from the Shanghai worldwide ranking of Universities.²⁴ This ranking criterion is meant to account for the fact that Canadian community colleges are not internationally renowned, and therefore attract foreign students for specific educational purposes that are most likely independent from their international reputation. By the same token, they also charge lower tuition fees, similar to those of community colleges. What's more, the implementation of the Study Direct Stream in 2018 suggests that Canadian universities could be regarded as comparable institutions with what regards visa policy, since the Canadian Government deemed the benefits of SPP worth extending to all post-secondary institutions receiving foreign students in Canada (see section 3.1). Finally, we exclude French-speaking only institutions, which are unlikely to appeal to international students from India or China. For similar reasons, we do not consider institutions whose programs of study focus exclusively on one of the following activities: Religion, dance, music, and circus.²⁵ Because Chinese, Indian and Vietnamese students together represent the majority of international enrollment at Canadian post-secondary institutions, our counterfactual includes all foreign students who did not benefit from SPP in order to build a control group with enough observations and properly estimate the difference in enrollment trends. The list of control institutions and countries of origin can be found in Tables 13 and 14.

In the robustness section of the paper (section 6.2), we also address several limitations of our baseline control group.

First, one may be concerned about the validity of this counterfactual to the extent that Indian, Chinese, or even Vietnamese students are not directly comparable to students

²⁴Source: www.shanghairanking.com.

²⁵As expected the inclusion of those institutions in the control group does not affect the baseline estimates. The results are not reported in the paper and are available upon request.

from all other countries. We therefore test our results using foreign students from non-OECD countries as an alternative control group. These students are closer substitutes to Indian, Chinese and Vietnamese students to the extent that they are likely to meet similar economic conditions influencing their migration decision at origin and are also more likely to be regarded as posing a risk of misrepresentation by Canadian visa officers. In addition, we propose in Appendix difference-in-difference model to capture the nationality-specific difference in enrollment between treated and non-treated institutions.

Second, because a significant share of control institutions are a close substitute to community colleges that participated in SPP, there is a risk that the treatment effect is biased upwards if SPP induced potential students to apply to - and subsequently enroll at - SPP instead of non-SPP institutions. This substitution effect would artificially increase our estimates of the impact of the SPP reform on international student enrollment. To assess the scope of the substitution bias, we split the control group between community colleges on the one hand and universities, which are less prone to substitution, on the other hand. Third, concerns about selection into the program could cast doubts about the validity of the analysis. In particular, because SPP was initially designed to help institutions recruit students from specific countries, there is a risk that treated and control institutions faced different incentives to join the program. To test the sensitivity of our results to a possible selection bias, we use propensity score matching and experiment with a different specification where we augment model (3) by adding lagged approval rates as a control variable. It is worth stressing however that the inclusion of universities in the baseline control group should already mitigate these concerns. Indeed, because only community colleges were lawfully eligible to participate in SPP, the risk of selection bias is limited as a significant share of institutions in the control group were barred from joining SPP for institutional reasons.

5.3 Descriptive Evidence

In the triple-difference model outlined in Equation 3, we exploit the fact that a number of college institutions gradually joined SPP over time. The difference-in-difference set up usually requires a parallel trend assumption for the estimated effect to have a causal interpretation. Even though the triple difference estimator is the difference between two difference-in-differences, it does not actually require parallel trend assumptions on both dimensions of heterogeneity (see Olden and Møen (2022)). Rather, it requires the relative outcome of non-eligible and eligible origins within the treatment group (in our context, institutions) to trend in the same way as the relative outcome in the control group, in the absence of treatment. In other words, the crucial assumption for a causal interpretation of β in Equation 3 is that student enrollment from both eligible and non-eligible origins follow a parallel trend within treated and non-treated institutions before SPP was introduced, i.e. in the absence of policy change.

Figure 3 compares the trend over time of yearly student enrollment for treated (left panel) and non-treated institutions between eligible and non-eligible origins. In the period before the SPP reform – prior to the introduction of the Pilot program when most treated college institutions joined SPP - there were no visible differences in the enrollment trends across nationalities within treated and non-treated institutions. After 2009 when the reform kicked in - once SPP was officially introduced -, we observe a substantial increase in student enrollment for treated nationalities relative to non-treated nationalities, which occurs exclusively at treated institutions, while the parallel trend in student enrollment between SPP and non-SPP nationalities remains substantially unchanged in the absence of the treatment. In support of the underlying assumptions of the Triple-Diff model estimated for each treated origin, Figure 4 shows the parallel trends for Indian, Chinese and Vietnamese students, comparing the trends over time between the single eligible nationality with non-treated origins within treated and non-treated institutions. There

seems to be a clear diverging trend after the policy was introduced for Indian students within institutions participating in SPP, and no evidence of a significant impact of the reform for the Chinese counterparts.

6 Assessing the Impact of SPP on International Student Enrollment

6.1 Main results

Table 1 reports Poisson Pseudo Maximum Likelihood (PPML) triple-difference estimates for Equation 3. The coefficient in Column 1 indicates that - on average - the student partnership program (SPP) increased the enrollment of foreign students by 33,4% ($e^{0.288} - 1$). In other words, absent the reform, international enrollment of Indian, Chinese, and Vietnamese students at treated institutions would have been 33,4% lower than what it was after the reform during the years covered in our analysis. As emphasized in the theoretical framework (Section 4.2), we expect that the aggregate point estimate hides some heterogeneity in treatment effect across nationalities. Columns (2-4) of Table 1 show the result of the triple-diff model of Equation 3 estimated separately for each treated nationality. In line with our prediction, we find that the effect of the program decreases with the pre-reform approval rates. While SPP was very effective among Indian and Vietnamese students - for whom the approval rate in the pre-reform years stood at 34 and 45 % -, increasing enrollment by respectively 105% and 74%, it had virtually no impact on Chinese students, whose study visa approval rate prior to the SPP rollout was significantly higher (66 %). For the latter, the estimated coefficient approaches statistical significance at conventional levels but remains small in magnitude (8 %). In what follows, we propose a series of robustness tests assessing the validity of the identification strategy and the degree to which these results can be interpreted as causal. We also provide greater

insights into the mechanisms driving the aggregate effect as well as the heterogeneity in our results.

6.2 Identification and Robustness Tests

A first possible concern regards the possibility of pre-existing differential trends in international student enrollments in treated relative to non-treated institutions driving the results. To gauge if that is the case, we conduct an event study analysis for international students. Because of the staggered implementation of SPP and the fact that institutions participating in the program were different across eligible nationalities, we run this analysis separately for each treated nationality. We include up to 5 years prior and 7 years post each SPP reform, except for Vietnam, for which the CES (SPP equivalent for Vietnamese students) ran from 2016 onwards. Coefficients are measured relative to one year prior to the introduction of the reform. We include institution and year fixed effects. Figure 5 plots the estimated coefficients, along with the corresponding 95% confidence intervals. We find evidence of generally higher international student enrollments of Indian and Vietnamese students after the SPP reforms, but not before. Moreover, international enrollment of Chinese students is not distinguishable from zero after to the introduction of SPP. These results suggest that our findings are not subject to pre-existing differential trends in enrollment before the implementation of the program.

Next, we check that our baseline point estimates are not sensitive to restricting the control group of international students. As outlined previously, we focus our attention on foreign students from non-OECD countries, which can be regarded as closer substitutes to Indian, Chinese and Vietnamese students than those born in high-income countries. Moreover, the list of countries currently eligible to the Study Direct Stream program suggests that concerns regarding visa applications are mostly salient for non-OECD countries.²⁶ Results

²⁶The Study Direct Stream is an expedited study permit processing program for international students who are applying to study in Canada at a post-secondary institution (DLI). It replaced SPP in 2018. As

are presented in Table 2. The aggregate and nationality specific point estimates are very close to the baseline in both magnitude and statistical significance. Although now significant at the conventional level, the coefficient for China remains small in magnitude as compared to other treated nationalities. We can therefore safely conclude that our results are robust to restricting control nationalities to non-OECD students.

To address concerns about a possible substitution effect between control institutions - especially community colleges - and treated institutions, we compare the results of our baseline using either community colleges or universities as control institutions. Within the control group, universities can be regarded as somewhat less prone to substitution insofar as they do not offer typical "*college*" education. By the same token, they are less likely to suffer from substitution of students opting out to enroll at SPP institutions. This comparison therefore allows us to assess the extent to which our baseline coefficients capture net growth in international enrollment as opposed to students switching from non-SPP to SPP institutions, who would represent a substitution rather than an actual increase in enrollment and bias our estimates upwards. Columns 1 to 4 of Table 3 capture to what extent our main results depend on using only colleges as control institutions. The aggregate coefficient is hardly sensitive to restricting the control group (0.311 VS 0.288), and country-specific estimates remain very close to the baseline presented in Table 1. More importantly, these coefficients are very similar to the one presented in columns 5 to 8, which estimate model (3) using universities as the control group.²⁷ The substitution bias therefore appears to be very limited, from which we conclude that the SPP reform had an actual, positive impact on the net growth in the number of eligible students enrolled at Canadian community colleges.

of 2023, it offers a special visa pathway to students from Antigua and Barbuda, Brazil, China, Colombia, Costa Rica, India, Morocco, Pakistan, Peru, Philippines, Senegal, Saint Vincent and the Grenadines, Trinidad and Tobago, Vietnam.

