



Non-Linear PSE Pathways and Credential Accumulation

Statistical Portrait and Evaluation of Labour Market Outcomes

June 18, 2021

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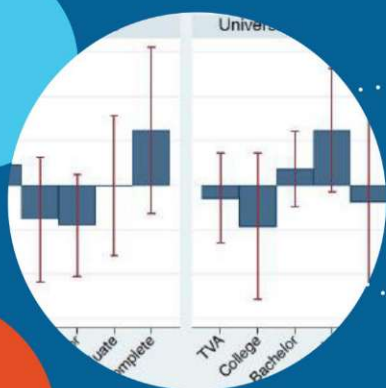
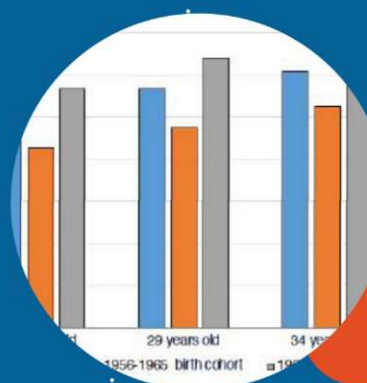
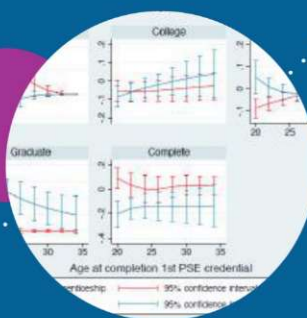


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ACKNOWLEDGEMENTS

This work received financial support under the Research Insight program of the Ontario Council for Articulation and Transfer (ONCAT).

The analysis presented in this paper was conducted at the Quebec Interuniversity Centre for Social Statistics which is part of the Canadian Research Data Centre Network (CRDCN). The services and activities provided by the QICSS are made possible by the financial or in-kind support of the Social Sciences and Humanities Research Council (SSHRC), the Canadian Institutes of Health Research (CIHR), the Canada Foundation for Innovation (CFI), Statistics Canada, the Fonds de recherche du Québec - Société et culture (FRQSC), the Fonds de recherche du Québec - Santé (FRQS) and the Quebec universities. The views expressed in this paper are those of the authors, and not necessarily those of the CRDCN or its partners.

INTRODUCTION

Context

Research over the last decades in social sciences has emphasized that a large proportion of students follow non-conventional and non-linear pathways through PSE (Denice 2019; Hearn 1992; Milesi 2010). This includes not completing a program, transferring between programs and institutions (Goldrick-Rab and Pfeffer 2009; Monaghan and Attewell 2015; Goldrick-Rab and Han 2011), delaying or interrupting enrollment (Bozick and DeLuca 2005; Goldrick-Rab 2006; Goldrick-Rab and Han 2011), studying part-time, combining different social roles (parent and student, worker and student, etc.) (Roksa and Velez 2012; 2010; Weiss and Roksa 2016), and accumulating credentials in a non-linear way (college after bachelor's, or the accumulation of several credentials at the same level) (Walters 2003; Wall 2021; Ntwari and Fecteau 2020).

Transfer and articulation policies and programs can contribute to supporting students taking various pathways through postsecondary education (PSE), and address obstacles students face when aiming to change programs or institutions during the course of a program of study. Appropriate interventions can therefore play an important role in structuring the pathways students follow through PSE.

In this report, we adopt a perspective on PSE pathways that focuses on PSE credential accumulation dynamics. In a context where an increasing share of students complete more than one PSE credential, we base our report on the insight that transfer and articulation policies may gain to be informed by a better understanding of pathways that involve different sequences of accumulation of two or more PSE credentials. For example, measures that support the completion of a bachelor's degree as a first credential through transfers may be beneficial if bachelor's graduates are likely to then follow specific credential accumulation pathways such as the completion of a graduate or professional degree.

More specifically, this project is motivated by a related set of considerations. First, many studies of non-conventional or non-linear PSE pathways and of the labour market outcomes associated with them use data that measure short-term trajectories and outcomes for subsamples of all PSE participants, often at specific stages of their experience through PSE (for example, students below 25 years old attending a college program). Second, for related reasons, we lack a clear account of the long-term labour market outcomes associated with a broad range of PSE credential accumulation pathways. An understanding of these dynamics may contribute to the design and orientation of transfer and articulation policies and programs.

Objectives

The primary expected outcome of this report is to document dynamics related to PSE pathways that include more than one credential, and to better understand the labour market

benefits and penalties associated with non-linear pathways that involve various patterns of credential accumulation. To do so, this report sets three objectives:

1. Present a statistical portrait of different PSE credential accumulation pathways in Ontario and in Canada, in order to identify the share of postsecondary students who follow non-linear pathways such as those completing several postsecondary certificate, diplomas or degrees at the Bachelor level or below.
2. Document the drivers of different PSE credential accumulation pathways by leveraging the high level of detail available in the Longitudinal and International Study of Adults (2016).
3. Evaluate the employment and labour market outcomes associated with different PSE credential accumulation pathways, such as earnings differences between individuals following different pathways. In doing so, we aim to analyse the drivers of income differences between PSE credential accumulation pathways.

Key findings in brief

The first set of findings presented in this report shows that by the time Canadians born between 1956 and 1980 reached 35 years old, approximately 60% of them had completed one PSE credential, and more than 20% completed a second credential or more. For some Canadians, this means completing a graduate degree after a bachelor's degree. At the same time, credential accumulation pathways are often non-linear, and a large proportion of the population complete their first or second credentials well into their 20s, 30s or even 40s.

The results presented in this report yields two main analytical insights:

1. The level of the first completed credential is strongly related to the level of the highest credential to ever be obtained, which has an influence on access to more highly rewarded PSE pathways. Specifically, those who enter PSE at a level below a bachelor's degree have low probabilities of completing a second credential, low probabilities of completing bachelor's degree, and even lower probabilities of completing a graduate or professional degree. This is consequential given that a graduate or professional degree is associated with substantially higher employment income than other levels of educational attainment. Different background characteristics are associated with the level of the first credential and with the level of the second credential conditional on the first credential among PSE participants, and in particular parental education and visible minority status.
2. The accumulation of the same two credentials (college and bachelor's) but in different orders is associated with different average income levels, net of observed characteristics. More generally, the same level of highest credential is associated with different income levels depending on the credential accumulation pathways followed to complete them. Importantly, the size of the premium associated with completing a bachelor's degree as their second credential after a trade/vocational or apprenticeship certificate or a college certificate or diploma is smaller than the

premium associated with completing a bachelor's degree as one's first and single credential.

This has implications for transfer and articulation policies to the extent that they may contribute to attenuating the impact of certain obstacles to accessing pathways that are most likely to translate into advantageous labour market outcomes.

Finally, the results suggest that selection dynamics are at play based on characteristics that are not measured in most datasets. More broadly, the mechanisms underpinning some of the differences in income associated with different PSE credential accumulation pathways remain unaccounted for even in analyses leveraging detailed data on the characteristics of PSE pathways and of jobs held by respondents. In order to better understand the drivers of PSE credential accumulation pathways and the outcomes associated with them, causal research designs or more fine-grained data may be necessary.

REVIEW OF THE LITERATURE

The classical literature on human capital (Becker 1964) and status attainment (Blau and Duncan 1967; Featherman and Hauser 1978) focuses on years of education and conceptualize education in terms of a relatively continuous quantity of skills, capital, or resources. Some of the literature on access to postsecondary education adopts a perspective with similar consequences to the extent that it conceptualizes access in terms of binary participation or non-participation (Finnie and Pavlic 2013). Some sociologists have emphasized the importance of conceptualizing educational attainment as a sequence of steps (Mare 1980). The common shortcoming of all these perspectives is that they do not leave room for conceptualizing pathways into and through PSE as a non-linear and possibly disorderly process.

Indeed, a literature on PSE pathways increasingly recognizes the heterogeneity in student trajectories (Denice 2019; Childs, Finnie, and Martinello 2017). This literature also highlights the association between background characteristics such as parental socioeconomic status and different dimensions of PSE pathways (not just level of educational attainment) (Goldrick-Rab 2006; Zarifa et al. 2018).

In Canada, many studies that adopt a perspective taking into account non-linearity and complexity in PSE pathways are limited to a single institution, or a single subnational region. Further, many studies are constrained by the short duration between completion of the first observed credential/pathway and the end of the observation period because of the available sources of data. For these reasons, little is known about the long-term outcomes, especially for older individuals, for those who follow conventional post-secondary pathways and those who do not at a national level. For example, Stewart and Martinello (2012) use a small sample from a single institution to study persistence in postsecondary education among transfer and non-transfer students. Childs, Finnie and Martinello (2017) use a representative sample of the Canadian population to study the persistence of transfer students in postsecondary education. However, the dataset does not allow to quantify all different pathways and transfers, especially those occurring later in the life course of students (the sample includes individuals between 15 and 23 years old, therefore limited in coverage to transfers and program changes taking place early in the education trajectory of postsecondary students). A number of more dated studies suffer from similar limitations (Vaala 1993; 1991; Gawley and McGowan 2006).

While valuable contributions, these studies leave open several data gaps on the importance of diverse postsecondary education pathways in Ontario and in Canada, and do not allow to properly assess the outcomes associated with each of the different pathways. This is in part related to the focus of the studies discussed above on transfer pathways, which are generally observed within the first few years of a spell in a program of study. At the same time, the narrow time range of most studies is an important limitation to existing studies because a large part of pathways through PSE tends to occur at later ages (see for example Hango 2010). A minority of college applicants in Ontario (40%) are originated from high school, while so-called “non-direct entrants” are often older, with previous experience in PSE (including completed PSE credentials (Kerr 2011). An international literature on lifelong learning

likewise emphasizes that late PSE participation age (after 25) for a large portion of HS graduation cohorts, often motivated by reskilling (Chesters, Cuervo, and Fu 2020).

More broadly, non-transfer university (76.17%) and non-transfer college (15.86%) are the most prevalent pathways to the completion of a PSE credential in Ontario (Zarifa, Sano, and Hillier 2020). Few students transfer institutions (Childs, Finnie, and Martinello 2017; Finnie, Dubois, and Miyairi 2021; Zarifa, Sano, and Hillier 2020). We argue that this justifies a broader approach to the study of non-linear PSE pathways to include PSE credential accumulation and related outcomes over the longer term.

For example, many credential accumulation pathways may gain to be the focus on transfer and articulation programs even when involving completed programs. Indeed, a relatively limited literature documents the accumulation of credentials after a first credential (Walters 2003; Wall 2021; Ntwari and Fecteau 2020). The scope of this literature may be extended to include contributions focusing on access to graduate school (Zarifa 2012) to the extent that it consists of one among many possible credential accumulation pathways. At the same time, the contributions that document the reverse or horizontal accumulation of credentials are almost non-existent in Canada. Boothby and Drewes (2006) do document multiple credentials accumulation using Census data from 1980 to 2000, which showed that a non-negligible share of trades, college and bachelor graduates held more than one credential (which was not necessarily associated with an earnings premium). However, that data did not allow to measure those who held two credentials at the same level.

In the US and the UK literature, some literature focuses on re-enrollment and adult/lifelong learning. It highlights differences by parental socioeconomic status (Bukodi, Bourne, and Betthäuser 2019; Jacob and Weiss 2011; Elman and O'Rand 2007) as well as a greater likelihood of re-enrollment of in vocational or college programs (Townsend 2003). Again, many of the contributions focus on a specific subpopulation.

In sum, we lack a clear portrait of the patterns and drivers of PSE credential accumulation pathways in the overall population, as well as the long-term outcomes associated with different pathways. This evaluation of the state of the literature guides this paper and its stated objectives.

DATA AND METHODS

Data

We use data from Wave 3 of the Longitudinal and International Study of Adults, a survey conducted by Statistics Canada between January and June 2016. The first and second waves of the survey were conducted over the same 6-month period in 2012 and 2014 respectively.

The sample includes responding sample members, who are 15 to 65 years old at the time of the survey. It also includes children of respondents younger than 15 years old. These sample members are not administered the questionnaire. Once they turn 15 years old, they become responding sample members. All original sample members, that is those who resided in a sampled household at Wave 1, are followed longitudinally in subsequent waves even if they change households. Adults who join a household where at least one of the original sample members resides are temporarily included in the sample but no data is collected from them. There are no other refreshments to the sample.

Because of these design features of the survey, the LISA sample is representative of the non-institutionalized Canadian population residing outside of the territories in 2012. Cross-sectional respondent weights that account for attrition between waves are produced at each wave to allow the production of corresponding population estimates.

The initial sample included approximately 34,000 respondents residing in 11,000 Canadian households (excluding the territories). At wave 3, attrition (sample members not responding to the survey because of refusal, death, emigration, or non-contact) resulted in an overall smaller sample even if some children aged into the responding sample when they turned 15 (new responding sample members).

Our analysis uses data from Wave 3 because it includes a retrospective postsecondary education history module. This module includes information on the first four PSE certificates, diplomas or degrees completed by respondents, and more specifically the level of each credential and its field of study, as well as the duration and start and completion date of the credential. Importantly, note that no data is collected for programs of study that were not completed.

In other words, the Wave 3 PSE history module provides information on PSE credential accumulation but not on transfers between programs of study where the program of origin is not completed. Nevertheless, the PSE history module also collects information on the first year when a respondent participated to PSE. If that year is different from the year when the first completed PSE credential was started, we can infer that a transfer or another type of pathway involving non-completion of the first credential occurred. No such information can be derived for programs that may have been started (but not completed) after the start date of the first completed degree.

The LISA variable capturing the level of each PSE credential uses 11 different categories, which we recode into four aggregate categories that capture the most relevant differences in

levels: trades/vocational/apprenticeship certificates; certificates or diploma at the college/CEGEP/university below bachelor's level; Bachelor's degrees; graduate and first professional degrees. The correspondence is reported in table 1. Note that in analyses using samples of the overall Canadian population, pre-university CEGEP diplomas (obtained in Quebec) are not counted as PSE credentials because they are not intended to be terminal credentials and they are a re-requisite for access to bachelor's programs and include content that is part of the last year of secondary education in other provinces. This would lead to an inflation of the number of respondents with more than one PSE credentials. Technical CEGEP diplomas (*DEC de formation technique*) and A.C.S. (*Attestation d'études collégiales*) certificates, intended to be terminal and relatively equivalent to college diploma or certifications offered in other provinces, are included in the analysis. Credentials with a duration below three months are also excluded from the sample.

Table 1.

Derived variable, level of PSE credentials

Categories of the derived var	Categories from raw LISA variable on PSE level
1. Trade/vocational/ apprenticeship certificate (Abbreviation: TVA)	Trade/vocational certificate (includes an attestation of vocational training, diploma of vocational studies, or attestation of vocational specialization offered in Quebec) Apprenticeship certificate
2. College/CEGEP/university below bachelor's diploma or certificate (Abbreviation: College)	CEGEP diploma or certificate [exclusion in this study: pre-university CEGEP programs; not excluded: DEC "technique" and "A.C.S"] Non-university certificate or diploma from a college, school of nursing, technical institute University transfer program University certificate or diploma below bachelor's degree
3. Bachelor's degree	Bachelor's degree
4. Graduate or first professional degree (Abbreviation: Graduate)	University certificate above the bachelor's First professional degree (degree in law (LL.B.), medicine (M.D.), dentistry (D.D.S., D.M.D), veterinary medicine (D.V.M.), optometry (O.D.), divinity) Master's Ph.D.

Several additional data cleaning steps were necessary in order to construct the PSE pathway variables used in our analyses. These steps were necessary to address inconsistencies and missingness in the raw data. This includes the deterministic imputation of missing credential start and end dates based on standard program durations.

Construction of the analytic sample

We leverage the fact that the PSE history module of the Wave 3 of LISA provides information on the number and level of PSE credentials accumulated by respondents, including in what order and with what timing. Most of the analysis is restricted to respondents who obtained at least one PSE credential. In addition, some of our analysis implements an upper age bound to the PSE history variable to allow for analyses pooling cohorts together. This step is implemented because the LISA sample is cross-sectional, and respondents are observed at very different ages in 2016, when Wave 3 data is collected. This step also allows for the comparison of different birth cohorts or for tracking the outcomes of a given birth cohort at different ages (setting different upper age bounds). As an example, a large part of our analysis sets an upper age bound for credential accumulation at 35 years old, meaning that only the credentials *completed* by respondents before they turn 35 years old are included.

Throughout all of the report, the analytic sample is restricted to respondents who were 35 to 59 years old in (early) 2016, corresponding to the 1956 to 1980 birth cohorts. Respondents below 35 years old are excluded because the objective of this paper is to focus on PSE pathways and their outcomes in a long-term perspective, in contrast with studies that focus exclusively on young graduates (often excluding older adult graduates) and on outcomes observed within a small number of years from graduation.

In order to include only respondents who completed most of their PSE in Canada, we exclude respondents who arrived in Canada after 15 years old. We also exclude immigrants who report spending less than 10 years in Canada after 15 years old. This yields an analytic sample of approximately 4000 respondents with at least one PSE credential in 2016, representing a population of 6,478,400 individuals age 35 to 59 in 2016 with at least one PSE credential.

Ontario is the focus of this report, but some of the results are reported for Canada only because of sample size limitations. The Ontario analytic sample is drawn from respondents with at least one PSE credential in 2016 reported having graduated from an Ontario high school (no geographic identifier is available for the institution of the first credential). This yields a sample size of close to 1000 observations representing a population of 2,300,100 Ontario high school graduates age 35 to 59 in 2016 with at least one PSE credential.

Methods

The report presents results from three types of analyses. First, we provide an overall description of the different PSE pathways followed by the sample respondents. Second, we report results from multinomial regressions providing estimates of the relationship between different background characteristics and different pathways through PSE. Third, we estimate a set of ordinary least square (OLS) regressions models to document to what extent specific PSE pathways are associated with different labour market outcomes, and what are the drivers of income differences between respondents who followed different pathways.

In most of the analysis, our focus is on the first completed credential and the highest of any of the second, third or fourth credentials subsequently completed, if any.¹ This research design allows to study the role of the first completed credential in the pathways subsequently taken by respondents in PSE. As reported below, most respondents complete only one or two credentials. Very few respondents complete three or more.

Results based on regression models allow to estimate the relationship between the dependent variable and independent variables net of other variables included in the model. This allows to address cases of omitted variable bias, where the association between two variable is driven by a third variable correlated with both the dependent and the main independent variable. For example, the association between income and a specific PSE pathway may be biased if that pathway is more likely to be followed by respondents who complete their PSE at a later age, if in turn, completing PSE at a later age is itself associated with a lower income.

Regression models including several predictors, or independent variables, are called multivariate regression models. We use two distinct classes of regression models that are each appropriate for a different type of dependent variables (categorical and continuous). The rest of this section provides general information on the regression models. Note that the estimates from our regression models may not be interpreted as causal estimates because respondents may select into certain pathways based on unobserved characteristics (not measured in the LISA dataset), such as grades or abilities.

Multinomial regression

The results from multinomial regressions use the variable capturing the four levels of the the second completed PSE credential as the dependent variable (the level of the second or third credential is used if the respondent completed more than two credentials and one of them is at a higher level than the second credential). An additional category of the dependent variable is created for respondents who completed only a single PSE credential. That dependent variable is regressed on a variable capturing the level of the first completed credential. In other words, the model estimates the odds of completing a second credential at a given level (or to complete no further credentials), conditional on the level of the first PSE credential.

The following variables capturing the background of respondents as well as other dimensions of their PSE pathways are included in order to document the relationship between different PSE pathways on one hand, and parental background and of the respondent's characteristics on the other.

Background variables:

- Gender (male/female)
- Parental education

¹ Specifications using information on the first and second completed credentials only yield results that are very consistent with those obtained from our preferred specification. Regression output used for this comparison are reported in Appendix Figure A.1 and Table A.3.

- Immigration status
- First-generation immigrant parents
- Visible minority
- Indigenous identity (“Aboriginal Identity” variable)
- Province (at time of survey or at high school completion, depending on specification)
- Birth cohort (quadratic)

PSE pathway variables:

- Age when completed first credential
- Field of study of first credential
- Any non-completed PSE program before start of first completed degree (dummy)

The sample is restricted to respondents who completed at least one PSE credential before 35 years old. Any credentials completed after that age are excluded from the analysis.²

OLS regression

Regression analysis is also used to document income differences between respondents who followed different PSE credential accumulation pathways. These models regress income on PSE pathway variables and a set of controls. Two different dependent variables are used:

1. The log of annual employment income in 2015 including T4 earnings and net self-employment income, for respondents with non-zero employment income (source: T1FF data with imputation by Statistics Canada);
2. Weekly labour earnings in the survey reference week, for respondents employed at survey date only (source: survey questionnaire with imputation by Statistics Canada);

The first specification excludes respondents who report being employed for zero week or being employed part time part year in 2015. The second specification excludes respondents who were not employed at survey date.

The controls include those listed in the previous section as well as the following controls:

- Employment participation in 2015³;
- Years of labour force experience (self-reported at survey date);
- Some models use field of study of first and last credentials;

² See Appendix Figure A.2 for an analysis restricted to respondents age 50 to 59 in 2016, allowing to include all credentials completed before 50 years old.

³ This derived variable uses the following categories:

Full-time full year employment;
 Full-time part year employment (at least half of the year);
 Part-time full year employment;
 Part-time part year employment (at least half of the year);
 Full-time part year employment (less than half of the year);
 Part-time part year employment (less than half of the year);
 Not employed in 2015.

- Whether the respondent completed credentials in more than one field of study;
- Whether the respondent completed any STEM program;
- Whether the respondent changed fields of study between the first and second completed PSE credential;
- A set of job characteristics for the job held in the survey reference period (occupation, industry, job skill use demand, and the supervision of any employees).

RESULTS

Credential accumulation over the life course

In the introduction, we argued that the scope of many analyses of PSE pathways are limited by their use of data with samples limited to young respondents, likely to miss important dimensions of pathways and important variations in outcomes that can be observed at later ages. Here, we report data showing the share of the population in the 1956-1980 birth cohorts who had completed one PSE credential (Figure 1.1) and two or more PSE credentials (Figure 1.2) by the time they reached different ages.

The figures plot cumulative shares, meaning that the estimates reported at 25 years old, for example, include those who completed a credential before 21 years old and those who completed it between 21 and 25 years old. Results are reported separately for two cohort groups in addition to the overall population born in 1956-1980: the sample is divided between the 1956-1965 and 1966-1980 birth cohorts. The first cohort group is observed at 35 years old in 2016 at the latest, and the second cohort group is observed at 50 years old at the latest, allowing to observe the second cohort's credential accumulation at older ages.

Figure 1.1 shows that many Canadians completed a first PSE credential at very different ages. At 21 years old, 25.0% of Canadians born between 1956 and 1980 had completed one credential. That proportion doubled to 50.3% by 25 years old and increased to 60.9% by 34 years old.⁴ We also find disparities across cohorts, with the rate of completion of a first PSE credential after 21 years old being substantially higher for the younger cohort even if no gap is observed by 21 years old. Finally, results specific to the 1956-1965 birth cohort show an increase of 7.1% in the share of Canadians completing their first PSE credential between 35 and 49 years old.

