Enrolling in Bad Times: College Persistence and Labor Market Outcomes*

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Abstract

Using administrative data covering the universe of student enrollments in public universities in Canada since 2009, we show that individuals who start an undergraduate degree when unemployment is high are less likely to graduate within five years. Compositional changes along observable student characteristics including gender, age at enrollment, and parental income do not account for this result, nor does sorting across universities or fields of study. While a simple model of negative selection into university during downturns can account for the decline in graduation rates, it would imply that post-schooling earnings should be lower among non-completers who enroll during high unemployment periods compared to those who enroll when unemployment is lower. Using a panel of administrative tax data linked to the student enrollment records, we show that higher unemployment rates at enrollment are not associated with lower annual earnings among non-completers. A model that features heterogeneity in the idiosyncratic costs of post-secondary education can rationalize this result.

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1 Introduction

Business cycle fluctuations have important long-lasting impacts on individual outcomes. Economic downturns have been documented to lead to persistent declines in individuals' earnings and employment (Kahn, 2010; Oreopoulos et al., 2012; Schwandt & von Wachter, 2019; Yagan, 2019; Rothstein, 2020), as well as impacting a variety of social outcomes, such as fertility, family formation, divorce, risky behavior, health, and mortality (von Wachter, 2020). Experiencing economic downturns when young has also been shown to have a positive impact on numeracy, literacy and years of schooling (Haraldsvik & Strøm, 2021), and to increase human capital investments by expanding both high-school enrollment (Weinstein, 2022) and enrollment in post-secondary education (Betts & McFarland, 1995; Dellas & Sakellaris, 2003; Clark, 2011; Ferrer & Menendez, 2014; Barr & Turner, 2015; Sievertsen, 2016; Alessandrini, 2018).

Although the pattern of increased enrollment into post-secondary education (PSE) during downturns is fairly well established in the literature, little is known about the subsequent outcomes of individuals who enroll at different points of the business cycle. This paper provides new evidence on the link between business cycle conditions at the time of undergraduate entry and the probability of successfully completing a degree within five years, as well as the link with future labor market earnings of those who enroll.

Using administrative data on the universe of students who enrolled in Canadian public universities between 2009-2014, we show that students who enroll when unemployment is above average are less likely to graduate with a bachelor's degree within five years. This negative effect is widespread across groups defined by gender and age at enrollment, as well as among students with different parental income backgrounds. We take advantage of the linkage of the enrollment records to administrative tax data, and show that higher unemployment rates at enrollment are not associated with lower annual earnings among non-completers. We then discuss how a model that allows for differential selection into university over the business cycle, and also features heterogeneity in the idiosyncratic costs of post-secondary education, can rationalize our set of empirical findings.

Our analysis uses data from the Post-Secondary Student Information Systems (PSIS), which includes the population of students in publicly funded Canadian PSE institutions from 2009 to 2019. The dataset allows us to track students across institutions, programs, and years and–given that it has been linked to administrative tax records from the T1 Family Files (T1FF)–also allows us to observe their post-schooling labor market earnings.

We focus on Canadian citizens who first enroll in an undergraduate degree between 2009 and 2014, and determine the extent to which their observed educational and labor market outcomes vary with the economic conditions that they experienced in their home province in the year leading up to their first enrollment. We adopt an empirical strategy commonly used in the related literature that estimates the effect of the business cycle on cohort outcomes (e.g. Oreopoulos et al., 2012; Schwandt & von Wachter, 2019; Blom et al., 2021). Specifically, we exploit regional and time-series variation across the 10 Canadian provinces in the severity of the Great Recession and the subsequent recovery.

Our first key outcome is whether individuals successfully complete an undergraduate degree within five years of their first enrollment. We show that when unemployment at the time of enrollment is high, students are less likely to graduate with a bachelor's degree within 5 years. Our estimates indicate that a one percentage point increase in unemployment at enrollment decreases the probability of on-time graduation by 2 to 4 percentage points, depending on the specification. The magnitude is similar to the gap in the probability of graduating within 5 years between the students from the top versus the bottom quartile of parental income. The impact of the unemployment rate at enrollment on the probability of on-time graduation is unaffected by controlling for the unemployment rate experienced in the years after enrollment, suggesting that improved economic conditions offering better outside options cannot explain our findings.

We investigate whether the adverse effect on graduation could be driven by negative selection into PSE along observable dimensions. We find that there is little compositional change in terms of gender or parental income between cohorts enrolling at different points of the business cycle. Moreover, the adverse impact of unemployment at entry on the probability of on-time graduation is surprisingly homogeneous across

gender and parental income quartiles.

Following the evidence from Blom et al. (2021) on the impact of economic conditions on the choice of major, we ask whether part of the adverse effect on completion within 5 years is driven by students sorting into fields with higher dropout rates or longer typical times to graduation. We also explore whether differential sorting across institutions can account for part of the negative impact of unemployment at entry on on-time graduation. We find, however, that controlling for field and institution fixed effects does not alter our coefficient of interest. We therefore conclude that our finding cannot be explained by these potential mechanisms.

Although we find no evidence of changes along observable characteristics across cohorts enrolling at different points in the business cycle, it is plausible that selection on unobservables (conditional on these observed characteristics) could vary across cohorts. Intuitively, if high unemployment draws additional students into tertiary education, the marginal student whose college enrollment decision is affected by the business cycle is likely to be of lower unobserved ability than the infra-marginal enrollees who attend regardless of the state of the business cycle.

In order to conceptualize this idea, we develop a simple model of negative selection into university over the business cycle. While this simple model can successfully account for the decline in graduation rates among individuals who enroll when unemployment is higher, it unambiguously implies that post-schooling earnings among non-completers who enroll during high unemployment periods should be lower compared to those who enroll when unemployment is lower. Using the linkage of the administrative tax data to the student enrollment records, we show that this is not what we observe in the data. Instead, we find that higher unemployment rates are, if anything, associated with higher annual earnings among non-completers.

We therefore expand the simple model to allow for heterogeneity in the idiosyncratic costs of post-secondary education. We show that a model with this simple extension can rationalize both the graduation and the earnings results. Intuitively, if there is a group of individuals who face high idiosyncratic costs of education, then only the highest ability students from that group will optimally choose to enroll in PSE. The reduction in the opportunity cost of education that arises due to an increase in the unemployment rate relaxes this constraint and induces the enrollment

of students who, although marginal in terms of ability within their group (i.e., among individuals with high costs of education), are of above-average ability among the overall pool of enrollees. These students might not be able to graduate, which would tend to reduce the graduation rate, but can still increase the overall unobserved ability of non-graduates from their cohort. This would, in turn, account for the increase in average earnings observed in the data.

This paper extends several strands of existing research. First, we contribute to the literature showing that enrollment in PSE tends to expand during downturns (Betts & McFarland, 1995; Dellas & Sakellaris, 2003; Clark, 2011; Ferrer & Menendez, 2014; Barr & Turner, 2015; Sievertsen, 2016; Alessandrini, 2018) by determining whether students who enroll during bad times actually graduate and by analyzing the subsequent labor market outcomes of these students.

We also contribute to the literature focusing on PSE completion rates (Light & Strayer, 2000; Bound et al., 2010; Arcidiacono et al., 2016; Denning et al., 2022a) and on the time to PSE degree completion (Bound et al., 2012; Kurlaender et al., 2014; Denning et al., 2022b). Our results indicate that the business cycle conditions at the time of enrollment are an important margin to consider when analyzing the determinants of successful graduation and its timing. We complement the evidence of Burga & Turner (2022), who document a positive impact of adverse local economic shocks on high school enrollment (but not high school completion) in the U.S., and Sievertsen (2016) who documents a positive impact of negative local economic shocks on enrollment and completion of shorter PSE programs (but not college) in Denmark.

Given that our empirical setting exploits variation in economic conditions in the aftermath of the Great Recession, our findings also speak to the literature that discusses the impacts of this particular economic episode (e.g. Yagan, 2019; Rothstein, 2020).