²⁷This statement should be nuanced for India, where the coefficient obtained using colleges as counterfactual is 0.626 as compared to 0.81 with the universities. That said, the point estimate is smaller with the former as opposed to larger, as we would expect if coefficients were seriously affected by a substitution bias.

We now address possible concerns regarding selection into SPP. As argued previously, the risk of endogeneity is limited by the inclusion of universities which were barred from joining SPP on institutional grounds. That said, because the SPP program hoped to lift visa officers' doubts about the intentions of foreign applicants who wanted to study at community college in Canada, there is a possibility that participating institutions were selected based on their willingness to attract students from treated origins and the barriers they faced to do so.²⁸ Using propensity score matching, we create an alternative control group that accounts for a possible bias along this dimension. For each institution, we capture willingness to recruit students eligible to SPP through the share those students represent in total international enrollment and proxy their ability to do so using study visa approval rates prior to the reform. Because the participation of institutions in SPP is origin-specific, with many colleges only participating in the program for a single nationality (see Tables 10, 11, and 12), we run separate regressions for each of the three treated countries of origin. We use the share of treated students in total international enrollment and the approval rates during the three years leading up to the reform (2006-2008 for India, 2007-2009 for China and 2013-2015 for Vietnam) as matching variables. Our results are presented in Table 4. Because of the scarcity of data on visa applications, the sample size used for the PSM analysis is significantly smaller (about 50 %) than the baseline control group. We therefore provide unweighted estimates obtained from running model (3) with the resulting sample in column (1), (3), and (5) for each nationality. Our results indicate that correcting for possible selection into the treatment does not change

²⁸Other policy reforms that potentially acted as a pull factor for international students took place roughly at the same time SPP was introduced, but their implementation did not affect neither treated nor control groups of our quasi-experimental design. Specifically, in April 2008 changes were made to Post-Graduation Work Permit (PGWP) that allowed recent graduates to obtain an open work permit in Canada for up to 3 three years (depending on length of their program of study) with no restrictions on the location of study or requirement of a job offer. Furthermore, Canada introduced Express Entry in 2015, a measure that awarded international students completing recognized degrees and diplomas in Canada extra points in their Canadian permanent residency applications. Both reforms applied indiscriminately to all tertiary education institutions in Canada and to every student foreign nationality. To further corroborate the absence of selection bias coming from other policy reforms, Table 16 in the Appendix shows the estimates of the baseline model until 2014, prior to the introduction of Express Entry. The statistics substantiate the baseline results, which we find reassuring.

our coefficients of interest, neither in magnitude nor statistical significance, for any of the treated origin country.

To further address potential selection issues, we use one-year lagged, institution-origin specific approval rates as an additional covariate. As pointed out in Olden and Møen (2022), including variables driving selection into treatment as controls in a triple difference framework rises the precision of the causal effect under scrutiny because it lowers the residual variance and accounts for compositional differences across groups, making the parallel trend assumption more credible. In our setting, the inclusion of pre-treatment bilateral (institution-origin) approval rates would therefore mitigate the role of selection in the identification strategy. Such inclusion, however, substantially reduces the statistical power of our model: Applications data is available for only a fraction of institutions and also suffer from a break in series in 2014, which forces us to restrict the analysis between 2003 and 2013. Incidentally, Vietnam is not included as the reform took place after 2013 in this country. That said, the estimates reported in Column (2) and (3) of Table 5 suggest that the model is well specified: They show that the coefficients are close to the baseline and very stable across specifications with and without the inclusion of approval rates as a control variable. Also, the impact of the reform is only significant for Indian students when disaggregating across treated nationalities (Column 4-5).

Finally, we carry out a placebo test. Table 6 shows the triple diff estimates of Equation 3 using the baseline specification on naturalized Canadian students born outside of Canada. If the effect of the SPP reform on international student enrollment was indeed channeled through the benefits of the new visa stream, it should not affect the enrollment of students with Canadian nationality. As expected, the coefficients of interest are all negligible in magnitude and statistically not significant. More importantly, this finding applies irrespective of the treated nationality under scrutiny - which substantiates the causal interpretation of our benchmark results.

Further robustness tests experimenting with different time periods and alternative estimators are presented in the Appendix.

6.3 Mechanisms

Our main findings indicate that SPP had a significant and positive impact on international student enrollment. In this section, we look into the supply-side mechanisms driving this result. We present in Table 7 the results of model 3 using the number of student visa applications and the approval rate of student visa applications as dependent variables. The first column of each panel reports the baseline estimates for total student enrollment when limiting the analysis to the pre-2014 years.²⁹

The objective of the SPP visa stream was to provide greater information about the intentions of prospective applicants, thereby increasing the approval rate and enrollment of Indian students at community colleges in Canada. On aggregate, we find that the program effectively worked by increasing the rate at which visa applications were approved, as illustrated by the positive and significant coefficient in column 2. Further, the effect of SPP on approval rates is only visible in India (column 6), while no effect is visible for Chinese students (column 9). This result is in line with the theoretical prediction of Section 3 based on pre-reform approval rates that the effect of SPP on enrollment should be greater in India than in China because it had a much larger impact on the approval rates of Indian applicants. However, the null effect on Chinese students remains puzzling. In fact, it is possible that other confounding factors outside of our theoretical framework are driving the aggregate effect of SPP. First, many Chinese students rely on visa consulting services to build their visa applications. In the regular stream, these third-party intermediaries help applicants provide clearer and more accurate information, which may be comparable to the level of information required in the SPP visa stream. If SPP conveyed

²⁹As indicated in the previous section, we are forced to limit any analysis involving a comprehensive use of applications data to the 2003-2014 period.

little additional information to visa officers about Chinese applicants, this could explain why the reform failed to have an effect on approval rates. Also, it is possible that the SPP take-up was slower or limited in China, as a result of administrative hurdles related to the provision of the Guaranteed Investment Certificate and additional language tests. By the same token, a last possibility is that the participation constraint of prospective applicants, as modelled in Section 3, was not met for a significant share of applicants in China, who then preferred to keep using the regular stream.³⁰

Perhaps more surprisingly, we also find that SPP increased the volume of applications at colleges participating in the program, which can be regarded as a positive spillover of the reform. A plausible mechanism behind this result is the increase in the relative benefit that prospective students derived from applying to participating institutions. Indeed, by lowering processing times and increasing the likelihood of obtaining a visa, SPP reduced the cost of applying to colleges participating in the program for international students and therefore made them more likely pick a SPP-eligible college over an alternative institution. We find that this channel only operates for Indian students (column 5), for whom those benefits were more likely to materialize, while the reform had no effect on the applications from Chinese students to institutions that participated in SPP (column 8). It is worth stressing that similar outcomes have been documented in the recent literature, where random utility models (RUMs) are sometimes used to understand how the change in expected utility from improved economic outcomes and higher chances of success at destination affect international student enrollment (see for instance Amuedo-Dorantes et al. (2019)).

³⁰Unfortunately, data on the proportion of applicants using the SPP as opposed to the traditional visa stream are not available before 2015, which prevents us from investigating in greater details the take-up ratio of the program.

6.4 Crowding-out

Finally, we explore the crowding-out of domestic students by international students at Canadian community colleges around the time the reform was implemented. Our econometric specification focuses on the institution-year dimension of the data.

We first regress the share of domestic students on the total number of foreign students:

$$\ln \left(\frac{N_{jt}^{(i=Can)}}{\sum_{i=1}^I N_{jt}^{(i)}} \right) = \alpha_j + \alpha_{pt} + \delta \ln \sum_{i=1}^{i \neq Can} N_{jt}^{(i)} + e_{jt}^{(i)} \quad (4)$$

where the term α_j accounts for institution fixed-effect and α_{pt} refers to province - year fixed effects controlling for unobservable province-specific characteristics that might affect students' decision to apply to colleges in a particular geographical area.

It is also possible that both domestic and foreign students' decision to enroll is influenced by time-varying institution characteristics that we fail to observe because of lack of available data, such as their size, the quality of infrastructures, connections to local businesses or the variety of academic programs. This, in turn, could result in an omitted variable bias, which we address using an instrumental variable strategy. More specifically, we leverage the introduction of SPP as an instrument for the number of foreign students. The validity of SPP as a powerful instrument is supported by the results showed so far in this paper. First, the benchmark estimates of Equation 3 suggest that the instrument should be strong enough since SPP is positively associated with the volume of (eligible) foreign students. As expected, the KP-F Statistic is well above conventional levels (see Table 8), which points to the validity of SPP as an instrument to predict the number of foreign students in Equation 4. Moreover, the reduced form test reported in Column (5-6) suggests that the reform is correlated with the share of domestic students, but only through its effect on the volume of international students.

The estimates reported in Column (1-4) of Table 8 reveal a significant negative relationship between changes in the volume of international students and the share of Canadian students enrolled at community colleges. Taking our preferred IV estimates at face value, a 10% increase in the volume of international students at Canadian community colleges leads to a 0.6% reduction in the share of domestic students over the total number of enrollments.³¹ In a context of Canadian community colleges, this finding can be explained by either (i) a crowding out effect on domestic students, or (ii) the growth rate of foreign enrollment that simply outpaces that of Canadian students.