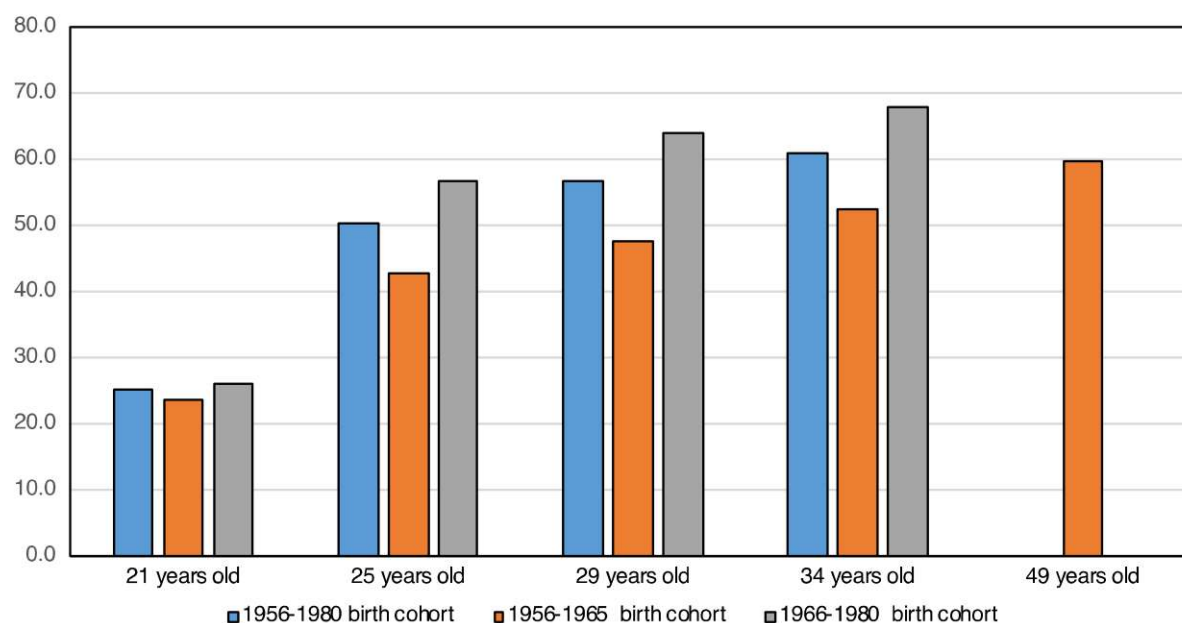
Next, we report results on the completion of a second credential (or more). In Figure 1.2, we find that by 25 years old, 11.1% of Canadians had completed a second credential. By 29 years old, that proportion increased to 17.3%, and by 34 years old, to 22.8%. Again, we find a large gap between the 1956-1965 and 1966-1980 birth cohorts, with the younger cohort having an almost 10 percentage points higher 2nd credential completion rate before reaching 35 years old. Results from the 1956-1965 cohort also show a substantial increase in the share of the population with a second PSE credential between 35 and 49 years old, from 17.1% to 24.5%.

Together, these results point to the relevance of using PSE history data covering a longer age range when studying PSE pathways, especially in analyses focusing on credential accumulations. Importantly, second credentials are often completed well after one's mid-20s. The timing of completion of many PSE credentials also calls for measuring labour market and economic outcomes at later ages than some of the existing literature. The "return on investment" to a PSE credential is likely to become visible only a certain time after graduation

⁴ Note that these estimates are consistent with similar estimates drawn from the 2016 Long-form Census public-use data.

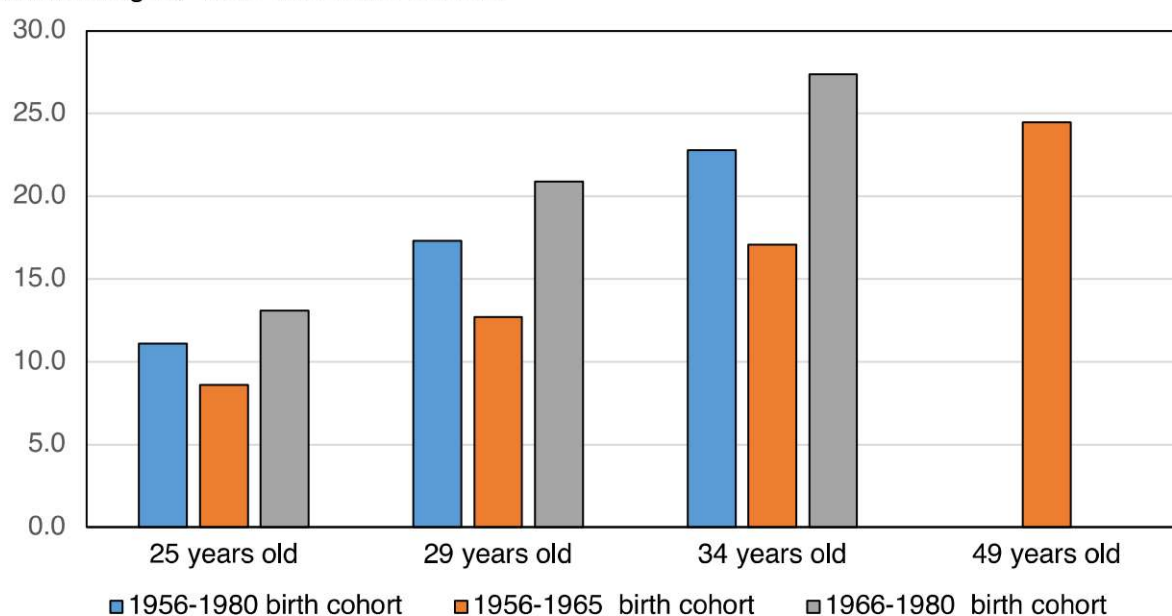
and the accumulation of some labour force experience. The data used in this study allow to take into account these initial findings and conclusions.

Figure 1.1. Cumulative share of population with a first PSE credential at different ages, 1956-1980 birth cohorts



Source: Longitudinal and International Study of Adults, Wave 3 (2016).

Figure 1.2. Cumulative share of population with a second or more PSE credential at different ages, 1956-1980 birth cohorts



Source: Longitudinal and International Study of Adults, Wave 3 (2016).

Overview of different PSE credential accumulation pathways in the Canadian and Ontario populations

Building on the previous section, we focus on the distribution of educational attainment in Canada and Ontario including information on PSE credential accumulation. This allows to highlight the different PSE credential accumulation pathways that may lead to the same final or highest credential.

To do so, we reconstruct PSE histories for each respondent age 35 to 59 years old in our sample. In Figure 2.1, we report data based on derived a variable capturing broad PSE credential accumulation pathways showing the level of the first completed PSE credential, and then the level of the second, third or fourth credential, whichever the highest. Those who complete a single PSE credential are included in the “Complete” category. The values plotted on the y-axis (and reported at the top of each bar) correspond to the percentage of the overall population following each pathway. Figure 2.2 reports percentages based on the same data, but conditional on the level of the first PSE credential. Results are reported separately for Canada overall and for Ontario. The distribution of PSE pathways in Ontario is relatively similar to the Canadian distribution.

We find that the PSE participation rate (share of the population with a PSE credential) in the 1956-1980 birth cohorts in 2016 (at 35-59 years old) is 60.9% in Canada and 64.9% in Ontario. The most frequent PSE entry pathway is the completion of a first PSE credential below a bachelor’s degree (trade, apprenticeship, or vocational certificate, college certificate or diploma, or other equivalent credentials): 35.8% of Canadians and 33.9% of Ontario residents have followed that pathway compared with 25% Canadians and 31% Ontario residents completing a first PSE credential at the bachelor’s level or above (e.g., first professional degree).

Consistent with Figure 1, Figure 2.1 shows that a relatively large share of Canadians accumulates more than one PSE credential. At the same time, Figure 2.2 shows that the population completing a bachelor’s degree as their first credential are more likely to complete a second degree: around 50% do so, predominantly at the graduate level. Among those who completed a first PSE credential below the bachelor’s level, 30% obtain a second PSE credential.

Importantly, Figure 2.1 also shows that analyses focusing only on the highest degree are likely to miss important differences between graduates driven by non-linear PSE credential accumulation.⁵ The share of respondents who follow a linear pathway of completing a bachelor’s degree followed by a graduate degree is 7.4% in Canada and 10.1% in Ontario. In contrast, 15.4% of Canadians and 15.9% of Ontario residents follow a non-linear credential accumulation pathway. Analyses focusing only on the highest PSE credential would ignore the possible impact of the other degrees held by these individuals.

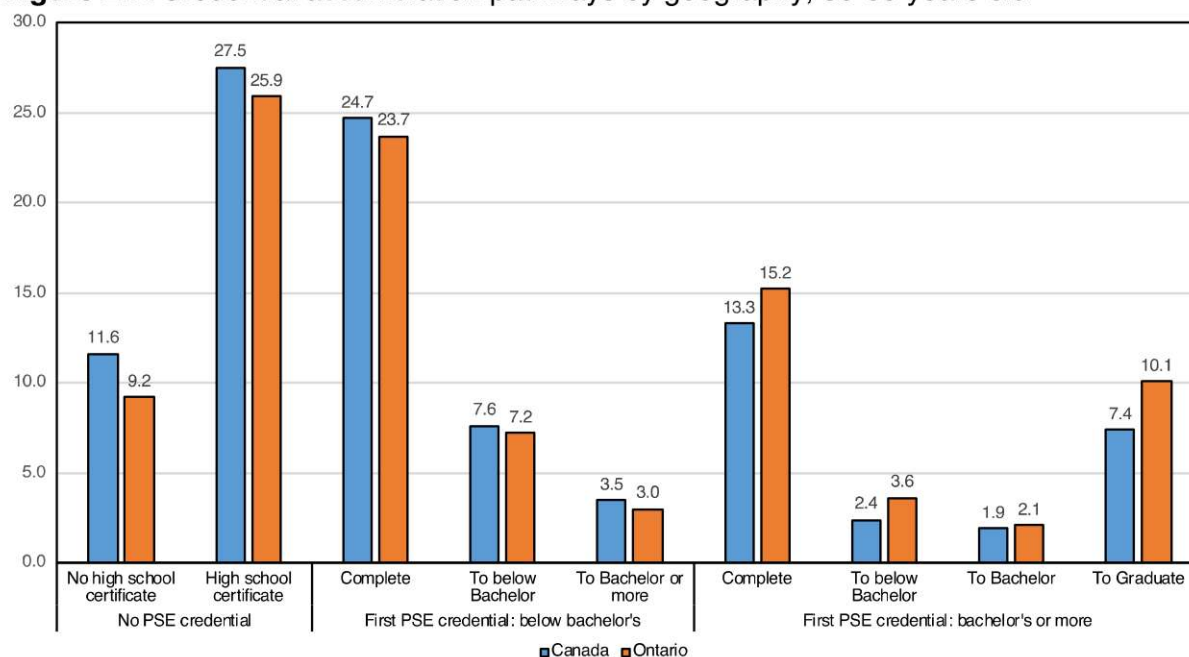
⁵ Note that our data only captures one of many dimensions of non-linear or non-conventional pathways, as highlighted in the review of the literature.

More specifically, close to 30% of those who complete a first PSE credential then go on to complete a second credential at the same level as the first (lateral or horizontal accumulation), such as those accumulating two or more certificates or diploma below the bachelor's level). Around five percent complete a bachelor's degree (or more)⁶ after a first PSE credential below the bachelor's level, or the reverse, which are generally regarded as non-conventional pathways. Standard analyses measuring the highest degree (in this case, the bachelor's degree) would not report the existence of that additional trades/vocational/apprenticeship or college credential.

Finally, one important finding stands out: of all Canadian in our sample, only 3.5% followed a TVA/college-to-bachelor's degree pathway (3.0% in Ontario). In other words, among bachelor's graduates in our sample, only 12.3% obtained their bachelor's degree as a second, third or fourth degree (8.8% in Ontario). Note that this represents less than 10% of those who completed a first PSE credential below the bachelor's level (see Figure 3.2). The 91.7% of other bachelor's graduates in our sample obtained their bachelor's as their first PSE credential. This finding, combined with the fact that access to graduate school is almost exclusively limited to those who complete a bachelor's degree as their first credential, suggests that the level of the entry pathway into PSE is related to overall achievement. A focus on PSE pathways can highlight the existence of cumulative disadvantage dynamics. The next sections explore the drivers and outcomes associated with these dynamics.

⁶ The category "to bachelor's or more" includes graduate degrees and first professional degrees. However, almost no respondents in our sample followed that pathway. The large majority of respondents following that pathway completed a bachelor's degree after their first PSE credential below the bachelor's level.

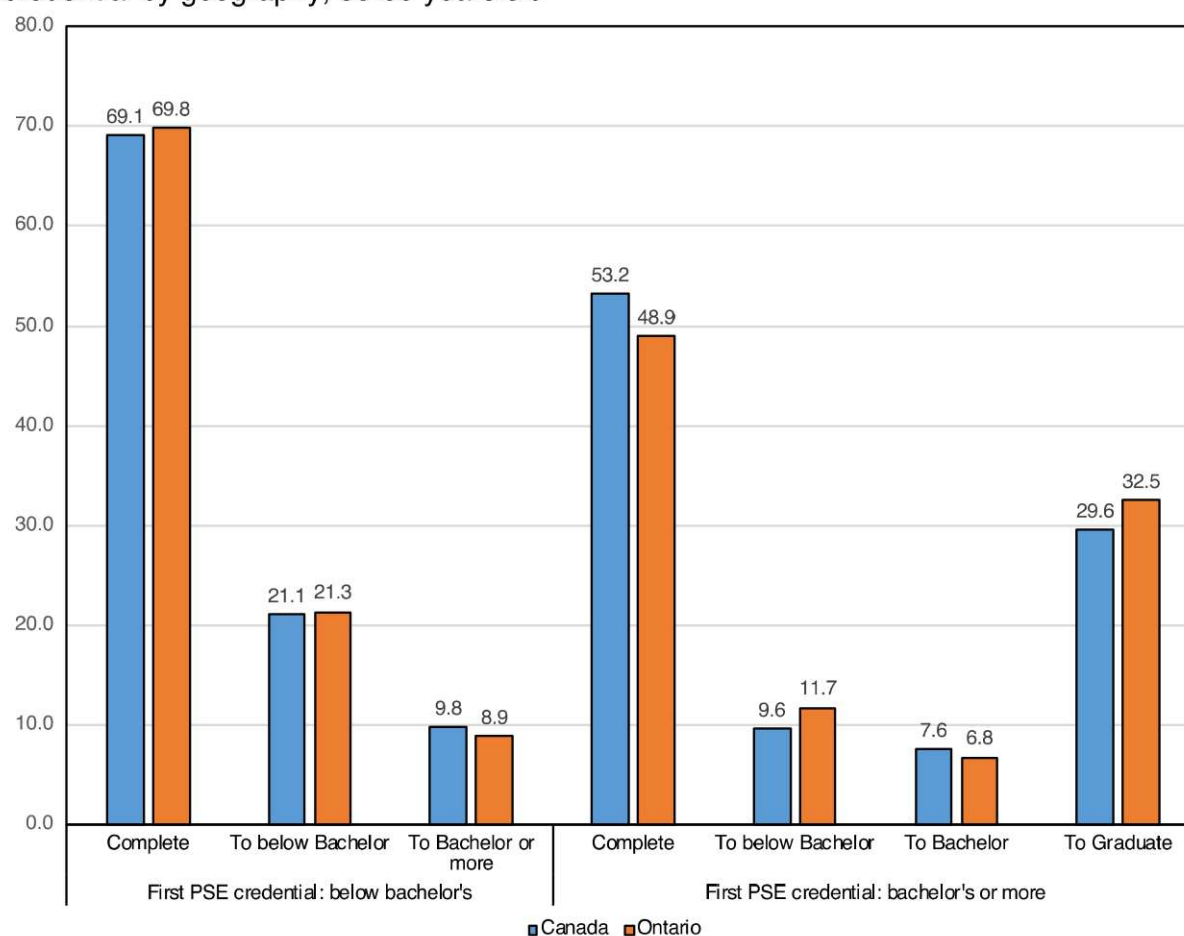
Figure 2.1. Credential accumulation pathways by geography, 35-59 years old



Source: Longitudinal and International Study of Adults, Wave 3 (2016).

Note: The Ontario subsample corresponds to LISA respondents who resided in Ontario at survey date.

Figure 2.2. Credential accumulation pathways conditional on the level of first PSE credential by geography, 35-59 years old



Source: Longitudinal and International Study of Adults, Wave 3 (2016).

Note: The Ontario subsample corresponds to LISA respondents who resided in Ontario at survey date.

Drivers of variation in PSE credential accumulation pathways

In this section, we report results from multinomial logistic regression models to documents which variables are associated with different PSE credential accumulation pathways. The models regress the five possible destination categories for the second PSE credential (or more, whichever is the highest) on the level of the first PSE credential and on a set of background (gender, visible minority status, parental background, etc.) and PSE pathway characteristics (age at completion of first PSE credential, whether any spell in PSE that did not lead to a degree was completed by the respondent before the first credential was completed, and field of study of first credential). With these results, we aim to document the characteristics of the population following different PSE credential accumulation pathways.

The results presented in the figures are average marginal effects (AME) derived from the multinomial regression log odds estimates. These can be interpreted as the difference in the probability of completing a second credential at a given level (TVA, college, bachelor, or graduate, or not completing a second credential [the “complete”] category in the figures) that is associated with certain characteristics, or category of an independent variable, compared to the reference category. In other words, the AMEs estimate the difference in the probability of following different PSE credential accumulation pathways between categories of respondents. The figures also report the 95% confidence intervals associated with each AME estimate. AMEs are statistically significant at the $p < 0.05$ level if the confidence intervals do not cross zero on the y-axis of the figures.

Association between first and second completed PSE credential

First, we focus on the relationship between the first PSE credential and the level of the highest credential completed afterwards, if any. This will contribute to our understanding of cumulative processes such as differences in the ability to complete more highly rewarded credentials conditional on the first completed credential at entry in PSE.

Figure 3 shows the probability of completing a second (or more) credential at a given level (if any) conditional on the level of the first credential. Estimates are AMEs from models controlling for a set of background characteristics (gender, visible minority status, immigration status of self and parent, parental education, Indigenous identity, province of residence at high school graduation, age, age at completion of first credential, and whether the respondent completed any PSE before the start date of their first completed credential).

The level of the first credential appears to be strongly related to the subsequent pathway into PSE. More specifically, those who completed a first PSE credential at the bachelor's level were significantly less likely than their counterparts who completed a college credential to then complete a second credential. In Canada overall, this difference is driven by a probability of completing a graduate degree 25 points higher for bachelor's degree graduate than college graduates. The difference is in the same direction and the estimates are of larger sizes in Ontario. There is no significant difference in the probability of completing a graduate degree

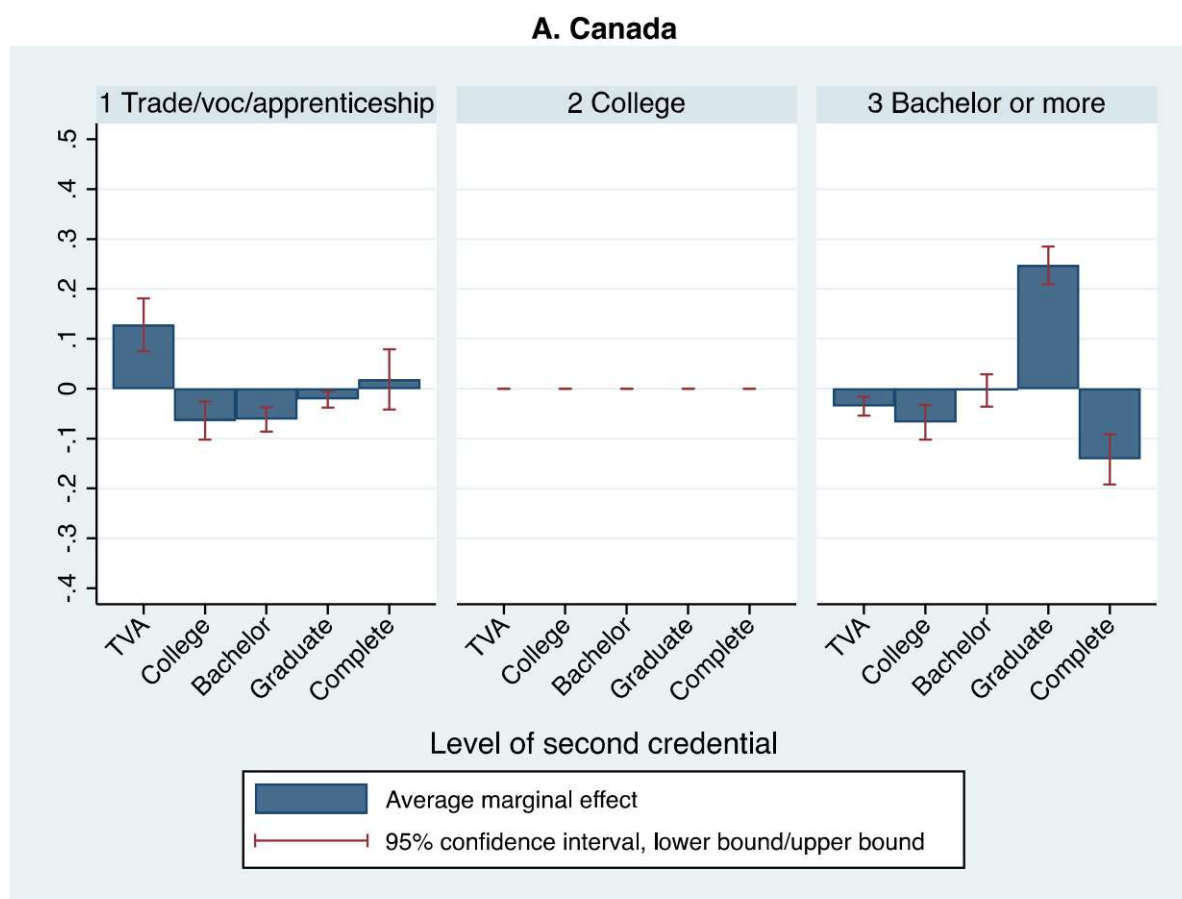
as a second credential between college graduates and those who completed a TVA certificate as a first credential.

In addition, we find no difference between the three first credential levels in the probability of completing a bachelor's degree as a second credential, meaning that those who complete their first degree below the bachelor's level are not more likely to then follow an upward pathway into bachelor's or, especially, graduate education. Moreover, at the Canadian level, there is evidence of horizontal accumulation for those not completing college as their first credential, since they are less likely to then complete a second credential at the college level. The same goes for the probability of completing a second TVA certificate for those who completed a TVA certificate as their first PSE credential.

