Program Non-Completion and Postsecondary Credential Accumulation Pathways across Canadian Provinces

Report presented to the Ontario Council for Articulation and Transfer (ONCAT)

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Introduction and overview

The pathway to graduation from a postsecondary education (PSE) program is not always a linear one for Canadian students. While existing research has investigated those non-linearities extensively in the Canadian context, analyses of the impact of non-linear pathways to graduation from a first PSE program on further credential accumulation remains limited.

This report presents results from the second phase of a project on non-linear PSE pathways and credential accumulations.[1] The first phase focused exclusively on PSE credential accumulation (vertical/linear, horizontal, and reverse), and on the pathways of individuals who obtain more than one PSE certificate, diploma, or degree in their life course. In this second phase, we leverage a survey-administrative data linkage to provide a unique perspective on how non-linearities in pathways leading to the obtention of a first PSE certificate, diploma or degree may influence the likelihood of obtaining a second PSE credential.

Our focus on credential accumulation is motivated by the large earnings premiums associated with certain credential accumulation pathways and with graduate and professional degrees more specifically (St-Denis et al., 2021).

Key take-aways from Phase 1 and need for further research

The first phase of this project produced two key findings that we build upon in this report:

1. **The level of the first completed credential is strongly related to the level of the highest credential to ever be obtained.** Specifically, those who enter PSE at a level below a bachelor's degree have a low probability of completing a second credential relative to those who complete a bachelor's degree as their first credential. In addition, they have a low probability of ever completing a bachelor's degree, and even lower probabilities of completing a graduate or professional degree.

2. **The sequence of credential accumulation matters.** The income of individuals with the same level of education (e.g., bachelor's degree) varies depending on the credential accumulation pathways followed to obtain that credential. For example, completing a college credential followed by a bachelor's degree is associated with a lower income level than completing a bachelor's degree followed by a college credential. That said, a linear pathway that includes a bachelor's degree followed by a graduate or first professional degree is associated with substantially higher employment income than most other credential accumulation pathways.

[1] The report from the first phase is the following: St-Denis, Xavier, Yacine Boujija, and Stephen Sartor. "Non-Linear Postsecondary Education Pathways and Credential Accumulation." Toronto, ON: Ontario Council for Articulation and Transfer, July 28, 2021. https://www.oncat.ca/en/projects/non-linear-pse-pathways-and-credential-accumulation-statistical-portrait-and-evaluation

In the second phase of our project, we aim to extend this analysis by addressing a key limitation of phase 1. Phase 1 did not take into account spells registered in non-completed PSE programs that resulted in transfer, stopping out, or dropping out. This is an important shortcoming because while we know that there are differences in graduation rates between transfer and non-transfer university students (Pizarro Milian & Zarifa, 2022), we have only limited information on how that translates into attending and graduating from a second PSE program.

For example, the literature (including our Phase 1 report) produced no results on whether bachelor's graduates whose pathway to graduation included a transfer are less likely to then obtain an additional degree in comparison with bachelor's graduates who followed a linear pathway to graduation. This is consequential given the finding from the Phase 1 report that several credential accumulation pathways are associated with significant earnings premiums. More broadly, the literature highlights that credential accumulation carries significant premiums, especially when the second credential is at the graduate level (Altonji & Zhong, 2020; Boudarbat et al., 2010; Lindley & Machin, 2016; Wall et al., 2018). Our inability to document this dimension of PSE pathways in the Phase 1 report was due to the absence of information on non-completed PSE programs in the data available to us.

Phase 2 objectives

In this report, our key objective is to document whether program non-completion episodes in early PSE pathways are related to subsequent credential accumulation pathways. In addition, we provide results separately for Ontario, Québec, and other Canadian provinces in order to provide insights on the potential strengths of various provincial systems. Our results should guide the development of student mobility, transfer, and articulation policies and programs at the provincial level as well as interventions by postsecondary institutions.

To achieve these two objectives, we leverage information available in tax data from the T1 Family Files (T1FF) to indirectly identify spells in non-completed PSE programs, coupled with information on relatively long-term PSE credential accumulation pathways available in Wave 3 of the Longitudinal and International Study of Adults (LISA). This approach required a specific innovation in processing and analyzing tax data: we used information on tuition amounts reported by tax filers in their T1 form. Because this information is known to be imperfect, we conducted an original data validation exercise that will be useful for the broader Canadian education research community. The results of this analysis are presented as a technical appendix at the end of this report.

Overview of main results

In the rest of this introductory section, we present an overview of our main results. Our analysis produced the following three key findings:

1. **Among Canadians born between 1981 and 1988, 15 percent have participated in PSE from 18 to 27 years old without completing any certificate, diploma, or degree (18 percent in Ontario).** It represents almost 20 percent of all Canadians in our sample who participated in PSE. This "drop out" group is a segment of PSE participants that receives relatively limited attention in the literature, relative to the US where analyses of educational inequalities such as those focusing on labour market or health disparities often include a group of individuals with "some college" but no credential.

2. **Approximately 40 percent of Canadians who undertake PSE do not graduate from their first program of study. About half go on to complete another program.** Note that we do not distinguish between those who transfer and those who stop-out before returning to another program after a gap.

3. **The likelihood of obtaining a second credential is significantly lower if graduation from the first credential follows an initial spell in PSE with no program completed.** This is especially the case in Ontario, where almost half of those with a first credential but no prior incomplete PSE spell obtain a second credential while only 20 percent of those who have a prior incomplete spell in PSE obtain a second credential after graduating from their first credential. This gap is even stronger among those who graduate from a bachelor's as their first credential: the rate of graduation from a second credential among those with no prior incomplete PSE spell is almost triple that of those with a prior incomplete PSE spell (47 vs 17 percent). This pattern at the Canadian level seems to be driven almost exclusively by Ontario, suggesting that specific characteristics of the provincial education system or labour market dynamics penalize bachelor's graduates with prior incomplete PSE spells.

Our study stands out from previous studies of PSE pathways in a specific way: we focus on documenting the share of Canadians and Ontarians from the 1981-1988 birth cohorts who follow different PSE pathways. In contrast, most existing studies aim to quantify the share of students in a given entry cohort who had previously completed some PSE (Finnie et al., 2017, 2020). The research design used in this type of studies make it difficult to document exactly what share of the population follows various types of PSE pathways because some students in a given entry cohort may be younger students at the beginning of their trajectory into PSE while others may be older students who have already spent several years in PSE.

Data and methods

The data requirements for this report are relatively complex. First, we need a source of data providing information on PSE pathways over the relatively long term in order to document non-linear credential accumulation pathways, especially those that include bachelor's degrees preceded by spells in an uncompleted PSE program *and* followed by participation in another PSE program. Second, we need information on PSE history over our whole observation window, including both completed and uncompleted PSE programs in which individuals participated.

However, obtaining comprehensive longitudinal data that provides this type of complete picture of educational pathways and dynamics remains challenging. A first option would be to use the Postsecondary Education Information System (PSIS). At the time of finalizing our research design, we deemed this data source unsuitable in light of our first criterion. In fact, it provides only seven years of data for Ontario, a relatively short time frame (a period of seven academic years from 2013/2014 to 2019/2020) (Statistics Canada, 2023).

Instead, we opted to use the same data source as in Phase 1: wave 3 of the Longitudinal and International Study of Adults (LISA), a survey collected in 2016 by Statistics Canada. This data source has the advantage of including a PSE history module in which respondents list the four most recent PSE credentials they ever completed (only a negligible number of Canadians complete more than four PSE programs). This maximizes our observation window.

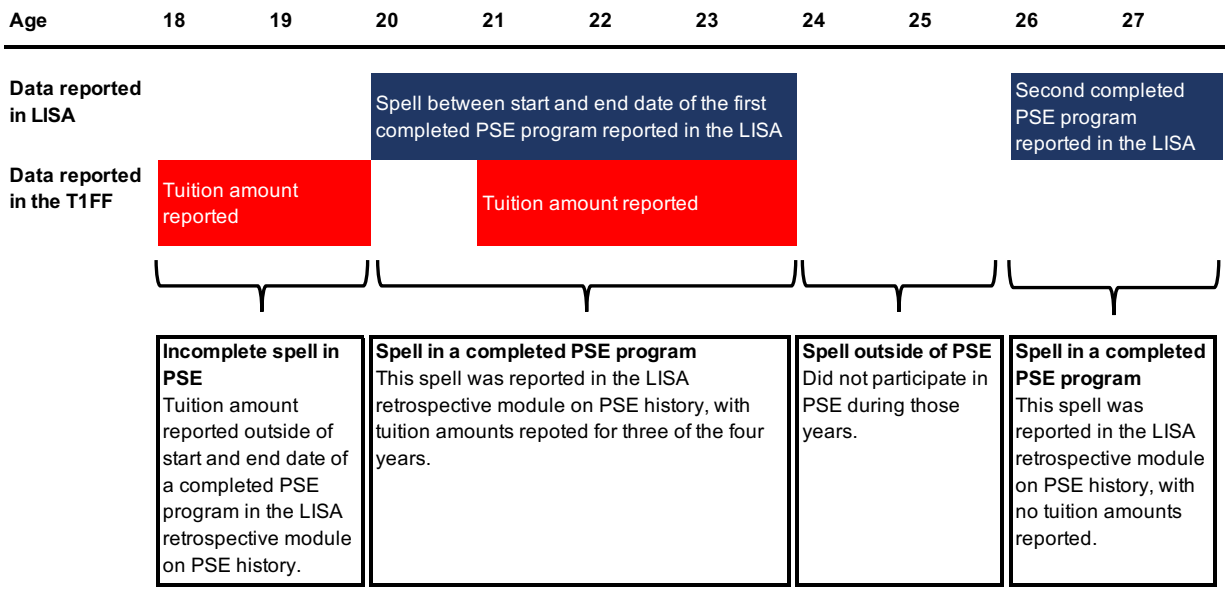
However, survey data from the LISA does not fully meet our second criterion because it does not include information on uncompleted PSE programs in which respondents participated. To address this important shortcoming, we supplement the survey questions from the PSE history module with information from administrative records. Specifically, data from the T1 Family Files (T1FF), a dataset developed by Statistics Canada from tax records, has been linked to all LISA respondents who gave their consent (and filed their taxes in the years preceding survey data collection). This data includes information from schedule 11, in which tax filers indicate both whether they were registered in a PSE program in a given fiscal year, and the amount of tuition fees incurred. In doing so, we follow an approach used in previous Canadian research (Finnie & Pavlic, 2013).