Finally, our paper is closely related to the emerging literature that considers the impact of economic conditions before and during enrollment on future labor market outcomes (Blom et al., 2021; Bičáková et al., 2021b,a; Weinstein, 2022). These papers have so far focused solely on undergraduate degree holders, and thus provide evidence only on those who successfully complete their degrees. The focus of our analysis is much wider, as we are able to consider the impact of economic conditions at enrollment

on the probability and timing of graduation, as well as on the labor market outcomes of non-completers (in addition to those of graduates). Our use of administrative enrollment data linked to tax records also allows us to overcome many of the data limitations faced by earlier papers. For example, Blom et al. (2021) and Bičáková et al. (2021b) proxy the economic conditions experienced by college graduates based on their age, assuming that all individuals enroll at age 18. Bičáková et al. (2021a), meanwhile, use information on the year of graduation, but must assume that all graduates completed their degree within the standard program length. Our data contain precise information on individuals' enrollment and graduation dates, thus allowing us to accurately measure the timing of enrollment and graduation and to directly analyze outcomes such as enrolling at later ages and delaying graduation. Moreover, earlier work has generally imputed the economic conditions experienced by an individual using information on their state of birth. Our dataset contains information on students' permanent home address at the time of application, thus allowing us to construct a more precise measure of the economic conditions that they experienced in the year leading up to enrollment.

The rest of the paper is organized as follows. Section 2 discusses our dataset and our empirical strategy. Section 3 presents our main results on the probability of on-time graduation. Section 4 discusses the theoretical frameworks of selection into university over the business cycle and the empirical evidence regarding labor market outcomes, in light of these frameworks. Finally, Section 5 discusses the directions in which we are working to expand the results in this paper.

2 Data and Empirical Strategy

2.1 Data

We analyze the universe of enrollments in public post-secondary institutions in Canada for the period 2009–2019 (the Post-Secondary Student Information System dataset, PSIS).[1] The dataset allows students to be tracked across institutions, programs, and

[1]The data are part of the Canadian Education and Labour Market Longitudinal Platform (ELMLP). Note that our data cover the near-universe of post-secondary students, since very few individuals attend private post-secondary institutions in Canada.

years. We focus on Canadian citizens enrolled in undergraduate programs at institutions classified as universities.[2] We only consider individuals who are pursuing a degree; those who are enrolled in not-for-credit courses are excluded from the analysis.

PSIS records have been linked by Statistics Canada to tax filings, specifically to the T1 Family Files (T1FF), which include information on total labor earnings, as well as total income, as declared by individuals on their official tax returns filed with the Canada Revenue Agency. Students in the PSIS are matched to their own tax records up to 2019, as well as their parents' tax filings.

We are interested in identifying new entrants into university in the PSIS files, in order to link individual outcomes to the local economic conditions prevailing at the time of their (first) university enrollment. In order to identify new entrants, we use the PSIS information on the date at which an individual started their undergraduate program.

We restrict the analysis to individuals whose first observed undergraduate program started in the 2009-10 to 2014-15 academic years. Individuals who start prior to 2009 are excluded, as they are only observed conditional on remaining enrolled in 2009 or later, which would generate selection problems. Individuals who first enroll after 2014 are excluded, as they are not observed for at least five full academic years. Unfortunately, institutions in Quebec and Alberta do not report the date when students started their program. We therefore exclude individuals studying in these provinces .

To measure the economic conditions that students experienced in the year leading up to their first enrollment, we use information on students' home province, as reported in their application for admission to university. We calculate the average unemployment rate in a student's home province in the 12 months leading up to August of their enrollment year. We exclude individuals whose home address is one of the territories (i.e., Yukon, the Northwest Territories, or Nunavut), as well as those who report a home address that is outside of Canada or missing.

Our analysis sample, for graduation outcomes, includes approximately 885,000

[2]The Council of Ministers of Education Canada determines whether a program is officially considered to lead to an undergraduate degree, and whether an institution is officially considered to be a university (rather than a college).

individuals (rounded following confidentiality procedures). Figure 1 plots the fraction of individuals graduating with an undergraduate degree within five years of their first undergraduate enrollment, by home province. Overall, 58% of enrollees complete their degree within five years. The highest shares of completion within five years are for students whose home province is Alberta and Quebec, but recall that individuals from these two provinces will only be in our dataset if they studied outside of their province, so this is a selected sample. The next highest graduation rate is for students from Ontario, at 63%. The lowest graduation rates are for students from Manitoba, at 38%, and Saskatchewan, at 41%.

2.2 Empirical Strategy

Our goal is to estimate the link between the economic conditions experienced by individuals at the time that they first enroll in university, and the probability that they graduate within five years. In order to do this, we estimate the following linear probability model:

$$y_{i(p,c)} = \alpha + \beta U_{p,c} + \theta_p + f_p(c) + \epsilon_i \tag{1}$$

where $y_{i(p,c)}$ is a binary outcome variable that indicates whether student i (whose home province is p and first enrolls in an undergraduate degree in year c) completed *any* undergraduate degree within five years (i.e. by year $c+5$). $U_{p,c}$ is the unemployment rate in province p in the year leading up to individual i's enrollment year c. θ_p is a home province fixed effect, and $f_p(c)$ is a function that controls for time trends across enrollment cohorts (which are allowed to vary across provinces in our preferred specification). ϵ_i is the error term. Standard errors are clustered at the cohort $\times$ province level. Given that we have six enrollment cohorts (2009-2014) and 10 home provinces (see Figure 1), we have a total of 60 clusters.

β is our main coefficient of interest. It captures the impact of provincial economic conditions at the time of first enrollment on the probability of graduating within 5 years. Since we include home-province fixed effects θ_p, identification is obtained from variation over time in economic conditions and graduation rates within home provinces. The inclusion of a (province-specific) cohort trend $f_p(c)$ allows us to rule out the possibility of obtaining a spurious correlation between economic conditions

and (on-time) graduation rates due to coinciding trends in the two outcomes over our time period. Indeed, given that we focus on cohorts enrolling between 2009-2014, which coincides with the recovery period from the Great Recession, there is a negative trend over time in the unemployment rate in most provinces. If graduation rates were also rising over this time period due to other longer term factors (see e.g. Denning et al., 2022a), then in the absence of any controls for cohort trends, we would obtain a spurious correlation between economic conditions at enrollment and on-time graduation rates. The inclusion of cohort trends limits our identification to province- and cohort-specific deviations from these trends.[3]

3 Results: On-Time Graduation Rates

3.1 Main Results

Table 1 contains our main results on the relationship between unemployment at enrollment and the probability of graduating within 5 years, obtained from the estimation of Equation (1). We present three specifications in which we change how we account for cohort effects (i.e. different versions of the function $f_p(c)$ in Equation (1)). In Column (1), we allow for an aggregate quadratic cohort trend that is assumed to be common across provinces. In Column (2), we allow for a province-specific linear cohort trend. Finally, in Column (3) we again assume a common cohort trend across provinces, but allow this to vary flexibly over time by controlling for cohort (i.e., enrollment year) fixed effects. Our preferred specifications control for province-specific linear trends–Column (2). The economic experiences of Canadian provinces during our period was heterogeneous (e.g., Appendix Figure A.1), suggesting the importance of accommodating province-specific trends. We believe our time window is short enough that a linear function is sufficient to approximate trends.

Our estimated coefficient is negative and significant across specifications. A one percentage point increase in unemployment at college entry decreases the probability

[3]In order to illustrate the source of identifying variation in the unemployment rates, Appendix Figure A.1 plots deviations of the unemployment rate from province-specific linear trends. As the figure shows, there is quite a bit of variation across provinces and cohorts. For example, fluctuations in oil prices have a disproportionate impact on provinces that rely heavily on natural resources.

of on-time graduation between 2 and 4 percent points, depending on the specification. This is sizable, given the average on-time graduation rate of 58% (see Figure 1), and the fact that a 1 percentage point change in unemployment is a relatively small change. Another way to put the magnitude of this gap into perspective is to compare it to the difference in graduation rates across parental income quartiles. As Figure 3 shows (and as we discuss in further detail below), the gap in on-time graduation rates between students from the highest and lowest parental income quartiles is approximately 5 percentage points. Hence, small changes in unemployment rates at enrollment generate variation in on-time graduation rates that are comparable in magnitude to the gaps across top and bottom parental income quartiles.

The results in Table 1 show a clear decrease in on-time graduation rates for individuals who enroll during worse economic conditions. This lower probability of graduating within 5 years could be because students take longer than 5 years to graduate, or it could be because students are more likely to drop out of college. In order to shed light on the importance of these two possibilities, Table 2 considers the joint probability of not having graduated *and* not being enrolled at various points in time after students' first enrollment.