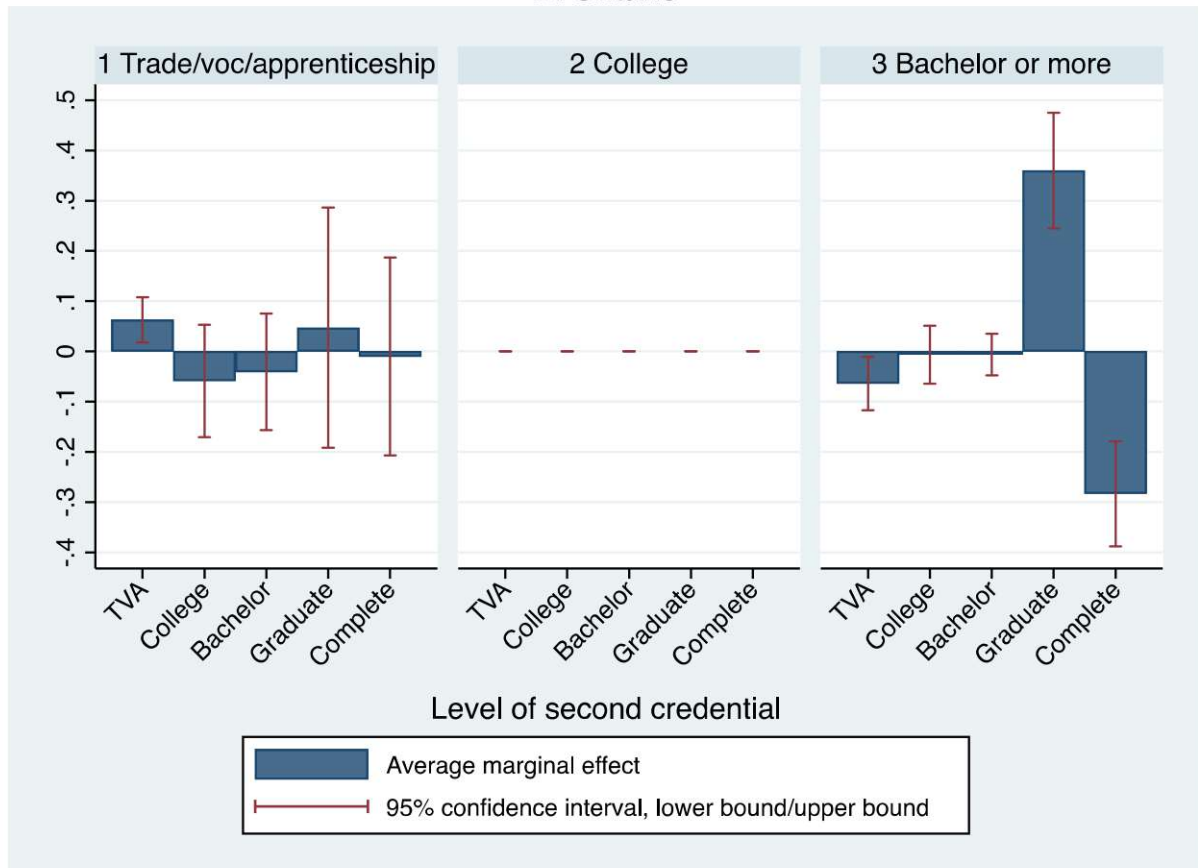
We conduct a set of robustness checks to ensure that our estimates are consistent across a set of model specifications. In Figure A.1, we restrict the analysis to the relationship between the first and second credential, if any, rather than between the first and the highest of the second, third, or fourth credential, if any. We find no notable difference between the two specifications. In Figure A.2, we restrict the analysis to the birth cohorts who were 50 to 59 years old in 2016 (the 1956-1965 birth cohorts). This restriction allows us to estimate two types of models: one restricting the analysis to PSE credentials completed before 35 years old by the respondents in these birth cohorts, and the other including all credentials completed before the same respondents were 50 years old. Again, the results are consistent with those reported in Figure 3, and the same patterns are observed at both ages⁷. These robustness checks suggest that 35 years old is an appropriate upper age bound for measuring the PSE pathways of respondents for the purpose of this analysis, even if Figure 1 shows that close to 10 percent of the population complete a first and a second PSE credential between 35 and 50 years old. This may be due to the fact that the same dynamics that drive differences at early ages also drive differences at later ages.

⁷ The size of estimates from different logistic regression models cannot be directly compared because differences may be driven by the rescaling factor included in the estimates rather than differences between the true estimates (Allison 1999). We therefore refrain from discussing differences in effect sizes between Canada and Ontario, and with figures B1 and B2.

Figure 3. Average marginal probabilities of completing a second credential (or more) before 35 years old by level of first credential, 1956-1980 birth cohorts



B. Ontario



Source: Longitudinal and International Study of Adults, Wave 3 (2016).

Notes: PSE credential completed at 35 years old or later are not counted. The level of the second credential is the level of the highest PSE credential completed after the first credential (if any).

“Complete” means that a single PSE credential was completed (no second credential). The Ontario subsample includes respondents reporting graduating from high school in Ontario.

Background characteristics as drivers of differences in PSE pathways

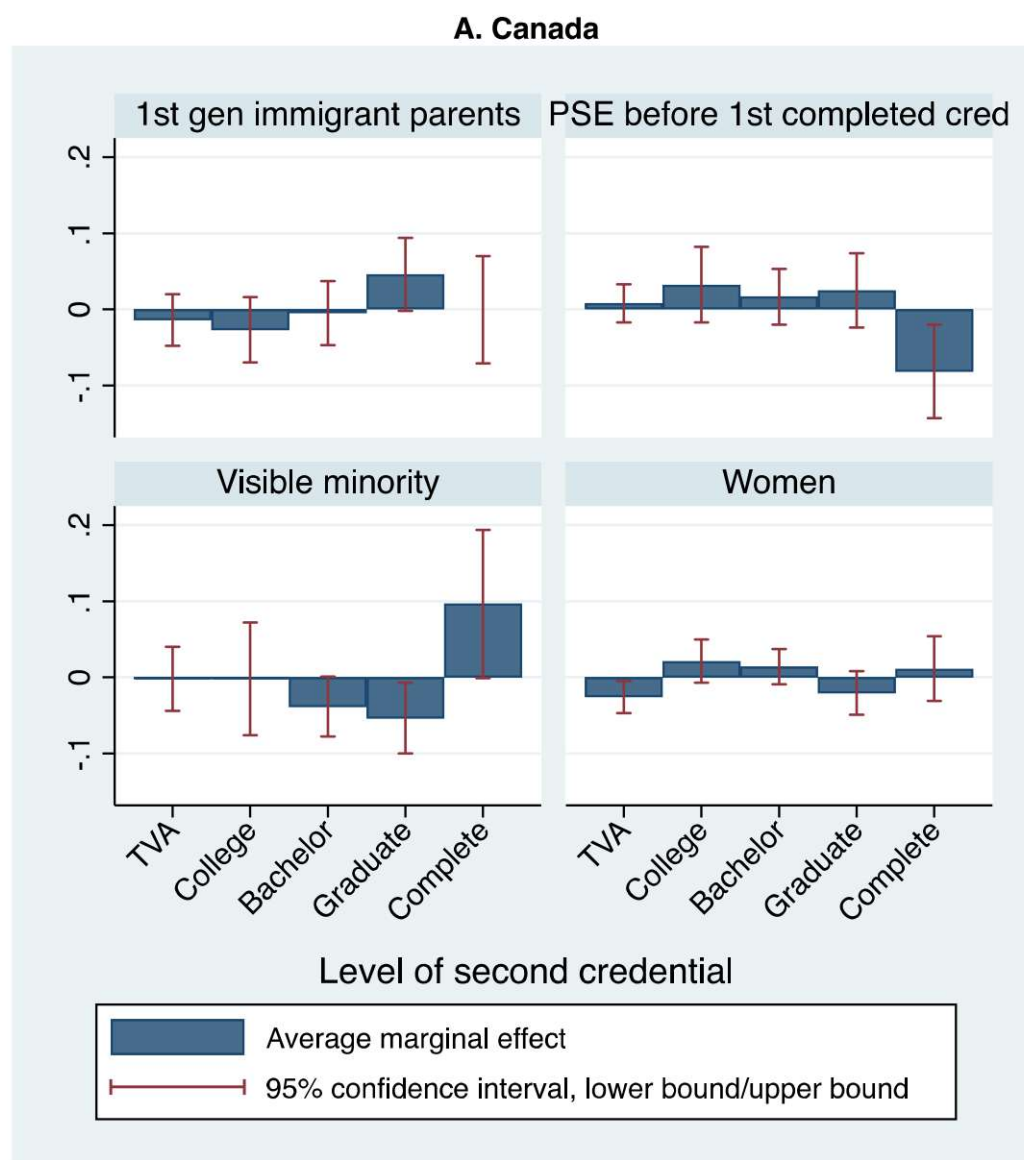
Next, we explore how the level of the second credential (or more) is associated with the background characteristics of the respondents. We focus on the education and immigration status of parents, on gender differences, and on differences by visible minority status. We also explore the role of PSE spells that did not lead to the completion of a PSE credential before the start of the first completed PSE credential. Together, these findings will improve our understanding of inequalities between groups in their credential accumulation pathways. It is a first step in improving our understanding of the role of different PSE pathways in accounting for group differences in income.

Figures 4 and 5 report AMEs capturing group differences in the probability of completing a second credential (or more) at a given level (the outcome variable/dependent variable in the model). The AMEs are derived from the same model as the one from which the estimates in Figure 3 are drawn. In other words, the estimates are net of the level of the first completed credential and other controls. The association between our background characteristics of interest and our outcome variable does not vary by level of the first credential. In separate models with interactions between these two variables, we found little variation in the impact of background characteristics across levels of the first credential, except for parental education. The results of this interaction model for parental education are reported below.

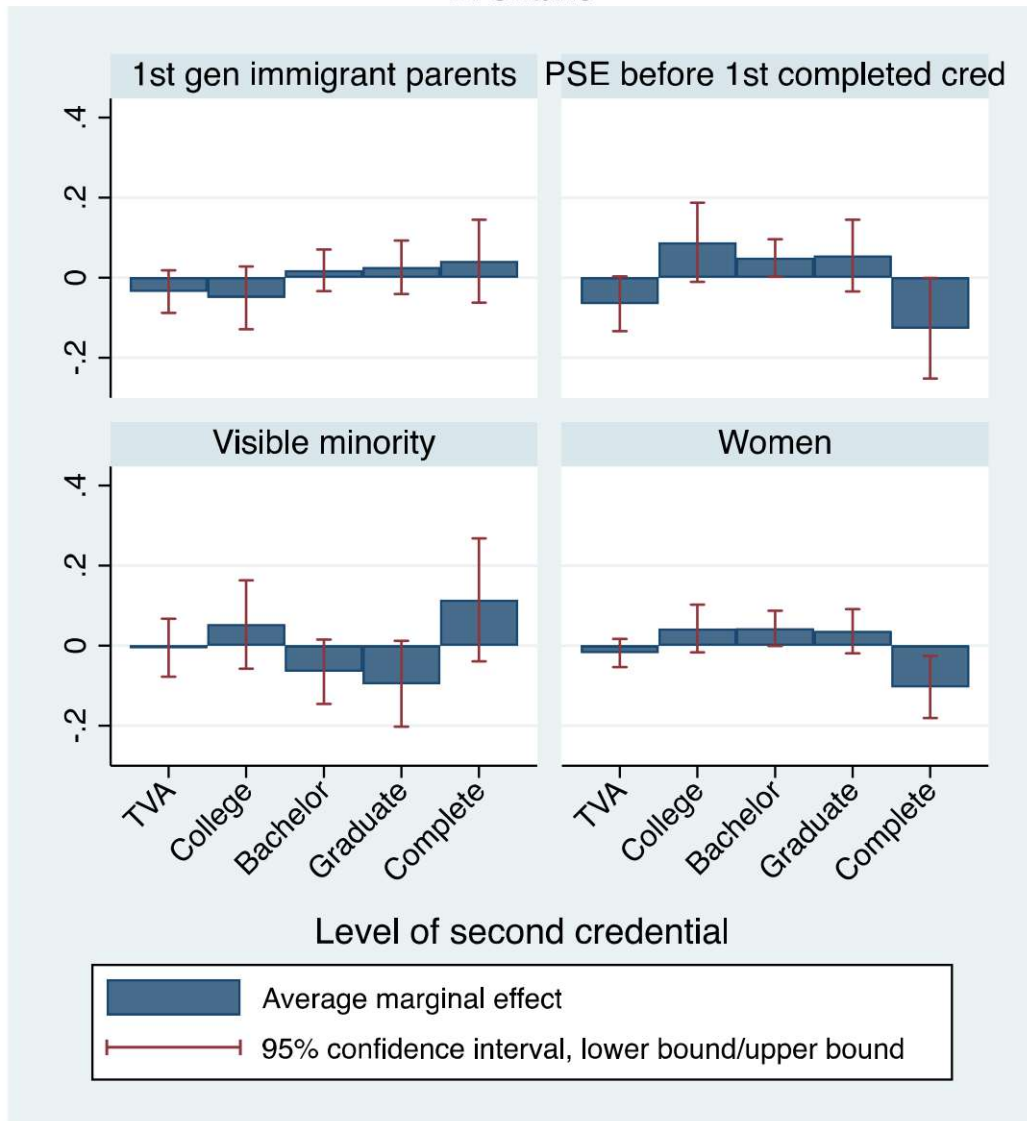
The results reported in Figure 4 can be interpreted the following way:

1. We observe little gender differences at the Canadian level except for a lower probability of completing a TVA credential as a second credential for women than men. At the Ontario level, we find a statistically significant difference of 10 probability points between men and women in the likelihood of completing a single credential, with women more likely than men to accumulate more than one credential before 35 years old.
2. In Canada in general and in Ontario, PSE graduates who are part of a visible minority group are less likely than those who are not part of a visible minority group to complete a second PSE credential, mostly driven by their lower probability of completing a bachelor or a graduate degree as their second credential. However, the estimates for bachelor's degree and single credential completion are only statistically significant at the $p < 0.10$ level, but not at the $p < 0.05$ level, in the Canadian sample. In the Ontario sample, only the AME for graduate degree is statistically significant at the $p < 0.10$ level, while the others two estimates are slightly above that threshold.
3. None of the AMEs for the relationship between parental immigration status and the respondent's second credential pathway are statistically significant.
4. Respondents who report a PSE spell before the start date of their first completed PSE credential have a smaller probability of completing a single credential than those who did not, although this is not associated with an increased probability of completing a second PSE credential at any level in particular, as shown by the similar effect sizes and absence of statistical significance for the other coefficients.

Figure 4. Average marginal probabilities of completing a second credential (or more) before 35 years old by background characteristics, 1956-1980 birth cohorts



B. Ontario



Source: Longitudinal and International Study of Adults, Wave 3 (2016).
 Notes: PSE credential completed at 35 years old or later are not counted. The level of the second credential is the level of the highest PSE credential completed after the first credential (if any). "Complete" means that a single PSE credential was completed (no second credential). The Ontario subsample includes respondents reporting graduating from high school in Ontario.

Next, we focus on parental education. Figure 5 shows that at the Canada level, the population with at least one parent who completed a university degree is significantly more likely to complete more than one PSE credential, driven by the higher probability of completing a graduate degree as a second credential than those with at least one parent with PSE below the university level, and those with no parent having completed any PSE. No other differences are found. Importantly, having parents with some PSE below the university level does not appear to be associated with different credential accumulation patterns than those with no parents with any PSE. The patterns for Ontario are broadly similar, but none of the estimates are statistically significant.

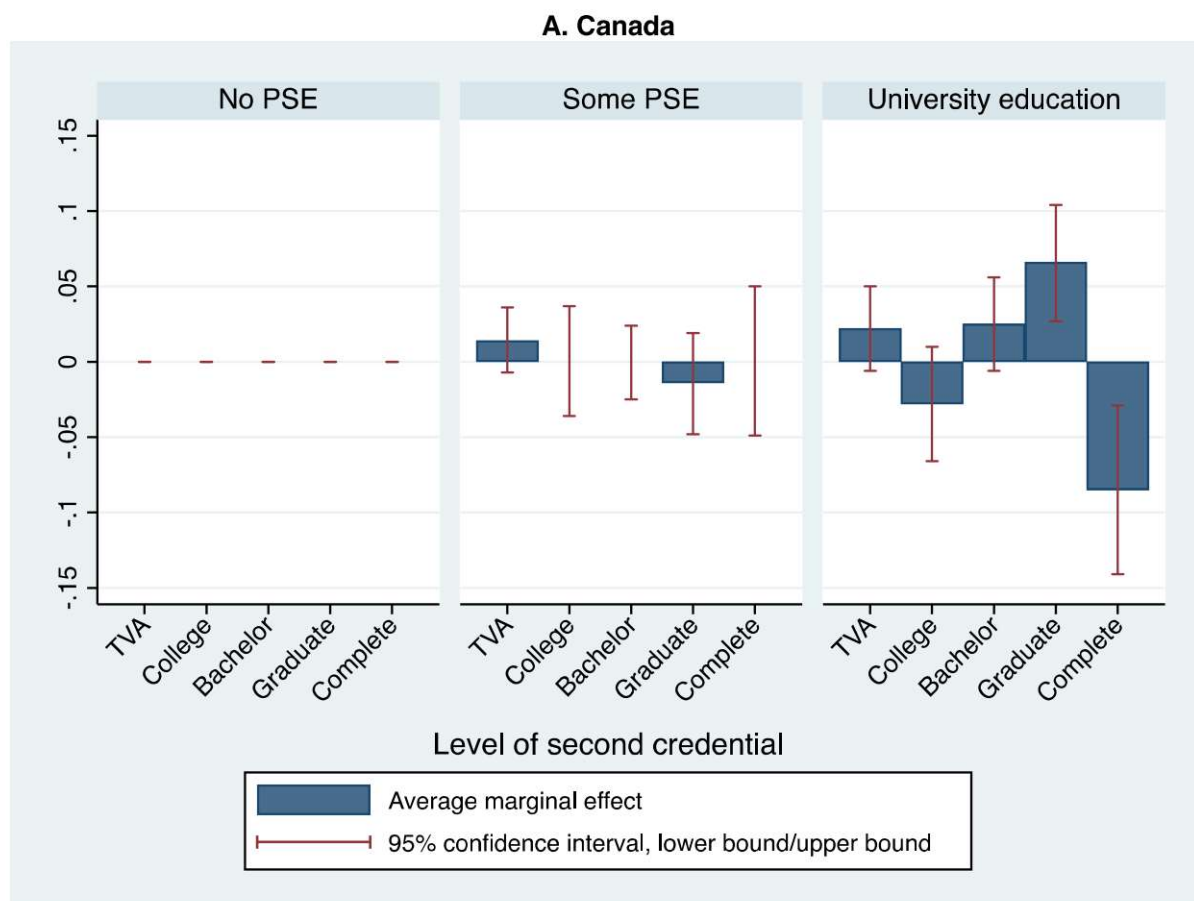
We let the relationship between parental education and the level of the second credential (or more) vary by the level of the first credential by adding an interaction term to the baseline model already described in this section. The results of this supplemental model are reported in Figure 6 (for Canada only due to sample size limitations). In that figure, average predicted probabilities rather than average marginal effects are reported, for ease of interpretation. The main findings are the following:

1. Among those who completed a TVA certificate as their first credential, respondents with at least one parent with university-level education have a lower probability of completing a single PSE credential than those with parents with lower levels of education. This is driven by their higher probability of completing a second TVA certificate rather than completing a second PSE credential at another level (college, bachelor's or graduate level).
2. Among those who completed a college certificate or diploma as their first credential, there appears to be a positive relationship between parental education and the probability of completing a second credential at the bachelor's or graduate level. However, the confidence intervals largely overlap.
3. Finally, among those who completed a bachelor's degree (or higher) as their first credential, those with at least one parent with university-level education have a lower probability of completing a single PSE credential than those with parents with lower levels of education. This is driven by their higher probability of completing a graduate degree.

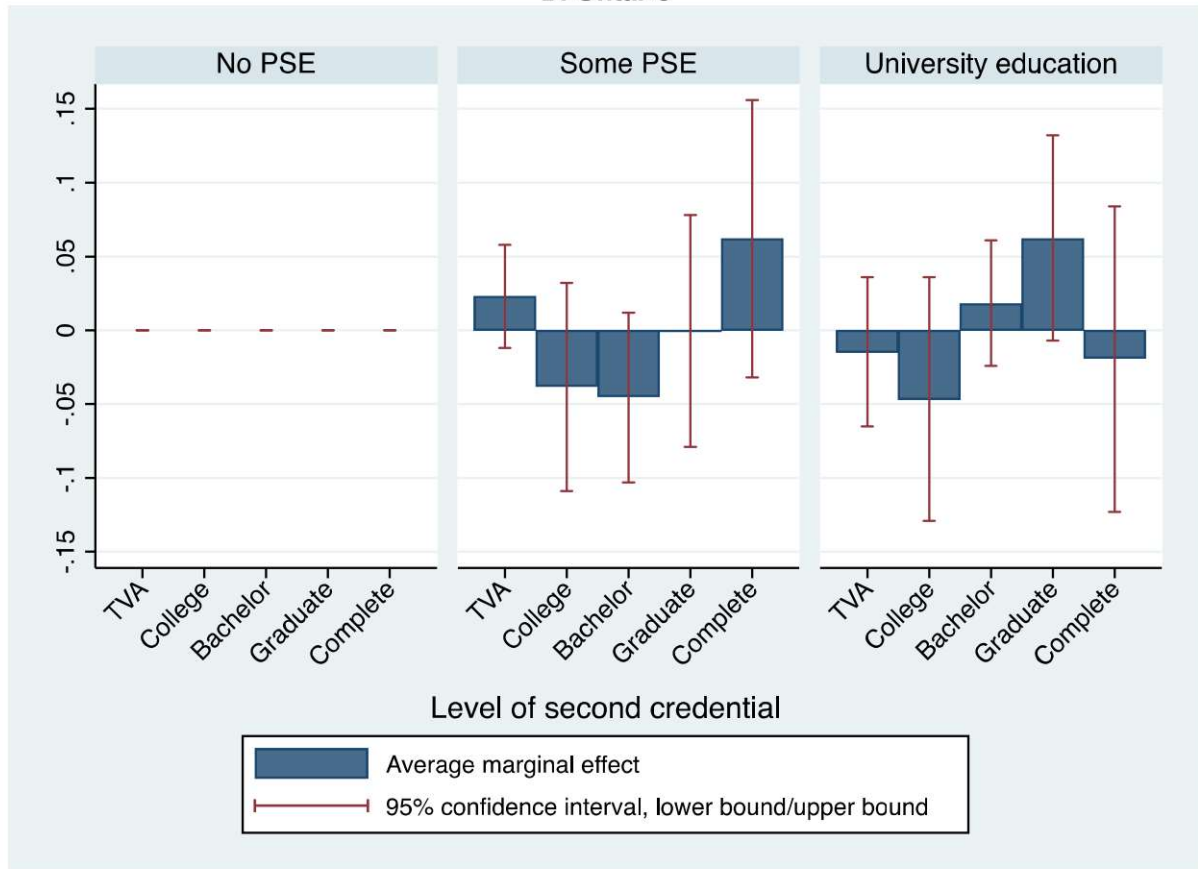
The results from the interaction model improve our understanding of the drivers of patterns found earlier in the data: the greater probability of completing a second TVA certificate among respondents with a TVA certificate as their first credential is partly driven by the subgroup of those respondents with more educated parents. The same is true for the greater probability of completing a graduate degree as a second credential among those with a bachelor's degree as their first credential: this difference is also partly driven by the bachelor graduates with more educated parents.