Note that the information available in tax records is partial. It does not indicate which program a tax filer attended, and whether they graduated or not (or when). However, the data from both sources are longitudinal and overlaps between 1997 and 2015. We can therefore combine this information with the survey questions on PSE history to reconstruct detailed PSE pathways. We describe the resulting measures in greater detail below. Because of data quality and coverage issues in the early years of schedule 11, we restrict our analysis to the 1999-2015 period.

The combination of these two data sources allows us to identify years when a respondent participated in a PSE program that they did not complete. In Chart 1, we provide an

illustration of the data using an imagined LISA observation. We can see from the first row that from 18 to 19, the LISA respondent did not report attending a PSE program that they ended up completing. These years are excluded from the year ranges between the start and end date of the credentials the respondent reported as having completed in the retrospective module on PSE history. However, the tax data linked to the respondent shows that they reported tuition amounts on their tax records, meaning that they did participate in PSE, but the program the respondent attended during that spell was not completed (and perhaps resulted in a transfer). On the other hand, the second spell of tuition amount is observed during a range of years during which the respondent reported attending the first PSE program that they did complete.

Chart 1. Example of a student pathway as observed in LISA and T1FF data



Source: Authors' design.

Finally, some years spent attending a PSE program that was not completed are associated with no tuition amounts reported in tax records. This is possible in cases when the respondent did not claim those amounts in their tax records. In fact, while some research has used information from tax records to infer PSE participation (Arim & Frenette, 2019; Finnie & Pavlic, 2013; Garon-Carrier et al., 2022; McDonald et al., 2019; Morissette & Qiu, 2021), little is known about the coverage and validity of education estimates derived from this data (Frenette, 2017). This is important because such administrative data are not exhaustive and missingness patterns are not random. For instance, younger individuals and recent immigrants, who may be more likely to be in education, are less likely to file taxes in a given year (Robson & Schwartz, 2020). In addition, some individuals may file their taxes, but not claim tax credits associated with annual tuition amounts paid or the time spent in education. Such spells will also be missing from tax-derived PSE trajectories.

In order to assess the quality of this source of data and whether it is likely to provide us with reliable information, we conduct a data validation analysis. The results of this

analysis are reported in the appendix. In short, we find that participation into most PSE programs of over one year of duration is reported in tax data. However, it is possible that very short spells remain underreported, which could lead to a downward bias in our estimate of the share of individuals with non-complete spells in PSE programs. Additionally, the accuracy of reporting educational enrollment in tax data seems to be higher during the ages when PSE attendance is most prevalent, particularly for the more recent cohorts.

Sample

Our unit of analysis is birth cohorts. Specifically, we aim to document the share of Canadians who follow various types of pathways in PSE. For that reason, we are not focusing on cohorts of entrants into a specific PSE program or cohorts of graduates, but instead we are interested in documenting the trajectories of individuals in certain birth cohorts over a fixed age range.

In selecting the age range over which we aimed to observe PSE pathways, we faced a trade-off between the number of years covered and the size of the sample available to us from the LISA. On one hand, our Phase 1 report highlighted that individuals tend to complete degrees late in their 20s, especially second credentials. This requires maximizing the observation window, especially beyond the relatively short period of seven years available in the PSIS. In order to capture early spells in PSE, we set our lower age bound at 18 years old and aimed to set our upper age bound as high as possible.

On the other hand, reliable information on PSE participation from tax records is available starting in 1999 only. This leaves us with 16 years of data. However, we could not select a single birth cohort and set our upper age bound at 34 years old (18 years old + 16 years) because this would leave with a very small sample and would prevent us from producing any results for Ontario or other provinces. In trying to maximize both the observation window and the sample size, we decided to focus on PSE pathways over a period of 10 years between 18 and 27 years old, which leaves enough time to capture non-linear PSE credential accumulation pathways. Therefore, our data provides information on the 1981-1988 birth cohorts, which can all be observed from 18 to 27 years old at some point between 1999 and 2015.

Measures of PSE pathways

In this report, we construct a measure of PSE pathways that aims to capture the dimensions relevant to our study while ensuring that the categories are not so detailed that they would result in small sample sizes, especially at the provincial level.

We distinguish between the first PSE credential and the second credential. In both cases, we identify respondents who had a spell in a non-completed PSE program prior to attending the program that led to their first PSE credential. We also identify individuals who only had a spell in a PSE program they did not complete but who did not go on to complete a first or second PSE credential.

First, we have the following possible pathways among all PSE participants:

1. Obtained first credential
2. Obtained first credential, with prior non-completed spell in PSE
3. Non-completed spell in PSE only (participated to PSE, but did not obtain any credential)

In some analyses, we create separate categories depending on the level of the first credential: below bachelor's (trades, vocational or apprenticeship certificate or diploma; cégep, college and other non-university certificate or diploma; university certificate or diploma below the bachelor's level) or bachelor's level or more (including first professional degrees that individuals in some provinces may be able to obtain as their first PSE credential).

Second, we have the following possible pathways among all individuals who obtained a first credential:

1. Obtained second credential (sample size does not allow to distinguish between those who had an intervening non-completed spell in PSE between their first and second credential, but that number appears to be negligible).
2. Non-completed spell in PSE only (participated in PSE after obtaining their first credential, but did not obtain a second credential)
3. Stopped PSE (did not participate in PSE after obtaining their first credential)

Together, these categories allow us to document whether non-linear pathways towards the completion of a first PSE credential influence the probability of obtaining a second credential (i.e., credential accumulation).

Methods

As a first step, we use descriptive statistics to present the share of individuals in our sample following different PSE pathways. We report the share of individuals who obtained at least one PSE credential, distinguishing between those who did and did not attend a prior non-completed PSE program. Then, we report the share of individuals with a first PSE credential who obtained a second credential, distinguishing again between those who did or did not attend a non-completed PSE program prior to that first credential. This second step of the analysis allows us to determine whether non-linear pathways towards graduating from a first credential is negatively associated with the probability of obtaining a second credential.

Second, we estimate multivariate multinomial regressions to conduct a comparison of Ontario, Québec, and the rest of Canada (ROC). Multivariate regressions allow us to determine whether individuals who grew up in each of the three geographic units have different probabilities of following specific PSE pathways, while controlling for observed differences in the characteristics of the population of each unit that may explain the gap in probabilities. The estimates net of control capture differences in the probabilities of following specific PSE pathways that are not due to differences in the composition of the

population of each geographic unit. These net differences may instead be attributed to differences in education policies and institutions as well as characteristics of the schooling system or the labour market. They may also be driven by differences in unobserved sociodemographic characteristics, or student ability levels and aspirations.

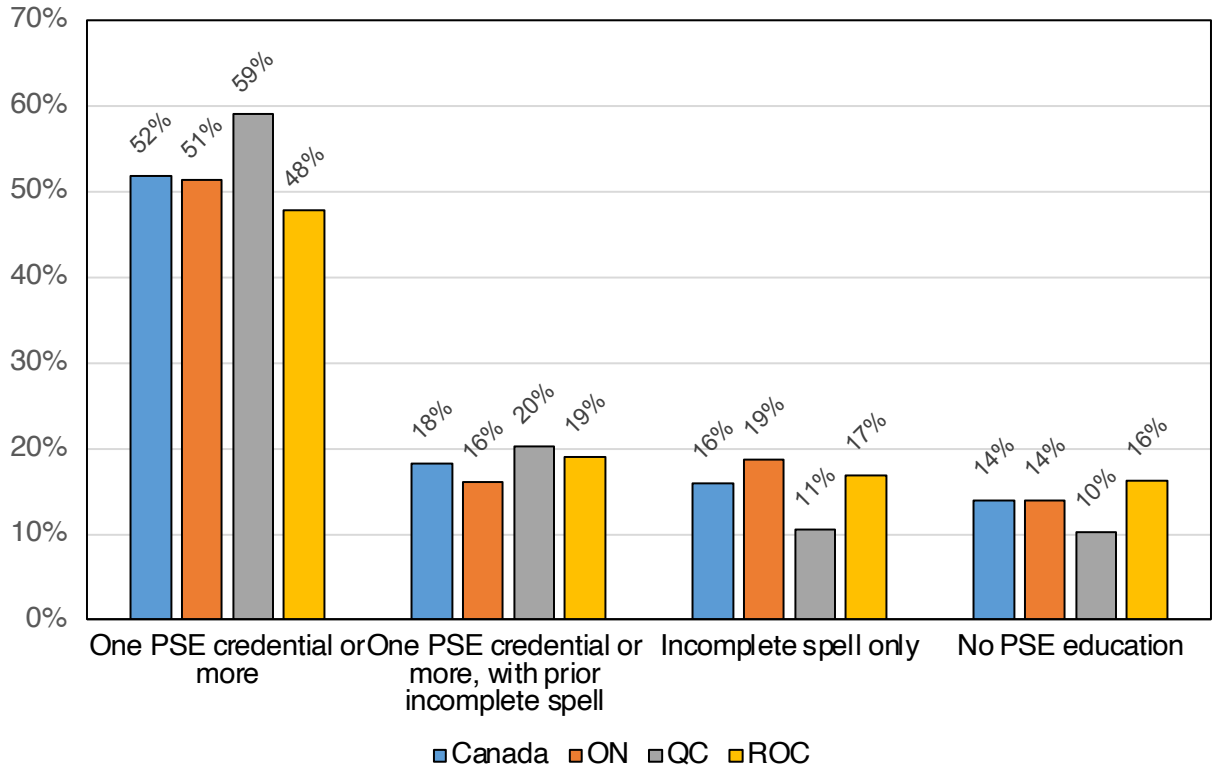
Results

Postsecondary education participation with and without graduation

In Figure 1, we report the proportion of Canadians who had different patterns of participation to PSE. Approximately 86 percent of Canadians born in the 1981-1988 birth cohorts participated in PSE at some point between 18 and 27 years old, with 14 percent never participating in PSE. The proportion was the same for Ontario, while it was lower for Québec (10 percent without any PSE) and higher for other Canadian provinces (16 percent without any PSE).