The first column reproduces our baseline result which shows that the probability of not having graduated five years after enrollment increases by around 4 percentage points for each 1 percentage point increase in the unemployment rate at enrollment. The second column instead uses as the outcome variable an indicator variable for individuals who have not graduated *and* are not enrolled 5 years after their first enrollment. These individuals are likely no longer pursuing their degree. The estimated coefficient indicates that this probability increases by around 2.5 percentage points for each 1 percentage point increase in the unemployment rate. Hence, it seems that individuals who are more likely dropouts rather than slow completers account for around 64% of non-graduates 5 years after first enrollment. Interestingly, the remaining columns show that this impact on non-enrollment is apparent only one year after enrollment. Hence, worse economic conditions at enrollment lead to a higher probability of students enrolling only for one year, while also leading, to some extent, to slower completion rates among those who persist.

One reason why the graduation probability is lower for individuals who enroll

during bad times may be that economic conditions improve in the years after enrollment, and this provides an incentive to leave school in order to work. In order to check whether this drives our key result, Table 3 expands our main specification by adding controls for the average unemployment rate *after* enrollment – specifically, the average unemployment rate for the year after enrollment (when students would be in their second year of study, if they remained in school), and the two subsequent years. Column (1) uses average unemployment rates in students' home provinces. It shows that improving economic conditions (i.e., lower unemployment rates) significantly reduce the probability of graduating within 5 years. However, the coefficient on unemployment at enrollment is very similar in magnitude to our baseline specification.

One might think that students would be more likely to be impacted, in terms of their enrollment decision, by economic conditions in their study province, rather than their home province. Hence, Column (2) instead controls for unemployment rates in the year after enrollment and the two subsequent years in the *study province*. Interestingly, economic conditions in the study province occurring after enrollment do not have a significant effect on the probability of graduating within 5 years. Our key coefficient of interest also remains unchanged. Thus, we conclude that the decline in the probability of graduating within 5 years observed for individuals who enroll during periods of high unemployment is not simply explained by improvements in economic conditions that induce them to drop out of school after enrollment.

3.2 Selection on Observables: Changes in Composition

Enrollment in post-secondary education is counter-cyclical (Betts & McFarland, 1995; Sievertsen, 2016; Alessandrini, 2018). Therefore, changes in the composition of individuals who enroll may explain the decline in on-time graduation rates that we observe for individuals who enroll during periods of higher unemployment. In order to explore this possibility, we begin by considering whether there are compositional changes in terms of observable characteristics of enrollees. Given the available data, we examine the changes in composition along three dimensions: gender, age at enrollment, and parental income. We use of the same regression specification from Equation (1), simply replacing the outcome variable $y_{i(p,c)}$ with an indicator variable

for our demographic characteristic of interest.

Table 4 shows the results by gender and age. The first column shows that the unemployment rate at the time of entry does not change the gender balance of college-goers. The second column shows no statistically significant relationship between age at enrollment among those who enroll and the provincial unemployment rate. However, the final column reveals a 1 percentage point increase in the unemployment rate at the time of entry is associated with a 1 percentage point higher share of enrollees who are older than 25. Hence, there is some evidence that enrollments tilt toward older students during bad economic times.

Table 5 presents the results for the composition by parental income. Parental income is taken from the T1FF dataset when the sample members are aged 16 to 18. We average parental income across ages 16 to 18 and divide by the square root of household size. We then divide individuals into parental income quartiles. Parental income is only observed when children file from the same address as their parents, or when the parents claim a federal child benefit. As such, we only observe parental income for a subset of the sample, an in particular we are missing parental income for older enrollees. To avoid dropping these individuals from the sample, we also create a residual category for those with missing values.

Remarkably, the results in Table 5 show that there is no compositional change in terms of enrollment by parental income quartiles across cohorts enrolling under different economic conditions. Along with the results in Table 4, they show that there is little to no evidence of substantial compositional changes in terms of the observable characteristics of individuals who enroll at different points of the business cycle.

3.3 Heterogeneous Effects

To explore further the link between economic conditions at enrollment and the demographic groups that we have considered above, in this section we analyze whether the impact of unemployment at enrollment on the probability of on-time graduation varies between men and women, between students who start college at different ages, or between students of different economic backgrounds.

Table 6 presents the results of a regression in which we include a female dummy and its interaction with the unemployment rate in the home province at the time of college enrollment. As in our base model, we include home-province fixed effects and province-specific cohort trends. The estimated coefficients show that women are more likely to graduate within 5 years. However, we do not find any evidence of heterogeneity in the effect of an increase in the unemployment rate at enrollment.

Next, we estimate a similar specification where, instead of gender, we now allow for differences in on-time graduation probabilities, and in the impact of unemployment at enrollment, according to individuals' ages when they enroll. Figure 2 plots the results from this analysis. Panel 2a plots the direct effects of age at enrollment, which show the difference in the probability of graduating on time between students who start college at 16 and students who start at later ages. Panel 2b plots the interaction terms, showing the impact of unemployment at the beginning of college on on-time graduation probabilities for students in each age-at-enrollment category. We find that there are no statistically significant baseline differences in graduation probabilities according to age at enrollment (though the coefficients are quite noisy). In terms of the relationship with unemployment at enrollment, we find that the probability of on-time graduation decreases for students from all age groups when unemployment at enrollment is higher. The point estimates imply somewhat stronger unemployment effects for individuals who enroll at older ages.

Figure 3 analyzes differences across parental income categories. Panel 3a shows that, relative to students in the bottom parental income quartile, students in the top quartile have a 5-percentage point higher probability of graduating within 5 years. Conversely, students for whom information on parental income is missing have a 5-percentage point disadvantage relative to the same category. The impact of an increase in the unemployment rate at entry, plotted in Panel 3b, is consistently negative across parental income groups, with cross-quartile differences that are never statistically significant. This implies that the probability of graduating on time falls by a very similar magnitude for all students who enroll in bad times, regardless of their parental income background.

In summary, the effects of unemployment at entry on on-time completion are quite homogeneous between the sexes and parental income categories and are only slightly

more severe for students who enroll at older ages.

3.4 Institution and Field of Study Composition

Could the lower on-time graduation rates for individuals who enroll during worse economic times arise because they tend to enter fields of study or institutions that have lower on-time graduation propensities? Blom et al. (2021) show that students who choose their major during periods of high unemployment tend to choose more financially rewarding ones. If these majors are also those that require more effort and study time, then the longer time to graduation that we estimate might be a consequence of the different sorting.

To understand whether this mechanism drives our results, in Table 7 we expand our baseline model by including controls for the major studied. For reference, Column (1) reproduces our baseline result. Then, Column (2) introduces a set of field of study fixed effects.[4] A comparison of the coefficients in the two columns reveals that sorting across major explains little, if any, of the reduction in on-time graduation rates for cohorts entering during periods of higher unemployment.

In addition to the potential effect of sorting across majors, there may be differential sorting across institutions over the business cycle. Not all institutions may expand their enrollment proportionally, and hence students who enroll during periods of higher unemployment may be concentrated in less-selective institutions, for example. A higher concentration in institutions that tend to have lower on-time graduation rates could potentially explain our key finding. In order to test this hypothesis, in Column (3) we add a full set of institution fixed effects. The estimated coefficient on the unemployment rate at enrollment is not different from our baseline coefficient in Column (1). Hence, sorting across institutions does not appear to be important in explaining our main result. In Column (4), we further allow for a fully interacted set of field of study and institution fixed effects. The estimated coefficient of interest falls only marginally. Hence, we can conclude that essentially all of the decline in on-time graduation rates that we have estimated is observed within institution-field cells.

[4]These are based on the field chosen at the time of undergraduate entry and include ten categories based on the primary groups in the Classification of Institutional Programs developed by Statistics Canada and the National Center for Education Statistics.

4 Selection Over the Business Cycle and Earnings

Our results so far have shown that students who start college in a period of high unemployment have a lower probability of graduating on time. This lower probability cannot be explained by a change in the composition of college goers along a range of observed individual or program choice characteristics. However, it is plausible that selection on unobservables (conditional on these observable characteristics) could change over the business cycle. Intuitively, if high unemployment draws additional students into tertiary education, the marginal student whose decision on college enrollment is affected by the business cycle is likely to have lower unobservable ability than the infra-marginal enrollees who attend regardless of the state of the business cycle. Such negative selection may be the reason behind the decline in on-time graduation rates that we observe.