We therefore take a closer look at the substitution between domestic and international students. First, we run model 4 using the number rather the share of domestic students as a dependent variable - where the introduction of SPP serves again as an instrument for the independent variable $\sum_{i=1}^{i \neq Can} N$. The results reported in Table 9 indicate that greater inflows of foreign students generally do not affect the number of domestic students, pointing towards (ii). To further explore this alternative, we look at the substitution between foreign students eligible to the SPP stream and those coming from non-eligible countries, using model 4 to regress the number of students from non-eligible countries on the total number of students from India, China and Vietnam. Our findings in Table 9 suggest that while higher enrollment of foreign students generally did not affect the number of domestic students, inflows of students from SPP eligible origin countries crowded-in students from other, non-treated countries. More precisely, the IV estimates indicate that a 10% increase in the volume of treated students is associated with a 3.5% rise in the number of students from non eligible nationalities. In line with existing studies (Shih (2017) and Machin and Murphy (2017)), a possible interpretation of this crowding-in effect is that

³¹The introduction of SDS in 2015 made all Canadian post-secondary institutions eligible to the program as far as Chinese students were concerned. In practical terms, this doesn't affect the validity of SPP as an instrument of foreign students. As a further robustness test we restrict the sample to the pre-2015 period; the results - available upon request - still point to a negative effect.

inflows of SPP-eligible students led to additional tuition revenues which were used by colleges to expand their capacity and enroll additional international students.

7 Conclusion

In the context of growing demand for global education, international student mobility is a key factor of success for OECD countries' plan to attract highly skilled workers. While the recent economic literature documents the role of foreign students' transition into the labour market, human capital portability, economic conditions, geographical distance or university quality as drivers of international student mobility, this paper focuses on the effect of information frictions in the processing of student visa applications. Understanding to what extent and under which circumstances correcting those frictions can improve international student mobility is an important policy question that has received little attention in the literature so far. It is also interesting from an economic perspective because it engages with informational asymmetries which are a common feature of the economic literature but rarely, if ever, discussed in the context of immigration policy.

This article proposes a theoretical framework and an empirical analysis to quantify the effect of the Student Partners Program - a policy that gave visa applicants the opportunity to provide a more accurate signal of their financial and educational credentials - on international student enrollment at community colleges in Canada.

Our results show that introducing origin-specific requirements in visa application processes can help reduce statistical discrimination and has the potential to significantly increase international enrollment from countries where migration fraud is a major concern. We find that on average - across all three nationalities eligible to SPP - the reform increased enrollment of foreign students at institutions participating in the program by 33%. In line with the theoretical prediction of our model, our results further indicate that the

program was very successful among applicants who suffered from lower approval rates, respectively increasing the enrollment of Indian and Vietnamese students by 105% and 74%, but had no significant effect on their Chinese counterparts. Our findings also shed light on the mechanisms through which the SPP policy worked and the impact it had on non-treated students. Our investigation of the supply-side mechanisms suggest that the reform increased student enrollment through both the total number of applications processed by visa officers and the approval rates of these applications, suggesting that SPP was not only effective at removing immigration officers' bias and reduce statistical discrimination but also managed to increase the relative attractiveness of participating colleges with respect to non-treated comparable institutions. Finally, while inflows of international students did not reduce the number of domestic students, it slightly reduced the share of total enrollment they account for at Canadian community colleges domestic students, suggesting that foreign enrollment grew faster than domestic enrollment between 2003 and 2017. This growth was fueled by the crowding-in of international students from non-treated countries after the reform was implemented, perhaps encouraged by larger enrollment capacities financed by the additional tuition revenues from SPP students.

Whether or not the SPP and similar reforms have the potential to increase the average quality of international students lies beyond the scope of this paper but is an interesting avenue for future research. More generally, asymmetric information between prospective immigrants and national administrations arise at various stages of the migration process and represents a fundamental policy issue that scholars should see fit to address.

References

- Abbott, A. and Silles, M. (2016). Determinants of international student migration. *The World Economy*, 39(5):621–635.
- Amuedo-Dorantes, C., Furtado, D., and Xu, H. (2019). Opt policy changes and foreign born stem talent in the us. *Labour economics*, 61:101752.
- Amuedo-Dorantes, C., Shih, K., and Xu, H. (2020). International student enrollments and selectivity: Evidence from the optional practical training program.
- Antecol, H., Cobb-Clark, D. A., and Trejo, S. J. (2003). Immigration policy and the skills of immigrants to australia, canada, and the united states. *Journal of Human Resources*, 38(1):192–218.
- Arenas, A. (2021). Human capital portability and international student migration. *Journal of Economic Geography*, 21(2):195–229.
- Beine, M., Delogu, M., and Ragot, L. (2020). The role of fees in foreign education: evidence from italy. *Journal of Economic Geography*, 20(2):571–600.
- Beine, M., Noël, R., and Ragot, L. (2014). Determinants of the international mobility of students. *Economics of Education review*, 41:40–54.
- Beine, M. and Parsons, C. (2015). Climatic factors as determinants of international migration. *The Scandinavian Journal of Economics*, 117(2):723–767.
- Beine, M., Peri, G., and Raux, M. (2023). International college students’ impact on the us skilled labor supply. *Journal of Public Economics*, 223:104917.
- Berck, P. and Villas-Boas, S. B. (2016). A note on the triple difference in economic models. *Applied Economics Letters*, 23(4):239–242.

- Bertrand, M. and Mullainathan, S. (2004). Are emily and greg more employable than lakisha and jamal? a field experiment on labor market discrimination. *American economic review*, 94(4):991–1013.
- Bessey, D. (2012). International student migration to germany. *Empirical Economics*, 42:345–361.
- Bohren, J. A., Haggag, K., Imas, A., and Pope, D. G. (2019). Inaccurate statistical discrimination: An identification problem. Technical report, National Bureau of Economic Research.
- Borjas, G. J. (2007). do foreign students crowd out native students from graduate programs, v in science and the university, edited by ronald g. ehrenberg and paula e. stephan.
- Ciani, E. and Fisher, P. (2019). Dif-in-dif estimators of multiplicative treatment effects. *Journal of Econometric Methods*, 8(1).
- Dreher, A. and Poutvaara, P. (2008). Student flows and migration: An empirical analysis. *World Development*, 39:1294—1307.
- Dreher, A. and Poutvaara, P. (2011). Foreign students and migration to the united states. *World Development*, 39(8):1294–1307.
- Gopal, A. (2016). Visa and immigration trends: A comparative examination of international student mobility in canada, australia, the united kingdom, and the united states. *Strategic enrollment management quarterly*, 4(3):130–141.
- Hersch, J. (2008). Profiling the new immigrant worker: The effects of skin color and height. *Journal of Labor Economics*, 26(2):345–386.
- Hunt, J. (2011). Which immigrants are most innovative and entrepreneurial? distinctions by entry visa. *Journal of Labor Economics*, 29(3):417–457.

- Kato, T. and Sparber, C. (2013). Quotas and quality: The effect of h-1b visa restrictions on the pool of prospective undergraduate students from abroad. *Review of Economics and Statistics*, 95(1):109–126.
- Kerr, W. R. and Lincoln, W. F. (2010). The supply side of innovation: H-1b visa reforms and us ethnic invention. *Journal of Labor Economics*, 28(3):473–508.
- Lanati, M. and Thiele, R. (2020). International student flows from developing countries: do donors have an impact? *Economics of Education Review*, 77.
- Larch, M., Wanner, J., Yotov, Y. V., and Zylkin, T. (2019). Currency unions and trade: A ppml re-assessment with high-dimensional fixed effects. *Oxford Bulletin of Economics and Statistics*, 81(3):487–510.
- Machin, S. and Murphy, R. (2017). Paying out and crowding out? the globalization of higher education. *Journal of Economic Geography*, 17(5):1075–1110.
- Mayda, A. M., Ortega, F., Peri, G., Shih, K., and Sparber, C. (2018). The effect of the h-1b quota on the employment and selection of foreign-born labor. *European Economic Review*, 108:105–128.
- Olden, A. and Møen, J. (2022). The triple difference estimator. *The Econometrics Journal*, 25(3):531–553.
- Oreopoulos, P. (2011). Why do skilled immigrants struggle in the labor market? a field experiment with thirteen thousand resumes. *American Economic Journal: Economic Policy*, 3(4):148–171.
- Perkins, R. and Neumayer, E. (2014). Geographies of educational mobilities: Exploring the uneven flows of international students. *The Geographical Journal*, 180(3):246–259.
- Ragot, L. and Beine, M. (2022). Assessing the role of immigration policies for foreign students: the case of campus france.