A large majority of the 1981-1988 birth cohorts (70 percent) obtained at least one credential by 27 years old (at either trades/vocational/apprenticeship, college/cégep/other non-university, or bachelor's level). In Ontario, 67 percent of individuals graduated from a PSE program. However, 16 percent of Ontario respondents (or 24 percent of Ontario graduates) attended PSE in a program that they did not complete before starting in the program they graduated from. In other words, they had a spell in PSE prior to graduation that was not associated with a completed credential. This number is lower than in other Canadian provinces by a few percentage points.

Figure 1. Proportion of individuals with completed PSE credential and incomplete PSE spells between 18 and 27 years old by province, 1982-1988 birth cohorts



Source: LISA Wave 3 (2016) and T1FF (1999-2015).
ROC: Rest of Canada (all provinces outside of Ontario and Québec).

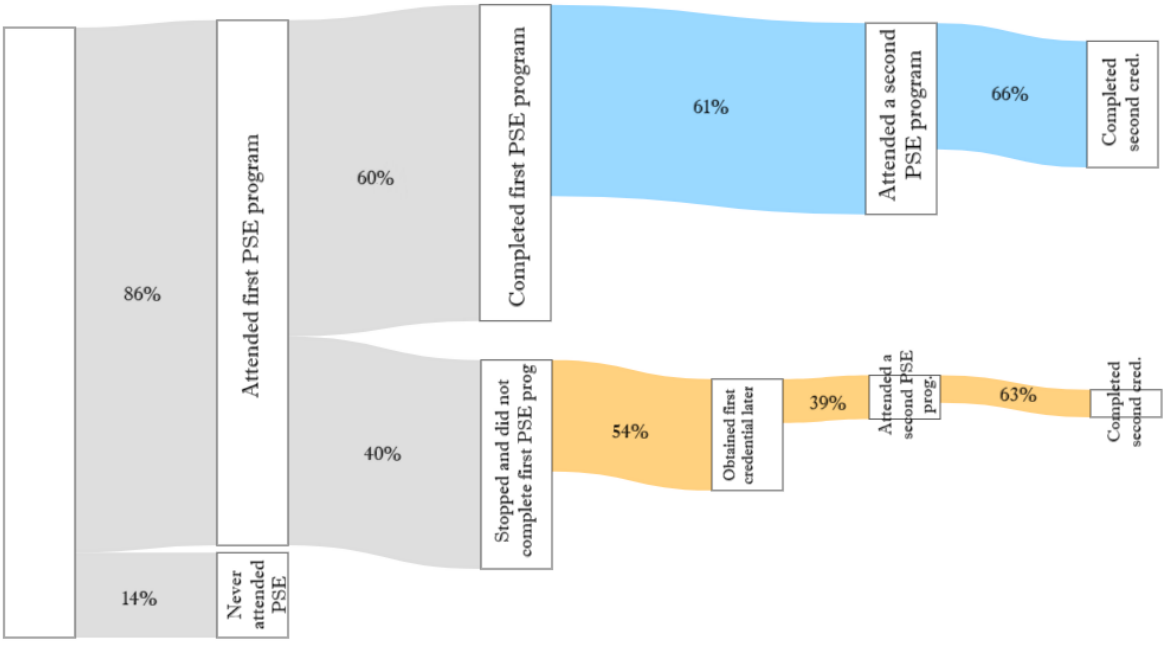
Finally, Figure 1 shows that 16 percent of Canadians attended PSE on at least one year between 18 and 27 years old without ever graduating from a PSE program. That proportion is the highest in Ontario, representing 22 percent of all individuals who ever participated in PSE. It is the lowest in Québec (12 percent of all PSE participants). This means that a substantial share of Ontario PSE students dropping out of the first program they participated in without returning to PSE by 27 years old.

Credential accumulation pathways and incomplete spells in PSE

In Figure 2, we explore the PSE pathways of Canadians between 18 and 27 years old at a more detailed level. Specifically, we explore credential accumulation patterns in combination with incomplete spells in PSE. In doing so, we aim to gain insights on whether pathways including incomplete spells (many of which being transfers) are associated with lower chances of subsequently accumulating two credentials.

First, we find that 61 percent of Canadians who obtained their first PSE credential without a prior incomplete spell in PSE attended a second PSE program. Among them, 66 percent went on to graduate from a second program (at any level), with the remainder attending further PSE without obtaining a second credential. This means that around 40 percent of all graduates from a first PSE credential without a prior incomplete spell in PSE obtained a second PSE credential.

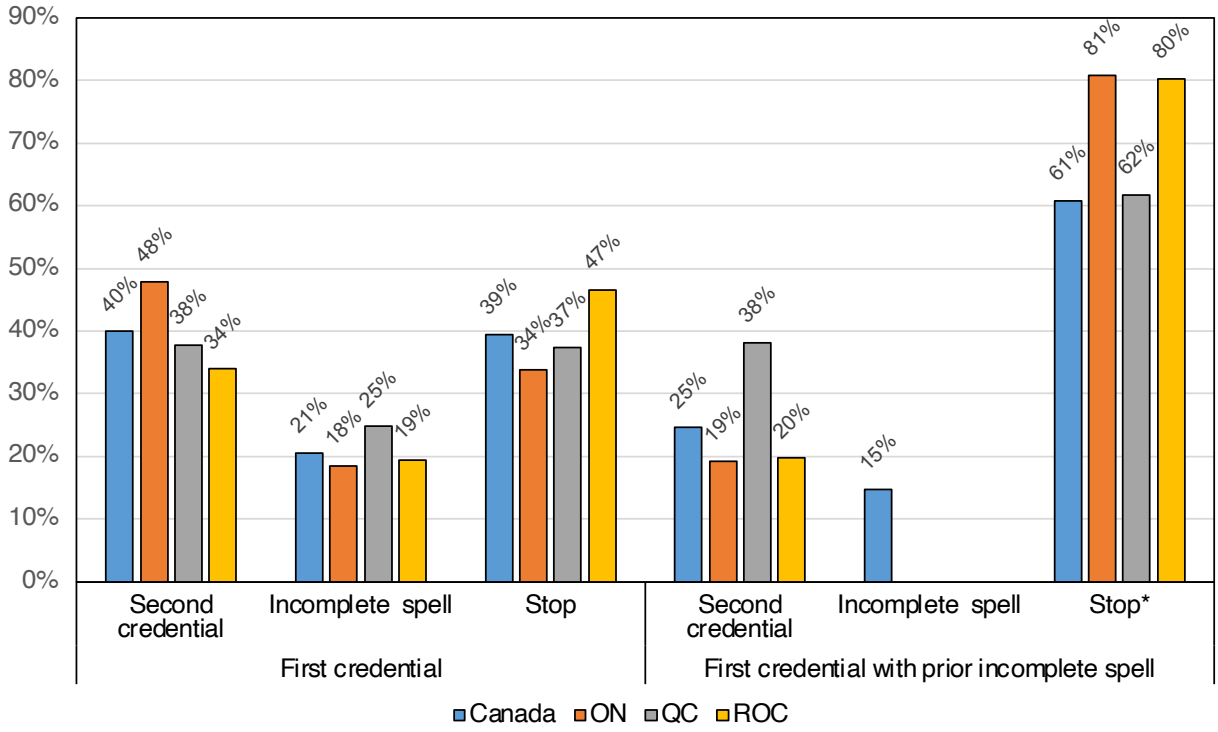
Figure 2. Pathways with PSE credential accumulation and incomplete spells in PSE programs between 18 and 27 years old, 1981-1988 birth cohorts



Source: LISA Wave 3 (2016) and T1FF (1999-2015).

Second, we compare these results with those for students who had a spell in PSE that did not lead to the completion of any program before completing the program that led to obtaining their first credential. Only 39 percent of Canadians in this second group went on to attend a second PSE program by 27 years old, a substantially smaller share than the 61 percent observed for students who obtained their first credential without a prior incomplete spell in PSE. However, among those who attended a second program, 63 percent completed that program, a proportion similar to the 66 percent observed in the other group. Overall, Figure 2 highlights that those who do not complete the first PSE program they attend are unlikely to (1) graduate from any subsequent PSE program (only 54 percent do so) and to (2) also *graduate* from a second PSE program (25 percent do so, or 63 percent of the 39 percent that do *attend* a second PSE program), primarily because of the lower rate of persistence in PSE after graduation from this first program.

Figure 3. Distribution of PSE credential accumulation pathways and incomplete spells in PSE programs between 18 and 27 years old by province, 1982-1988 birth cohorts



Source: LISA Wave 3 (2016) and T1FF (1999-2015).
ROC: Rest of Canada (all provinces outside of Ontario and Québec).
*For the Ontario, Québec and ROC results, this category includes individuals who had an incomplete spell in PSE before stopping. The two categories were collapsed due to small sample sizes.