Overall, these results point at some differences in the PSE credential accumulation pathways in Canada and Ontario for visible minority respondents (remember, these estimates are net of the immigration status of respondents and their parents, and no respondent in the sample immigrated after age 15). This points at possible obstacles specific to racialized individuals. On the other hand, the absence of differences by gender and parental immigration status is in line with the existing literature.

Figure 5. Average marginal probabilities of completing a second credential (or more) before 35 years old by parental education level, 1956-1980 birth cohorts

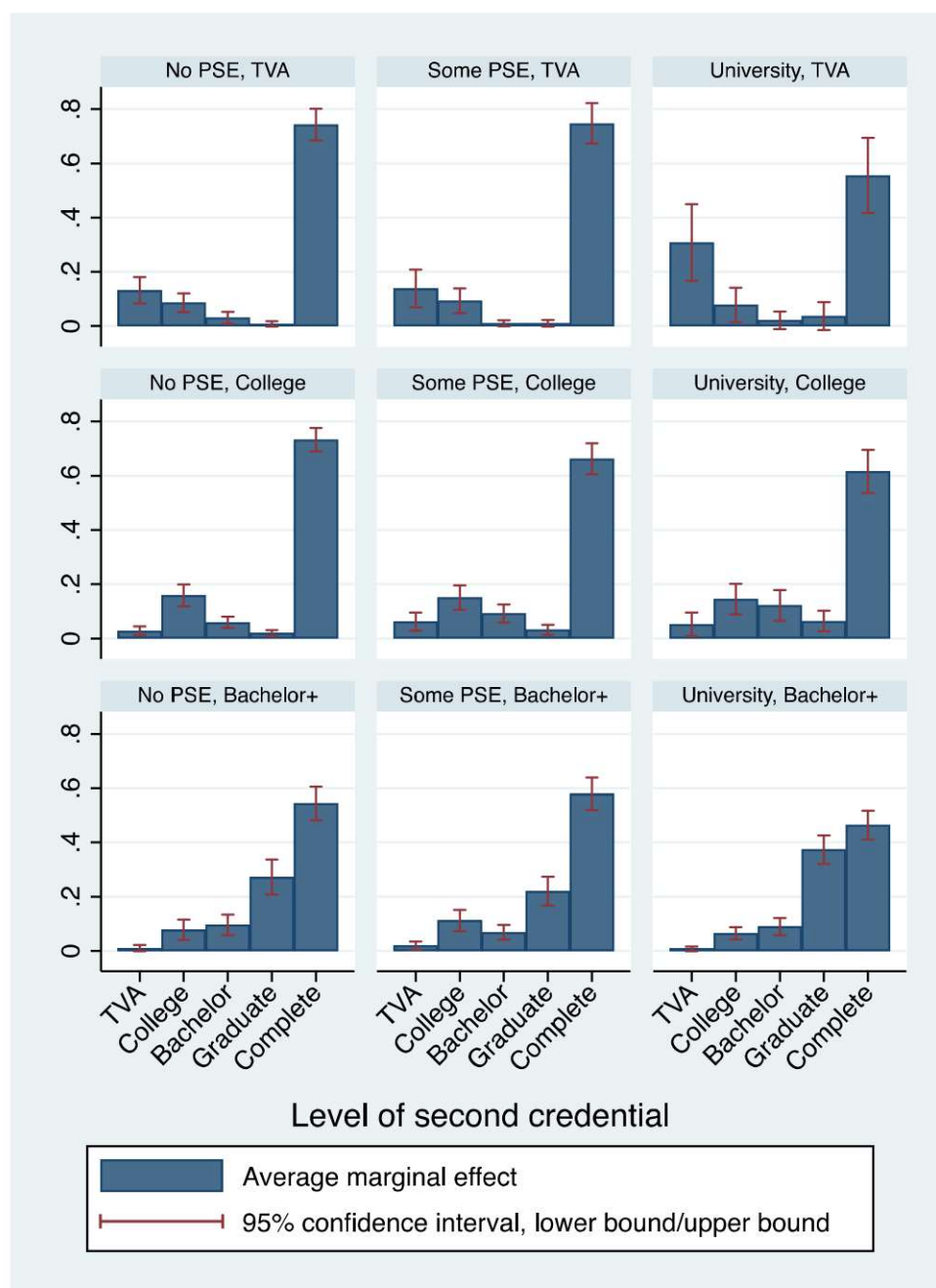


B. Ontario



Source: Longitudinal and International Study of Adults, Wave 3 (2016).
 Notes: The three categories in the panel subtitles correspond to the educational attainment of the most educated parent. PSE credential completed at 35 years old or later are not counted. The level of the second credential is the level of the highest PSE credential completed after the first credential (if any). "Complete" means that a single PSE credential was completed (no second credential). The Ontario subsample includes respondents reporting graduating from high school in Ontario.

Figure 6. Average predicted probabilities of completing a second credential (or more) before 35 years old by parental education, 1956-1980 birth cohorts



Source: Longitudinal and International Study of Adults, Wave 3 (2016).
 Notes: The three categories before the comma in the panel subtitles correspond to the educational attainment of the most educated parent. The three categories after the comma in the panel subtitles correspond to the first completed PSE credential of the respondent. PSE credential completed at 35 years old or later are not counted. The level of the second credential is the level of the highest PSE credential completed after the first credential (if any). "Complete" means that a single PSE credential was completed (no second credential).

Supplemental results on the relationship between background characteristics and the level of the first PSE credential

The results reported here focus on pathways from the first to the second (or more) credential. In Appendix Figures A.3 and A.4, we explore whether these group differences are likely to reinforce differences found between these groups when analyzing differences in the level of the first PSE credential they complete. We find that this is indeed the case. Multinomial logistic model regressing the level of the first credential (TVA, college, or bachelor+) on parental education and immigration status, gender, immigration status of self, visible minority status, Indigenous identity, whether a PSE spell before the start date of the first completed PSE credential is reported, and province of high school graduation yield the following results:

1. Women in the Canada and Ontario samples are less likely than men to complete a first credential at the TVA level and more likely to complete a college or a bachelor's degree (last estimate is statistically significant for Canada overall only);
2. Visible minority individuals in both Canada and Ontario are more likely than those reporting being white to complete a college certificate or diploma as their first credential. In the Canada sample, this difference is predominantly driven by the lower probability of completing a TVA as their first credential.
3. Respondents with at least one first generation immigrant parent are more likely to complete a bachelor's degree and less likely to complete a college certificate or diploma as their first credential than respondents with both parents born in Canada. The AMEs for college are only statistically significant at the $p < 0.10$ level in both samples.
4. Respondents with at least one university-educated parent have a likelihood of completing a bachelor's degree as their first PSE credential at least 20 probability points greater than those with no parent with any PSE education. They are also significantly less likely (in the Canadian and Ontario samples) to complete a first credential at both the TVA and college level. Those with at least one parent with some PSE are also slightly more likely to complete a bachelor's degree than respondents with less educated parents, but that effect is small (and non-statistically significant in the Ontario sample).
5. Finally, respondents with a PSE spell before the start of their first completed PSE credential have a higher probability of completing a bachelor's degree as their first credential in the Canadian sample (at the $p < 0.10$ level). However, the reverse is true in the Ontario sample, with a greater probability of completing a college certificate or diploma and a lower probability of completing a bachelor's degree than their counterparts who do not report any previous spell in PSE (both differences are statistically significant at the $p < 0.05$ level).

Overall, these findings highlight the emergence of differences in credential accumulation between groups visible at entry into PSE, with those differences largely persisting as individuals accumulate a second credential or more.

The role of other characteristics of PSE pathways

Finally, we document the role of some of the characteristics of the first completed credential: the field of study and age at completion. The literature does identify fields of study as important drivers of transfer pathways (Finnie, Dubois, and Miyairi 2021) and suggests that they play a role in credential accumulation (Ntwari and Fecteau 2020). To the extent that some fields of study are associated with lower probabilities of employment and lower expected employment income, graduates from these fields of study may decide to complete a second credential to compensate that disadvantage before they enter the labour market, or to return to PSE after an initial spell on the labour market. The variable for time at completion of first credential is likely to capture the combined effect of delayed enrollment and degree duration in PSE (e.g. discontinuous enrollment or part-time studies in a single program), two factors known to be inversely associated with persistence and completion rates (Goldrick-Rab 2006).

Age at completion of first PSE credential

In Figure 7, panel A, we report average predicted probabilities of completing a second credential (or more) at a given level as a function of age at completion of the first credential. The reported estimates are derived from the same model used in previous sections (with controls for background characteristics and province of high school graduate, as well as conditional on the level of the first credential). In panel B, we report results of a model interacting the age at completion of the first credential with the level of the first credential. The predicted probabilities are calculated at two-year intervals between age 20 and 34, stopping before our upper age bound of 35 years old.

The results in panel A show a rapid decrease in the probability of completing a bachelor's degree as a second credential as age at first credential increases, and an overall increase in the probability of completing a single credential rather than two or more credentials as the age of completion of the first degree increases. In panel B, the interaction model estimates show that most of the differences in the level of the second credential across respondents with different first credential levels is attenuated among respondents who complete their first credential at later ages, and trend towards zero (the size of the coefficients estimate the difference in probability points compared to the baseline category, college graduates, for different ages at completion of the first credential).

Importantly, the higher probability of completing a graduate (or first professional) degree as a second credential for those with a bachelor's degree as their first credential relative to the two other groups slowly decreases as age at completion of the first credential increases, but the difference loses statistical significance at 34 years old only. This is a noteworthy finding because graduate/first professional degrees can have long durations but are associated with important labour market advantages in Canada (Boudarbat & Lemieux 2010). In other words, this finding suggests that more advantageous credential accumulation pathways among bachelor's graduates persist even when a bachelor's degree is obtained as a first PSE credential at an older age.

Robustness check: the impact of censoring PSE history at 35 years old

Importantly, results reported in Figure 7 may underestimate differences at older completion ages because the youngest birth cohort in the sample was 35 years old at survey date, leading us to exclude from the analysis any credential completed after that age across all cohorts of the sample, for consistency purposes. As a robustness check, we adopt the same approach as the one implemented in Figure A.2. We replicate the models in Figure 7, restricting our sample to the 1956-1965 birth cohorts (age 50-59 at survey date). This allows us to document the relationship between the level of the second credential (or more) and age at completion of the first credential at completion age 20 to 48⁸.

In Figure A.5, we show that censoring PSE histories at 35 years old does appear to lead to an underestimation of the gap between bachelor's graduates and other groups in the probability of completing a graduate degree as a second credential when the first credential is completed at an older age. In models censoring the PSE histories at 50 years old, that gap remains stable at later completion ages, including at completion ages above 35 years old. This finding supports our interpretation that completing a bachelor's degree as a first credential is associated with distinct PSE credential accumulation pathways (most notably, substantially greater probability of a graduate degree) even when a bachelor's degree is completed as a first credential at older ages.

Field of study of first PSE credential

To conclude this section, we report the results of a multinomial logistic regression model adding a variable capturing the field of study of the first PSE credential as an independent variable (no interaction term). All other variables are the same as the ones in the baseline model used throughout this section. The field of study variable is based on the Classification of Instructional Programs (2011) 1-digit categories.

Figure 8 reports average marginal effects in the probability of completing a second credential (or more) at a given level, if any, relative to the baseline group, Business, management and public administration programs. The estimates are net of all other covariates in the model. Note that due to large differences in effect sizes, the scale of the y-axis in each panel varies.

The following fields of study are more likely to accumulate a second credential or more (the level of the second credentials that respondents in each field of study are more likely to complete are reported in parentheses):

1. Humanities (college, bachelor's, and graduate/first professional level credentials);
2. Social and behavioural sciences, and law (graduate/first professional degree);
3. Physical and life sciences (Bachelor's and graduate/first professional degrees);
4. Those with another or unknown field of study (graduate/first professional degree).

⁸ Predicted probabilities are reported for the 20-44 years old completion age only because of the small number of individuals completing a PSE credential outside of that range, and the unreliable point estimate and confidence intervals resulting from that feature of the data.

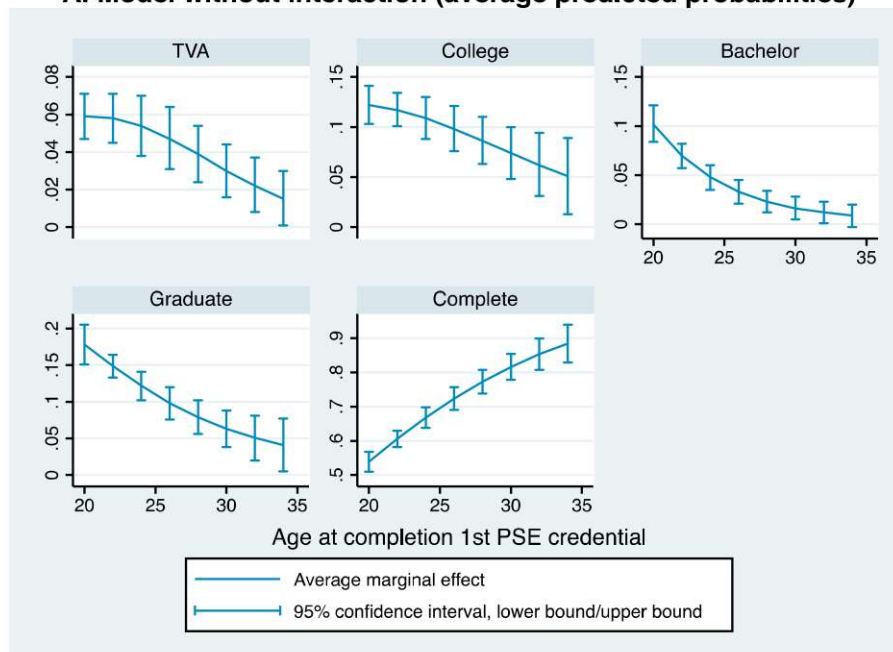
Note that graduates from a first credential in health and related fields are less likely to complete a college degree as a second credential than the baseline group.

In sum, it appears that Canadians who complete a first credential in a more general and less vocationally-oriented/less professionally-focused field of study are more likely to accumulate a second credential. For humanities graduates, this translates into a high relative probability of completing a college degree, and for all of the four groups listed above, this also translates into a higher probability of completing a graduate degree as a second credential (or more). For humanities and physical and life sciences graduates, the same is true for completing a bachelor's degree as a second credential.

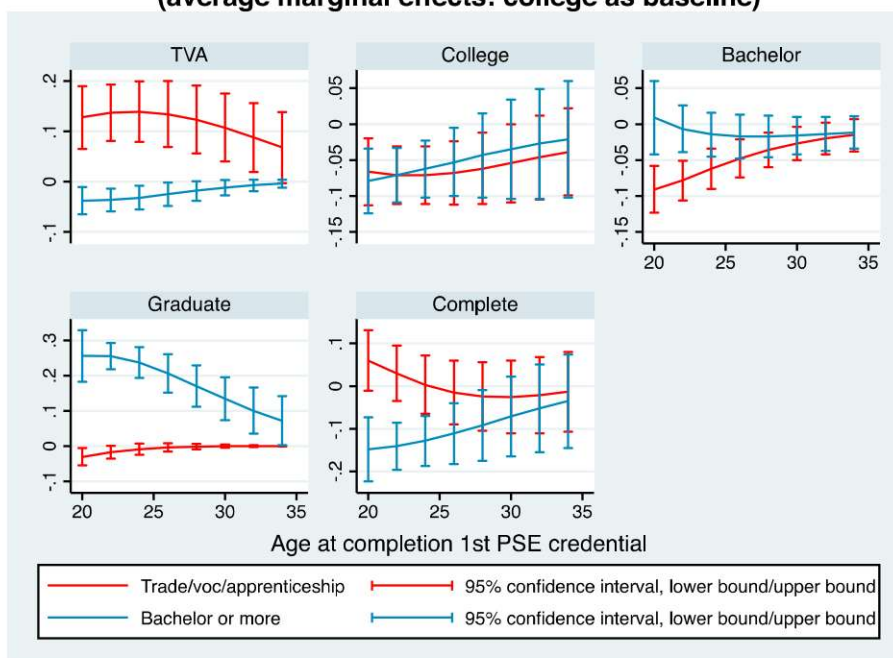
Overall, this subsection has highlighted that the timing of entry into PSE and the selected field of study of the first credential have an influence on later credential accumulation pathways.

Figure 7. Average predicted probabilities of completing a second credential (or more) before 35 years old by age at completion of first PSE credential, 1956-1980 birth cohorts

A. Model without interaction (average predicted probabilities)

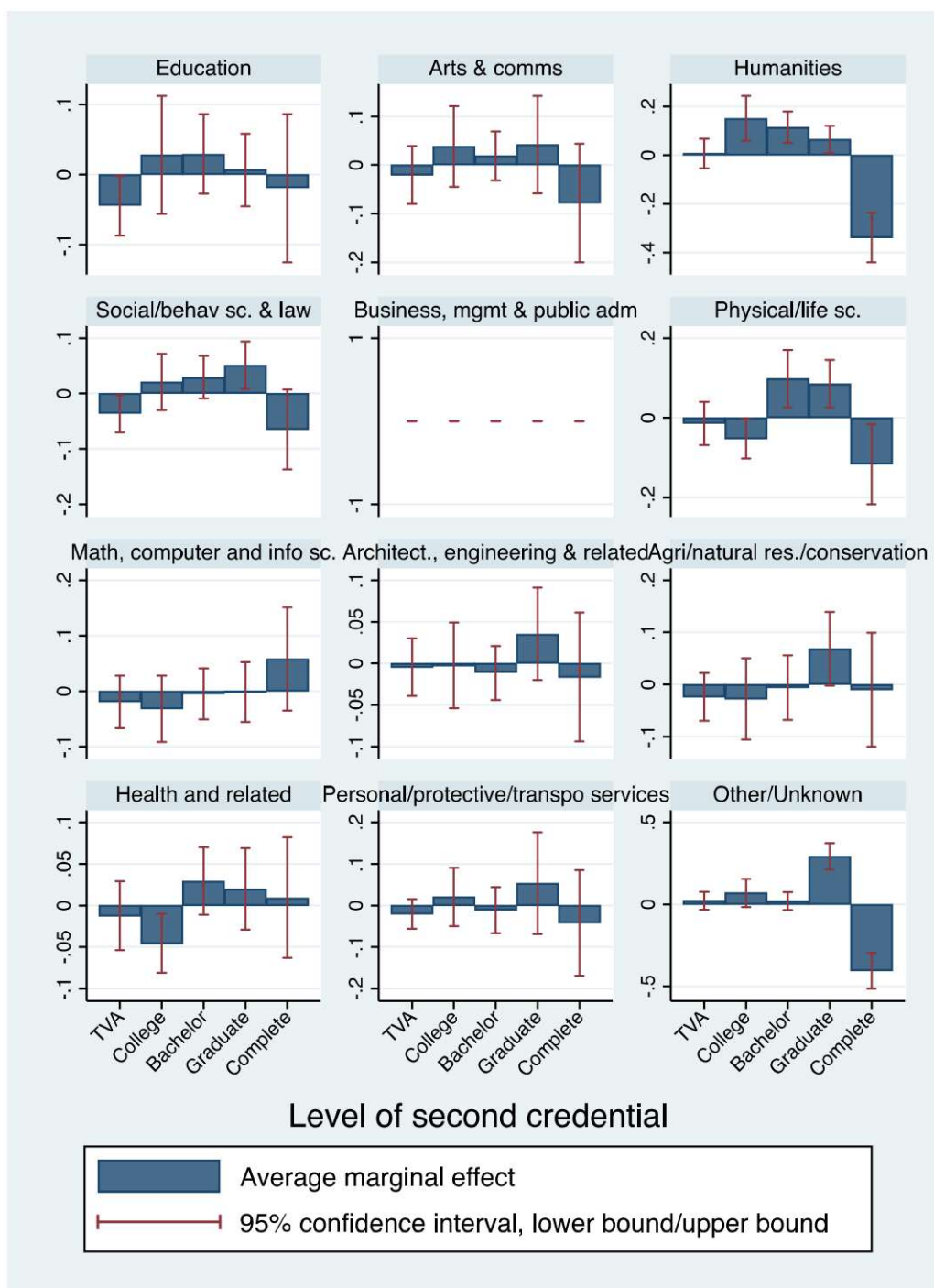


B. Interaction with interaction: age at completion x level of first credential (average marginal effects: college as baseline)



Source: Longitudinal and International Study of Adults, Wave 3 (2016).
 Notes: PSE credential completed at 35 years old or later are not counted. The level of the second credential is the level of the highest PSE credential completed after the first credential (if any). "Complete" means that a single PSE credential was completed (no second credential).

Figure 8. Average marginal probabilities of completing a second credential (or more) before 35 years old by field of study (CIP) of first credential, 1956-1980 birth cohorts



Source: Longitudinal and International Study of Adults, Wave 3 (2016).

Notes: PSE credential completed at 35 years old or later are not counted. The level of the second credential is the level of the highest PSE credential completed after the first credential (if any). "Complete" means that a single PSE credential was completed (no second credential). Field of study of first credential based on the Classification of Instructional Programs 2011 (CIP).

PSE credential accumulation pathways as drivers of income differences in adulthood

Having established a relationship between PSE credential accumulation pathways and a set of background variables and characteristics of the first completed PSE credential, we now turn to an analysis of the relationship between credential accumulation and employment income. The objective of this section is to document whether we observe any income gaps between different credential accumulation pathways, especially those that complete their highest credential at the same level, but through different routes.

We also aim to explore the drivers of any differences we may find. First, we investigate the role of field of study differences, knowing that different pathways are associated with different fields of study, and that fields of study are differently rewarded on the labour market. Second, we narrow in on the role of a set of job characteristics in accounting for the relationship between different PSE pathways and employment income. More specifically, we aim to document whether any income differences may be driven by the sorting and selection of graduates into different occupations and industries, and into jobs with different skills demand. This will allow to better understand the labour market dynamics that underpin income differences between respondents with various PSE pathways.