- Ragot, L., Beine, M., Delogu, M., et al. (2017). Understanding the impact of tuition fees in foreign education: the case of the uk. Technical report, University of Paris Nanterre, EconomiX.
- Rissing, B. A. and Castilla, E. J. (2014). House of green cards: Statistical or preference-based inequality in the employment of foreign nationals. *American Sociological Review*, 79(6):1226–1255.
- Rosenzweig, M. R. (2008). Higher education and international migration in asia: Brain circulation. In *Annual World Bank conference on development economics*, pages 59–100. World Bank Washington, DC.
- Schaafsma, J. and Sweetman, A. (2001). Immigrant earnings: age at immigration matters. *Canadian journal of Economics*, pages 1066–1099.
- Shih, K. (2016). Labor market openness, h-1b visa policy, and the scale of international student enrollment in the united states. *Economic Inquiry*, 54(1):121–138.
- Shih, K. (2017). Do international students crowd-out or cross-subsidize americans in higher education? *Journal of Public Economics*, 156:170–184.
- Silva, J. S. and Tenreyro, S. (2006). The log of gravity. *The Review of Economics and statistics*, 88(4):641–658.
- Silva, J. S. and Tenreyro, S. (2011). Further simulation evidence on the performance of the poisson pseudo-maximum likelihood estimator. *Economics Letters*, 112(2):220–222.
- Stuen, E. T., Mobarak, A. M., and Maskus, K. E. (2012). Skilled immigration and innovation: evidence from enrolment fluctuations in us doctoral programmes. *The Economic Journal*, 122(565):1143–1176.

Table 1: Baseline Statistics

| | (1) | (2) | (3) | (4) |
|-------------------|--------------------|--------------------|------------------|--------------------|
| Estimator | PPML | PPML | PPML | PPML |
| Dep. Var. | N_{jit} | N_{jit} | N_{jit} | N_{jit} |
| Treated Origin(s) | All | India | China | Vietnam |
| Pol_{jit} | 0.288*** (3.67) | 0.717*** (3.38) | 0.0785 (1.43) | 0.552*** (3.49) |
| Inst×Year FE | ✓ | ✓ | ✓ | ✓ |
| Origin×Year FE | ✓ | ✓ | ✓ | ✓ |
| Inst×Origin FE | ✓ | ✓ | ✓ | ✓ |
| Obs | 101758 | 98878 | 99015 | 98568 |
| % Zeros | 62.6% | 63.5% | 63.3% | 63.7% |

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard Errors are clustered by Institution*Origin pairs. The sample covers the period 2003-2017. Table shows difference-in-differences-in-differences estimates of the impact of the SPP reform. The dependent variable is the total number of enrolled students in institution j from country of origin i at a given year t .

Table 2: Non-OECD Origin Countries as Control Group

| Control Group | (1) Non-OECD | (2) Non-OECD | (3) Non-OECD | (4) Non-OECD |
|-------------------|--------------------|--------------------|-------------------|--------------------|
| Estimator | PPML | PPML | PPML | PPML |
| Dep. Var. | N_{jit} | N_{jit} | N_{jit} | N_{jit} |
| Treated Origin(s) | All | India | China | Vietnam |
| Pol_{jit} | 0.335*** (4.03) | 0.768*** (4.12) | 0.0987* (1.79) | 0.529*** (3.23) |
| Inst×Year FE | ✓ | ✓ | ✓ | ✓ |
| Origin×Year FE | ✓ | ✓ | ✓ | ✓ |
| Inst×Origin FE | ✓ | ✓ | ✓ | ✓ |
| Obs | 77065 | 74056 | 74346 | 73773 |

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard Errors are clustered by Institution*Origin pairs. The sample covers the period 2003-2017. Table shows difference-in-differences-in-differences estimates of the impact of the SPP reform on foreign student enrollment by removing OECD origin countries from the control group. The list of OECD countries include countries that were OECD members before the SPP reform started.

Table 3: Substitution effect

| Control Group | (1) Colleges | (2) Colleges | (3) Colleges | (4) Colleges | (5) Univ. | (6) Univ. | (7) Univ. | (8) Univ. |
|-------------------|--------------------|--------------------|------------------|--------------------|--------------------|--------------------|------------------|--------------------|
| Estimator | PPML | PPML | PPML | PPML | PPML | PPML | PPML | PPML |
| Dep. Var. | N_{jit} | N_{jit} | N_{jit} | N_{jit} | N_{jit} | N_{jit} | N_{jit} | N_{jit} |
| Treated Origin(s) | All | India | China | Vietnam | All | India | China | Vietnam |
| Pol_{jit} | 0.311*** (3.07) | 0.626*** (2.78) | 0.0588 (1.04) | 0.507*** (2.93) | 0.285*** (3.56) | 0.810*** (2.89) | 0.0869 (1.27) | 0.476*** (3.08) |
| Inst×Year FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Origin×Year FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Inst×Origin FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Obs | 72924 | 70905 | 70905 | 70635 | 91694 | 78697 | 77425 | 82960 |
| % Zeros | 62.7% | 62,14% | 63,4% | 63.7% | 61.7% | 62.9% | 62.5% | 62.4% |

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard Errors are clustered by Institution*Origin pairs. The sample covers the period 2003-2017. In Columns 1-4 the Reduced control group excludes lower-ranked Canadian Universities, whereas in Columns 5-8 only Universities (Univ.) are used as a counterfactual.

Table 4: Propensity score matching

| Estimator | (1) PPML | (2) PPML | (3) PPML | (4) PPML | (5) PPML | (6) PPML |
|-------------------|-------------------|-------------------|------------------|------------------|--------------------|--------------------|
| Treated Origin(s) | India | India | China | China | Vietnam | Vietnam |
| Model | DDD | DDD | DDD | DDD | DDD | DDD |
| Method | Unweighted | PSM | Unweighted | PSM | Unweighted | PSM |
| Dep. Var. | Enrollment | Enrollment | Enrollment | Enrollment | Enrollment | Enrollment |
| Pol_{jit} | 0.621** (2.57) | 0.652** (2.14) | 0.0717 (1.05) | 0.0784 (1.13) | 0.642*** (3.34) | 0.672*** (3.32) |
| Inst×Year FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Origin×Year FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Inst×Origin FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Obs | 50777 | 50544 | 50857 | 50513 | 50557 | 45150 |

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard Errors are clustered by Institution-Origin pairs. The sample covers the period 2003-2017. Columns (2,4,6) report the PSM weighted regression results on common support for each nationality. The PSM score is built using as matching variables the approval rate and the share of students in foreign enrollment averaged over the three years leading up to the treatment. Columns (1,3,5) report the corresponding unweighted regressions.

Table 5: (Lagged) Approval Rates as Additional Control

| Estimator | (1) PPML | (2) PPML | (3) PPML | (4) PPML | (5) PPML |
|------------------------------------|----------------------|--------------------|----------------------|----------------------|----------------------|
| Treated Origin(s) | All | All | All | India | China |
| Model | DDD | DDD | DDD | DDD | DDD |
| Dep. Var. | Enrollment | Enrollment | Enrollment | Enrollment | Enrollment |
| App. Rate _{<i>ji,t-1</i>} | 0.00239*** (4.67) | | 0.00240*** (4.72) | 0.00170*** (3.24) | 0.00152*** (3.33) |
| Pol _{<i>ji,t</i>} | | 0.356*** (2.92) | 0.356*** (2.95) | 0.990*** (4.52) | 0.160 (1.38) |
| Inst×Year FE | ✓ | ✓ | ✓ | ✓ | ✓ |
| Origin×Year FE | ✓ | ✓ | ✓ | ✓ | ✓ |
| Inst×Origin FE | ✓ | ✓ | ✓ | ✓ | ✓ |
| Obs | 12201 | 12201 | 12201 | 11401 | 11446 |

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard Errors are clustered by Institution-Origin pairs. The sample covers the period 2004-2013.

Table 6: Placebo Test

| | (1) | (2) | (3) | (4) |
|-------------------|------------------|------------------|------------------|-------------------|
| Estimator | PPML | PPML | PPML | PPML |
| Dep. Var. | N_{jit} | N_{jit} | N_{jit} | N_{jit} |
| Treated Origin(s) | All | India | China | Vietnam |
| Pol_{jit} | 0.0435 (0.92) | 0.0676 (0.92) | 0.0334 (0.57) | -0.167 (-0.94) |
| Inst×Year FE | ✓ | ✓ | ✓ | ✓ |
| Origin×Year FE | ✓ | ✓ | ✓ | ✓ |
| Inst×Origin FE | ✓ | ✓ | ✓ | ✓ |
| Obs | 48893 | 46947 | 47248 | 46710 |

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard Errors are clustered by Institution-Origin pairs. The sample covers the period 2003-2017. The dependent variable is the number of Canadian Students (with Canadian citizenship) born in countries other than Canada. The institutions for which we use approved applications data are excluded from the sample.