Our data also allow for interprovincial comparisons, with some limitations due to sample sizes. We report these results in Figure 3, alongside with the Canada-level results also reported in Figure 2, for comparison purposes. In Figure 3, we find that the largest share of graduates from PSE programs without a prior incomplete spell who then complete a second credential is found in Ontario, and the lowest share in the ROC. Meanwhile, Québec stands out as the province where the largest share of graduates from a first PSE

program with a prior incomplete spell subsequently complete a second credential. At 38 percent, that proportion is double the rates found in Ontario and the ROC.

Together, these findings suggest that students whose pathway to graduation from their first PSE program includes a transfer or an interruption may experience difficulty completing a second PSE credential. This second credential is often a graduate or professional degree, which is associated with substantial earnings advantages on the labour market relative to most other PSE credential accumulation pathways (St-Denis et al., 2021).

As a complement to our results from Figures 2 and 3, Figure 4 differentiates between individuals whose first credential is at the bachelor's level and those for whom it is at a lower level (trades, vocational, apprenticeship, college, cégep, or other university or non-university certificate or diploma below a bachelor's degree). We do so for a sample excluding Québec because of the distinct pattern of results for that province identified in Figure 3. Sample size constraints did not allow to provide reliable results for Ontario specifically, but the aggregate pattern should provide insights applicable to the Ontario context.

The figure plots the share of individuals who completed a first PSE credential and either completed a second credential, pursued further PSE without completing a second credential, or stopped and did not participate in further PSE before 27 years old. The results are broken down by the level of the first credential (below bachelor's or not) and by whether there was an incomplete PSE spell before the program that led to a first credential.

First, our results show that bachelor's graduates with no prior incomplete spell in PSE have the highest rate of completion of a second credential, at 47 percent. Only 34 percent did not pursue further PSE, and another 19 percent pursued further PSE without completing any program (this represents less than one third of all graduates in this category who pursued further PSE).

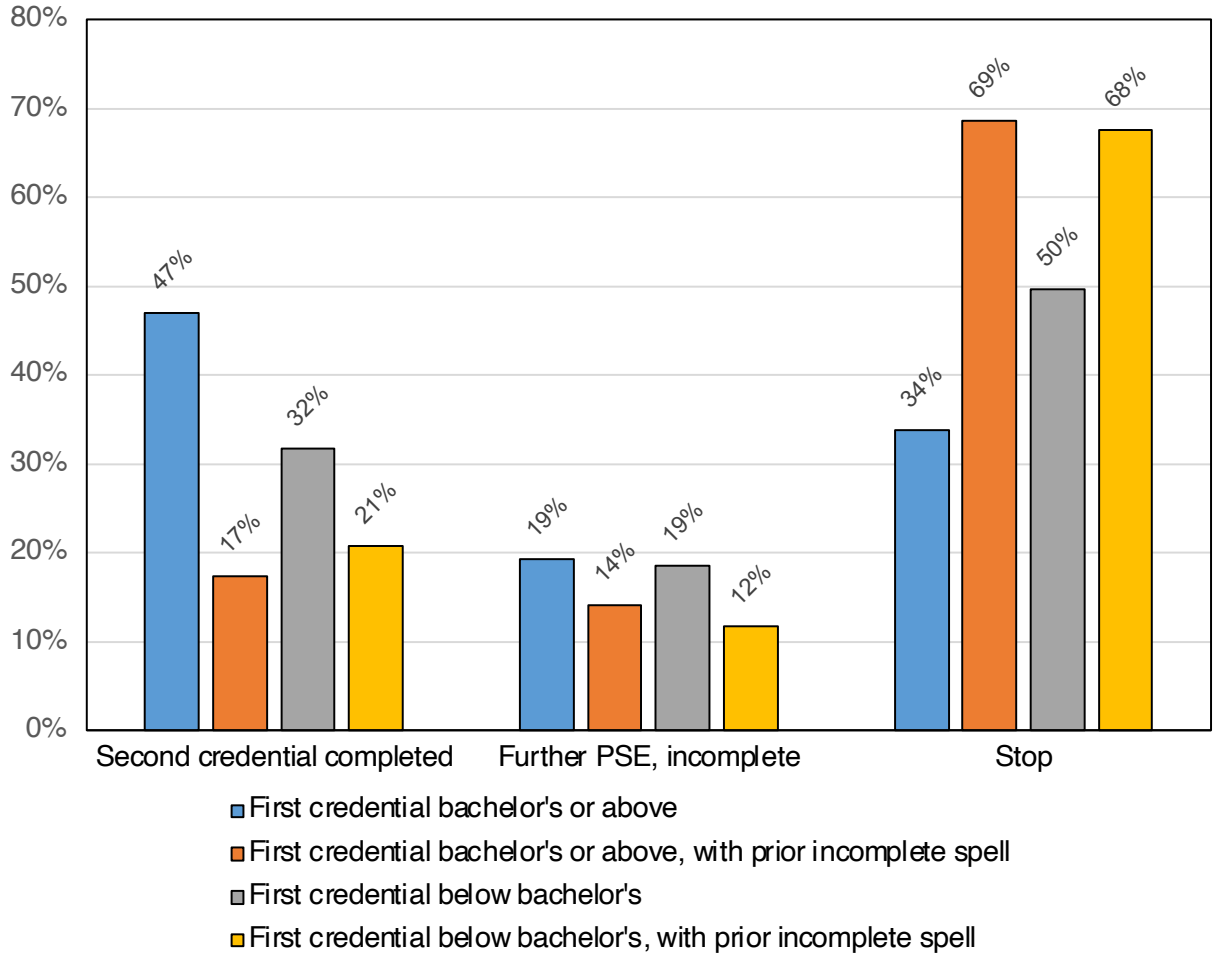
Second, we focus on bachelor's graduates who had a prior incomplete spell in PSE (likely including many transfer students). Only a small portion of this group chose to pursue further PSE (31 percent), and 17 percent of bachelor's graduates in this group or about half of those who did pursue further PSE graduated with a second credential. In other words, the rate of completion of a second credential was three times as large among bachelor's graduates with no prior incomplete spell in PSE than among those with a prior incomplete spell.

Third, we find a similar gap but of smaller magnitude among graduates of a first PSE program below the bachelor's level. Those who had an incomplete spell in PSE prior to obtaining their first credential at a level below bachelor's interrupted their education (stopped PSE) at the same rate (68 percent) as those who had an incomplete spell in PSE prior to obtaining their first credential at the bachelor's level or above (69 percent). However, only 32 percent of individuals who obtained a first credential below the

bachelor's level without a prior incomplete spell in PSE went on to obtain a second PSE credential, a gap of 15 percentage points with those who followed a similar pathway but obtained their first credential at the bachelor's level or above.

In sum, it appears that bachelor's graduates who follow a linear, uninterrupted pathway to graduation experience an especially high rate of graduation from a second PSE program before 27 years old, while graduates from bachelor's programs and programs below the bachelor's level after a non-completed spell in PSE are the least likely to obtain a second credential. Non-linear pathways towards graduation are therefore associated with a disadvantage in terms of second credential accumulation.

Figure 4. Distribution of PSE credential accumulation pathways and incomplete spells in PSE programs between 18 and 27 years old by level of first credential in all Canadian provinces outside of Québec, 1982-1988 birth cohorts



Source: LISA Wave 3 (2016) and T1FF (1999-2015).

Regression estimates

In order to account for differences in the sociodemographic characteristics of individuals who follow different pathways towards the completion of their first credential, which may also be associated with whether or not they completed a second credential, we estimate multivariate regression models. Specifically, we use a dependent variable with three categories: second PSE credential completed, further PSE after first credential but no second credential completed, and no further PSE (stop) after the first credential. We estimate a multinomial logistic regression model separately for Ontario, Québec and the ROC.

Our key independent variable includes the same categories as the variable used in Figure 3 to categorize first credential graduates: four categories differentiating individuals based on the level of the first credential (below bachelor's or not) and the presence of an incomplete spell in PSE prior to attending the program that led to a first credential. We control for sociodemographic covariates that may bias our estimates.

In table 1, we report predicted gaps in the probability of each of the three pathways (second credential completed, further PSE incomplete, and stopping PSE), comparing all categories of our key independent variable to a reference category: individuals who obtained their first credential at the bachelor's level or above with no prior incomplete PSE spell. In other words, the coefficients reported in the table represent the percentage point difference between our reference category and the three other categories for the probability of completing or not a second credential (or attempting to do so).

First, we find that the results for Canada overall are broadly in line with the descriptive results from Figure 3: those with a first credential below the bachelor's level are significantly less likely to complete a second credential and significantly more likely to stop PSE than those who completed a first credential at the bachelor's level or above without any prior incomplete PSE spell.

Second however, we find that it is *only* in Ontario that graduates of a first credential at the bachelor's level or above with a prior incomplete PSE spell experience a significantly lower probability of obtaining a second credential than bachelor's graduates without a prior incomplete spell. In other words, the pattern identified in Figure 3, which we may call a "second credential disadvantage" associated with an incomplete PSE spell prior to graduating from a bachelor's program, appears to be unique to Ontario. This has important implications for the design of transfer programs because many students with incomplete PSE spells prior to graduation will be transfer students who stopped out before returning to PSE to complete a bachelor's degree.

In Québec, we find the opposite pattern: graduates of a first credential at the bachelor's level or above with a prior incomplete PSE spell experience a significantly *higher* probability of obtaining a second credential, a puzzling result that seems to be related to the lower probability of pursing further PSE without graduating from a second program. The greater affordability of graduate programs including medical and business degrees

and/or the availability of short graduate programs (DESS) may account for that different pattern. Finally, no statistically significant difference is found in the ROC.