Baseline results

As described in the methods section, this section reports results of OLS regression models. In these models, the natural log of annual employment income in 2015 is regressed against the credential accumulation pathway variable also used in Figure 2.2, and the following set of controls: sociodemographic characteristics (parental education, gender, marital status immigration status of self and of parents, visible minority status, Indigenous identity), age, age at completion of first PSE credential, dummies for employment pattern in 2015, and a quadratic work experience term.⁹ Sample excludes respondents with zero weeks of employment in 2015. For analyses of the Ontario sample, observations include all Ontario residents at survey date (2016).¹⁰

The coefficients of interest in these OLS regressions are the dummies for the categorical PSE credential accumulation pathway variable. The reference category for that variable is respondents who completed a single PSE credential at the college level. The coefficients for other categories capture the difference in the log of income between the reference category

⁹ Note that for this analysis, we use control variables measured at survey date (employment patterns in 2015, work experience as of survey date, and importantly, annual income in 2015; in some analyses, we also use other job characteristics measured at survey date such as occupation and industry). Accordingly, we do not censor PSE histories in our main models. Rather, we construct our PSE pathway variable based on the credentials accumulated by survey date, when respondents are between 35 and 59 (allowing enough time for the youngest cohorts to accumulate PSE credentials).

¹⁰ We do not use the province of graduation for these analyses because the province controls aim to net out any inter-provincial income differences that would be observed at survey date, when income is also observed.

and a given PSE pathway, net of control variables. Differences in the log of income can be interpreted as the average percentage difference in income associated with a given PSE pathway relative to the reference category.¹¹

In Figure 9, we report the coefficients from a series of seven OLS regression models. The first model is the baseline model estimated with the specification described in the two paragraphs above. The seven panels in the figure correspond to the seven categories of the main independent variable (PSE pathway type), with the third category (single PSE credential at the college level) left blank as it is the reference category. The effect sizes of the coefficients are reported using dots and plotted against the y-axis, scaled in natural log points. As described in the figure legend, different types of markers indicate statistical significance levels. For reference, Appendix Table A.1 reports the exact point estimates and p-values, as well as fit statistics and other details on the model specification.

First, we discuss baseline estimates reported in Figure 9 (model 1 “Baseline”, with markers further on the left of the x-axis of each panel). We will discuss the other six models in the next sub-section. The baseline results for both panels (Canada and Ontario) show a statistically significant gap between the baseline category and all other PSE credential accumulation pathway categories except the pathway capturing those who completed a credential below the bachelor’s level as a first credential, and completed a second credential at the same level.

At the same time, there are substantial differences in the size of the income premium across pathway types. First, the two pathways associated with the highest income are those with a bachelor’s degree as their first credential and who completed a second credential at the same level or at the graduate level. In panel A, completing a graduate degree as a second credential is associated with an employment income level 60.9% higher on average than the reference category. For those completing a bachelor’s degree as a second credential, the premium is 56.3%. In panel B, restricted to residents of Ontario, the order is reversed, with accumulating two credentials at the bachelor’s level associated with an income level 78.4% higher on average than the reference category, and a bachelor’s followed by a graduate degree being associated with a 70.8% premium.

Second, we find that completing a single credential at the bachelor’s level is associated with a smaller income premium than the two other categories, but a higher income premium than both other categories that also have a bachelor’s degree as their highest credential. More specifically, we find a smaller coefficient size for respondents who complete a bachelor’s degree and then a credential below the bachelor’s level (TVA or college), and for those who completed the same two credentials in the reverse order (credential below bachelor level followed by a bachelor’s degree), relative to those who completed a single credential at the bachelor’s level. In all three cases, the difference with the reference category is statistically significant. In the Canada panel, accumulating the two credentials in a “reverse” order (bachelor’s degree followed by a credential below bachelor’s) is associated with lower income levels, on average, than those who follow the opposite, upward pathway, with a coefficient of 0.274 compared with 0.358. In the Ontario panel, the order is reversed, and the size of the

¹¹ For example, a log coefficient of 0.10 can be interpreted as a 10 percent average difference in income between a given pathway and the reference category.

gap is smaller, with coefficients of 0.398 and 0.349 respectively. That is, in the Ontario sample, the premium associated with completing a credential below the bachelor's level after completing a bachelor's degree is substantially larger than in the Canadian sample.

Robustness check: complex measures of PSE pathways with interaction models

Our main analysis relies on a derived variable that consists in a simplified categorisation of all the possible PSE credential accumulation pathways, especially the collapsing of the TVA and college categories into a single “below bachelor's degree” category. In Appendix Figure A.6, we present the results of an alternative specification that captures more of the possible pathways, at the expense of a much greater number of model parameters. Except from that difference in the pathway variable(s), the specification of the model in Figure A.6 is identical to the specification in the baseline model in Figure 9. It regresses the log of annual employment income on a categorical variable capturing the level of the first credential (three categories: TVA, college, and bachelor or more), another categorical variable capturing the level of the second credential (TVA, college, bachelor's degree, graduate or first professional degree, and completed PSE for those with a single PSE credential only), as well as an interaction between those two variables. This yields 14 parameters from which predicted probabilities are derived. The full model parameters are reported in Appendix Table A.2. We focus our attention on the predicted probabilities reported in Figure A.6.¹²

The results in Figure A.6 show patterns similar to those in Figure 9, but also reveals some heterogeneity masked by the simplified pathway variable used in Figure 9. Several differences emerge:

1. There are essentially no net income premiums associated with credential accumulation among those who obtain a TVA certificate as their first credential.
2. There is a statistically significant net income difference between college graduates (first credential) who obtain a second credential at the TVA or college level (see the p-values for the corresponding dummies in Table A.2) relative to those who complete a single college certificate or diploma.
3. The net difference in the income associated with completed a single credential at the bachelor's level versus first completing a college certificate or diploma before completing a bachelor's degree as a second credential is small, at less than 0.05 log points.
4. The pathway consisting of first completing a college credential before completing a graduate or first professional credential (as a second, or more likely a third or fourth credential) is associated with an income premium substantially higher than the two pathways listed in point 3. Note that as shown in the first part of the results section, the probability of following that pathway is very small.

¹² Each bar in the figure reports the income gap between a given pathway and the baseline pathway (a single college credential), net of controls (holding other sample characteristics constant). The predicted probabilities are obtained by adding the coefficients associated with each pathway. First example, the estimate for the bar corresponding to completing a first credential at the Bachelor's level followed by a graduate degree is obtained by adding the coefficient for each of the two dummies and for the interaction between those dummies.

At the same time, the difference in the size of the coefficient between those who first complete a bachelor's degree and then complete a second credential at the TVA or college level relative to those who follow a pathway from college to bachelor's degree (the reverse) is similar to the one observed in Figure 9 for the corresponding categories.

Overall, readers should keep this masked heterogeneity in mind when interpreting the results. At the same time, R-squared fit statistics suggest that little explanatory power is gained from this more detailed specification. Accordingly, we rely on our baseline specification with a simplified derived pathway variable in order to avoid overfitting the data and for ease of interpretation.

Other robustness checks

We run an additional series of checks to document the underlying dynamics of our regression models. First, we document the impact of using a measure of pathways that use the level of the second credential rather than the level of the highest credential completed after the first credential. The results are reported in Appendix Table A.3. We find negligible differences in the size of the estimates.

Second, we document the impact of the controls for employment in 2015 and for years of work experience on the estimates, as well as the sensitivity of the estimates to sample exclusions based on employment patterns in 2015. Results reported in Appendix Table A.4 show that the absolute and relative size of the coefficients are not substantially influenced by the exclusion of marginally employed respondents (employed part-time, part year for less than half of the year in 2015) in addition to the exclusion of respondents not employed in 2015. Also importantly, comparing the coefficients for models 1 and 2 in Table A.4.2 shows that some of the pathway coefficients in the Ontario sample are impacted by the addition of employment patterns and work experience controls. More specifically, the employment income premium for completing two bachelor's degree is close to 0.15 log points larger in models with those two controls, suggesting that respondents following this pathway are less likely to be employed full-time, full year and/or to have a large number of years of work experience than the reference category (and those who complete a bachelor's degree followed by a graduate degree). More generally, results from Appendix Table A.4 point at important differences in the labour force participation patterns of respondents with different pathways, which account for some of the income gaps between those categories to the extent that differences in labour force participation patterns are associated with different average income levels.

Accounting for the role of fields of study

Estimates from models 2 to 7 reported in Figure 9 allow to start answering a question stemming from our baseline results: what are the mechanisms that underpin income gaps between PSE pathways? We know from the first part of the results section that some of the

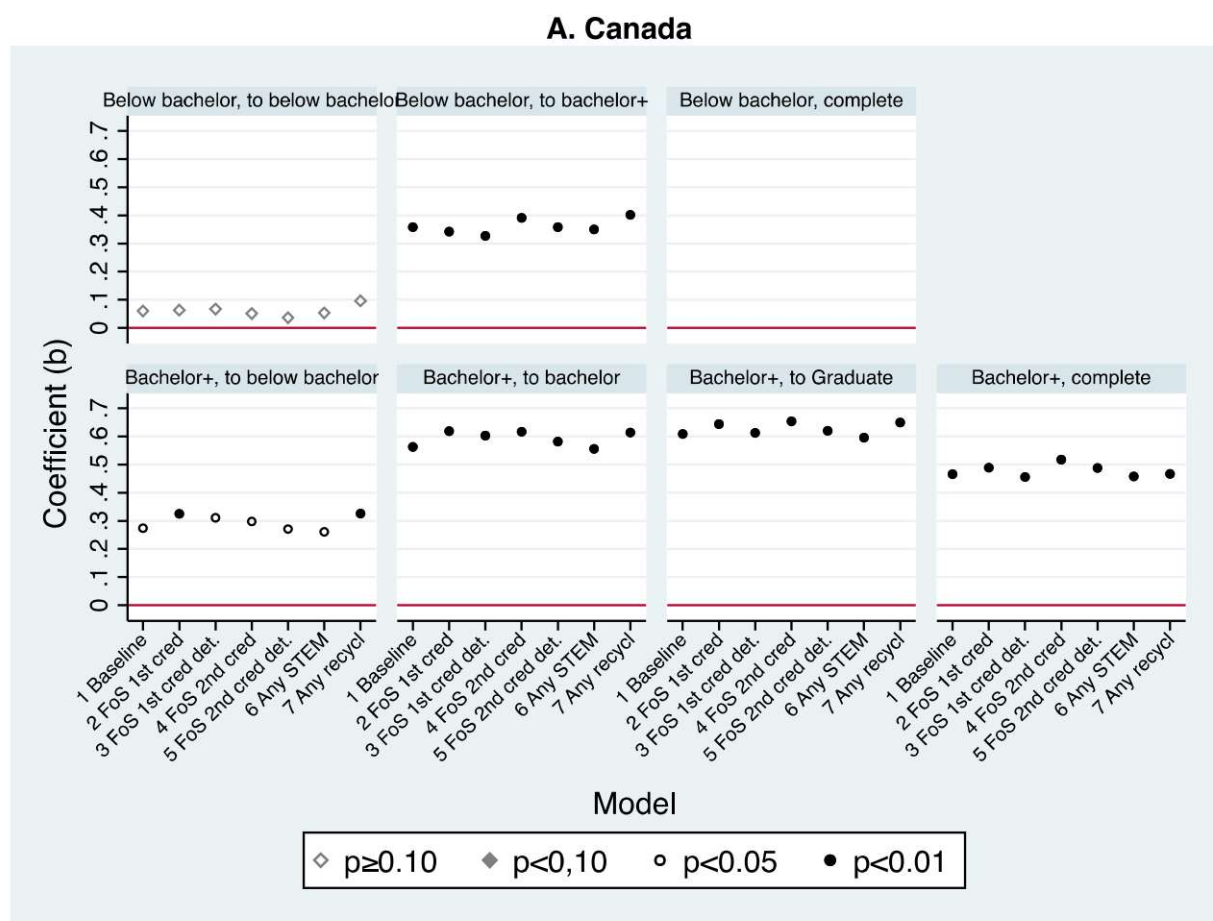
fields of study of first completed credentials are associated with specific PSE credential accumulation pathways. If there is also a relationship between the field of study of the first credential and employment income, then it is possible that the lower (or higher) income associated with a given PSE pathway is driven by the lower (or higher) income associated with the fields of study most prevalent among those who followed that given pathway. In practice, if income differences between pathways are attenuated by controlling for the field of study of the first credential, these income differences between pathways can be attributed to income differences between fields of study (and the association between fields of study with different income premiums and pathway type).

In Figure 9, we implement that approach by controlling for different measures related to the fields of study of respondents in our sample. Models 2 and 3 control for the 1-digit and 2-digit CIP codes (2011) of the first completed credential respectively. Models 4 and 5 do the same for the fields of study of the second completed credential. Then, model 6 investigates whether the net income differences associated with different pathways can be accounted for by the fact that respondents who follow specific pathways are more likely to have at least one STEM credential (a group of fields of study that are expected to be associated with more favourable labour market outcomes). Finally, model 7 follows the same intuition and investigates whether some pathways are more likely to involve a change in field of study (also called recycling), which may itself be associated with lower income on average, net of controls. Indeed, changing fields of study during program transfers is associated with a short-term earnings penalty (Finnie, Dubois, and Miyairi 2021).

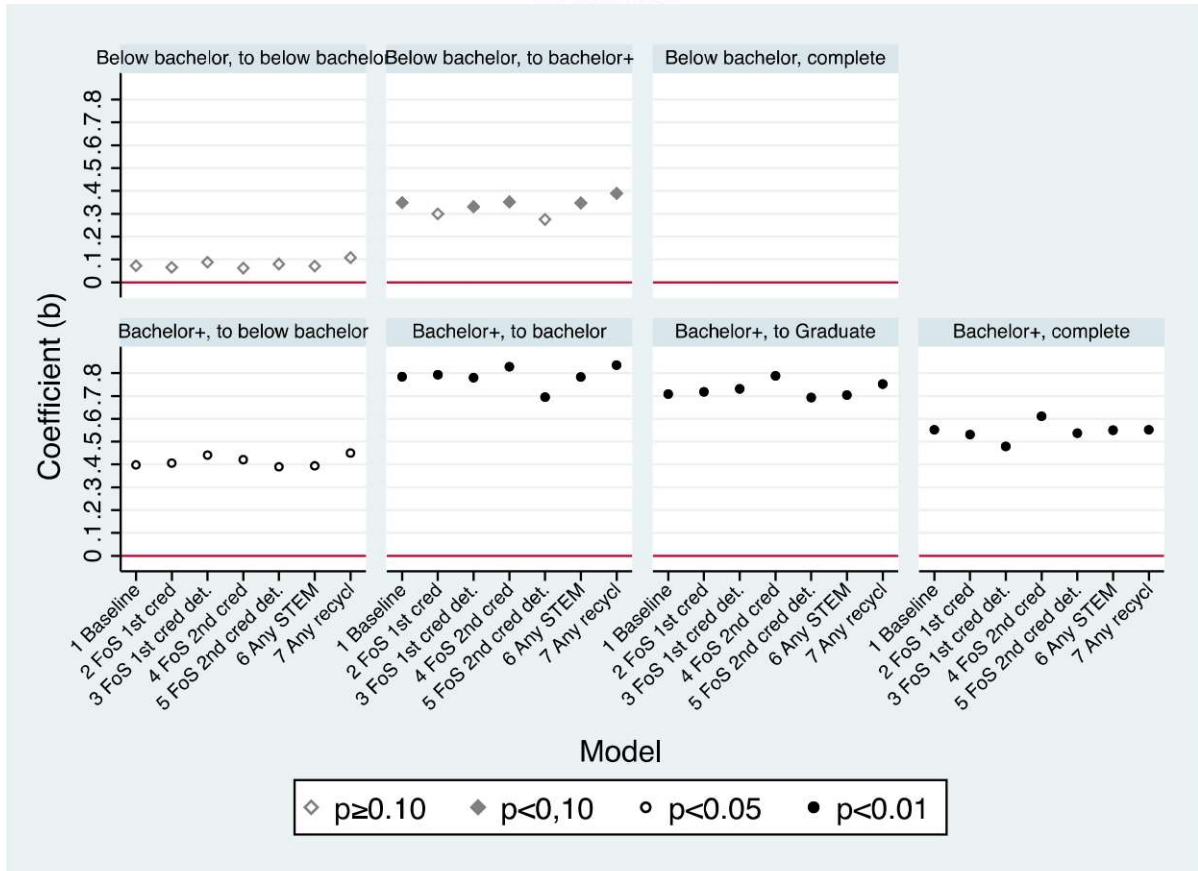
We find that the field of study of the first credential, especially when measured at the 2-digit level, accounts for most of the gap between the coefficient for the bachelor-to-college pathway and the college-to-bachelor pathway in the Canadian sample, and between the coefficients of the bachelor-to-college pathway and completing a single bachelor's degree in the Ontario sample. This may be interpreted as evidence that bachelor's graduates in less rewarded fields of study may seek to pursue a more applied second credential at the college level to supplement the skills developed in PSE.¹³ Overall, however, field of study variables, and especially the dummy for any STEM, account for little of the net average differences in income between most pathways. In other words, Figure 9 provides little supporting evidence of a possible role of fields of study as drivers of income differences among respondents who follow various PSE credential accumulation pathways.

¹³ At the same time, we refrain from a causal interpretation to the extent that students with different unobserved characteristics such as abilities and competencies may select into different fields of study in the first place.

Figure 9. Relationship between PSE pathway and annual employment income in 2015 (ln), 1956-1980 birth cohorts



B. Ontario



Source: Longitudinal and International Study of Adults, Wave 3 (2016).

Notes: The reference group for all plotted coefficients is Below bachelor's, complete. All PSE credentials completed at survey date are counted. The level of the second credential is the level of the highest PSE credential completed after the first credential (if any). "Complete" means that a single PSE credential was completed (no second credential). All models include controls for sociodemographic characteristics (parental education, gender, marital status, immigration status of self and of parents, visible minority status, Indigenous identity), province of residence in 2016, age, age at completion of first PSE credential, dummies for employment pattern in 2015, and a quadratic work experience term. Sample excludes respondents with zero weeks of employment in 2015. The Ontario sample includes all Ontario residents at survey date (2016). Estimates also reported in Appendix Table A.1.

FoS = Field of study. Det. = Detailed, 2-digit FoS CIP 2011 code (no Det. Mentions stands for 1-digit CIP 2011 code). Recycl = Recycling (change in field of study between credentials).

Job characteristics as mechanisms underpinning differences in employment income

In this final results subsection, we supplement our analysis of variables that may account for differences in annual employment income across different PSE pathways by considering the role of job characteristics. This analysis can contribute to shed light on the role of sorting and selection into different types of jobs in driving income differences between respondents who followed specific PSE credential accumulation pathways. We rely on the same approach as the previous subsection, controlling for different variables capturing the characteristics of the jobs held by respondents, and more specifically their occupation (47 categories), industry (26 categories), any responsibility supervising employees, and the demand for job skill use¹⁴.

Tables 2.1 (Canada sample) and 2.2 (Ontario sample) report the results of models using the natural log of annual employment income in 2015 as the dependent variable. As in previous models, the sample is restricted to respondents who were employed for at least one week in 2015. The same controls as those used in the models reported in Figure 9 are used, in addition to the job characteristics variables. Tables 3.1 (Canada sample) and 3.2 (Ontario sample) replicate the analysis using weekly earnings. In this case, the sample is restricted to those who were dependent employees (not self-employed) in the survey reference period. The dependent variable measures the natural log of earnings from wages and salaries (excluding bonuses and self-employment income). The control employment patterns in 2015 is replaced by a measure of weekly worked hours.

When comparing the PSE pathway coefficients from model 1 to models 2 to 7 in Tables 2.1, 2.2, 3.1 and 3.2, we find that controls for all types of job characteristics reduce the size of the estimates, with occupation dummies and job skill use indices having the strongest impact. We interpret the results as evidence that the net average employment income gaps between the reference category (single credential below the bachelor level) and the other pathway categories is driven by the sorting and selection of respondents following other pathways than the reference category into occupations, industries and jobs with skill levels that are associated with higher net income premiums on average. For example, in Figure 2.2., after controlling for job characteristics, as shown by comparing models 1 and 7, the coefficient for a single bachelor's degree diminishes from 0.533 to 0.130 log points, meaning that the net annual employment income gap between that pathway category and the reference category in Ontario decreases to 13% (and is not statistically significant) net of job characteristics.

However, the difference in the size of the coefficients relative to pathway types other than the baseline category remains constant in most cases. For example, the difference in the coefficient for respondents with a single bachelor's degree and those with a bachelor's degree followed by a graduate degree is 0.167 log points in model 1 (0.700-0.533) while it is 0.102 log points in model 7 (0.232-0.130). Similar patterns are found across specifications and pairs of coefficients. We interpret this as evidence that even net of differences in an extensive number of observed job characteristics, there remains important net income differences

¹⁴ These variables are additive indices based on survey questions asking respondents to report the importance of the use of several types of general skills in their jobs. We aggregate these questions into five categories: literacy, numeracy, computer, soft and physical skills by adding the importance scores of the items in each skill category.

associated with different PSE pathways, which may be associated with unobserved characteristics of the respondents or their jobs. Also note that the coefficient for a linear credential accumulation pathway from a bachelor's degree to a graduate degree remains substantial and statistically significant across specifications.

In sum, our analysis highlights important income differences associated with specific PSE credential accumulation pathways. It also points at the role of fields of study and job characteristics as partial drivers of these differences. The limited role of fields of study suggests that some pathways involve completing programs in less economically rewarding fields of study, but that this is an overall marginal driver of income differences across PSE pathways. The role of occupations and job skill use suggest that certain pathways may be associated with the development of competencies and skills more highly rewarded on the labour market, although some heterogeneity remains unaccounted for in fully specified models.