Table 7: Mechanisms - Applications

| Estimator | (1) PPML | (2) PPML | (3) PPML | (4) PPML | (5) PPML | (6) PPML | (7) PPML | (8) PPML | (9) PPML |
|--------------------------|-------------------|-------------------|--------------------|--------------------|--------------------|--------------------|------------------|------------------|-------------------|
| Treated Origin(s) | All | All | All | India | India | India | China | China | China |
| Model | DDD | DDD | DDD | DDD | DDD | DDD | DDD | DDD | DDD |
| Dep. Var. | Enrollment | App. Total | App. Rate | Enrollment | App. Total | App. Rate | Enrollment | App. Total | App. Rate |
| <i>Pol_{jit}</i> | 0.257** (2.05) | 0.279** (2.18) | 0.244*** (3.87) | 1.036*** (4.82) | 0.657*** (3.88) | 0.633*** (5.80) | 0.0161 (0.13) | -0.112 (0.99) | -0.0492 (0.87) |
| Inst×Year FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Origin×Year FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Inst×Origin FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Obs | 32533 | 42302 | 17039 | 31409 | 41131 | 16129 | 31408 | 41149 | 16175 |

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard Errors are clustered by Institution-origin pairs. In each regression the time span is reduced till 2013. In Columns (1-3) the dependent variables are the total number of enrolled students, the total number of college applications, the total number of approved applications, the approval rate calculated as the ratio of approved student visa applications over the total number of student visa applications, and the number of students enrolled, respectively. The Triple-Diff estimates are reported when using India and China as the only treated nationalities in Columns (4-6) and (7-9), respectively.

Table 8: Crowding-Out on Native Students - The Impact of Foreign Students on the Share of Natives

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|----------------------|----------------------|---------------------|---------------------|----------------------|----------------------|--------------------|
| Estimator | OLS | PPML | IV-2SLS | IV-PPML | OLS | PPML | OLS |
| Dep. Var. | Share Can Studs | Share Can Studs | Share Can Studs | Share Can Studs | Share Can Studs | Share Can Studs | Int. Studs |
| | | | | | Reduced Form Test | Reduced Form Test | First Stage |
| $\ln[\sum_{i=1}^{i \neq Can} N_{jt}^{(i)}]$ | -0.040*** (-6.17) | -0.037*** (-6.62) | -0.061** (-3.01) | -0.063** (-3.03) | | | |
| $Pol_{jt}^{(i)}$ | | | | | -0.025*** (-3.11) | -0.023*** (-3.31) | 0.412*** (4.35) |
| Cragg-Donald F-Stat | | | 54.670 | | | | |
| Kleibergen-Paap F-Stat | | | 18.906 | | | | |
| Inst FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Province*Year FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Obs | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 |

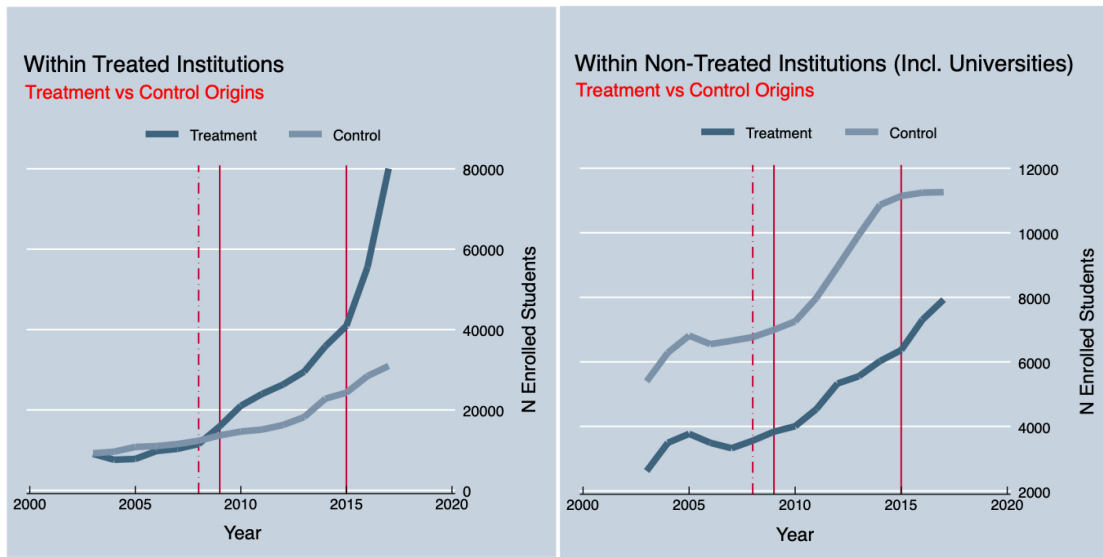
Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard Errors are clustered by Institution. The sample covers the period 2003-2017. The dependent variable is the number of enrolled Canadian Students in Columns (1-6); Column 7 reports the first stage coefficient. In all IV regressions SPP was used as an instrument for international students. In Column 4 the IV-PPML estimates are obtained with the control function approach.

Table 9: Crowding-Out on the Number of Native and Non-Treated Foreign Students

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|-------------------|-------------------|--------------------|---------------------------|---------------------------|---------------------------|
| Estimator | OLS | IV-2SLS | IV-PPML | PPML | IV-2SLS | IV-PPML |
| Dep. Var. | Canadian Studs | Canadian Studs | Canadian Studs | Non-Treated Int. Studs | Non-Treated Int. Studs | Non-Treated Int. Studs |
| $\ln[\sum_{i=1}^{i \neq Can} N_{jt}^{(i)}]$ | 0.0171 (0.612) | 0.007 (0.055) | 0.011 (0.100) | | | |
| $\ln[\sum_{i=1}^{i=Treated} N_{jt}^{(i)}]$ | | | | 0.129*** (3.477) | 0.350* (1.940) | 0.313* (1.840) |
| Cragg-Donald F-Stat | | 54.670 | | | 39.559 | |
| Kleibergen-Paap F-Stat | | 18.906 | | | 11.509 | |
| Pol _{jt} (1st Stage) | | | 0.412*** (4.35) | | | 0.566*** (3.58) |
| Inst FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Province*Year FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Obs | 1250 | 1250 | 1250 | 1250 | 1250 | 1250 |

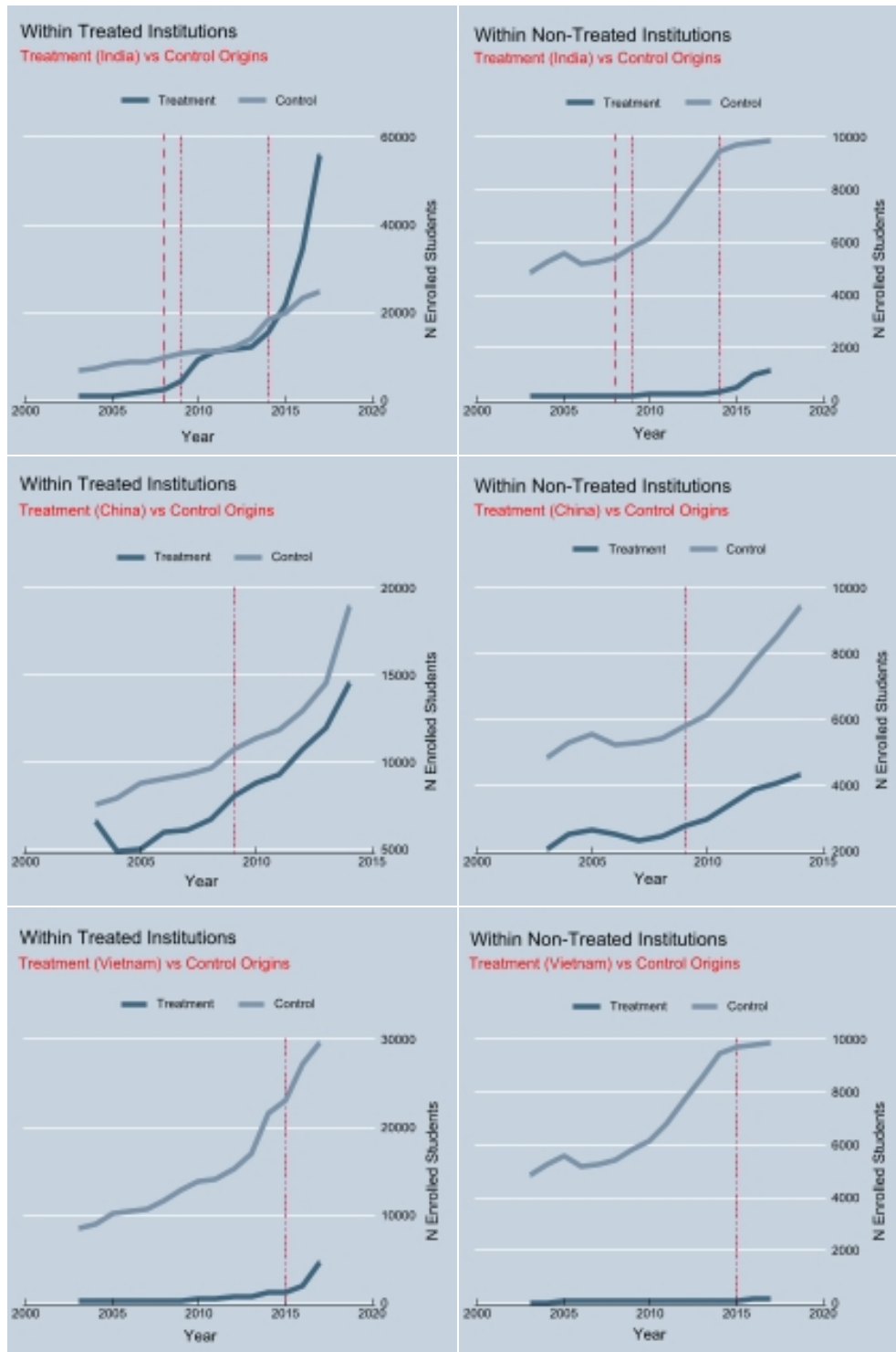
Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard Errors are clustered by Institution. The sample covers the period 2003-2017. The dependent variable in Columns (1-3) is the number of enrolled Canadian students, while in Columns (4-6) is the number of enrolled foreign students from non-treated nationalities. In all IV regressions SPP was used as an instrument for international students. In Column (3) and (6) the IV-PPML estimates are obtained with the control function approach. The regressions in Column (4-6) include the number of Canadian students as a control variable.