Table 1. Gap in the probability of completing a second PSE credential or pursuing further PSE without graduation by level of first credential and presence of prior incomplete spells in PSE by province

		Canada	Ontario	Québec	ROC
Second credential completed	First credential bachelor's or above	ref.	ref.	ref.	ref.
	First credential bachelor's or above, with prior incomplete spell	0.01	-0.28 **	0.19 **	0.01
	First credential below bachelor's	-0.29 ***	-0.25 **	-0.42 ***	-0.25 ***
	First credential bachelor's or above, with prior incomplete spell	-0.22 ***	-0.24 **	-0.28 ***	-0.20 ***
Further PSE, incomplete	First credential bachelor's or above	ref.	ref.	ref.	ref.
	First credential bachelor's or above, with prior incomplete spell	-0.05	-0.02	-0.11 *	-0.04
	First credential below bachelor's	0.00	0.01	0.05	-0.04
	First credential bachelor's or above, with prior incomplete spell	-0.01	-0.06	0.12	-0.04
Stop	First credential bachelor's or above	ref.	ref.	ref.	ref.
	First credential bachelor's or above, with prior incomplete spell	0.05	0.31 **	-0.07	0.03
	First credential below bachelor's	0.29 ***	0.25 **	0.37 ***	0.29 ***
	First credential bachelor's or above, with prior incomplete spell	0.23 ***	0.31 ***	0.15 *	0.24 ***

*** p<0.01; ** p<0.05; * p<0.01.

Note: Reference category is "First credential bachelor's or above". Controls: sex, immigrant (yes/no), visible minority (yes/no), age at first credential, parental education. Models estimated separately by province.

Source: LISA Wave 3 (2016) and T1FF (2000-2015).

Conclusion

Building on a previous report by St-Denis, Boujija and Sartor (2021), this report aimed to document credential accumulation pathways across Canadian provinces. In contrast with existing research, it provides results on the pathways that lead to graduation from a second postsecondary education credential. Leveraging a novel combination of survey and tax data, it identifies pathways that include incomplete spells in PSE (transfer, stopping out, or other) prior to graduation from a first PSE program. It then explores whether there are differences in the probability of obtaining a second credential between graduates who did or did not have an experience of a non-completed PSE spell in their pathway towards graduation from their first credential.

The relevance of this analysis stems from the earnings associated with obtaining a second credential, especially if it is at a level higher than the first (St-Denis et al., 2021). Our report identifies obstacles faced by students seeking to obtain a second PSE credential depending on their pathway to graduating from their first credential. More specifically, our results show that an incomplete spell in PSE before graduating with a first credential is associated with lower probabilities of completing a second credential. This is especially true in Ontario, and for graduates of programs below the bachelor's level.

As mentioned above, a certain proportion of individuals with an incomplete spell in PSE before graduating with a first credential are transfer students, while others are students who interrupted their studies before returning to PSE at a later date (a pattern sometimes called "stopping out"). For that reason, our results identify a challenge of transfer pathways that has rarely been emphasized: while efficient transfer programs can encourage and support graduation, especially at the bachelor's level, not all graduates face the same prospects after obtaining their first credential. Some may be disadvantaged on the job market. Our contribution is to show that others may face obstacles when seeking to pursue further PSE.

In addition, our results suggest that a large number of individuals who participate in PSE do not complete any credential before reaching 27 years old. This is the case for 19 percent of the Ontario sample. An additional 16% transfer or stop out of their first PSE program.

Discussion

One key point of discussion is whether our baseline results are consistent with those from other data sources. Our review of the existing literature suggests that this is the case. Drawing on a subsample of respondents from the Youth in Transitions Survey (YITS-A) born in 1984 and who enrolled in their first PSE program, Finnie et al. (2012) report four-year college graduation rates of 60 percent and five-year university graduation rates of 45 percent approximately for all provinces excluding Ontario. Comparable graduation rates are slightly higher in our data, at 60 percent for Canada in general and 57 percent for all Canadian provinces outside of Ontario and Québec, with no distinction between

college and university students (see Figure 1, the share of those who completed a first program without a prior incomplete spell in PSE among all PSE participants). Our rates may be slightly higher because we look beyond four- or five-year graduation windows and because some program changes counted as switches in Finnie et al. (2012) may not have been perceived as interruptions by LISA respondents (the questionnaire is retrospective, and the question wording is different). That said, the similarity of the estimates indicate that the LISA provides plausible estimates.

Our results differ from those from other studies in important ways, however. Those differences are due to the specific research design we adopt rather than potential differences in data quality. In fact, an important contribution from our study comes from our focus on birth cohorts rather than the focus on cohorts of PSE entrants or PSE graduates widely used in studies leveraging data from the PSIS or the NGS (Ferguson & Wang, 2014; Finnie et al., 2017). Importantly, we are able to show that a large proportion (40 percent) of students who enter PSE do not complete the first program they attend. In addition, only half of those students continue in PSE and end up obtaining their first credential (for example, by transferring or returning to PSE later). In contrast, research focusing on graduating cohorts reports that transfer students represent less than 5 percent of all students. This research is likely to miss dropouts who did not return to PSE later or who did not transfer, and transfer students who did not graduate. Consequently, these studies appear to underestimate the share of individuals following non-linear pathways in PSE.

In addition, many studies of PSE pathways follow observations over short windows and often restrict their analyses to continuing students. A study using a one-year observation window shows that only 1 or 2 percent of students transfer every year (Finnie et al., 2020). Another one observes transfers over a window of two years and finds that less than 10 percent do so (Hillier et al., 2020). This approach misses students who did not transfer but did return to PSE later. Such students may have persisted in PSE if specific transfer policies had been available, and they may benefit from transfer and articulation programs that accommodate interruptions. Our results suggest that a large share of students fall in this situation (40 percent of individuals in our birth cohorts of interest among those who started a first PSE program), and our approach allowed us to document their PSE pathways over a long observation window of 10 years (this is especially long in contrast with studies focusing on year-to-year transitions only).

That said, the combination of both approaches is useful. First of all, Finnie et al. (2020) show that in the 2009 entry cohort (restricted to those who also enrolled in the Fall of 2010), transfer students had six-year graduation rates only marginally lower (6-7 percentage points) than those who did not transfer. Others find larger gaps of around 14 percentage points (Davies & Pizarro Milian, 2020). Meanwhile, we show that among students who do not complete the first program they enrolled in (a group which includes transfer students, but also students who interrupt their study), 46 percent do not graduate from a PSE program (these include students who transferred and those who dropped out and who may or may not subsequently have returned to PSE). In other words, while transfer students may experience small (but meaningful) graduation gaps relative to non-

transfer students, those who experience an interruption and do not use any transfer opportunities fare much worse in terms of eventual graduation rates (we do not know to what extent this is because they never return to PSE or because they face obstacles to graduation if they do so).

Policy implications

In this section, we formulate a few discussion points on the policy implications of our findings. Specifically, we identify two groups of students who would benefit from interventions, including student transfer, articulation and mobility programs that are adapted to their needs.

1. A large group of students who enter their first PSE program do not graduate from that program. Many of them do not subsequently graduate from any other program, a subgroup that may especially benefit from new transfer programs, including programs leaving room for interruptions and stopping out.

2. Among those who graduate from a first PSE program after following a non-linear pathway (having a prior incomplete spell in PSE), only a small proportion obtain a second PSE credential, primarily because just 39 percent of them enroll in a second PSE program.

   Two areas of intervention may help increase the rate of graduation from a second PSE program among this group of students. First, ensuring that transfer and other programs facilitate timely graduation despite non-linearity in pathways to graduation from a first PSE program. In fact, the existing evidence suggests that time to graduation is significantly longer for transfer students relative to non-transfer students (Finnie et al., 2017).

   Second, conducting further research to identify the obstacles that discourage graduates from a first PSE program from attending a second PSE program (and graduating from such programs once they enroll, although our report does not identify graduation penalties for students who do enroll in a second program after taking a non-linear pathway to graduation from a first program).

3. Our analysis was conducted at the Canada level, but also included results for Ontario, Québec, and the rest of Canada. In these analyses, we were able to identify that some of the above challenges appear specific to Ontario. For that reason, higher education stakeholders in Ontario may seek to learn lessons from successful programs in other provinces.

Finally, it is important to note that our results are descriptive and not causal, which means that the evidence presented in the report does not allow us to directly conclude that non-linear pathways to graduation from a first PSE program *cause* lower rates of participation into a second PSE program. Instead, it is possible that observed and unobserved student characteristics are both related to the pathway that they take and to their likelihood of

graduating from a second degree. This includes all unobserved factors that we were not able to account for in our multivariate analysis but that may have an important influence on student outcomes, such as financial resources, motivation, aspirations, abilities, and grades.

With that nuance in mind, we can nevertheless emphasize that our report has identified a large group of students who experience non-linearities in their PSE pathways and low likelihoods of accumulating PSE credentials. This is a group of students that may benefit from well-designed interventions that favour persistence and credential accumulation. That said, these interventions should be designed in a way that allow for the evaluation of their impact. Qualitative research or other forms of data collection would also be necessary to better understand the experiences and specific obstacles faced by these students, and to develop appropriate interventions.

Limitations and avenues for further research

Our report features a few limitations that need to be emphasized. First, it relies on data from 1999 to 2015 and the sample is restricted to birth cohorts from the 1980s. Future researcher should use more recent data from Statistics Canada's Post-Secondary Information System (PSIS) to update our results. At the same time, our data offers the benefit of observing PSE pathways over a long time interval, from 18 to 27 years old. Until recently, this was not possible with the PSIS (especially in Ontario) due to the limited number of years available in the data. Consequently, past research has focused on transfer or other student pathways over just a few years.

Second, the small size of our sample complicates inter-provincial comparisons. Here again, the large sample from the PSIS could be used in the future. Nevertheless, our research demonstrates the importance of documenting the relationship between pathways to graduation from a first PSE program and the probability of obtaining a second credential.

Third, because we are using tax data, we do not know at what level students are studying in non-completed programs. Because of this, we cannot provide the same level of detail as studies based on the PSIS in our categorization of transfer types (whether from college or from university). In addition, because of data limitation, we do not distinguish between transfers or other types of interruptions as others have done (e.g., stopping-out, swirling, etc.). Further research with PSIS data would be necessary here.