Table 2.1. Influence of job characteristics on relationship between PSE pathway and annual employment income in 2015 (ln), 1956-1980 birth cohorts, Canada

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
	b p	b p	b p	b p	b p	b p	b p
PSE pathways							
Below Bachelor, to below Bachelor	0.046 0.388	0.058 0.278	-0.010 0.840	0.017 0.738	-0.014 0.763	0.010 0.855	-0.032 0.484
Below Bachelor, to Bachelor+	0.336 0.000	0.325 0.000	0.243 0.001	0.142 0.060	0.071 0.323	0.188 0.011	0.025 0.725
Below Bachelor, complete	0.000 .	0.000 .	0.000 .	0.000 .	0.000 .	0.000 .	0.000 .
Bachelor+, to below Bachelor	0.268 0.005	0.253 0.007	0.210 0.020	0.144 0.129	0.105 0.232	0.147 0.113	0.066 0.450
Bachelor+, to Bachelor	0.550 0.000	0.567 0.000	0.496 0.000	0.390 0.000	0.321 0.000	0.384 0.000	0.271 0.001
Bachelor+, to Graduate	0.616 0.000	0.584 0.000	0.554 0.000	0.418 0.000	0.319 0.000	0.426 0.000	0.262 0.000
Bachelor+, complete	0.451 0.000	0.426 0.000	0.410 0.000	0.289 0.000	0.247 0.000	0.316 0.000	0.207 0.000
Supervising employees (ref.: No)							
Yes		0.246 0.000	Yes		0.249 0.000		0.210 0.000
Industry dummies					Yes		Yes
Occupation dummies				Yes	Yes		Yes
Job skill use indices							
Literacy skills							
Numeracy skills						0.006 0.030	0.000 0.942
Computer skills						-0.007 0.059	-0.006 0.051
Soft skills						0.004 0.158	0.009 0.002
Physical skills						0.008 0.001	0.006 0.017
						-0.041 0.000	-0.031 0.000
Employment in 2015							
Full-time full year	0.000 .	0.000 .	0.000 .	0.000 .	0.000 .	0.000 .	0.000 .
Part-time full year	-0.902 0.000	-0.854 0.000	-0.847 0.000	-0.843 0.000	-0.748 0.000	-0.844 0.000	-0.745 0.000
Full-time part year (half or more)	-0.491 0.000	-0.457 0.000	-0.455 0.000	-0.441 0.000	-0.390 0.000	-0.430 0.000	-0.368 0.000
Part-time part year (half or more)	-1.584 0.000	-1.524 0.000	-1.541 0.000	-1.414 0.000	-1.367 0.000	-1.549 0.000	-1.347 0.000
Full-time part year (less than half)	-1.220 0.000	-1.204 0.000	-1.174 0.000	-1.122 0.000	-1.071 0.000	-1.154 0.000	-1.034 0.000
Part-time part year (less than half)	-2.456 0.000	-2.383 0.000	-2.442 0.000	-2.433 0.000	-2.340 0.000	-2.331 0.000	-2.272 0.000
Years of work experience	0.041 0.001	0.040 0.001	0.038 0.000	0.037 0.000	0.035 0.000	0.036 0.003	0.034 0.000
Years of work experience, squared	-0.001 0.035	-0.001 0.026	-0.001 0.016	-0.001 0.012	-0.001 0.007	-0.001 0.033	-0.001 0.005
Constant	8.849 0.000	9.075 0.000	8.646 0.000	10.500 0.000	10.163 0.000	8.342 0.000	9.938 0.000
R-squared	0.366	0.381	0.429	0.436	0.488	0.394	0.499
Adjusted R-squared	0.359	0.373	0.418	0.422	0.470	0.386	0.481

Source: Longitudinal and International Study of Adults, Wave 3 (2016).

Notes: All PSE credentials completed at survey date are counted. The level of the second credential is the level of the highest PSE credential completed after the first credential (if any). "Complete" means that a single PSE credential was completed (no second credential). All models include controls for sociodemographic characteristics (parental education, gender, marital status immigration status of self and of parents, visible minority status, Indigenous identity), province of residence in 2016, age, and age at completion of first credential. Sample excludes respondents with zero weeks of employment in 2015.

Table 2.2. Influence of job characteristics on relationship between PSE pathway and annual employment income in 2015 (ln), 1956-1980 birth cohorts, Ontario

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7	
	b	p	b	p	b	p	b	p	b	p	b	p	b	p
PSE pathways														
Below Bachelor, to below Bachelor	0.062	0.509	0.078	0.402	-0.039	0.666	-0.018	0.849	-0.071	0.458	0.008	0.933	-0.114	0.239
Below Bachelor, to Bachelor+	0.318	0.064	0.342	0.044	0.110	0.515	0.092	0.588	-0.039	0.827	0.120	0.452	-0.119	0.480
Below Bachelor, complete	0.000	.	0.000	.	0.000	.	0.000	.	0.000	.	0.000	.	0.000	.
Bachelor+, to below Bachelor	0.410	0.010	0.393	0.011	0.241	0.116	0.257	0.098	0.107	0.466	0.221	0.149	0.020	0.890
Bachelor+, to Bachelor	0.804	0.000	0.825	0.000	0.737	0.000	0.601	0.000	0.480	0.007	0.609	0.000	0.416	0.019
Bachelor+, to Graduate	0.700	0.000	0.655	0.000	0.617	0.000	0.455	0.000	0.301	0.014	0.469	0.000	0.232	0.066
Bachelor+, complete	0.533	0.000	0.479	0.000	0.432	0.000	0.297	0.005	0.201	0.062	0.348	0.001	0.130	0.231
Supervising employees (ref.: No)														
Yes									0.367	0.000			0.339	0.000
Industry dummies					Yes				Yes				Yes	
Occupation dummies							Yes		Yes				Yes	
Job skill use indices														
Literacy skills														
Numeracy skills											0.004	0.494	-0.001	0.797
Computer skills											-0.011	0.077	-0.005	0.441
Soft skills											0.004	0.468	0.003	0.612
Physical skills											0.014	0.006	0.010	0.041
											-0.067	0.000	-0.056	0.000
Employment in 2015														
Full-time full year	0.000	.	0.000	.	0.000	.	0.000	.	0.000	.	0.000	.	0.000	.
Part-time full year	-0.930	0.000	-0.863	0.000	-0.804	0.000	-0.800	0.000	-0.648	0.000	-0.858	0.000	-0.637	0.000
Full-time part year (half or more)	-0.847	0.000	-0.808	0.000	-0.752	0.000	-0.811	0.000	-0.702	0.000	-0.761	0.000	-0.679	0.000
Part-time part year (half or more)	-1.167	0.000	-1.115	0.001	-1.212	0.000	-0.949	0.007	-1.007	0.002	-1.163	0.000	-1.007	0.003
Full-time part year (less than half)	-0.976	0.024	-0.922	0.020	-1.077	0.006	-0.786	0.049	-0.855	0.020	-0.862	0.021	-0.868	0.021
Part-time part year (less than half)	-2.388	0.000	-2.267	0.000	-2.493	0.000	-2.315	0.000	-2.259	0.000	-2.230	0.000	-2.161	0.000
Years of work experience	0.055	0.013	0.053	0.013	0.054	0.009	0.060	0.002	0.048	0.015	0.048	0.020	0.050	0.009
Years of work experience, squared	-0.001	0.095	-0.001	0.067	-0.001	0.080	-0.001	0.035	-0.001	0.084	-0.001	0.105	-0.001	0.060
Constant	8.250	0.000	8.255	0.000	8.345	0.000	9.583	0.000	9.004	0.000	7.334	0.000	9.101	0.000
R-squared	0.400		0.424		0.467		0.491		0.555		0.441		0.569	
Adjusted R-squared	0.375		0.399		0.421		0.431		0.480		0.412		0.492	

Source: Longitudinal and International Study of Adults, Wave 3 (2016).

Notes: All PSE credentials completed at survey date are counted. The level of the second credential is the level of the highest PSE credential completed after the first credential (if any). "Complete" means that a single PSE credential was completed (no second credential). All models include controls for sociodemographic characteristics (parental education, gender, marital status immigration status of self and of parents, visible minority status, Indigenous identity), province of residence in 2016, age, and age at completion of first credential. Sample excludes respondents with zero weeks of employment in 2015. The Ontario sample includes all Ontario residents at survey date (2016).

Table 3.1. Influence of job characteristics on relationship between PSE pathway and weekly earnings (ln), 1956-1980 birth cohorts, Canada

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7	
	b	p	b	p	b	p	b	p	b	p	b	p	b	p
PSE pathways														
Below Bachelor, to below Bachelor	0.041	0.180	0.048	0.108	0.001	0.972	0.013	0.636	-0.007	0.802	0.008	0.791	-0.027	0.304
Below Bachelor, to Bachelor+	0.382	0.000	0.374	0.000	0.316	0.000	0.214	0.000	0.168	0.000	0.268	0.000	0.136	0.002
Below Bachelor, complete	0.000	.	0.000	.	0.000	.	0.000	.	0.000	.	0.000	.	0.000	.
Bachelor+, to below Bachelor	0.185	0.002	0.174	0.003	0.138	0.014	0.079	0.167	0.050	0.356	0.079	0.172	0.021	0.707
Bachelor+, to Bachelor	0.379	0.000	0.388	0.000	0.353	0.000	0.247	0.000	0.188	0.000	0.255	0.000	0.146	0.004
Bachelor+, to Graduate	0.482	0.000	0.473	0.000	0.438	0.000	0.342	0.000	0.285	0.000	0.340	0.000	0.250	0.000
Bachelor+, complete	0.345	0.000	0.334	0.000	0.310	0.000	0.200	0.000	0.172	0.000	0.236	0.000	0.144	0.001
Supervising employees (ref.: No)														
Yes			0.119	0.000	Yes				0.090	0.000			0.045	0.053
Industry dummies									Yes				Yes	
Occupation dummies							Yes		Yes				Yes	
Job skill use indices														
Literacy skills											0.005	0.020	0.000	0.930
Numeracy skills											-0.004	0.104	-0.003	0.223
Computer skills											0.010	0.000	0.011	0.000
Soft skills											0.005	0.005	0.004	0.005
Physical skills											-0.014	0.005	-0.007	0.118
Weekly work hours	0.022	0.000	0.021	0.000	0.022	0.000	0.021	0.000	0.020	0.000	0.021	0.000	0.020	0.000
Years of work experience	0.031	0.001	0.031	0.001	0.027	0.000	0.026	0.000	0.024	0.000	0.028	0.001	0.024	0.000
Years of work experience, squared	0.000	0.061	0.000	0.056	0.000	0.031	0.000	0.026	0.000	0.018	0.000	0.039	0.000	0.009
Constant	6.386	0.000	6.498	0.000	6.007	0.000	6.988	0.000	6.664	0.000	5.946	0.000	6.338	0.000
R-squared	0.478		0.485		0.536		0.555		0.594		0.518		0.608	
Adjusted R-squared	0.472		0.479		0.526		0.543		0.578		0.512		0.592	

Source: Longitudinal and International Study of Adults, Wave 3 (2016).

Notes: All PSE credentials completed at survey date are counted. The level of the second credential is the level of the highest PSE credential completed after the first credential (if any). "Complete" means that a single PSE credential was completed (no second credential). All models include controls for sociodemographic characteristics (parental education, gender, marital status immigration status of self and of parents, visible minority status, Indigenous identity), province of residence in 2016, age, and age at completion of first credential. Sample restricted to employed respondents in survey reference week (excluding self-employed). Self-employment income and bonuses not included.

Table 3.2. Influence of job characteristics on relationship between PSE pathway and weekly earnings (ln), 1956-1980 birth cohorts, Ontario

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
	b	b	b	b	b	b	b
	p	p	p	p	p	p	p
PSE pathways							
Below Bachelor, to below Bachelor	-0.021	-0.011	-0.092	-0.033	-0.078	-0.054	-0.123
Below Bachelor, to Bachelor+	0.414	0.425	0.257	0.276	0.142	0.270	0.063
Below Bachelor, complete	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Bachelor+, to below Bachelor	0.253	0.247	0.143	0.147	0.048	0.101	-0.011
Bachelor+, to Bachelor	0.409	0.431	0.355	0.349	0.205	0.277	0.133
Bachelor+, to Graduate	0.575	0.577	0.472	0.473	0.318	0.417	0.261
Bachelor+, complete	0.390	0.377	0.299	0.256	0.158	0.256	0.114
Supervising employees (ref.: No)							
Yes		0.120	Yes		0.104		0.058
Industry dummies					Yes		Yes
Occupation dummies				Yes	Yes		Yes
Job skill use indices							
Literacy skills						0.004	0.000
Numeracy skills						-0.005	-0.003
Computer skills						0.010	0.011
Soft skills						0.007	0.007
Physical skills						-0.035	-0.028
Weekly work hours	0.020	0.019	0.021	0.018	0.018	0.018	0.017
Years of work experience	0.043	0.043	0.033	0.038	0.026	0.040	0.028
Years of work experience, squared	-0.001	-0.001	0.000	-0.001	0.000	-0.001	0.000
Constant	6.562	6.560	6.157	6.646	5.709	5.490	5.532
R-squared	0.523	0.530	0.605	0.621	0.681	0.582	0.701
Adjusted R-squared	0.503	0.509	0.568	0.570	0.617	0.560	0.638

Source: Longitudinal and International Study of Adults, Wave 3 (2016).

Notes: All PSE credentials completed at survey date are counted. The level of the second credential is the level of the highest PSE credential completed after the first credential (if any). "Complete" means that a single PSE credential was completed (no second credential). All models include controls for sociodemographic characteristics (parental education, gender, marital status, immigration status of self and of parents, visible minority status, Indigenous identity), province of residence in 2016, age, and age at completion of first credential. Sample restricted to employed respondents in survey reference week (excluding self-employed). Self-employment income and bonuses not included. The Ontario sample includes all Ontario residents at survey date (2016).

CONCLUSION

This report aimed to document PSE credential accumulation pathways, especially those involving non-linear trajectories. We have shown that more than 20% of Canadians complete more than one PSE credential, and around 15% of Canadians follow a non-linear credential accumulation pathway or another type of credential accumulation pathway that may be considered non-conventional, such as completed a college certificate or diploma as a first credential before completing a bachelor's degree.

At the same time, we find strong evidence of dynamics of cumulative disadvantages rooted in credential accumulation patterns. Certain types of credential accumulation are associated with substantial employment income premiums, but they are unevenly distributed based on the level of the first credential, which itself is associated with certain background characteristics such as parental education and visible minority status (as with the level of the second credential, conditional on the level of the first credential).

In sum, there are large earnings gaps between respondents whose first PSE credentials are a TVA certificate, a college certificate or diploma, or bachelor's degree or higher, in part driven by the pathways associated with that first credential. Also note that no pathway for TVA or college graduates appears to allow closing the gap between them and bachelor graduates, on average (except in the case of the small number of bachelor graduates who go on to complete a second credential below the bachelor level, a pathway associated with a smaller income premium than completing a single credential at the bachelor's level).

This points at a few directions:

1. Policies and programs that support transfer pathways from TVA or college to bachelor programs may translate into higher income levels not only because a bachelor is associated with a higher income level, but because bachelor graduates are more likely to then complete a graduate degree.
2. These programs can take many forms, including programs that facilitate the accumulation of completed credentials rather than transfers without completion of the initial program. The design of programs for credit transfer should take into consideration the patterns identified in this report in terms of drivers of different pathways and associated labour market outcomes. One may ask whether a college-to-university transfer is more beneficial than graduating from college before completing a bachelor's program, and under which circumstances. For example, credit transfer and recognition from a completed college program to a bachelor program may facilitate the successful completion of a bachelor program. But it may also support the subsequent completion of a graduate degree, especially knowing that so few college graduates end up completing a graduate degree.

These discussion points come with an important caveat. The results presented in this report are descriptive in nature. No causal inference may be directly drawn from the analysis. More specifically, it is possible that respondents who complete a TVA or college certificate as their first credential achieve a lower income level because of unobserved personal or background

characteristics that are associated both with educational access, aspiration, and success, and with income. In this case, the impact of any policy interventions aimed at supporting certain pathways on income may be attenuated compared with our reported estimates.

More broadly, future work should study to the profiles of those who go on to complete a TVA or college degree after a bachelor's degree. In this study, we were able to highlight the partial role of fields of study. However, other factors that drive students into those programs and into these pathways may play a role, such as abilities and grades, etc. This opens the door for a stronger focus on selection into different pathways based on background and personal characteristics, and on policy interventions focused on earlier stages of the life course. But it also points at the importance of the wage structure, although education policymakers have little influence on the wage structure (for example, which credentials and fields of study are most rewarded on the labour market).

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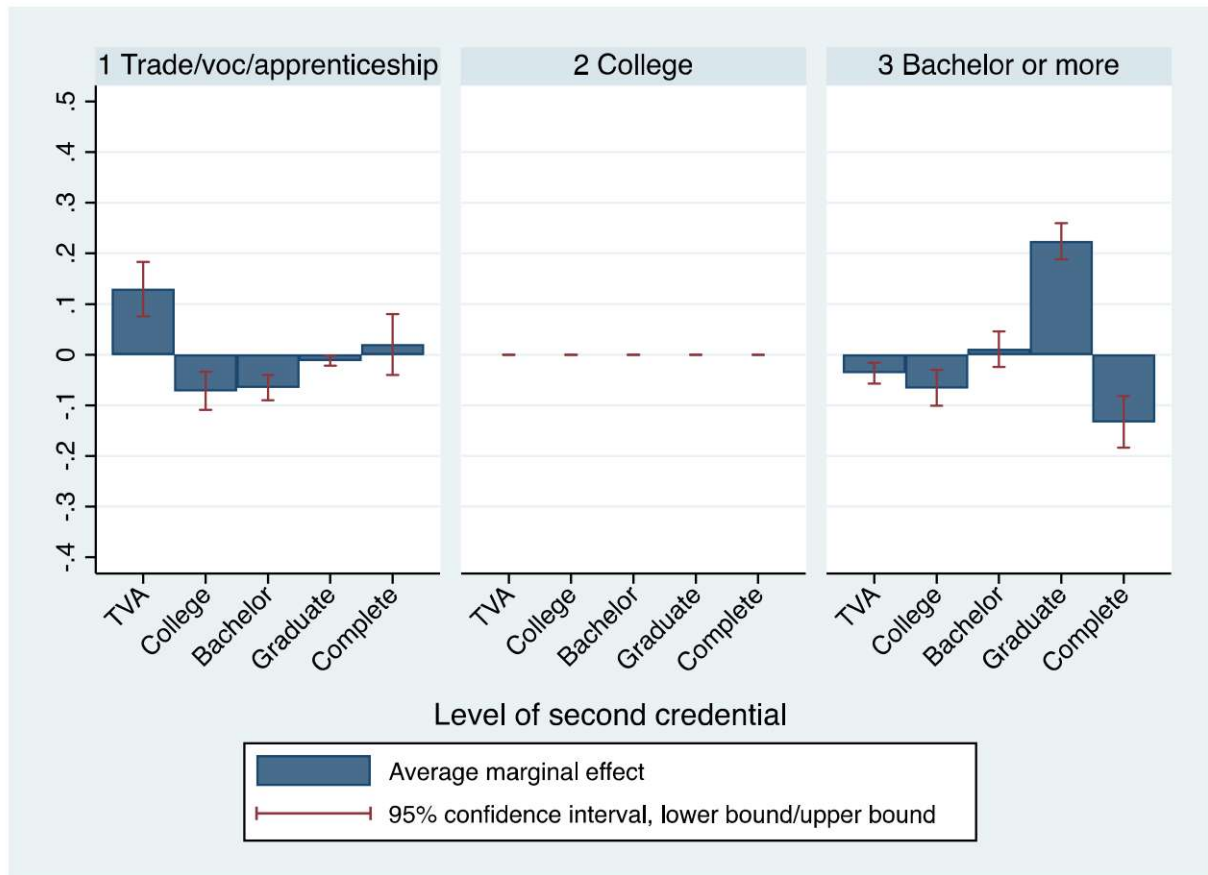
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APPENDIX A. SUPPLEMENTAL RESULTS

Figure A.1. Average marginal probabilities of completing a second credential before 35 years old by level of first credential, 1956-1980 birth cohorts (Canada)

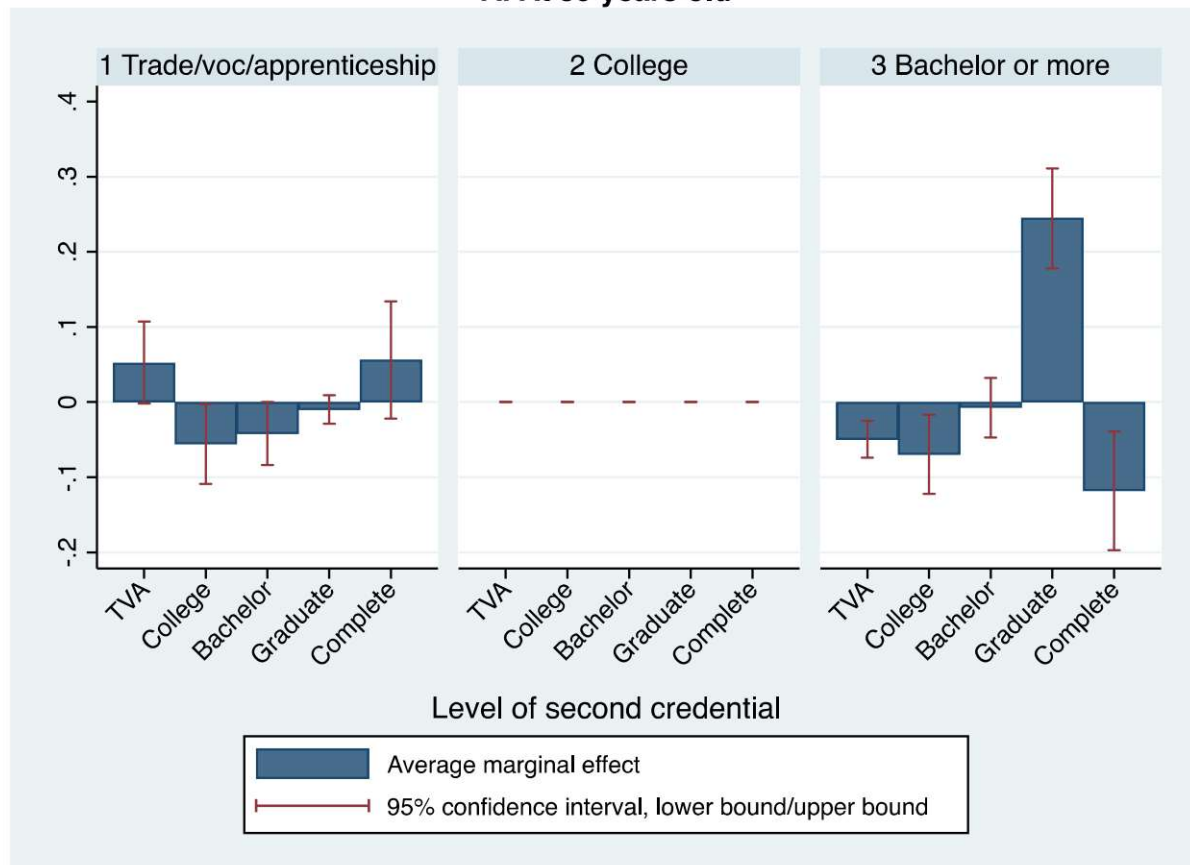


Source: Longitudinal and International Study of Adults, Wave 3 (2016).