In order to conceptualize this idea, in Section 4.1, we present a simple static model that formalizes the link between economic conditions at enrollment and graduation rates. This model generates predictions about how earnings should vary across cohorts of graduates and non-graduates who enroll at different points of the business cycle. We take these predictions to the data in Section 4.2, and find that the model is unable to fully rationalize what we observe empirically. We then introduce an extension to the simple model, in Section 4.3, and show that, by including idiosyncratic costs, the model predictions are consistent with the results of the empirical analysis.

4.1 A Simple Model of Enrollment over the Business Cycle

As a starting point, we use a simplified static version of Card's (2001) endogenous schooling choice model. Individuals make schooling choices based on the costs and benefits of schooling. For simplicity, we assume that ability (a) is uniformly distributed between 0 and 1. Individuals with at least some university education can obtain earnings (w) that are directly proportional to their ability. Panel (a) of Figure 4 illustrates this scenario: The horizontal axis represents ability, while the vertical axis represents potential earnings. The 45-degree line describes the linear, one-to-one mapping of ability to (potential) earnings for individuals with post-secondary education.

The cost of education is captured by foregone earnings, as given by the earnings rate of individuals without post-secondary education. We assume that these earnings are a function of the current unemployment rate u and are not a function of ability. We represent this in the graph as $w^{non}(u)$.

Individuals enroll in PSE if the earnings they can obtain with PSE are higher than the outside option, $w^{non}(u)$. This determines the endogenous ability threshold for enrollment into PSE, indicated by e on the graph.

We also assume that there is an exogenous ability threshold g, which represents the lowest level of ability that is needed to graduate from university. Hence, individuals with ability $a < e$ do not enroll in PSE; individuals with ability $e \leq a < g$ enroll but do not graduate; while individuals with ability $a \geq g$ enroll and graduate.

The graduation rate is the ratio of graduates over total enrollees, i.e.:

$$G = \frac{1-g}{1-e} \tag{2}$$

Given the assumption of a uniform distribution, the average wage of graduates is given by $\bar{w}_g = 0.5(1+g)$, and the average wage of non-graduates is given by $\bar{w}_n = 0.5(g+e)$. Hence, graduates earn more than non-graduates ($\bar{w}_g > \bar{w}_n$), as illustrated in Panel (b).

An increase in the unemployment rate earnings for individuals without any PSE, and consequently reduces the opportunity cost of enrollment. We illustrate this in Panel (c). The reduction in the wage to $w^{non}(u_R)$ (where $u_R > u$) leads to an endogenous decrease in the enrollment threshold from e to e_R. This implies that enrollment expands and the average ability of enrollees decreases. In other words, in this model, cohorts of students who enroll during periods of higher unemployment are more negatively selected. Absent any changes in the graduation threshold g, this leads to a decrease in the graduation rate.

As Panel (d) illustrates, the downward shift in e will also affect the average earnings of non-graduates, which will drop from $\bar{w}_n$ to $\bar{w}_{nR}$. Hence, the model leads to the intuitive prediction that high unemployment cohorts should have lower graduation rates, and non-graduates from these cohorts should have lower earnings than non-graduates from low unemployment cohorts. In other words, in a reduced form

equation, the effect of unemployment at enrollment on earnings should be negative for non-graduates.

So far, we have assumed the graduation threshold g to be exogenous and constant. In such a case, the average earnings of graduates from high and low unemployment cohorts would not systematically differ. However, this threshold might change over the business cycle. If, for example, universities grade on a curve, or if there is grade inflation when enrollment expands, then we would expect the graduation threshold g to be lower for high unemployment cohorts. As long as the decline in g is less than the decrease in the enrollment threshold e, we would still observe a decline in the graduation rate among high unemployment cohorts. In terms of earnings, the decline in g would imply that average earnings among graduates, $\bar{w}_g$, would be lower for graduates from high unemployment cohorts compared to graduates from low unemployment cohorts. Among non-graduates, the decline in average earnings $\bar{w}_n$ for high unemployment cohorts compared to low unemployment cohorts would be even stronger if g declines (compared to the case where g is fixed), since the pool of non-graduates is even more negatively selected if there is a decline in g.

4.2 Earnings Regressions

The simple model described above has clear implications for the sign of the relationship between the unemployment rate at enrollment and subsequent labor market earnings for college graduates and non-graduates. For the first group, it should be zero or negative, while for the second group, it should be unambiguously negative. In this section, we determine whether the observed earnings patterns for individuals enrolling under different economic conditions are consistent with these predictions.

To do this, we take advantage of the linkage of PSIS records to administrative tax records described in Section 2.1. We restrict the analysis to the same set of individuals considered in Section 3, and focus on their earnings observed at least six years after their first enrollment. Since we have access to tax records up to 2019, this implies that we have up to five observations per individual (with fewer observations for individuals from more recent enrollment cohorts).[5] Individual-year observations that are missing

[5]Requiring observations at least six years after first enrollment also implies that individuals from the 2014 enrollment cohort are not included in this part of the analysis.

in the tax records are not included in the analysis. However, we include individual-year observations in which taxes are filed but individuals report zero earnings.[6] This yields an analysis sample of approximately 2,096,000 individual-year observations.[7]

Using this short panel of earnings, we estimate the following model:

$$w_{i(p,c)t} = \alpha_w + \beta_w U_{p,c} + \theta_p + f_p(c) + \Gamma X_{i,t} + \gamma_t + \mu_{i,t} \tag{3}$$

The dependent variable $w_{i(p,c)t}$ is the logarithm of total real annual labor earnings of student i (whose home province is p and who first enrolled in an undergraduate degree in year c) in tax year t.[8] We set $w_{i(p,c)t} = 0$ if individual i files taxes in year t and reports zero labor earnings.

As in Equation (1), $U_{p,c}$ is the unemployment rate in province p in the year leading up to individual i's enrollment year c, θ_p are home province fixed effects, and $f_p(c)$ are province-specific cohort trends. $X_{i,t}$ is a set of characteristics of a student i in year t (namely, a gender dummy and a quadratic in age in the filing year), and γ_t are tax year fixed effects. $\mu_{i,t}$ is the error term. As before, we cluster standard errors at the cohort $\times$ province level.

β_w is the main coefficient of interest. It captures the reduced-form relationship between provincial economic conditions at the time of first enrollment and earnings, once again exploiting variation in terms of province-specific deviations of unemployment rates from their (province-specific) trend. To test the predictions of the model, we consider specifications that allow β_w to vary between those who graduate within five years and those who do not.

The results of the estimation of Equation (3) are in Table 8. Column (1) shows that the overall relationship between unemployment at enrollment and annual labor earnings is negative: a 1 percentage point increase in the unemployment rate at college entry decreases earnings by more than 2%. As we know from our earlier results, people who enroll when unemployment is higher are less likely to have graduated by the time we observe them in this earnings sample. Therefore, column (2) adds

[6]Individuals with no labor earnings have incentives to file taxes in Canada, as they may be entitled to various tax benefits available to low earners.

[7]As above, the exact number of observations cannot be reported due to confidentiality restrictions.

[8]This is the sum across all of the individuals' T4 forms, which are the Canadian equivalent of US W-2 forms.

an indicator variable for individuals who graduate within 5 years. The results show that individuals who graduate within 5 years earn substantially more than those who do not. Meanwhile, the coefficient on unemployment at enrollment becomes indistinguishable from zero, indicating that the negative effect on earnings in Column (1) is driven by the lower share of individuals who graduate within 5 years among those who enter college when unemployment is higher.

In Column (3), we allow the coefficient on unemployment at enrollment to differ between those who graduate within 5 years and those who do not. We also add an indicator variable equal to one for those who have graduated. This variable is always equal to one for individuals who graduate within 5 years (as all of our observations are at least 6 years after first enrollment), but may switch from being equal to zero to being equal to one for individuals who do not graduate within 5 years, if they graduate within our observation window. We also add indicator variables for the contemporaneous enrollment status of individuals in the year of observation.[9]

The results show that the premium for graduating within 5 years is almost as large as the premium for graduating at all. Moreover, the coefficient on unemployment at enrollment is negative and statistically significant for graduates, but it is positive and statistically insignificant for non-graduates. In other words, on-time graduates who enroll during periods of higher unemployment earn significantly less, on average, than on-time graduates who enroll during periods of lower unemployment. However, this is not the case for those who do not graduate within 5 years, even after controlling for potential subsequent differences in enrollment or graduation status.