Figure 3: Parallel Trends - Triple-Diff



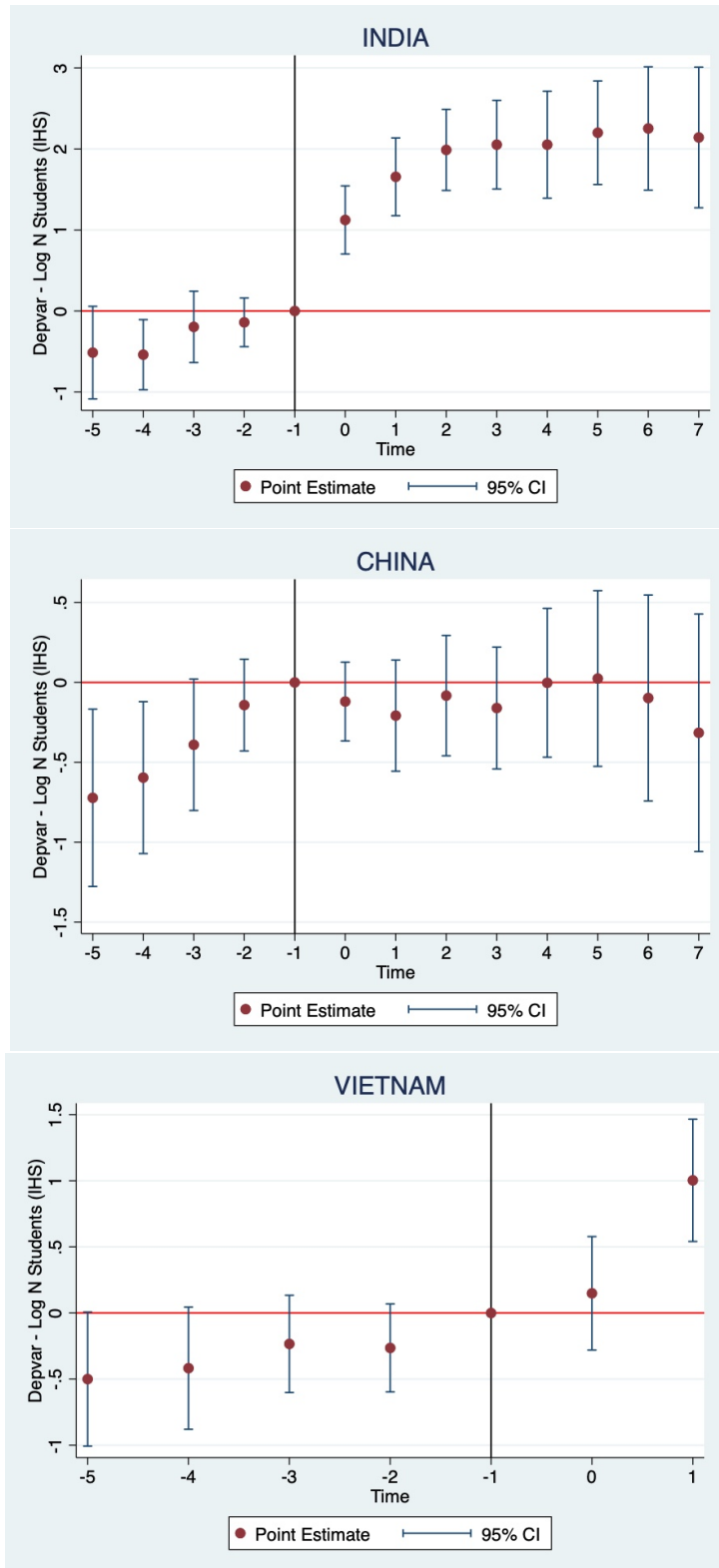
Notes: The figure shows the parallel trends in support of the underlying assumptions of the Triple-Diff model. The dashed red line refers to the (academic) year before (t-1) in which the pilot SPP program for Indian Students kicked in. The solid red lines refer to the (academic) years before (t-1) in which - for each eligible nationality - the majority of institutions joined the program. The sample includes treated and control institutions of the baseline sample (see Table 12-15 in the Appendix).

Figure 4: Parallel Trends - Triple-Diff (by Treated Origin)



Notes: The figure shows the parallel trends in support of the underlying assumptions of the Triple-Diff model for Indian (upper panel), Chinese (center panel) and Vietnamese (bottom panel) students, respectively. The dashed-dotted red line in the upper panel refers to the (academic) year before ($t-1$) in which the pilot SPP program for Indian Students kicked in. The dashed red lines refer to the (academic) years before ($t-1$) in which - for each eligible nationality - the majority of institutions joined the program. The center panel focuses on a reduced time-span (2003-2014) because in 2015 an equivalent of the SPP program was introduced for Chinese students which applied to all Canadian institutions.

Figure 5: Event Studies - By Treated Nationality



Notes: Effect of SPP on the enrollment of international students. Figure shows the coefficients and 95% confidence intervals from event study regressions that estimate enrollment levels for each academic year and across treated nationality.

Table 10: List of SPP institutions - China

| Institutions | Date of entry into SPP | Region |
|---|------------------------|----------------------|
| Bow Valley College | 2010 | Alberta |
| Grant MacEwan University* | 2010 | Alberta |
| Lethbridge College | 2010 | Alberta |
| Medicine Hat College | 2010 | Alberta |
| Northern Alberta Institute of Technology | 2010 | Alberta |
| Lakeland College | 2015 | Alberta |
| NorQuest College | 2015 | Alberta |
| Camosun College | 2010 | British Columbia |
| College of New Caledonia | 2010 | British Columbia |
| College of the Rockies | 2010 | British Columbia |
| Columbia College | 2010 | British Columbia |
| Douglas College | 2010 | British Columbia |
| Kwantlen Polytechnic University | 2010 | British Columbia |
| Langara College | 2010 | British Columbia |
| North Island College | 2010 | British Columbia |
| Northern Lights College | 2010 | British Columbia |
| Okanagan College | 2010 | British Columbia |
| Selkirk College | 2010 | British Columbia |
| University of the Fraser Valley** | 2010 | British Columbia |
| Vancouver Community College | 2010 | British Columbia |
| Vancouver Island University | 2010 | British Columbia |
| Coast Mountain College | 2015 | British Columbia |
| Red River College | 2010 | Manitoba |
| Manitoba Institute of Trades and Technology | 2012 | Manitoba |
| Assiniboine Community College | 2015 | Manitoba |
| New Brunswick Community College | 2011 | New Brunswick |
| Marine Institute of Memorial University** | 2010 | Newfoundland |
| Nova Scotia Agricultural College | 2010 | Nova Scotia |
| Cape Breton University* | 2012 | Nova Scotia |
| Algonquin College | 2010 | Ontario |
| Cambrian College | 2010 | Ontario |
| Centennial College | 2010 | Ontario |
| Conestoga College | 2010 | Ontario |
| Confederation College | 2010 | Ontario |
| Durham College | 2010 | Ontario |
| Fanshawe College | 2010 | Ontario |
| George Brown College | 2010 | Ontario |
| Georgian College | 2010 | Ontario |
| Humber College | 2010 | Ontario |
| Loyalist College | 2010 | Ontario |
| Mohawk College | 2010 | Ontario |
| Niagara College | 2010 | Ontario |
| Seneca College | 2010 | Ontario |
| Sheridan College | 2010 | Ontario |
| St. Clair College | 2010 | Ontario |
| St. Lawrence College | 2010 | Ontario |
| Canadore College | 2011 | Ontario |
| Lambton College | 2011 | Ontario |
| Centennial College | 2012 | Ontario |
| Northern College of Applied Arts and Technology | 2012 | Ontario |
| Fleming College | 2013 | Ontario |
| Holland College | 2010 | Prince Edward Island |
| Collège LaSalle | 2015 | Québec |
| Yukon College | 2010 | Yukon |

* Cape Breton University and Grant MacEwan University respectively left the program in 2013 and 2016.