Fourth, we did not extend our analysis to estimating earnings differences across pathways, because we focused on a relatively young sample, and earnings levels in the year or two following graduation are relatively irrelevant for assessing the long-term socioeconomic well-being of individuals. For most individuals, meaningful wage growth persists into their mid-30s before stabilizing, and measures of "permanent income" often center on income levels observed after 30 years of age. Future research will be needed to further document these trends. As the earliest cohorts from the PSIS-RAIS age, we will gradually be able to observe their incomes into their 30s in the linked T1FF data.

Finally, our analysis focuses on the 18-27 years old age range due to the restricted number of years during which tuition amount is available in tax data (starting in 1999). However, we know from the Phase 1 report that a large share of students completes their second credential well into their thirties. Graduates who follow non-linear PSE pathways may also attempt to complete a second PSE program later due to the possible delays associated with transfer pathways leading to a first PSE credential. That second credential may therefore be completed after 27 years old and fall outside of our observation window, leading us to underestimate credential accumulation among PSE students who follow non-linear pathways. That said, delays in graduation are costly, and transfer programs could be improved to facilitate timely graduation from a first (and second) PSE credential. This remains an area for further research and will require more years of data that are currently available to Canadian researchers through the LISA-T1FF linkage or the PSIS.

Technical appendix: Capturing incomplete PSE spells from tax datasets

The objective of the analysis presented in this Appendix is to evaluate the quality of PSE participation estimates derived from tax information. To do so, we assess the extent to which information is missed when relying solely on such data, by identifying which individuals and degrees may be systematically underreported. We compare self-declared PSE participation data from the Longitudinal International Survey of Adults (LISA), with its valuable insights into educational trajectories (specifically waves 2 and 3), to the tax family files (T1FF) data linked to the survey. This comparison allows us to compare three different estimates of PSE participation.

More specifically, we derive yearly indicators of PSE participation at the individual level using two distinct variables from the LISA survey, as well as information on claimed education and tuition credits from T1FF. We then compare aggregate estimates obtained from each source to highlight the overall differences. Then, at the individual level, we identify which individuals and degrees are more commonly missed in tax data when respondents report PSE participation in LISA during a given tax year.

We find that although younger individuals file taxes slightly less frequently, they are reliable credit claimants when actively pursuing education, thereby reducing potential biases. Tax data tends to undercount shorter-duration degrees, while longer-duration degrees are more consistently observed. In conclusion, we emphasize that the benefits of using tax data, especially when linked with other data sources like LISA, outweigh the potential biases. This approach has been instrumental in overcoming limitations in LISA data and effectively complementing it, enabling detailed observation of PSE pathways, including degree interruptions, as demonstrated by the main analysis in this report.

Data and methods

We use the second and third waves of the Longitudinal International Survey of Adults (LISA), which provide detailed information into the educational trajectories of the survey's respondents. LISA respondents also have their tax family files (T1FF) linked to the data. We derive and compare yearly PSE participation indicators on an individual level using both sources as described below.

Two LISA PSE participation estimates

Within the LISA data, two specific modules can be used for estimating PSE participation. The primary module used for our main analyses in this report is the retrospective questionnaire from wave 3. This module comprehensively gathers data on the four highest degrees each respondent has *completed*, without imposing any limits on the timeframe of observation.

The second estimate is derived from a specific question present in both wave 2 and 3 of the LISA survey. This question documents the respondents' monthly education enrollment status—*regardless of completion*—during the 24 months leading up to the survey date of each wave. Unlike the first estimate, which lacks data on interrupted PSE, this second variable successfully captures such instances. However, it has certain limitations: it is only available for a four-year period, from 2012 to 2015, and it includes all types of education, including high school. This last limitation is only problematic for the youngest cohorts, who are more likely to be enrolled in high school during the covered period.

Despite these differences and limits, comparing both sources simultaneously to tax derived estimates, particularly when disaggregated by cohorts, still allows for a robust evaluation of the accuracy of tax-derived PSE estimates.

T1FF PSE estimate

With the introduction of Schedule 11 in 1997, students in Canada have been required to file this form to claim tax credits for time enrolled in education and education-related expenses. This implies that starting in 1997, but only reliably from 1999 onwards, claimed amounts can be linked to the individual enrolled in education, even when the credits are transferred or carried forward to subsequent years.

Two types of credits exist: one based on the number of months spent in either part-time or full-time education in a given year, and the other based on the incurred costs of education (tuition and textbook amounts). Because T1FF data includes information on both, enrolment in free and lower-cost programs, such as CEGEP, can also be observed.

Using this data, yearly PSE estimates can then be easily derived from tax data for all years after 1999, and for any individual who filed their taxes, by flagging all tax years in which they had claimed any of the two education-related credits.

For the current analysis, we focus on LISA respondents from waves 2 and 3, who were aged 15 to 65 at anytime between 1999 and 2015.

Results

In the rest of the appendix, we first look at the filing patterns in T1FF, by age. We then compare the three PSE estimates by highlighting their overall differences. Finally, we examine, on an individual level, who and which degrees are typically missed when relying on tax data for estimating PSE participation.

Figure A.1 compares the proportion of our sample who had no tax declaration or who claimed education and tuition amounts at any given age, between 1999 and 2015. We note a significant proportion of missing tax declarations at age 17, standing at 39.8%. This proportion declines sharply to 14.7% by age 18, which corresponds inversely to the surge in education participation, from 9.4% at age 17 to 41.4% at age 18. The peak of

PSE participation is observed at age 20, reaching 61.0%, accompanied by a decreased missingness rate, reaching8%. As the age increases, the average missingness in tax data continues to decrease, reaching a lower rate of 6% by the age of 30.

These results suggest that tax declarations are more frequently absent among younger Canadians. However, this trend significantly diminishes during the years typically associated with PSE (and labor market entry), as incentives for filling taxes increase.

Figure A.1. Yearly proportion of respondents with missing tax information and enrolled in PSE (T1FF), by Age, 1999 to 2015

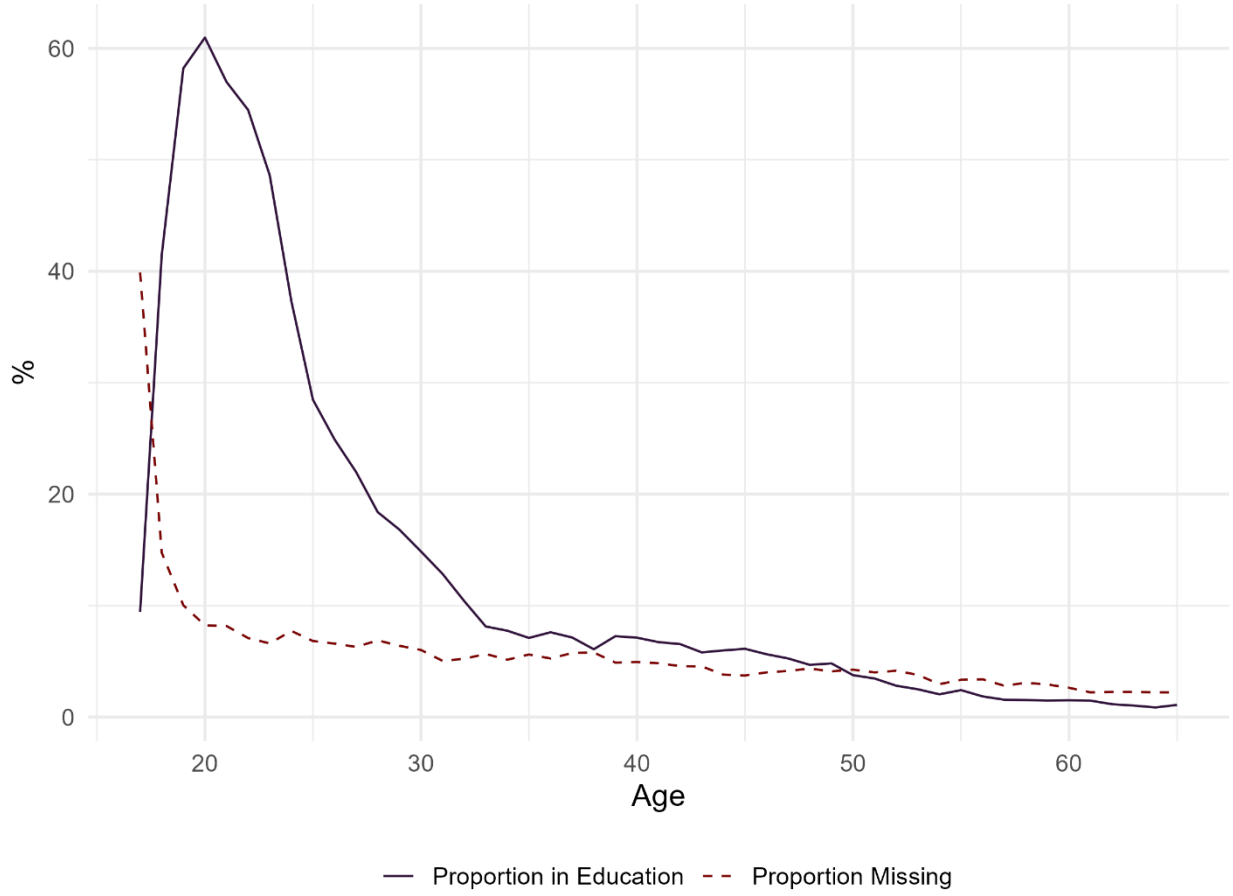
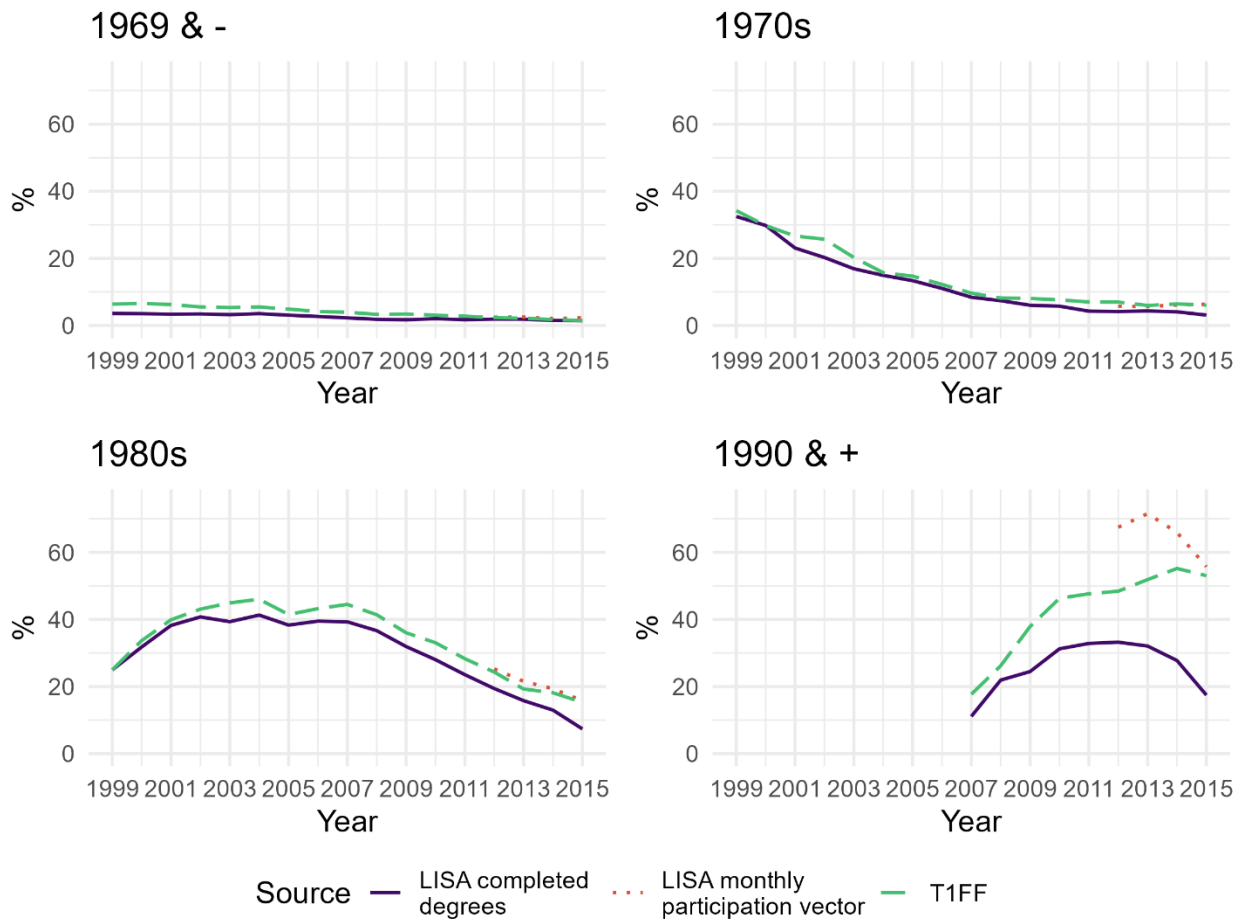