Table 9 presents some robustness checks for these earnings results. As results above show some differences in the age at enrollment composition over the business cycle, Column (1) controls for individuals' age at enrollment. This has no noticeable effect on our coefficients of interest. Column (2) adds field of study fixed effects, while Column (3) adds institution fixed effects. Perhaps not surprisingly given our earlier evidence, these controls do not explain the systematic differences across graduates and non-graduates who enroll under different economic conditions.

One potential reason for the differential earnings of individuals who enroll un-

[9]Specifically, we add separate indicator variables for being enrolled in an undergraduate, professional, master's or PhD program. We also add an indicator variable that is equal to 1 in the year in which individuals graduate, to allow for differential earnings within that calendar year.

der different economic conditions may be the differential economic conditions that they experience when we observe them in the labor market in their tax filing years. To account for this possibility, Column (4) introduces fixed effects for the province where tax records were filed, as well as controls for the contemporaneous unemployment rate in the tax year in the filing province. Not surprisingly, the coefficient on the contemporaneous unemployment rate is significantly negative, indicating that worse contemporaneous economic conditions are associated with lower annual earnings. However, the coefficients on unemployment at enrollment for graduates and non-graduates remain unaffected.

Table 10 analyzes the extent to which the earnings differentials that we have identified are observed at the intensive margin (i.e., in terms of annual earnings conditional on having non-zero earnings) and the extensive margin (i.e., in terms of the probability of having non-zero earnings). The results show that non-graduates who enroll in recessions are slightly less likely to be non-earners if they enroll during periods of higher unemployment (though this gap is not statistically significant). Among those who graduate within 5 years, the lower earnings effect comes both from a higher probability of having no earnings (extensive margin, as shown in the third column), and from lower earnings among those who do have earnings (intensive margin, as shown in the second column).

Overall, the results of our earnings regressions do not align well with the simple model of selection described in Section 4.1. The model has the key prediction that non-graduates who enroll in bad times should earn less on average than non-graduates who enroll in good times, given that they are more negatively selected. In contrast, our empirical analysis shows that the earnings of non-graduates who enroll in bad times are, if anything, somewhat higher than the earnings of non-graduates who enroll in good times.

4.3 Model Extension: Heterogeneous Costs

In order to rationalize the earnings results presented in the previous section, we extend the model by allowing for heterogeneous costs of education across individuals. For simplicity, we assume that these costs are orthogonal to ability and may be *high* or

low.[10]

Panel (a) of Figure 5 represents these two groups. The left panel plots potential earnings for individuals with post-secondary education against ability for the low-cost individuals (L); the right panel is the analogous plot for the high-cost individuals (H). For simplicity, we assume that for the L types, the idiosyncratic cost of education is sufficiently low, such that they always enroll, regardless of the outside option. Hence, the ability threshold for enrollment is $e^L = 0$. On the other hand, the H types face positive costs and will only enroll when the potential benefit from post-secondary education outweighs those costs. The costs are a function of the outside option, which as before is represented by $w^{non}(u)$, as well as the idiosyncratic cost c that individuals from this group face. This generates an endogenous enrollment threshold e^H. As before, g represents the ability threshold for graduation. This threshold is common across the two types, since they are otherwise indistinguishable once they enroll in university.

Given the common threshold g, the average wage of graduates from the two groups will be the same, and equal to $\bar{w}_g = 0.5(1+g)$. Meanwhile, as Panel (b) illustrates, the average wage of non-graduates will differ. It will be equal to $\bar{w}_n^L = 0.5(g + e^L) = 0.5g$ for individuals from the low-cost group, and equal to $\bar{w}_n^H = 0.5(g+e^H)$ for individuals from the high-cost group. Because the average ability among non-graduates of type H is higher than among non-graduates of type L, $\bar{w}_n^H > \bar{w}_n^L$.

If unemployment is higher, the opportunity cost of university, $w^{non}(u)$, decreases. This leads to a reduction in the enrollment threshold for individuals from the high cost group, as illustrated in Panel (a) of Figure 6, from e^H to e_R^H. Among individuals from the low cost group, there is no change, as all of them were already optimally choosing to enroll even when the opportunity costs were higher.

With a fixed graduation threshold and a wider pool of enrollees, the graduation rate will be lower when unemployment is higher. As Panel (b) shows, the average wage among non-graduates from the high-cost group who enroll during high unemployment, $\bar{w}_{nR}^H$, will be lower than the average wage among non-graduates from the high-cost group who enroll during low unemployment, $\bar{w}_n^H$. Importantly, however, even though

[10]Examples of idiosyncratic costs of education unrelated to ability include parents' evaluation of the benefits of education (Foley et al., 2014; Foley, 2019) or distance to the closest college (Card, 1993; Frenette, 2006).

the individuals who are induced to enroll when unemployment is high are marginal *within their group* (i.e., they have lower ability than inframarginal individuals from the high-cost group), they are actually of relatively high ability *among the pool of all non-graduates*.

In a case such as the one illustrated in Figure 6, the average ability among the overall pool of non-graduates may be higher in high unemployment cohorts. Given that it is still the case that $\bar{w}_{nR}^{H} > w_{n}^{L}$, and given that individuals from the high-cost group now represent a larger share of all non-graduates, the overall average wage of non-graduates may increase.

In short, our extended model with idiosyncratic costs of education can rationalize the result that high unemployment cohorts have lower graduation rates, as well as rationalizing the result that high unemployment cohorts have higher or similar average earnings for non-graduates (compared to non-graduates from low unemployment cohorts).

As discussed above, the graduation threshold g might also be lower for high unemployment cohorts. In such a case, graduation rates will again fall as long as the expansion in the number of enrollees is larger than the expansion in the number of graduates. Marginal graduates will be below average within both the low and the high cost groups, so average earnings for graduates fall, which is in line with the data. When g responds to unemployment, the best non-graduates become graduates, so non-graduates will be more negatively selected within both the low and the high cost groups as well. It is, however, still possible that average earnings among non-graduates do not fall. For this to be the case, the increase in the weight on the high-cost average wage must be large relative to the decline in their within-group average, and the decline in the low-cost non-graduate earnings must not be too large.

5 Discussion

Using administrative data on new enrollments to Canadian universities over the period 2009-2014, we show that students who enroll when unemployment is higher have a lower probability of completing an undergraduate degree within five years. Students enrolling during bad economic times do not differ from those enrolling in good times

along characteristics we can observe in our data. The lower graduation probability is also not explained by differential sorting across institutions or fields of study.

In addition to this, we find that, among students who graduate within five years, those who enroll during economic downturns have lower wages than those who enroll in better economic times. However, we find that the association between business cycle conditions at entry and earnings goes in the opposite direction for those who do not graduate on time.

We interpret our results as being consistent with a framework in which selection into university depends on both individual ability and the idiosyncratic cost of education. Assuming that the two are not (too strongly) correlated, we show that a relatively simple model can rationalize our empirical patterns. The model suggests that the marginal students who enroll in downturns are students of relatively high ability who face high idiosyncratic costs of education.

We are currently working on extending the paper in several directions. First, the proposed model predicts that enrollment in PSE expands during economic downturns, and this is concentrated among individuals with high idiosyncratic costs of education. We plan to verify these mechanisms to the extent possible. While expansions in enrollment have been documented in the literature (e.g., Betts & McFarland, 1995; Sievertsen, 2016; Alessandrini, 2018), it is not clear whether the increases in enrollment are due to new flows into PSE, or due to lower dropout rates or re-enrollment of previously enrolled students. This is something that we can disentangle using our data.

To shed more light on the mechanisms proposed in our model, we plan to look for proxies for the idiosyncratic education costs featured in our model, for example by relying on the detailed geographical information available in the data for students' permanent home address. This could allow us to test the predictions of our model and confirm that idiosyncratic education cost is a significant mechanism inducing our graduation and earnings results.