** These institutions were dropped from the analysis because of data limitations.

Table 11: List of SPP institutions - India

| Institutions | Date of entry into SPP | Region |
|---|------------------------|------------------|
| Bow Valley College | 2009 | Alberta |
| Grant McEwan College* | 2009 | Alberta |
| Northern Alberta Institute of Technology | 2009 | Alberta |
| Southern Alberta Institute of Technology | 2009 | Alberta |
| Medicine Hat College | 2010 | Alberta |
| Lakeland College | 2015 | Alberta |
| NorQuest College | 2015 | Alberta |
| Camosun College | 2009 | British Columbia |
| Columbia College | 2009 | British Columbia |
| Vancouver Community College | 2009 | British Columbia |
| Vancouver Island University | 2009 | British Columbia |
| College of New Caledonia | 2010 | British Columbia |
| College of the Rockies | 2010 | British Columbia |
| Douglas College | 2010 | British Columbia |
| Kwantlen Polytechnic University | 2010 | British Columbia |
| North Island College | 2010 | British Columbia |
| Northern Lights | 2010 | British Columbia |
| Okanagan College | 2010 | British Columbia |
| Selkirk College | 2010 | British Columbia |
| University of The Fraser Valley** | 2010 | British Columbia |
| Red River College | 2009 | Manitoba |
| Manitoba Institute of Trades and Technology | 2013 | Manitoba |
| Assiniboine Community College | 2015 | Manitoba |
| New Brunswick Community College | 2011 | New Brunswick |
| Marine Institute of Memorial University** | 2010 | Newfoundland |
| Algonquin College | 2009 | Ontario |
| Cambrian College | 2009 | Ontario |
| Centennial College | 2009 | Ontario |
| George Brown College | 2009 | Ontario |
| Georgian College | 2009 | Ontario |
| Humber College | 2009 | Ontario |
| Loyalist College | 2009 | Ontario |
| Mohawk College | 2009 | Ontario |
| Niagara College | 2009 | Ontario |
| Seneca College | 2009 | Ontario |
| Sheridan College | 2009 | Ontario |
| Conestoga College | 2010 | Ontario |
| Confederation College | 2010 | Ontario |
| Durham College | 2010 | Ontario |
| Fanshawe College | 2010 | Ontario |
| Lambton College | 2010 | Ontario |
| Northern College of Applied Arts and Technology | 2010 | Ontario |
| St. Clair College | 2010 | Ontario |
| St. Lawrence College | 2010 | Ontario |
| Fleming College | 2011 | Ontario |
| Canadore College | 2015 | Ontario |
| Sault College | 2015 | Ontario |
| Collège LaSalle | 2015 | Québec |
| Parkland College** | 2011 | Saskatchewan |
| Saskatchewan Polytechnic** | 2011 | Saskatchewan |

* Grant MacEwan University left the program in 2013.

** These institutions were dropped from the analysis because of data limitations.

Table 12: List of SPP institutions - Vietnam

| Institutions | Date of entry into SPP | Region |
|---|------------------------|------------------|
| Bow Valley College | 2016 | Alberta |
| Lakeland College | 2016 | Alberta |
| Medicine Hat College | 2016 | Alberta |
| Norquest College | 2016 | Alberta |
| Northern Alberta Institute of Technology | 2016 | Alberta |
| Southern Alberta Institute of Technology | 2016 | Alberta |
| British Columbia Institute of Technology | 2016 | British Columbia |
| Camosun College | 2016 | British Columbia |
| Capilano University | 2016 | British Columbia |
| College of New Caledonia | 2016 | British Columbia |
| College of the Rockies | 2016 | British Columbia |
| Douglas College | 2016 | British Columbia |
| Emily Carr University | 2016 | British Columbia |
| Kwantlen Polytechnic University | 2016 | British Columbia |
| Langara College | 2016 | British Columbia |
| North Island College | 2016 | British Columbia |
| Coast Mountain College | 2016 | British Columbia |
| Okanagan College | 2016 | British Columbia |
| Selkirk College | 2016 | British Columbia |
| University of the Fraser Valley** | 2016 | British Columbia |
| Vancouver Community College | 2016 | British Columbia |
| Northern Lights College | 2018 | British Columbia |
| Thompson Rivers University | 2018 | British Columbia |
| Vancouver Island University | 2018 | British Columbia |
| Assiniboine Community College | 2016 | Manitoba |
| Manitoba Institutions of Trades and Technology | 2016 | Manitoba |
| Red River College | 2016 | Manitoba |
| New Brunswick Community College | 2016 | New Brunswick |
| Marine Institute of Memorial University** | 2016 | New Foundland |
| Nova Scotia Agricultural College | 2018 | Nova Scotia |
| Algonquin College | 2016 | Ontario |
| Cambrian College | 2016 | Ontario |
| Canadore College | 2016 | Ontario |
| Centennial College | 2016 | Ontario |
| Conestoga College | 2016 | Ontario |
| Confederation College | 2016 | Ontario |
| Durham College | 2016 | Ontario |
| Fanshawe College | 2016 | Ontario |
| Fleming College | 2016 | Ontario |
| George Brown College | 2016 | Ontario |
| Georgian College | 2016 | Ontario |
| Humber College | 2016 | Ontario |
| Lambton College | 2016 | Ontario |
| Loyalist College | 2016 | Ontario |
| Mohawk College | 2016 | Ontario |
| Niagara College | 2016 | Ontario |
| Seneca College | 2016 | Ontario |
| St. Claire College | 2016 | Ontario |
| Northern College of Applied Arts and Technology | 2018 | Ontario |
| Sault College | 2018 | Ontario |
| Sheridan College | 2018 | Ontario |
| St. Lawrence College | 2018 | Ontario |
| Lasalle College | 2018 | Quebec |
| Saskatchewan Polytechnic** | 2016 | Saskatchewan |
| Parkland College | 2018 | Saskatchewan |

** These institutions were dropped from the analysis because of data limitations.

Table 13: List of control institutions

| Institutions | Region | Type |
|---|----------------------|-------------|
| Alberta College of Art and Design | Alberta | College |
| Burman University | Alberta | University |
| Concordia University of Edmonton | Alberta | University |
| Grande Prairie Regional College | Alberta | College |
| Keyano College | Alberta | College |
| Mount Royal University | Alberta | University |
| Northern Lakes College | Alberta | College |
| Olds College | Alberta | College |
| Portage College | Alberta | College |
| Red Deer College | Alberta | College |
| St. Mary's University | Alberta | University |
| The King's University | Alberta | University |
| University of Lethbridge | Alberta | University |
| Nicola Valley Institute of Technology | British Columbia | College |
| Royal Roads University | British Columbia | University |
| University of Northern British Columbia | British Columbia | University |
| Booth University College | Manitoba | College |
| Brandon University | Manitoba | University |
| University College of the North | Manitoba | College |
| Maritime College of Forest | New Brunswick | College |
| Mount Allison University | New Brunswick | University |
| St. Thomas University | New Brunswick | University |
| Acadia University | Nova Scotia | University |
| Mount St. Vincent University | Nova Scotia | University |
| Nova Scotia Community Colleges | Nova Scotia | College |
| NSCAD University | Nova Scotia | University |
| Saint Mary's University | Nova Scotia | University |
| St. Francis Xavier University | Nova Scotia | University |
| Université Sainte-Anne | Nova Scotia | College |
| Algoma University | Ontario | University |
| Brock University | Ontario | University |
| Kemptville College | Ontario | College |
| Lakehead University | Ontario | University |
| Laurentian University | Ontario | University |
| Nipissing University | Ontario | University |
| OCAD University | Ontario | University |
| Trent University | Ontario | University |
| Université de Moncton | Ontario | University |
| University of Ontario Institute of Technology | Ontario | College |
| University of Prince Edward Island | Prince Edward Island | University |
| Bishop's University | Québec | University |
| Campus Notre-Dame-de-Foy | Québec | College |
| CÉGEP d'Abitibi-Témiscamingue | Québec | College |
| CÉGEP de la Gaspésie et des Îles | Québec | College |
| CÉGEP de Sept-Îles | Québec | College |
| CÉGEP John Abbott | Québec | College |
| CÉGEP Marie-Victorin | Québec | College |
| Champlain Regional College | Québec | College |
| Collège Centennial / Centennial College | Québec | College |
| Collège Dawson | Québec | College |
| Collège Heritage / Heritage College | Québec | College |
| Collège Marianopolis | Québec | College |
| Collège Mother House | Québec | College |
| Collège O'Sullivan de Montréal inc | Québec | College |
| Collège O'Sullivan de Québec inc | Québec | College |
| Collège Shawinigan | Québec | College |
| Collège Vanier | Québec | College |
| Université du Québec à Trois-Rivières | Québec | University |
| University of Regina | Saskatchewan | University |