Figure A.2 illustrates annual PSE participation estimates based on our three sources (the two derived from LISA and the one from T1FF), by decadal cohort groups. For all cohort groups, a notable discrepancy exists between the T1FF and LISA estimates based on completed degrees, which may be cautiously ascribed to the exclusion of interrupted degrees in LISA's third wave. Looking at the cohorts from the 90s, there is a noticeable decrease in estimates based solely on completed degrees in recent years. This is anticipated, as more respondents in that age group are likely to be engaged in ongoing programs at the time of the survey, which are not captured by the variable.

Looking at the estimates derived from the LISA monthly vector, which captures all education regardless of level or completion, the rates seem aligned with those from T1FF for cohorts born in the 80s and before. For the 1990s cohort, since some respondents in this group may still be enrolled in high school during the last years of our study period, there's an important gap between both estimates, which slowly subsides, as more leave high school and enroll in PSE.

Except for the younger cohorts, for whom the gaps are anticipated, aggregate tax-derived yearly PSE participation rates appear to be fairly in concordance with estimates from the monthly LISA vector.

Figure A.2. PSE participation estimates derived from three sources, by tax year and cohort group



These results, however, only represent aggregate estimates. While they appear to indicate some coherence between T1FF and vector LISA estimates for cohorts not affected by the limitations of our data, they do not inform us on how years of PSE participation declared in each source correspond on an individual level. In other terms, we wish to know to what extent the years declared in LISA, are also declared in T1FF, as aggregate correspondence could be the result of self-cancelling errors.

Figure A.3 examines the proportion of years in which respondents, as reported in LISA's retrospective module on completed degrees, were enrolled in PSE and claimed education credits in tax data. Overall, it appears that the congruence between reported PSE enrollment and education credit claims—referred to as the match rate—is better for more recent cohorts than older ones, even within the same age ranges. Within cohorts, a higher match rate is perhaps noted during the peak ages for pursuing education. However, we can only partially examine this, as our observation period prevents a detailed observation of age-cohort effects.

Cohorts from the 1980s and 1990s exhibit the highest match rates during the observation period, at approximately 80 to 90%; an encouraging result, as these individuals are more likely to be within the ages of more intense PSE participation, where underreporting could introduce significant bias. Conversely, older respondents show a lower match rate, which may be attributable to underreporting of education credits for certain degrees, possibly shorter ones, which are more common at older ages.

Figure A.3. Enrollment years in PSE with claimed education credits by cohort group and tax year

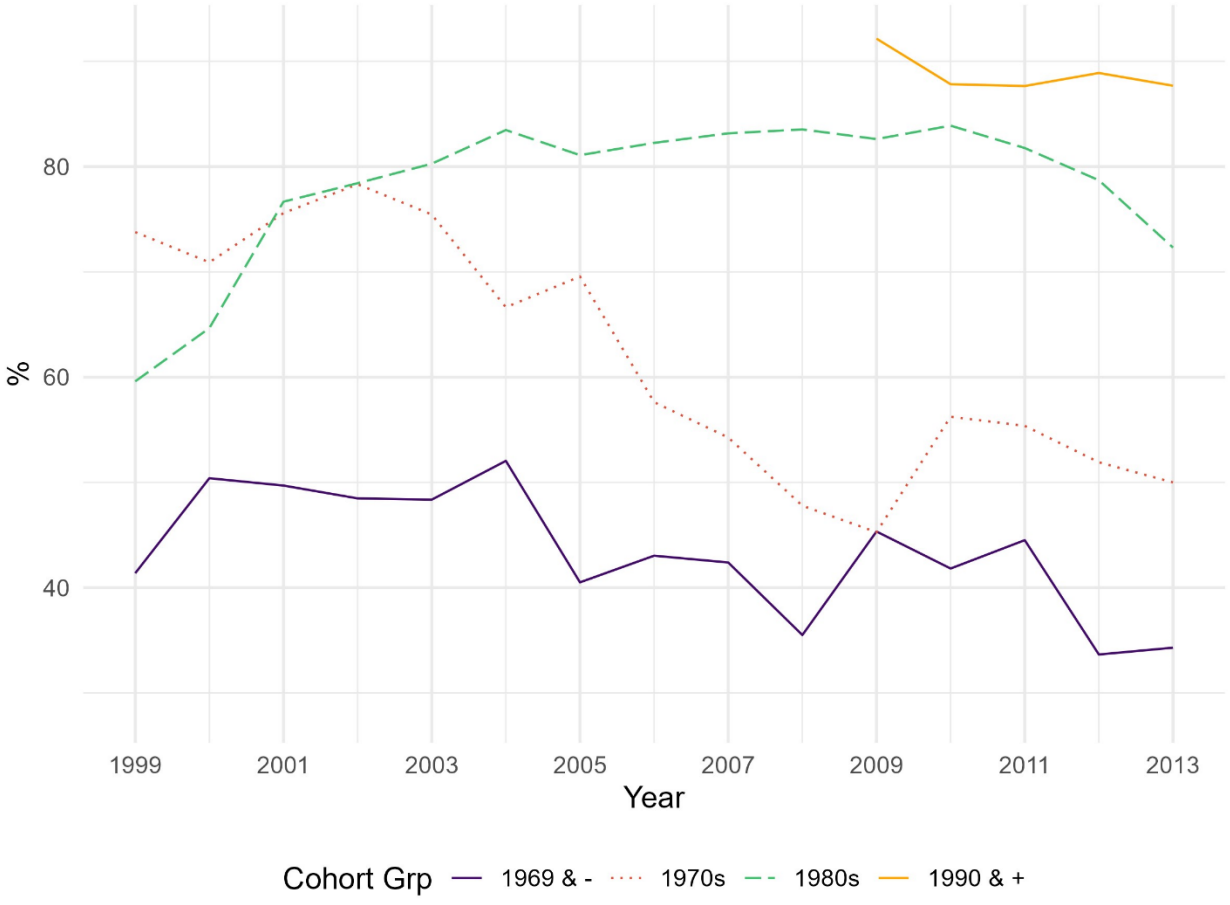
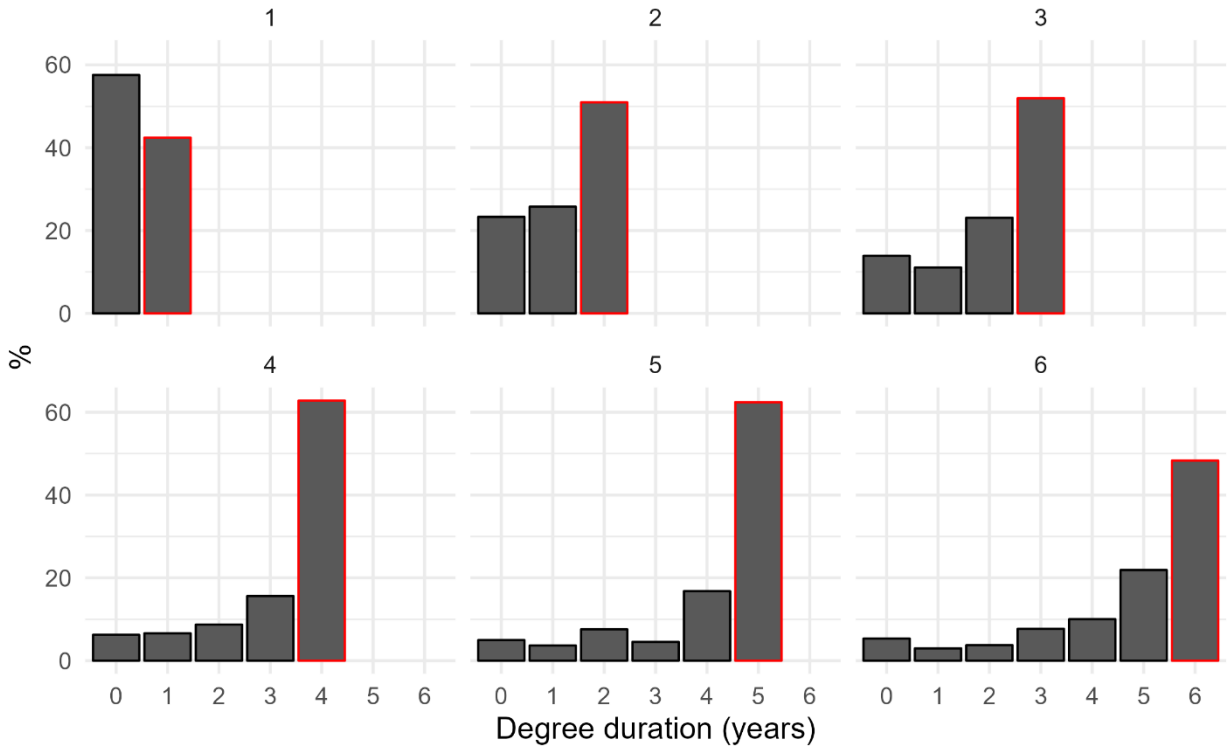