We also plan to consider alternative interpretations of the estimated impacts of the business cycle conditions at enrollment on graduation and earnings. For example, economic downturns may be associated with PSE funding cuts and course closures that lower the quality of education, increase the time to completion, and reduce the

graduation rate (Deming & Walters, 2017; Bound et al., 2019; Robles et al., 2021). This may also result in lower earnings of those who enroll in worse economic times, whether they graduate on time, prolong their studies, or drop out. We plan to collect information on the variation in local funding over the business cycle to further explore this channel.

In addition to this, we plan to account for the impact of work experience acquired both before and during PSE on future earnings. Finally, we plan to focus on those who do not graduate on time and consider the impact of business cycle conditions at enrollment separately on the outcomes of those whom we observe to drop out during the first five years of study and those who remain enrolled.

References

Alessandrini, D. (2018). Is post-secondary education a safe port and for whom? Evidence from Canadian data. *Economics of Education Review*, 67, 1–13.

Arcidiacono, P., Aucejo, E., Maurel, A., & Ransom, T. (2016). *College Attrition and the Dynamics of Information Revelation*. Working Paper 22325, National Bureau of Economic Research.

Barr, A. & Turner, S. (2015). Out of work and into school: Labor market policies and college enrollment during the great recession. *Journal of Public Economics*, 124(C), 63–73.

Betts, J. R. & McFarland, L. L. (1995). Safe port in a storm: The impact of labor market conditions on community college enrollments. *The Journal of Human Resources*, 30(4), 741–765.

Bičáková, A., Cortes, G. M., & Mazza, J. (2021a). Caught in the cycle: Economic conditions at enrolment and labour market outcomes of college graduates. *The Economic Journal*, 131(638), 2383–2412.

Bičáková, A., Cortes, G. M., & Mazza, J. (2021b). *Make Your Own Luck: The Wage Gains from Starting College in a Bad Economy*. CERGE-EI Working Papers wp698, The Center for Economic Research and Graduate Education - Economics Institute, Prague.

Blom, E., Cadena, B. C., & Keys, B. J. (2021). Investment over the business cycle: Insights from college major choice. *Journal of Labor Economics*, 39(4), 1043–1082.

Bound, J., Braga, B., Khanna, G., & Turner, S. (2019). *Public Universities: The Supply Side of Building a Skilled Workforce*. Working Paper 25945, National Bureau of Economic Research.

Bound, J., Lovenheim, M. F., & Turner, S. (2010). Why have college completion rates declined? An analysis of changing student preparation and collegiate resources. *American Economic Journal: Applied Economics*, 2(3), 129–57.

Bound, J., Lovenheim, M. F., & Turner, S. (2012). Increasing time to baccalaureate degree in the United States. *Education Finance and Policy*, 7(4), 375–424.

Burga, R. & Turner, S. (2022). Does enrollment lead to completion? Measuring adjustments in education to local labor market shocks. *Journal of Human Resources*.

Card, D. (1993). Using geographic variation in college proximity to estimate the return to schooling. *NBER Working Paper No. 4483*.

Card, D. (2001). Estimating the return to schooling: Progress on some persistent econometric problems. *Econometrica*, 69(5), 1127–1160.

Clark, D. (2011). Do recessions keep students in school? the impact of youth unemployment on enrolment in post-compulsory education in england. *Economica*, 78(311), 523–545.

Dellas, H. & Sakellaris, P. (2003). On the cyclicality of schooling: theory and evidence. *Oxford Economic Papers*, 55(1), 148–172.

Deming, D. J. & Walters, C. R. (2017). *The Impact of Price Caps and Spending Cuts on U.S. Postsecondary Attainment*. Working Paper 23736, National Bureau of Economic Research.

Denning, J. T., Eide, E. R., Mumford, K. J., Patterson, R. W., & Warnick, M. (2022a). Why have college completion rates increased? *American Economic Journal: Applied Economics*, 14(3), 1–29.

Denning, J. T., Eide, E. R., Mumford, K. J., & Sabey, D. J. (2022b). Decreasing time to baccalaureate degree in the United States. *Economics of Education Review*, 90, 102287.

Ferrer, A. M. & Menendez, A. (2014). The puzzling effects of delaying schooling on canadian wages. *Canadian Public Policy / Analyse de Politiques*, 40(3), 197–208.

Foley, K. (2019). The gender gap in university enrolment: Do parents play a role beyond investing in skills? *Canadian Journal of Economics/Revue canadienne d'économique*, 52(2), 441–489.

Foley, K., Gallipoli, G., & Green, D. A. (2014). Ability, parental valuation of education, and the high school dropout decision. *Journal of Human Resources*, 49(4), 906–944.

Frenette, M. (2006). Too far to go on? Distance to school and university participation. *Education Economics*, 14(1), 31–58.

Haraldsvik, B. M. & Strøm, B. (2021). Adult skills and labor market conditions during teenage years: Cross-country evidence from international surveys. *Oxford Economic Papers*, 74(3), 894–919.

Kahn, L. B. (2010). The long-term labor market consequences of graduating from college in a bad economy. *Labour Economics*, 17(2), 303–316.

Kurlaender, M., Jackson, J., Howell, J. S., & Grodsky, E. (2014). College course scarcity and time to degree. *Economics of Education Review*, 41, 24–39.

Light, A. & Strayer, W. (2000). Determinants of college completion: School quality or student ability? *The Journal of Human Resources*, 35(2), 299–332.

Oreopoulos, P., Von Wachter, T., & Heisz, A. (2012). The short-and long-term career effects of graduating in a recession. *American Economic Journal: Applied Economics*, 4(1), 1–29.

Robles, S., Gross, M., & Fairlie, R. W. (2021). The effect of course shutouts on community college students: Evidence from waitlist cutoffs. *Journal of Public Economics*, 199, 104409.

Rothstein, J. (2020). *The Lost Generation? Labor Market Outcomes for Post Great Recession Entrants*. NBER Working Papers 27516, National Bureau of Economic Research, Inc.

Schwandt, H. & von Wachter, T. (2019). Unlucky cohorts: Estimating the long-term effects of entering the labor market in a recession in large cross-sectional data sets. *Journal of Labor Economics*, 37(S1), S161–S198.

Sievertsen, H. H. (2016). Local unemployment and the timing of post-secondary schooling. *Economics of Education Review*, 50, 17–28.

von Wachter, T. (2020). The persistent effects of initial labor market conditions for young adults and their sources. *Journal of Economic Perspectives*, 34(4), 168–94.

Weinstein, R. (2022). Local labor markets and human capital investments. *Journal of Human Resources*, 57(5), 1498–1525.

Yagan, D. (2019). Employment hysteresis from the Great Recession. *Journal of Political Economy*, 127(5), 2505–2558.

Table 1: Probability of graduating within 5 years

Dependent variable: *Indicator for Graduating within 5 Years*			
	(1)	**(2)**	**(3)**
Unemployment at enrollment	-0.021***	-0.039***	-0.019*
	(0.007)	(0.009)	(0.010)
Province FE	Yes	Yes	Yes
Quadratic Trend	Yes	No	No
Province-specific Trend	No	Yes	No
Enroll-Year FE	No	No	Yes
R-squared	0.0272	0.0271	0.0273
Number of Clusters	60	60	60
Sample Size	885,000	885,000	885,000

Note: Standard errors clustered at the enrollment year x province level in parentheses. Sample sizes are rounded due to confidentiality restrictions. ***, ** and * denote statistical significance at the 99, 95 and 90%, respectively.

Table 2: Non-Enrollment Probabilities

	Dependent variable:					
	Grad in	Not enrolled and not graduated in:				
	$c+5$	$c+5$	$c+4$	$c+3$	$c+2$	$c+1$
Unemp at enrollment	-0.039***	0.025***	0.022***	0.024***	0.027***	0.022***
	(0.009)	(0.005)	(0.005)	(0.005)	(0.003)	(0.003)
R-squared	0.0271	0.0146	0.0118	0.0115	0.0118	0.0094
Number of Clusters	60	60	60	60	60	60
Sample Size	885,000	885,000	885,000	885,000	885,000	885,000

Note: c represents the year of first enrollment. All specifications include home-province fixed effects and province-specific cohort trends. Standard errors clustered at the enrollment year x province level in parentheses. Sample sizes are rounded due to confidentiality restrictions. ***, ** and * denote statistical significance at the 99, 95 and 90%, respectively.