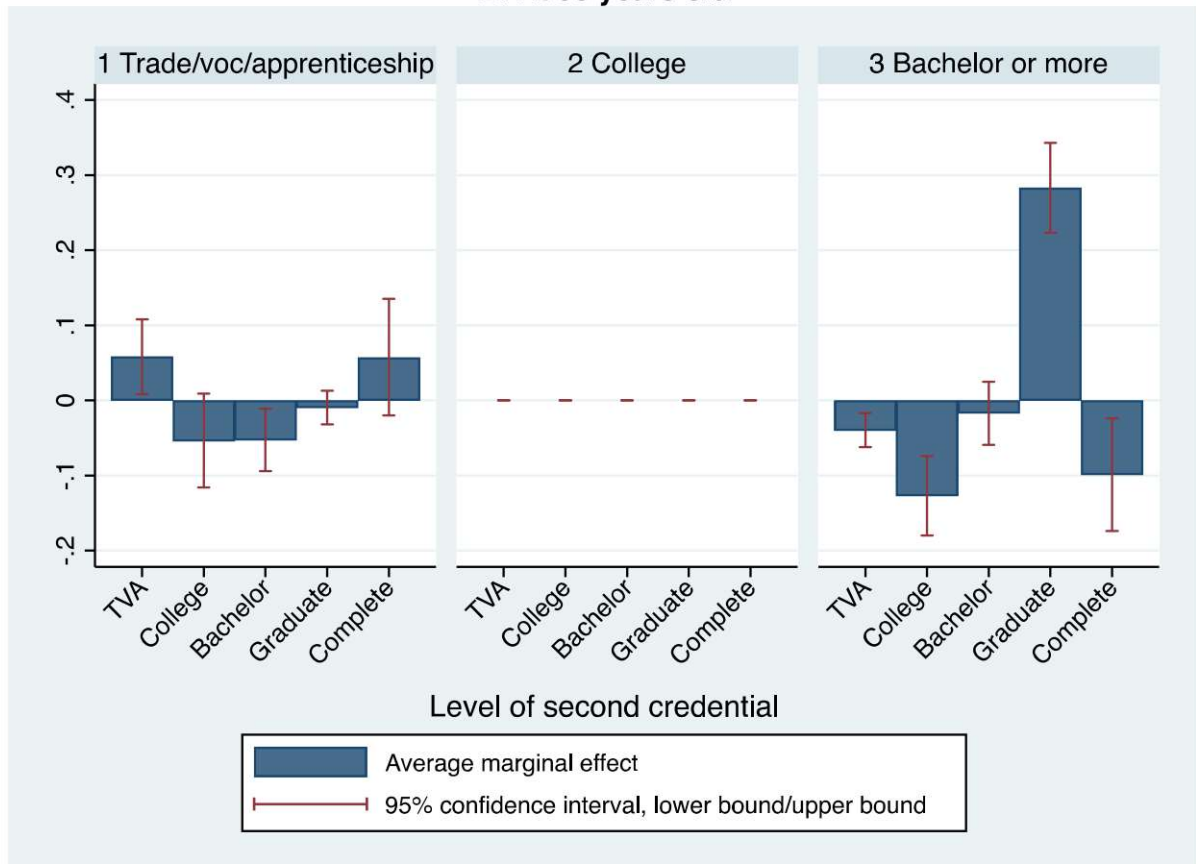
Notes: PSE credential completed at 35 years old or later are not counted. "Complete" means that a single PSE credential was completed (no second credential).

Figure A.2. Average marginal probabilities of completing a second credential (or more) before 35 and 50 years old by level of first credential, 1956-1965 birth cohorts (Canada)

A. At 35 years old

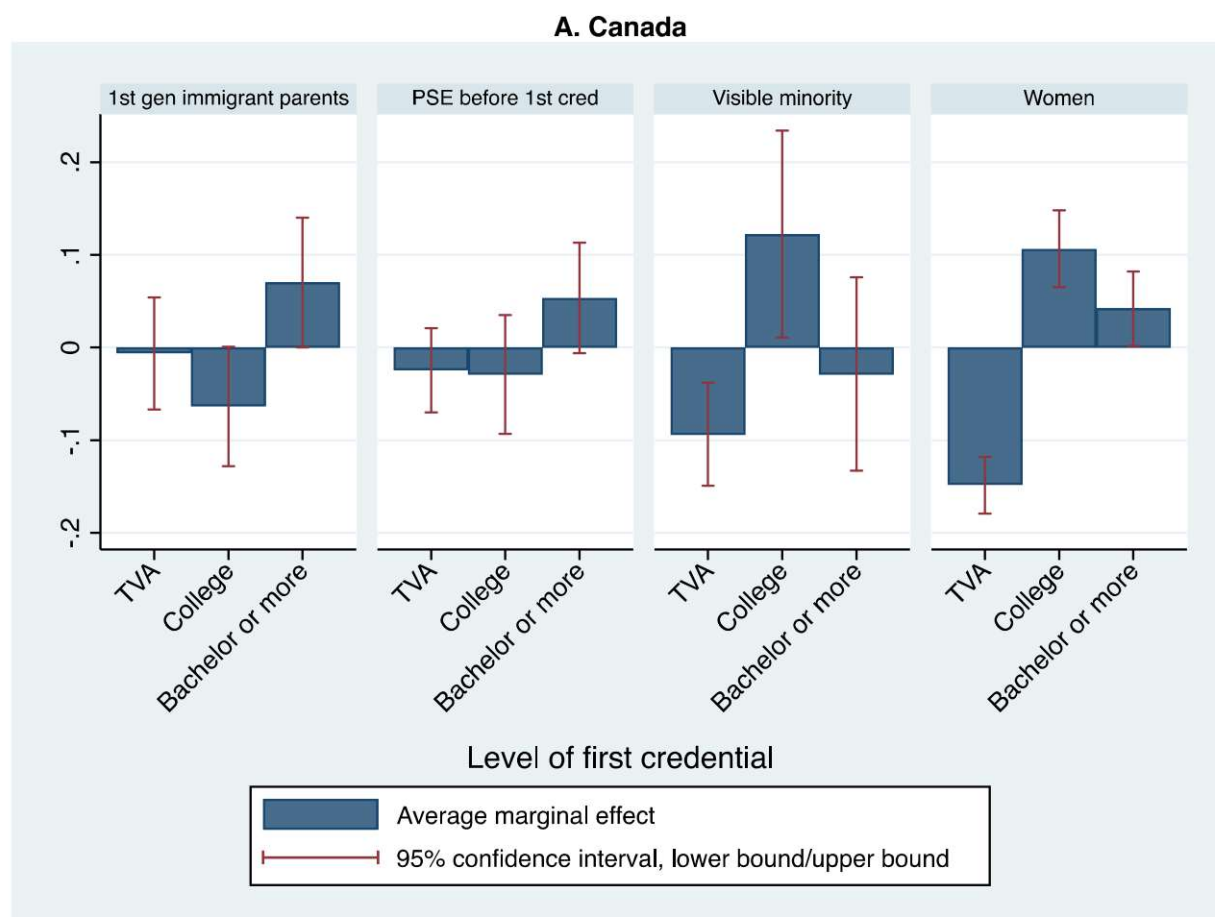


B. At 50 years old

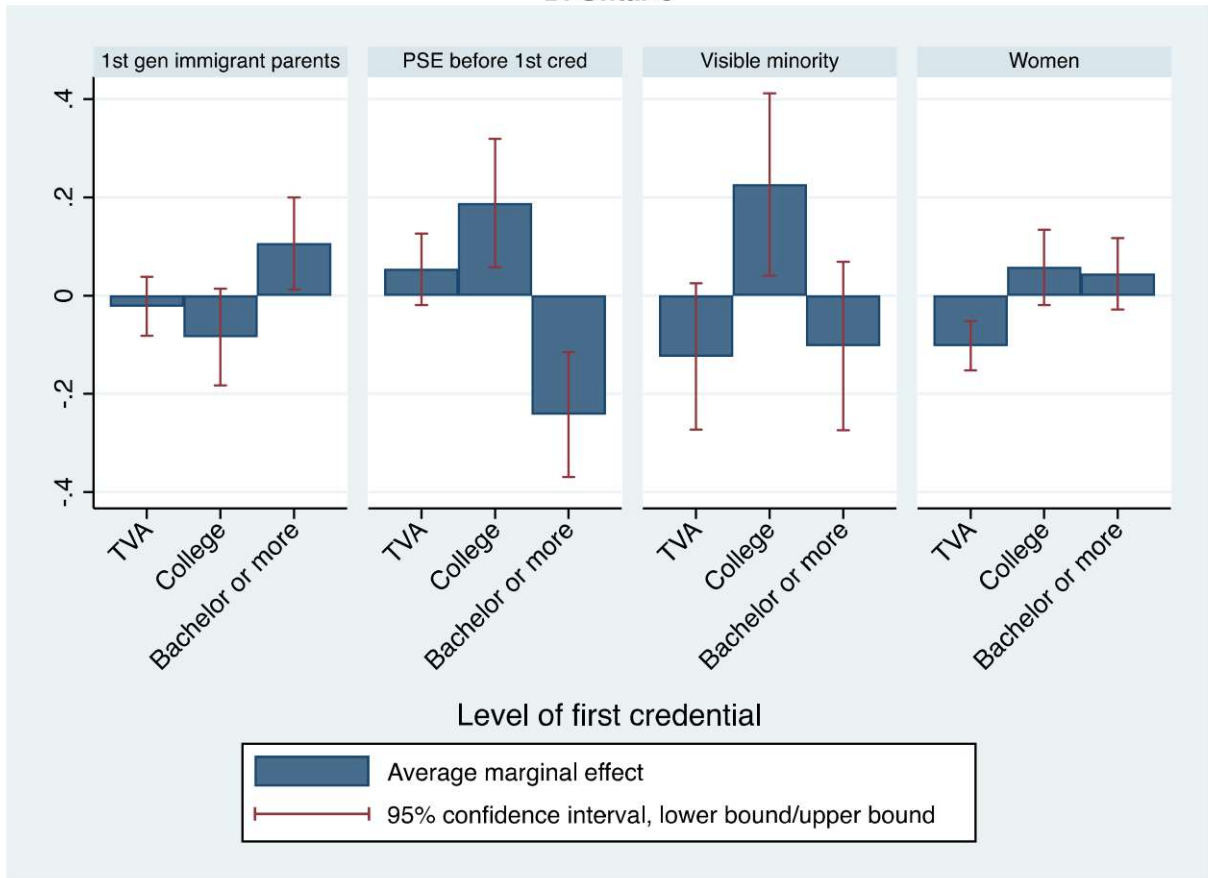


Source: Longitudinal and International Study of Adults, Wave 3 (2016).
 Notes: In panel A, PSE credential completed at 35 years old or later are not counted. In panel B, PSE credential completed at 50 years old or later are not counted. The level of the second credential is the level of the highest PSE credential completed after the first credential (if any). "Complete" means that a single PSE credential was completed (no second credential).

Figure A.3. Average marginal probabilities of completing a first PSE credential at a given level before 35 years old by background characteristics, 1956-1980 birth cohorts

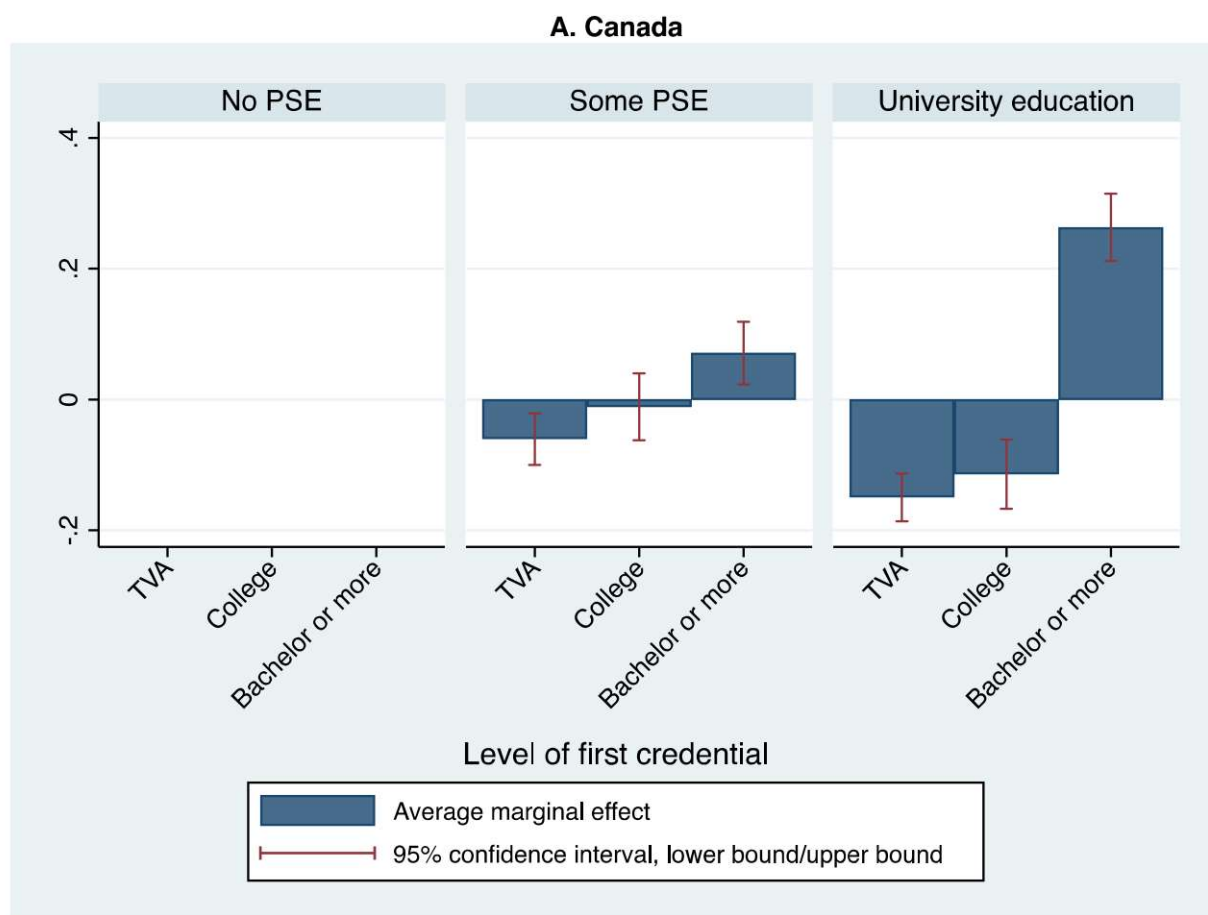


B. Ontario

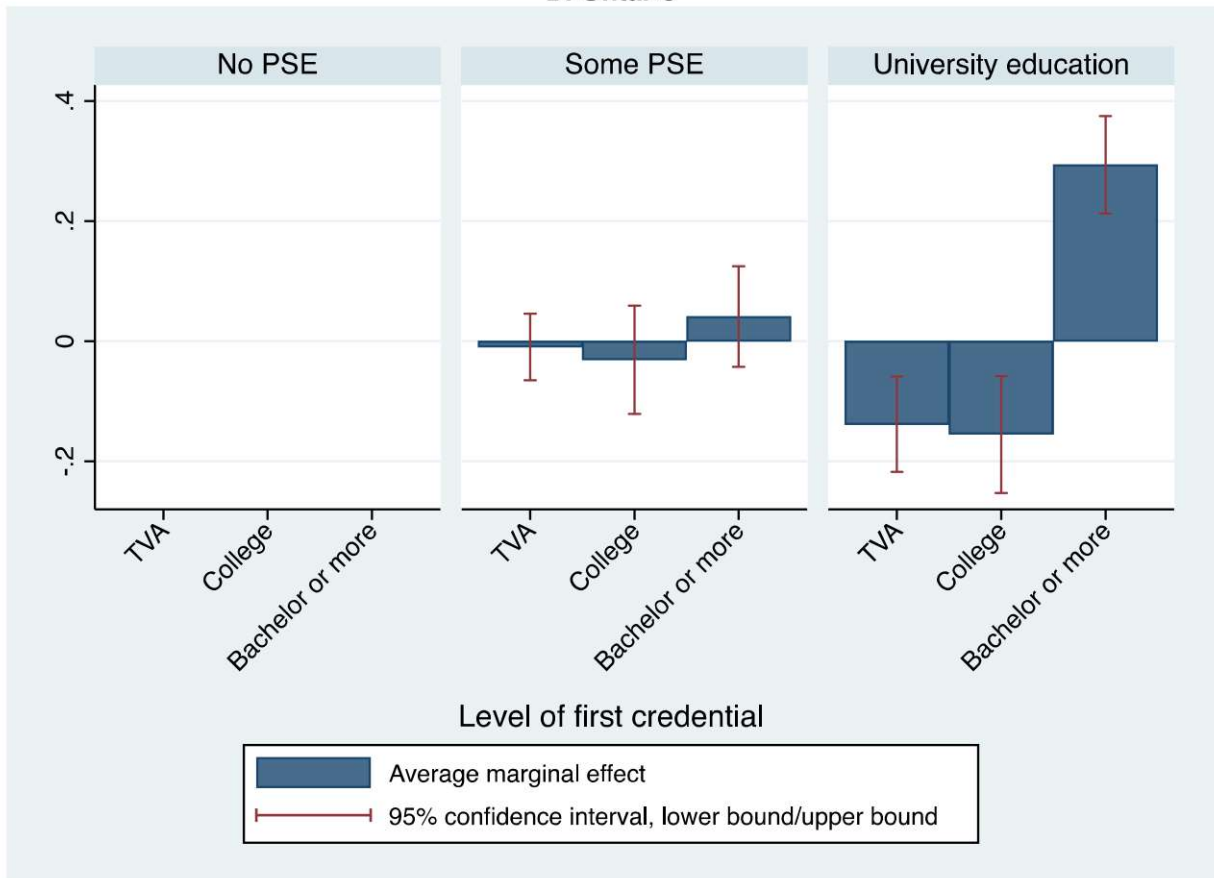


Source: Longitudinal and International Study of Adults, Wave 3 (2016).
 Notes: PSE credential completed at 35 years old or later are not counted. The Ontario subsample includes respondents reporting graduating from high school in Ontario.

Figure A.4. Average marginal probabilities of completing a first PSE credential at a given level before 35 years old by parental education level, 1956-1980 birth cohorts

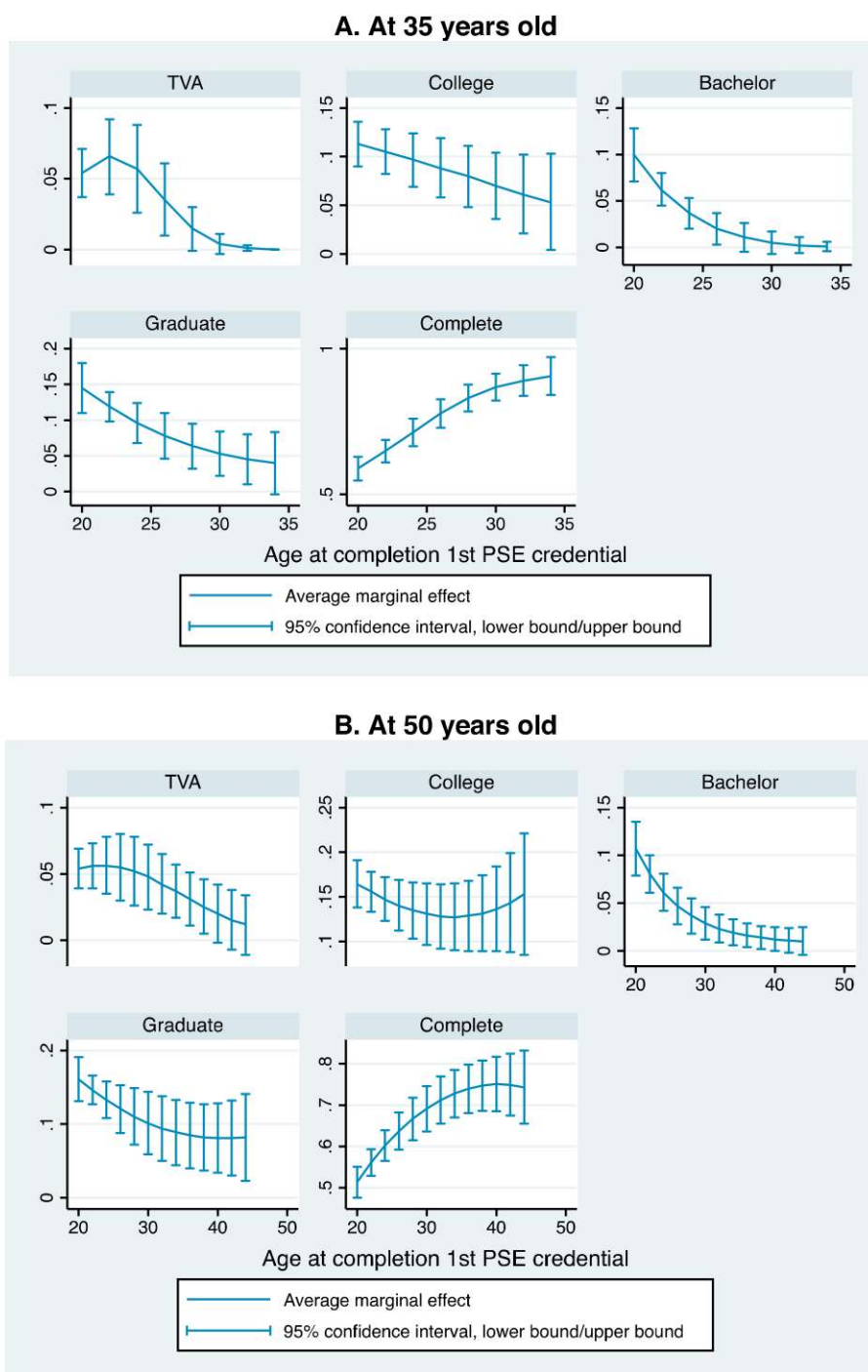


B. Ontario



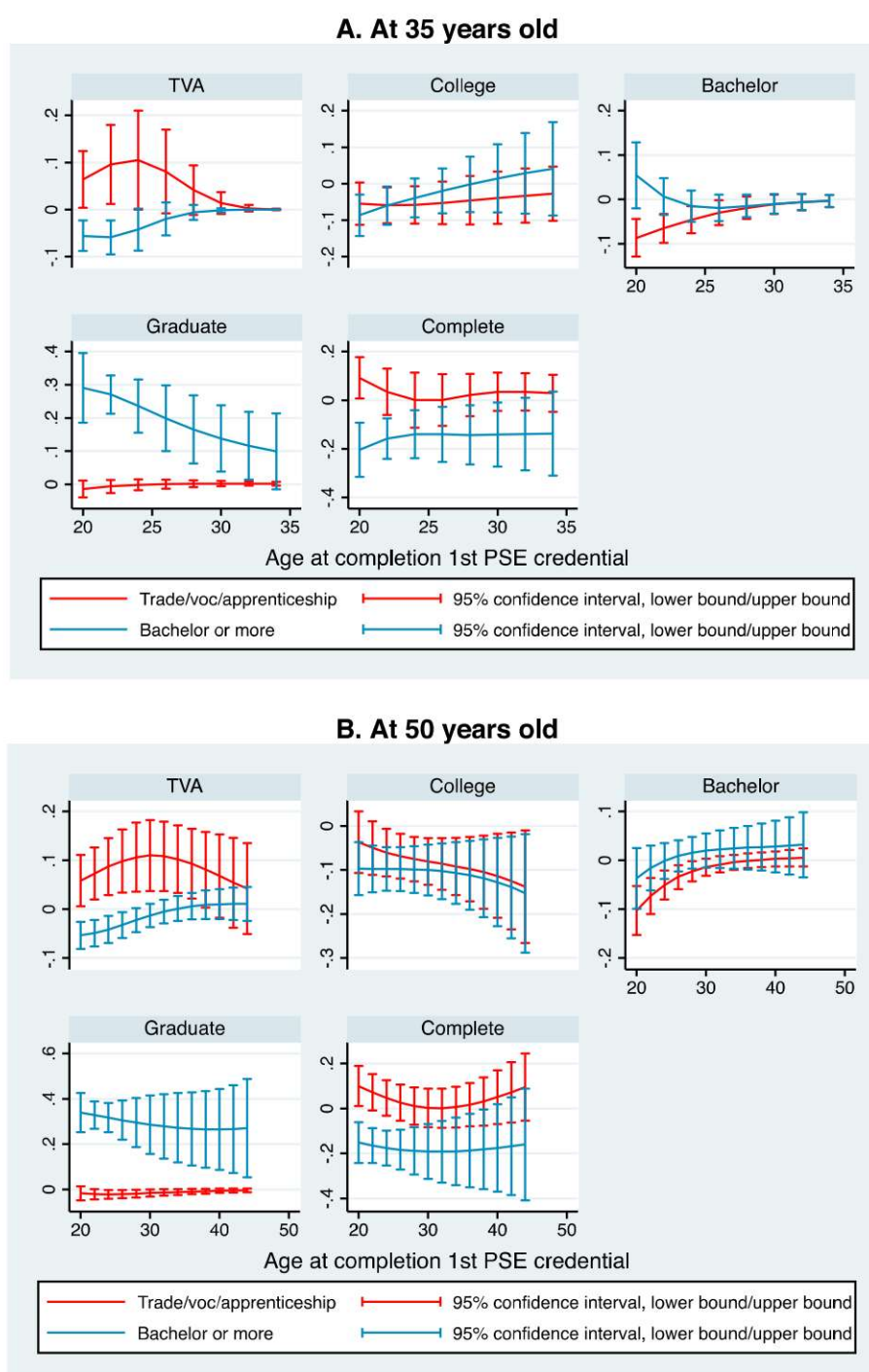
Source: Longitudinal and International Study of Adults, Wave 3 (2016).
 Notes: The three categories in the panel subtitles correspond to the educational attainment of the most educated parent. PSE credential completed at 35 years old or later are not counted. The Ontario subsample includes respondents reporting graduating from high school in Ontario.