Table 14: List of Countries of Origin / Nationalities

| | | | | |
|----------------------|--------------------|--------------|-----------------------|----------------------|
| Afghanistan | Congo, Rep. of the | Hungary | Morocco | Solomon Islands |
| Albania | Costa Rica | Iceland | Mozambique | Somalia |
| Algeria | Cote d'Ivoire | India | Myanmar | South Africa |
| Angola | Croatia | Indonesia | Namibia | South Korea |
| Antigua and Barbuda | Cuba | Iran | Nepal | South Sudan |
| Argentina | Curacao | Iraq | Netherlands | Spain |
| Armenia | Cyprus | Ireland | Netherlands Antilles | Sri Lanka |
| Aruba | Czech Republic | Israel | New Caledonia | Sudan |
| Australia | Denmark | Italy | New Zealand | Suriname |
| Austria | Djibouti | Jamaica | Nicaragua | Sweden |
| Azerbaijan | Dominica | Japan | Niger | Switzerland |
| Bahamas | Dominican Republic | Jordan | Nigeria | Syria |
| Bahrain | Ecuador | Kazakhstan | North Korea | Taiwan |
| Bangladesh | Egypt | Kenya | North Macedonia | Tajikistan |
| Barbados | El Salvador | Kosovo | Norway | Tanzania |
| Belarus | Equatorial Guinea | Kuwait | Oman | Thailand |
| Belgium | Eritrea | Kyrgyzstan | Pakistan | Togo |
| Belize | Estonia | Laos | Panama | Trinidad & Tobago |
| Benin | Eswatini | Latvia | Papua New Guinea | Tunisia |
| Bermuda | Ethiopia | Lebanon | Paraguay | Turkey |
| Bhutan | Fiji | Lesotho | Peru | Turkmenistan |
| Bolivia | Finland | Liberia | Philippines | Turks & Caicos Isl. |
| Bosnia & Herzegovina | France | Libya | Poland | Uganda |
| Botswana | French Polynesia | Lithuania | Portugal | Ukraine |
| Brazil | Gabon | Luxembourg | Qatar | United Arab Emirates |
| British Virgin Isl. | Gambia | Macao | Reunion | United Kingdom |
| Brunei | Georgia | Madagascar | Romania | United States |
| Bulgaria | Germany | Malawi | Russia | Uruguay |
| Burkina Faso | Ghana | Malaysia | Rwanda | Uzbekistan |
| Burundi | Greece | Maldives | St. Kitts & Nevis | Vanuatu |
| Cambodia | Grenada | Mali | St. Lucia | Venezuela |
| Cameroon | Guadeloupe | Malta | St. Pierre & Miquelon | Vietnam |
| Cape Verde | Guam | Martinique | Saudi Arabia | Yemen |
| Cayman Islands | Guatemala | Mauritania | Senegal | Zambia |
| Central African Rep. | Guinea | Mauritius | Serbia | Zimbabwe |
| Chad | Guinea-Bissau | Mayotte | Seychelles | |
| Chile | Guyana | Mexico | Sierra Leone | |
| China | Haiti | Moldova | Singapore | |
| Christmas Island | Honduras | Mongolia | Slovakia | |
| Colombia | Hong Kong | Montenegro | Slovenia | |

* Notes: in **bold** the treated countries of origin included in the baseline sample.

7.1 Appendix

7.1.1 Excluding Data on Approved Applications

As pointed out in Section 5, we constructed our baseline sample using data on approved applications for some selected institutions because information on student enrollment were not available. While approved study permit applications are – by definition - a very close substitute to international student enrollment, one could argue that some minor differences between them could bias the estimation. In particular, students who get their study permits approved might change their mind and decide not to travel to Canada, or they may fail to enroll in school once in Canada and therefore become illegal. While it is safe to assume that the former channel has no reason to be affected by the introduction of the SPP program and can therefore be controlled for with the use of origin-year fixed effect, the latter could bias our analysis if it affected international students applying to SPP and non-SPP institutions in specific ways after the implementation of the reform, potentially acting as a co-founder of the SPP treatment we are trying to capture.³² The risk then would be that our estimates of the true effect of SPP is biased downwards.

To address this potential threat to the identification strategy, we estimate model 3 without any applications data on a sample excluding institutions for which student enrollment data is missing. Results are presented in Table 15. Despite the difference in the sample size, the baseline coefficients are qualitatively similar, and we can safely conclude that the parameters of interest β of the quasi-experimental models reflect the true causal impact of the SPP reform on student enrollment.

³²More specifically, since SPP required participating institutions to set up a reporting mechanism providing feedback on student enrollment and attendance to the Canadian Government, it likely decreased the comparative share of SPP applicants entering the country on a study permit who then failed to enroll at school. Given that no such incentives played out among students applying to non-SPP institutions, it is possible that using study permit applications data rather than actual enrollment counts leads to underestimating the actual difference between the number of students who enrolled at non-SPP institutions and those who enrolled at SPP institutions after the implementation of the reform. However, we argue that the threat to the identification should be minimal. This is mainly because the regular visa stream was still opened for SPP institutions after the introduction of the reform, with bogus students still able to apply to SPP institutions.

Table 15: Excluding Approved Applications

| | (1) | (2) | (3) | (4) |
|-------------------|--------------------|--------------------|-----------------|-------------------|
| Estimator | PPML | PPML | PPML | PPML |
| Dep. Var. | N_{jit} | N_{jit} | N_{jit} | N_{jit} |
| Treated Origin(s) | All | India | China | Vietnam |
| Model | DDD | DDD | DDD | DDD |
| Pol_{jit} | 0.242*** (3.06) | 0.658*** (3.16) | 0.049 (0.89) | 0.322** (2.27) |
| Inst×Year FE | ✓ | ✓ | ✓ | ✓ |
| Origin×Year FE | ✓ | ✓ | ✓ | ✓ |
| Inst×Origin FE | ✓ | ✓ | ✓ | ✓ |
| Obs | 84863 | 82365 | 82643 | 82224 |

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard Errors are clustered by Institution*Origin pairs. The sample excludes the information on the approved number of applications included in our baseline sample.

7.1.2 Pre-2015 effect of SPP

When comparing the effect of SPP between Chinese and Indian students, one might object that the null effect in China is driven by the introduction of the SDS for Chinese students in 2015, a pilot program with similar benefits to those of SPP but open to any post-secondary education program (see Section 2.1). To test whether this is the case, we compare in Table 16 the effect of the SPP reform between Chinese and Indian students until 2014. The coefficient for Chinese students (Column 3) once again suggests that SPP had no impact on enrollment.

Table 16: Pre-2015 effect

| | (1) | (2) |
|-------------------|--------------------|-------------------|
| Estimator | PPML | PPML |
| Dep. Var. | N_{jit} | N_{jit} |
| Treated Origin(s) | India | China |
| Model | DDD | DDD |
| Pol_{jit} | 0.770*** (4.29) | 0.00915 (0.10) |
| Inst×Year FE | ✓ | ✓ |
| Origin×Year FE | ✓ | ✓ |
| Inst×Origin FE | ✓ | ✓ |
| Obs | 66515 | 66613 |

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard Errors are clustered by Institution. In each regression the time span is reduced till 2014. Vietnam is excluded from the results as SPP started in 2016 for this country.

7.1.3 Alternative estimators

Throughout this paper, we use Poisson PML as the workhorse estimator to estimate Equation 3, in the spirit of structural gravity model of international migration with high-dimensional fixed effects. This choice is in line with the literature and motivated mostly by the large presence of zeros in the dependent variable. In Table 17 we re-estimate the baseline specifications using Ordinary Least Squares, first by taking the log of student enrolments - which automatically excludes zeros from the sample. Alternatively, we also use enrollment counts specified in inverse hyperbolic sine. Overall - despite the inflated coefficients which are plausibly due to the inconsistency of the OLS estimator in the presence of a large share of zeros - the results are qualitatively very similar to the benchmark statistics.

Table 17: Alternative Estimators (with HDFEs)

| Treated Origin(s) | | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|-------------------|------------------|--------------------|--------------------|------------------|--------------------|---------------------|---------------------|---------------------|
| | | All DDD | India DDD | China DDD | Vietnam DDD | India DD | China DD | Vietnam DD |
| OLS | | | | | | | | |
| | Dep. Var. | $\ln(N_{jit})$ | $\ln(N_{jit})$ | $\ln(N_{jit})$ | $\ln(N_{jit})$ | $\ln(N_{jt}^{(i)})$ | $\ln(N_{jt}^{(i)})$ | $\ln(N_{jt}^{(i)})$ |
| | Pol_{jit} | 0.984*** (8.64) | 1.849*** (8.43) | 0.160 (1.54) | 0.981*** (6.40) | | | |
| | $Pol_{jt}^{(i)}$ | | | | | 2.038*** (8.62) | 0.0709 (0.61) | 1.241*** (6.29) |
| | Obs | 35897 | 33990 | 34187 | 33631 | 1032 | 1229 | 669 |
| OLS - IHS | | | | | | | | |
| | Dep. Var. | $N_{jit}IHS$ | $N_{jit}IHS$ | $N_{jit}IHS$ | $N_{jit}IHS$ | $N_{jt}^{(i)}IHS$ | $N_{jt}^{(i)}IHS$ | $N_{jt}^{(i)}IHS$ |
| | Pol_{jit} | 1.214*** (9.20) | 2.183*** (9.80) | 0.249* (1.75) | 0.937*** (4.51) | | | |
| | $Pol_{jt}^{(i)}$ | | | | | 2.290*** (9.84) | 0.212 (1.43) | 1.250*** (5.53) |
| | Obs | 101758 | 99069 | 99170 | 98943 | 1357 | 1458 | 1231 |

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.001$. In the upper panel enrollment are specified in log form, so all zeros are excluded from the specification. In the bottom panel enrollment are specified in inverse hyperbolic sine.