Table 3: Controlling for unemployment after enrollment

Dependent variable: *Indicator for Graduating within 5 Years*		
	(1)	(2)
Unemp at enrollment	-0.033***	-0.039***
	(0.008)	(0.009)
Avg Unemp yrs $c+1$ to $c+4$, home prov	0.056***	
	(0.018)	
Avg Unemp yrs $c+1$ to $c+4$, study prov		0.004
		(0.004)
R-squared	0.0274	0.0271
Number of Clusters	60	60
Sample Size	885,000	885,000

Note: c represents the year of first enrollment. All specifications include home-province fixed effects and province-specific cohort trends. Standard errors clustered at the enrollment year x province level in parentheses. Sample sizes are rounded due to confidentiality restrictions. ***, ** and * denote statistical significance at the 99, 95 and 90%, respectively.

Table 4: Gender and age composition of enrollment

	Dependent variable:		
	Female	Age in Years	Aged ≥ 25
Unemp at enrollment	-0.002	-0.084	0.011***
	(0.002)	(0.052)	(0.003)
R-squared	0.0013	0.0159	0.0111
Number of Clusters	60	60	60
Sample Size	885,000	885,000	885,000

Note: All specifications include home-province fixed effects and province-specific trends. Standard errors clustered at the enrollment year x province level in parentheses. Sample sizes are rounded due to confidentiality restrictions. ***, ** and * denote statistical significance at the 99, 95 and 90%, respectively.

Table 5: Parental income composition of enrollment

Dependent variable: Indicator for parental income category					
	Q1	Q2	Q3	Q4	Missing
Unemp at enrollment	0.002	-0.001	-0.003	0.000	-0.002
	(0.002)	(0.002)	(0.002)	(0.005)	(0.008)
R-squared	0.0117	0.0119	0.0129	0.0349	0.1108
Number of Clusters	60	60	60	60	60
Sample Size	885,000	885,000	885,000	885,000	885,000

Note: All specifications include home-province fixed effects and province-specific trends. Standard errors clustered at the enrollment year x province level in parentheses. Sample sizes are rounded due to confidentiality restrictions. ***, ** and * denote statistical significance at the 99, 95 and 90%, respectively.

Table 6: Gender heterogeneity

Dependent variable: *Indicator for Graduating within 5 Years*	
Unemp at enrollment	-0.040***
	(0.009)
Female	0.079***
	(0.013)
Female * Unemployment	0.002
	(0.001)
R-squared	0.0360
Number of Clusters	60
Sample Size	885,000

Note: This regression includes home-province fixed effects and province-specific cohort trends. Standard errors clustered at the enrollment year x province level in parentheses. Sample sizes are rounded due to confidentiality restrictions. ***, ** and * denote statistical significance at the 99, 95 and 90%, respectively.

Table 7: Institutions and field of study

Dependent variable: *Indicator for Graduating within 5 Years*				
	(1)	**(2)**	**(3)**	**(4)**
Unemployment at enrollment	-0.039***	-0.037***	-0.040***	-0.036***
	(0.009)	(0.008)	(0.006)	(0.006)
Field FE	No	Yes	Yes	No
Insitution FE	No	No	Yes	No
Field *Insitution FE	No	No	No	Yes
R-squared	0.0360	0.0618	0.1170	0.1385
Number of Clusters	60	60	60	60
Sample Size	885,000	885,000	885,000	885,000

Note: All specifications include home-province fixed effects and province-specific trends. Standard errors clustered at the enrollment year x province level in parentheses. Sample sizes are rounded due to confidentiality restrictions. ***, ** and * denote statistical significance at the 99, 95 and 90%, respectively.

Table 8: Effect of unemployment at enrollment on earnings

Dependent variable: *Ln Annual Earnings, with zeros*			
	(1)	**(2)**	**(3)**
Unemp. at enrollment	-0.022**	-0.001	
	(0.010)	(0.011)	
Graduating w/in 5 years		0.646***	0.516***
		(0.017)	(0.135)
Graduated			0.686***
			(0.063)
Unemp. non-graduates			0.019
			(0.016)
Unemp. graduates			-0.033***
			(0.009)
Enrolled indicator	No	No	Yes
R-squared	0.0037	0.0118	0.0338
Number of Clusters	60	60	60
Sample Size	2,096,000	2,096,000	2,096,000

Note: All specifications include home-province fixed effects and province-specific trends, as well as a gender dummy, a quadratic in age, and tax year fixed effects. The enrollment indicators in Column (3) include a set of indicator variables for being enrolled in an undergraduate, professional, master's or PhD. This specification also includes an indicator variable equal to one in the year of graduation. Standard errors clustered at the enrollment year x province level in parentheses. Sample sizes are rounded due to confidentiality restrictions. ***, ** and * denote statistical significance at the 99, 95 and 90%, respectively.

Table 9: Unemployment at enrollment and earnings: Robustness checks

Dependent variable: *Ln Annual Earnings, with zeros*				
	(1)	**(2)**	**(3)**	**(4)**
Unemp. non-graduates	0.018	0.025*	0.019	0.021
	(0.016)	(0.014)	(0.014)	(0.015)
Unemp. graduates	-0.034***	-0.027***	-0.031***	-0.032***
	(0.010)	(0.009)	(0.008)	(0.010)
Contemporaneous unemp				-0.063***
in filing province				(0.020)
Age at Enroll	Yes	No	No	No
Field FE	No	Yes	No	No
Insitution FE	No	No	Yes	No
Filing Prov FE	No	No	No	Yes
R-squared	0.0339	0.0435	0.0428	0.0344
Number of Clusters	60	60	60	60
Sample Size	2,096,000	2,096,000	2,096,000	2,096,000

Note: All specifications include home-province fixed effects and province-specific trends, as well as a gender dummy, a quadratic in age, tax year fixed effects, an indicator variable equal to one in the year of graduation, an indicator variable equal to one in the years after graduation, an indicator variable equal to one for individuals who graduate within 5 years, and a set of indicator variables for being enrolled in an undergraduate, professional, master's or PhD. Standard errors clustered at the enrollment year x province level in parentheses. Sample sizes are rounded due to confidentiality restrictions. ***, ** and * denote statistical significance at the 99, 95 and 90%, respectively.

Table 10: Unemployment at enrollment and earnings: Intensive and Extensive Margins

	Ln Annual Earnings		No Earnings
	with zeros	w/out zeros	
Unemp. non-graduates	0.019	-0.000	-0.002
	(0.016)	(0.005)	(0.001)
Unemp. graduates	-0.033***	-0.008*	0.003***
	(0.009)	(0.004)	(0.001)
Graduating w/in 5 years	0.516***	0.189***	-0.033***
	(0.135)	(0.033)	(0.010)
Graduated	0.686***	0.178***	-0.051***
	(0.063)	(0.022)	(0.004)
R-squared	0.0338	0.1494	0.0158
Number of Clusters	60	60	60
Sample Size	2,096,000	1,865,000	2,096,000

Note: All specifications include home-province fixed effects and province-specific trends, as well as a gender dummy, a quadratic in age, tax year fixed effects, an indicator variable equal to one in the year of graduation, an indicator variable equal to one in the years after graduation, an indicator variable equal to one for individuals who graduate within 5 years, and a set of indicator variables for being enrolled in an undergraduate, professional, master's or PhD. Standard errors clustered at the enrollment year x province level in parentheses. Sample sizes are rounded due to confidentiality restrictions. ***, ** and * denote statistical significance at the 99, 95 and 90%, respectively.