Figure A.5.1. Average predicted probabilities of completing a second credential (or more) by age at completion of 1st PSE credential, 1956-1965 birth cohorts



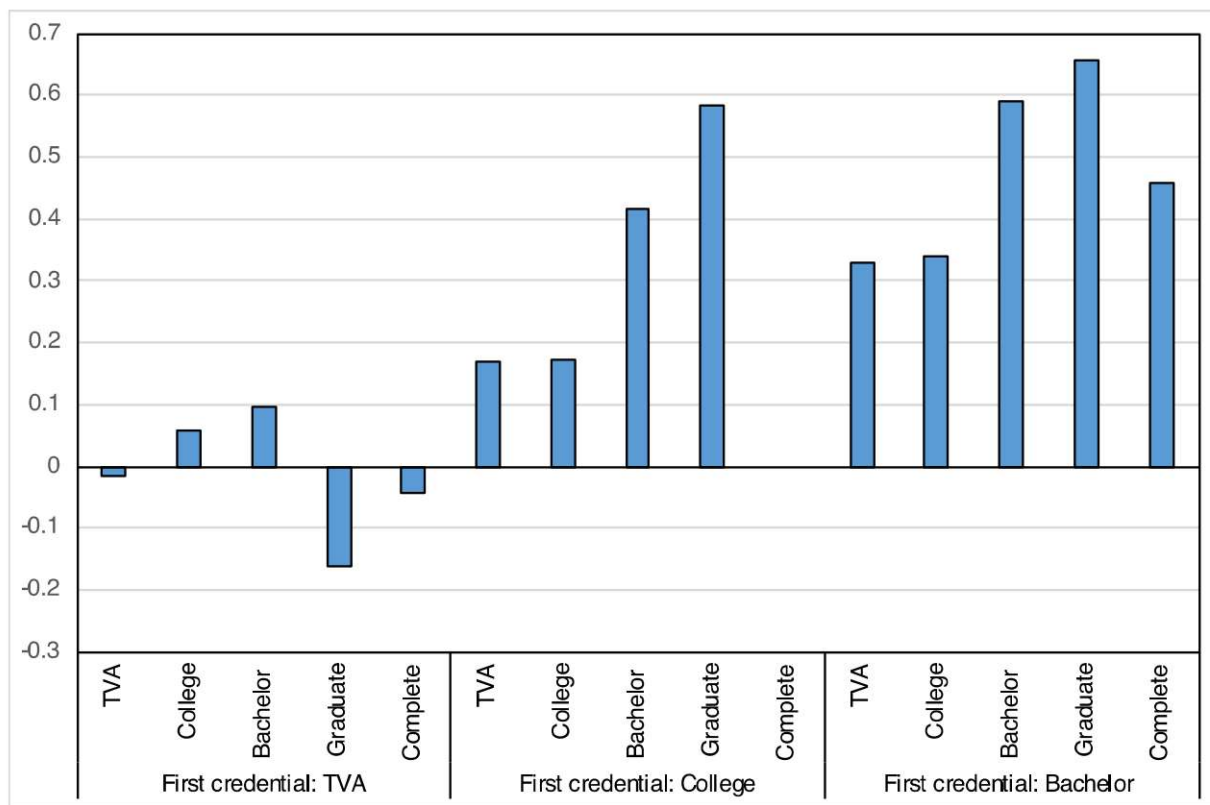
Source: Longitudinal and International Study of Adults, Wave 3 (2016).
 Notes: PSE credential completed at 35 years old or later are not counted. The level of the second credential is the level of the highest PSE credential completed after the first credential (if any). "Complete" means that a single PSE credential was completed (no second credential).

Figure A.5.2. Average predicted probabilities of completing a second credential (or more) by age at completion of 1st PSE credential, 1956-1965 birth cohorts (model with interaction)



Source: Longitudinal and International Study of Adults, Wave 3 (2016).
Notes: PSE credential completed at 35 years old or later are not counted. The level of the second credential is the level of the highest PSE credential completed after the first credential (if any). "Complete" means that a single PSE credential was completed (no second credential).

Figure A.6. Relationship between PSE pathway and annual employment income in 2015 (ln), detailed pathways from model with interaction between level of first and second credential, 1956-1980 birth cohorts



Source: Longitudinal and International Study of Adults, Wave 3 (2016).

Notes: The reference group for all plotted coefficients is *First credential: College x Complete* cell. All PSE credentials completed at survey date are counted. The level of the second credential is the level of the highest PSE credential completed after the first credential (if any). "Complete" means that a single PSE credential was completed (no second credential). All models include controls for sociodemographic characteristics (parental education, gender, marital status immigration status of self and of parents, visible minority status, Indigenous identity), province of residence in 2016, age, age at completion of last PSE credential, dummies for employment pattern in 2015, and a quadratic work experience term. Sample excludes respondents with zero weeks of employment in 2015. Detailed regression output reported in Appendix Table A.2.

Table A1.1. Relationship between PSE pathway and annual employment income in 2015 (ln), 1956-1980 birth cohorts, Canada

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7	
	b	p	b	p	b	p	b	p	b	p	b	p	b	p
PSE pathway														
Below Bachelor, to below Bachelor	0.060	0.257	0.063	0.254	0.067	0.226	0.051	0.359	0.036	0.512	0.053	0.315	0.096	0.147
Below Bachelor, to Bachelor+	0.358	0.000	0.342	0.000	0.327	0.000	0.391	0.000	0.358	0.000	0.350	0.000	0.402	0.000
Below Bachelor, complete	0.000	.	0.000	.	0.000	.	0.000	.	0.000	.	0.000	.	0.000	.
Bachelor+, to below Bachelor	0.274	0.004	0.325	0.001	0.311	0.002	0.298	0.002	0.271	0.003	0.261	0.006	0.326	0.002
Bachelor+, to Bachelor	0.563	0.000	0.619	0.000	0.603	0.000	0.617	0.000	0.582	0.000	0.556	0.000	0.614	0.000
Bachelor+, to Graduate	0.609	0.000	0.644	0.000	0.613	0.000	0.654	0.000	0.620	0.000	0.596	0.000	0.650	0.000
Bachelor+, complete	0.466	0.000	0.489	0.000	0.456	0.000	0.518	0.000	0.488	0.000	0.458	0.000	0.467	0.000
FoS, first credential	Yes													
FoS, first credential, detailed	Yes													
FoS, last credential	Yes													
FoS, last credential, detailed	Yes													
Any STEM: No (reference)	0.000 .													
Any STEM: Yes	0.081 0.062													
Any recycling: No (reference)	0.000 .													
Any recycling: Yes	-0.063 0.273													
Constant	8.951	0.000	9.063	0.000	8.686	0.000	8.915	0.000	8.529	0.000	8.905	0.000	8.979	0.000
R-squared	0.399		0.409		0.422		0.412		0.430		0.400		0.399	
Adjusted R-squared	0.393		0.401		0.410		0.403		0.419		0.394		0.393	

Source: Longitudinal and International Study of Adults, Wave 3 (2016).

Notes: All PSE credentials completed at survey date are counted. The level of the second credential is the level of the highest PSE credential completed after the first credential (if any). "Complete" means that a single PSE credential was completed (no second credential). All models include controls for sociodemographic characteristics (parental education, gender, marital status, immigration status of self and of parents, visible minority status, Indigenous identity), province of residence in 2016, age, age at completion of first PSE credential, dummies for employment pattern in 2015, and a quadratic work experience term. Sample excludes respondents with zero weeks of employment in 2015.

FoS = Field of study. Detailed = 2-digit FoS CIP 2011 code (no mention of detailed stands for 1-digit CIP 2011 code). Recycling = change in field of study between credentials.

Table A1.2. Relationship between PSE pathway and annual employment income in 2015 (ln), 1956-1980 birth cohorts, Ontario

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7	
	b	p	b	p	b	p	b	p	b	p	b	p	b	p
PSE pathway														
Below Bachelor, to below Bachelor	0.072	0.448	0.065	0.504	0.088	0.381	0.062	0.546	0.080	0.445	0.071	0.453	0.108	0.313
Below Bachelor, to Bachelor+	0.349	0.056	0.300	0.076	0.331	0.037	0.352	0.045	0.275	0.110	0.347	0.057	0.389	0.036
Below Bachelor, complete	0.000	.	0.000	.	0.000	.	0.000	.	0.000	.	0.000	.	0.000	.
Bachelor+, to below Bachelor	0.398	0.014	0.406	0.015	0.441	0.007	0.421	0.009	0.390	0.011	0.394	0.016	0.450	0.014
Bachelor+, to Bachelor	0.784	0.000	0.793	0.000	0.780	0.000	0.828	0.000	0.695	0.000	0.783	0.000	0.835	0.000
Bachelor+, to Graduate	0.708	0.000	0.718	0.000	0.731	0.000	0.788	0.000	0.693	0.000	0.704	0.000	0.752	0.000
Bachelor+, complete	0.552	0.000	0.531	0.000	0.479	0.000	0.611	0.000	0.537	0.000	0.550	0.000	0.552	0.000
FoS, first credential			Yes											
FoS, first credential, detailed					Yes									
FoS, last credential							Yes							
FoS, last credential, detailed									Yes					
Any STEM: No (reference)											0.000	.		
Any STEM: Yes											0.025	0.766		
Any recycling: No (reference)													0.000	.
Any recycling: Yes													-0.064	0.530
Constant	7.908	0.000	8.123	0.000	7.860	0.000	7.672	0.000	7.591	0.000	7.860	0.000	7.915	0.000
R-squared	0.420		0.443		0.474		0.434		0.468		0.420		0.421	
Adjusted R-squared	0.397		0.411		0.427		0.401		0.420		0.396		0.396	

Source: Longitudinal and International Study of Adults, Wave 3 (2016).

Notes: All PSE credentials completed at survey date are counted. The level of the second credential is the level of the highest PSE credential completed after the first credential (if any). "Complete" means that a single PSE credential was completed (no second credential). All models include controls for sociodemographic characteristics (parental education, gender, marital status, immigration status of self and of parents, visible minority status, Indigenous identity), age, age at completion of first PSE credential, dummies for employment pattern in 2015, and a quadratic work experience term. Sample excludes respondents with zero weeks of employment in 2015. The Ontario sample includes all Ontario residents at survey date (2016).

FoS = Field of study. Detailed = 2-digit FoS CIP 2011 code (no mention of detailed stands for 1-digit CIP 2011 code). Recycling = change in field of study between credentials.

Table A.2. Relationship between PSE pathway and annual employment income in 2015, comparison of detailed pathways interaction models, 1956-1980 birth cohorts

	First credential variable: Version 1						First credential variable: Version 2					
	Model 1		Model 2		Model 3		Model 1		Model 2		Model 3	
First credential												
TVA	-0.136	0.009	-0.112	0.018	-0.044	0.399	-0.136	0.009	-0.112	0.019	-0.044	0.401
College	0.000	.	0.000	.	0.000	.	0.000	.	0.000	.	0.000	.
Bachelor	0.395	0.000	0.340	0.000	0.458	0.000	0.381	0.000	0.326	0.000	0.444	0.000
Graduate							0.534	0.000	0.493	0.000	0.613	0.000
Second credential												
TVA			0.050	0.582	0.170	0.094			0.053	0.556	0.172	0.090
College			0.066	0.253	0.171	0.022			0.071	0.220	0.170	0.023
Bachelor			0.275	0.000	0.416	0.000			0.278	0.000	0.418	0.000
Graduate			0.283	0.000	0.585	0.000			0.285	0.000	0.587	0.000
Complete			0.000	.	0.000	.			0.000	.	0.000	.
Interaction terms												
TVA x TVA					-0.142	0.406					-0.144	0.401
TVA x College					-0.068	0.552					-0.067	0.558
TVA x Bachelor					-0.277	0.371					-0.280	0.365
TVA x Graduate					-0.702	0.056					-0.699	0.056
TVA x Complete					0.000	.					0.000	.
College x TVA					0.000	.					0.000	.
College x College					0.000	.					0.000	.
College x Bachelor					0.000	.					0.000	.
College x Graduate					0.000	.					0.000	.
College x Complete					0.000	.					0.000	.
Bachelor's x TVA					-0.300	0.131					-0.289	0.146
Bachelor's x College					-0.290	0.023					-0.313	0.014
Bachelor's x Bachelor					-0.282	0.026					-0.233	0.066
Bachelor's x Graduate					-0.386	0.001					-0.384	0.002
Bachelor's x Complete					0.000	.					0.000	.
Graduate x TVA											0.000	.
Graduate x College											0.000	.
Graduate x Bachelor											0.490	0.264
Graduate x Graduate											-0.797	0.001
Graduate x Complete											-0.407	0.097
Constant	8.702	0.000	8.904	0.000	8.849	0.000	8.723	0.000	8.929	0.000	8.809	0.000
R-squared	0.388		0.398		0.403		0.389		0.399		0.406	
Adjusted R-squared	0.382		0.392		0.396		0.383		0.393		0.398	

Source: Longitudinal and International Study of Adults, Wave 3 (2016).

Notes: In Version 1 models, the Bachelor category for the first credential includes those with a graduate degree as their first credential. All PSE credentials completed at survey date are counted. The level of the second credential is the level of the highest PSE credential completed after the first credential (if any). "Complete" means that a single PSE credential was completed (no second credential). All models include controls for sociodemographic characteristics (parental education, gender, marital status, immigration status of self and of parents, visible minority status, Indigenous identity), province of residence in 2016, age, age at completion of last PSE credential, dummies for employment pattern in 2015, and a quadratic work experience term. Sample excludes respondents with zero weeks of employment in 2015.

Table A.3. Relationship between PSE pathway and annual employment income in 2015 (ln), derived pathway variable, 1956-1980 birth cohorts

Pathway variable type:	1st to highest	1st to 2nd
	<i>b</i> <i>p</i>	<i>b</i> <i>p</i>
PSE pathway		
Below Bachelor, to below Bachelor	0.128 0.033	0.118 0.045
Below Bachelor, to Bachelor+	0.427 0.000	0.470 0.000
Below Bachelor, complete	0.000 .	0.000 .
Bachelor+, to below Bachelor	0.344 0.000	0.369 0.000
Bachelor+, to Bachelor	0.602 0.000	0.649 0.000
Bachelor+, to Graduate	0.666 0.000	0.661 0.000
Bachelor+, complete	0.470 0.000	0.470 0.000
Age at last credential squared term	Yes	Yes
Employment in 2015 dummies	Yes	Yes
Weekly work hours (ref week)		
Years of work experience squared term	Yes	Yes
Constant	10.778 0.000	10.946 0.000
R-squared	0.202	0.319
Adjusted R-squared	0.195	0.312

Source: Longitudinal and International Study of Adults, Wave 3 (2016).

Notes: All PSE credentials completed at survey date are counted. The level of the second credential is the level of the highest PSE credential completed after the first credential (if any). "Complete" means that a single PSE credential was completed (no second credential). All models include controls for sociodemographic characteristics (parental education, gender, marital status immigration status of self and of parents, visible minority status, Indigenous identity), province of residence in 2016, and age. Sample excludes respondents with zero weeks of employment in 2015.

Table A.4.1. Robustness checks of estimates of the relationship between PSE pathway and annual employment income in 2015 (ln), 1956-1980 birth cohorts, Canada

	Sample employed in 2015 (excl. zero weeks of empl)		Sample employed in 2015 (excl. PT/PY less than half yr)	
	Model 1	Model 2	Model 1	Model 2
	<i>b</i> <i>p</i>	<i>b</i> <i>p</i>	<i>b</i> <i>p</i>	<i>b</i> <i>p</i>
PSE pathways				
Below Bachelor, to below Bachelor	0.063 0.338	0.060 0.257	0.075 0.254	0.049 0.353
Below Bachelor, to Bachelor+	0.314 0.000	0.358 0.000	0.296 0.001	0.360 0.000
Below Bachelor, complete	0.000 .	0.000 .	0.000 .	0.000 .
Bachelor+, to below Bachelor	0.286 0.006	0.274 0.004	0.294 0.004	0.269 0.005
Bachelor+, to Bachelor	0.513 0.000	0.563 0.000	0.502 0.000	0.559 0.000
Bachelor+, to Graduate	0.621 0.000	0.609 0.000	0.646 0.000	0.628 0.000
Bachelor+, complete	0.460 0.000	0.466 0.000	0.473 0.000	0.472 0.000
Employment in 2015				
Full-time full year		0.000 .		0.000 .
Part-time full year		-0.914 0.000		-0.902 0.000
Full-time part year (half or more)		-0.466 0.000		-0.465 0.000
Part-time part year (half or more)		-1.631 0.000		-1.622 0.000
Full-time part year (less than half)		-1.374 0.000		-1.371 0.000
Part-time part year (less than half)		-2.845 0.000		
Years of work experience		0.039 0.001		0.041 0.001
Years of work experience, squared		-0.001 0.047		-0.001 0.035
Constant	6.479 0.000	8.951 0.000	6.887 0.000	9.048 0.000
R-squared	0.141	0.399	0.150	0.370
Adjusted R-squared	0.134	0.393	0.143	0.363

Source: Longitudinal and International Study of Adults, Wave 3 (2016).

Notes: All PSE credentials completed at survey date are counted. The level of the second credential is the level of the highest PSE credential completed after the first credential (if any).

“Complete” means that a single PSE credential was completed (no second credential). All models include controls for sociodemographic characteristics (parental education, gender, marital status, immigration status of self and of parents, visible minority status, Indigenous identity), province of residence in 2016, age, and age at completion of first credential.

Table A.4.2. Robustness checks of estimates of the relationship between PSE pathway and annual employment income in 2015 (ln), 1956-1980 birth cohorts, Ontario

	Sample employed in 2015 (excl. zero weeks of empl)		Sample employed in 2015 (excl. PT/PY less than half yr)	
	Model 1	Model 2	Model 1	Model 2
	<i>b</i> <i>p</i>	<i>b</i> <i>p</i>	<i>b</i> <i>p</i>	<i>b</i> <i>p</i>
PSE pathways				
Below Bachelor, to below Bachelor	0.064 0.576	0.072 0.448	0.059 0.598	0.033 0.727
Below Bachelor, to Bachelor+	0.290 0.165	0.349 0.056	0.258 0.217	0.344 0.060
Below Bachelor, complete	0.000 .	0.000 .	0.000 .	0.000 .
Bachelor+, to below Bachelor	0.398 0.017	0.398 0.014	0.422 0.010	0.383 0.019
Bachelor+, to Bachelor	0.647 0.000	0.784 0.000	0.606 0.000	0.777 0.000
Bachelor+, to Graduate	0.750 0.000	0.708 0.000	0.727 0.000	0.708 0.000
Bachelor+, complete	0.506 0.000	0.552 0.000	0.508 0.000	0.555 0.000
Employment in 2015				
Full-time full year		0.000 .		0.000 .
Part-time full year		-0.930 0.000		-0.920 0.000
Full-time part year (half or more)		-0.764 0.000		-0.763 0.000
Part-time part year (half or more)		-1.509 0.000		-1.505 0.000
Full-time part year (less than half)		-1.278 0.001		-1.272 0.001
Part-time part year (less than half)		-2.565 0.000		
Years of work experience		0.053 0.017		0.054 0.014
Years of work experience, squared		-0.001 0.140		-0.001 0.144
Constant	6.251 0.002	7.908 0.000	6.612 0.001	7.773 0.000
R-squared	0.173	0.420	0.178	0.399
Adjusted R-squared	0.148	0.397	0.153	0.375

Source: Longitudinal and International Study of Adults, Wave 3 (2016).

Notes: All PSE credentials completed at survey date are counted. The level of the second credential is the level of the highest PSE credential completed after the first credential (if any).

“Complete” means that a single PSE credential was completed (no second credential). All models include controls for sociodemographic characteristics (parental education, gender, marital status, immigration status of self and of parents, visible minority status, Indigenous identity), age, and age at completion of first credential. The Ontario sample includes all Ontario residents at survey date (2016).



oncat
Ontario Council on
Articulation and Transfer



caton
Conseil pour l'articulation
et le transfert – Ontario

oncat.ca/en/projects/non-linear-pse-pathways-and-credential-accumulation-statistical-portrait-and-evaluation



Established in 2011, the Ontario Council on Articulation and Transfer (ONCAT) was created to enhance academic pathways and reduce barriers for students looking to transfer among Ontario's public colleges, universities, and Indigenous Institutes.

This report was prepared for and funded by ONCAT. The opinions expressed within are those of the authors and do not necessarily reflect those of ONCAT or the Government of Ontario. © Copyright, ONCAT, 2021