Figure A.4 presents a comparison between the duration of completed educational programs reported within LISA and the corresponding years in which education credits were claimed in tax data. It reveals that short programs, those of one year or less, are consistently missed in tax records, with only 42.4% claimed. In contrast, programs extending two years or more exhibit a higher concordance with tax data, with the most frequently claimed number of years matching the actual program duration as recorded in LISA. Specifically, for two-year programs, which span two subsequent tax years, 23.3% go unreported while 51.0% are fully reported in tax data. Because of the necessity to match tax data, which merely indicates if education occurred in a given tax year, with retrospective survey data that provides precise start and end dates, some programs reported as two-year programs might be one-year programs, in terms of actual duration, but appearing in two consecutive tax years (e.g. beginning in the fall and ending in summer). This may inflate the estimated underreporting of two-year degrees.

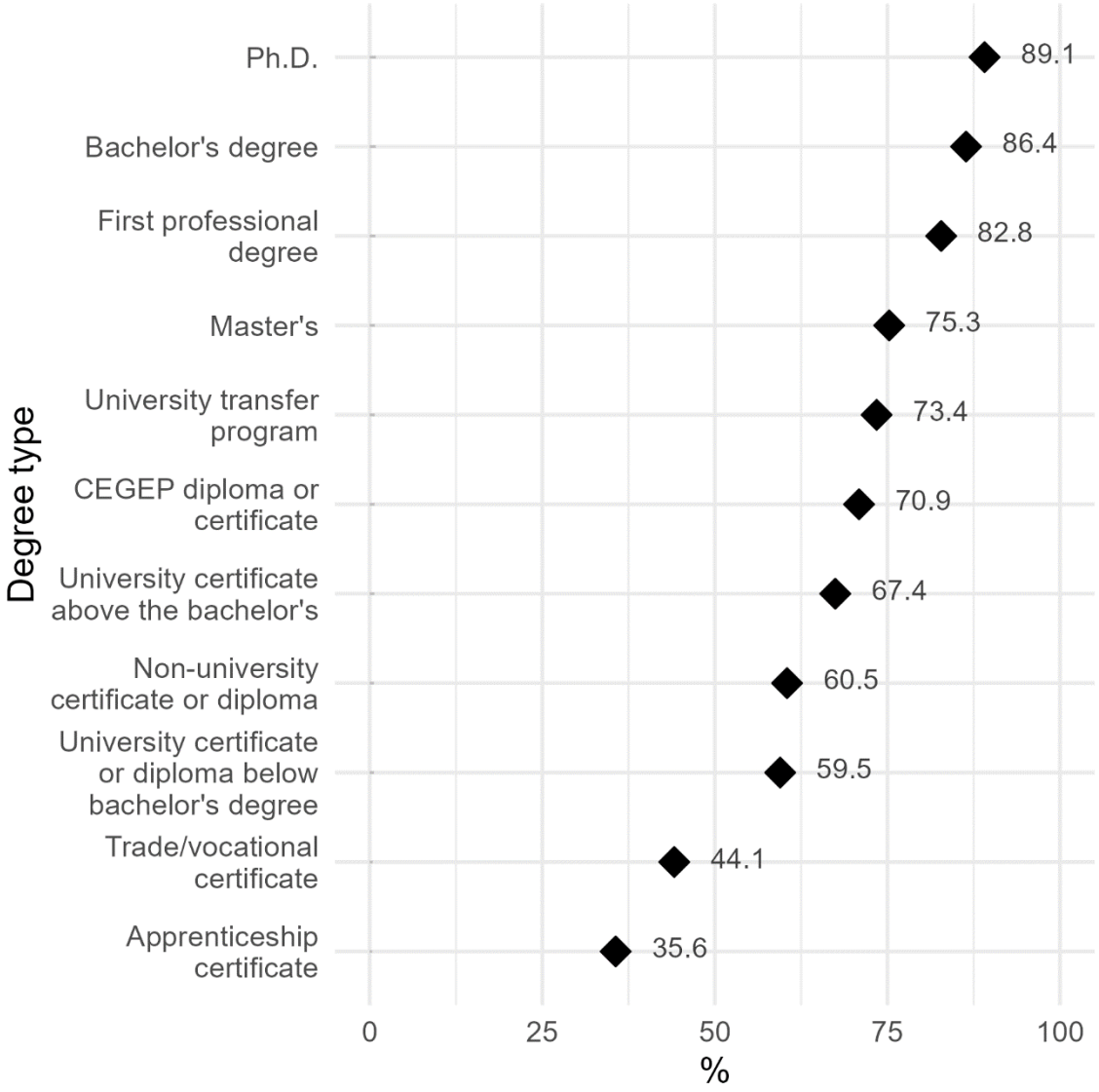
Figure A.4. Average proportion of years education credits were claimed for completed degrees declared in LISA, by degree duration



Longer programs, those extending three years or more, generally show substantial reporting in tax data. For example, programs lasting four, five, and six years are nearly always represented in some capacity, with less than 10% being completely absent from tax records, suggesting that the longer the program's duration, the more likely it is to be documented (at least partially) in tax data.

Figure A.5 examines the average percentage of years for which education credits were claimed in tax data, broken down by specific degree types. The findings correspond with those related to program duration. Degrees that typically take longer to complete and are at the bachelor's level or higher display the highest match rates in tax data, whereas shorter degree programs tend to have lower match rates.

Figure A.5. Average percentage of years for which education credits were claimed in tax data, by degree type



Conclusion

This technical appendix provides a detailed analysis of the completeness of tax-derived data on post-secondary education (PSE) participation, utilizing the unique linkage between the Longitudinal International Survey of Adults (LISA) and tax family files (T1FF) to assess the extent of underreporting in tax-derived PSE participation estimates. Our work complements the few previous efforts to evaluate the use of such data in education research (Frenette, 2017) and provides additional estimates and evidence on their reliability.

The analysis highlights several key points for education researchers using tax data to study PSE pathways. Our findings reveal that missing patterns in tax data, a primary concern when using administrative data, diminish significantly during ages of high PSE participation. Furthermore, when broken down by age and cohort, some differences in the patterns and accuracy of claiming education credits become apparent. Nonetheless, the data suggests that filing patterns seem most reliable during the 20s, the ages of peak PSE participation, especially among the more recent cohorts. These cohorts are more likely to be in education during the years where tax-derived education data is available and reliable (post-1999). This implies that bias related to age-cohort filing behavior should be minimal.

A significant finding concerns the underreporting of shorter-duration degrees. Programs lasting a year or less are substantially underreported, whereas longer-duration degrees typically receive at least some partial coverage in tax data. Researchers using tax-derived PSE estimates should be mindful of this potential bias. One significant limitation of our investigation into filing patterns by degree duration concerns our reliance on completed degrees. This implies an assumption that there are no differences in reporting patterns between completed and non-completed degrees, an assumption that is likely unrealistic.

Despite these disparities in reporting accuracy across various educational durations, cohorts and ages, tax data still appears to be an invaluable asset for measuring PSE participation at both aggregate and individual levels. When linked with other data, such as LISA, tax records may enhance or complement PSE estimates. On their own, they may provide an adequate longitudinal indicator for PSE participation, where none exists. Nonetheless, this does not negate the need for continuous efforts to link multiple datasets to maximize available information. Tax-derived data may not always present a comprehensive picture of PSE trajectories, particularly in terms of degree levels, fields, and educational institutions, and its utility may be restricted for research that delves into more nuanced aspects of education participation.

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