Figure 1: Percentage of Students Graduating within 5 Years, By Home Province

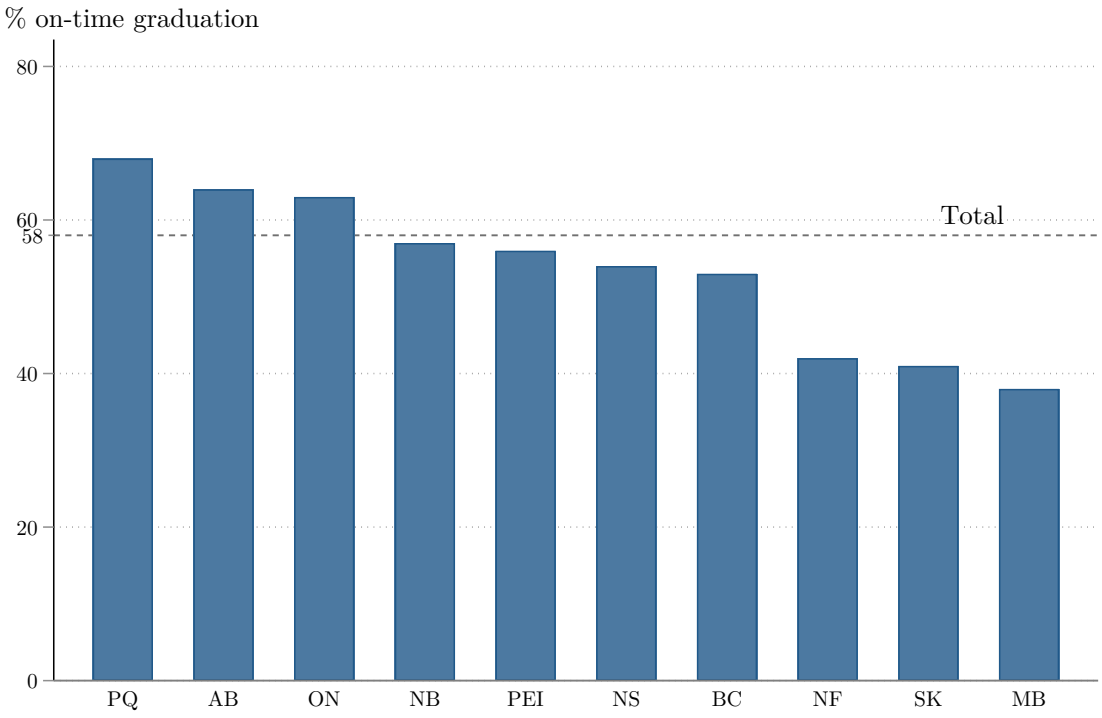
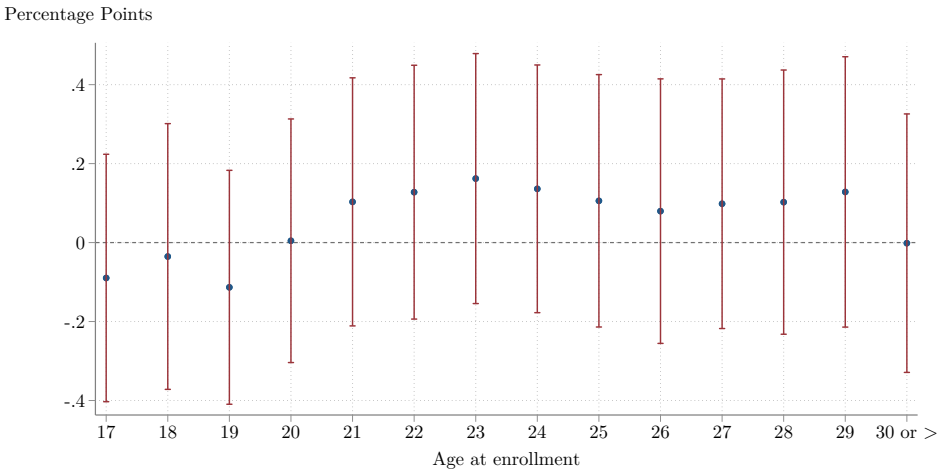
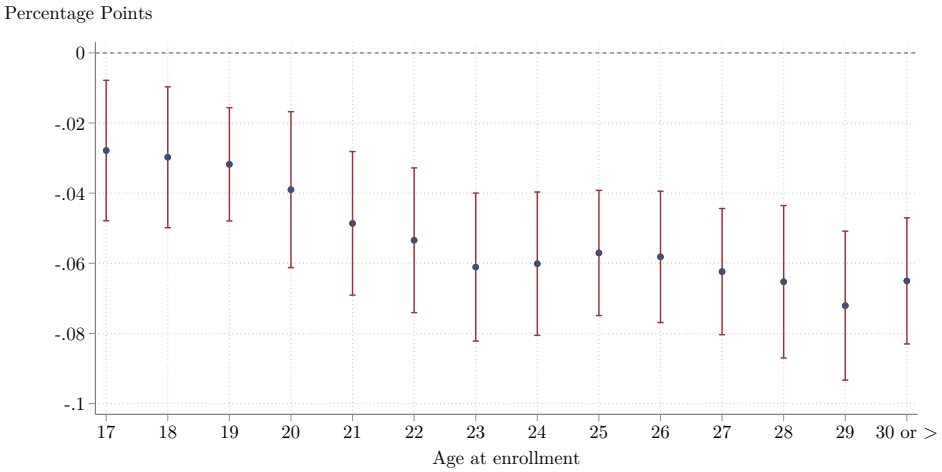


Figure 2: Effect of age at enrollment on on-time graduation

(a) Direct effect of age at enrollment, relative to age 16



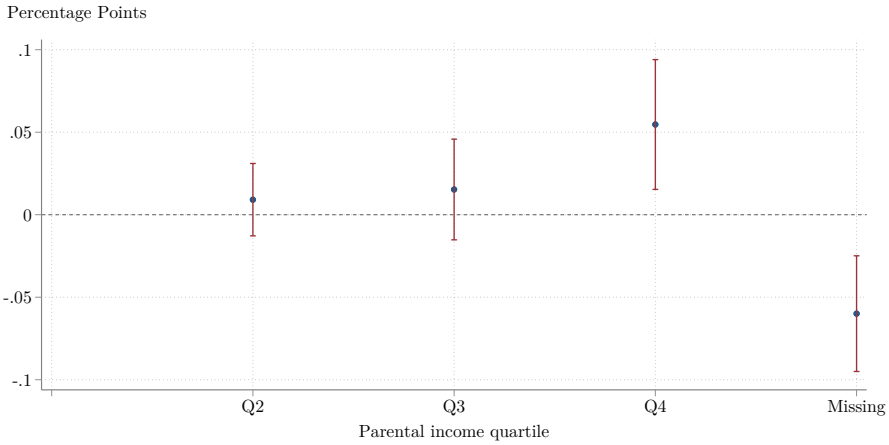
(b) Effect of unemployment at enrollment, by age at enrollment



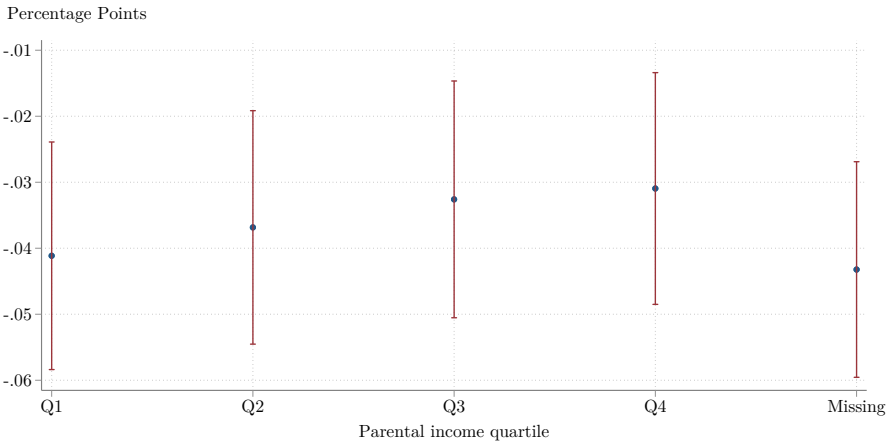
Note: Panel 2a reports the difference between the probabilities of on-time graduation for students enrolling at a given age compared to students enrolling at 16. Panel 2b reports the effect of a 1 pp. increase in the unemployment rate at enrollment on the probabilities of graduating within 5 years, by age at enrollment. The lines represent the 95% confidence intervals.

Figure 3: Effect of parental income on on-time graduation

(a) Direct effect of parental income, relative to bottom quartile



(b) Effect of unemployment at enrollment, by parental income



Note: Panel 3a reports the difference between the probabilities of on-time graduation for students whose parental income is in a given quartile of the income distribution compared to students whose parental income is in the bottom quartile of the income distribution. Panel 3b reports the effect of a 1 pp. increase in the unemployment rate at enrollment on the probabilities of graduating within 5 years, by parental income. The lines represent the 95% confidence intervals.

Figure 4: Simple model of enrollment and graduation

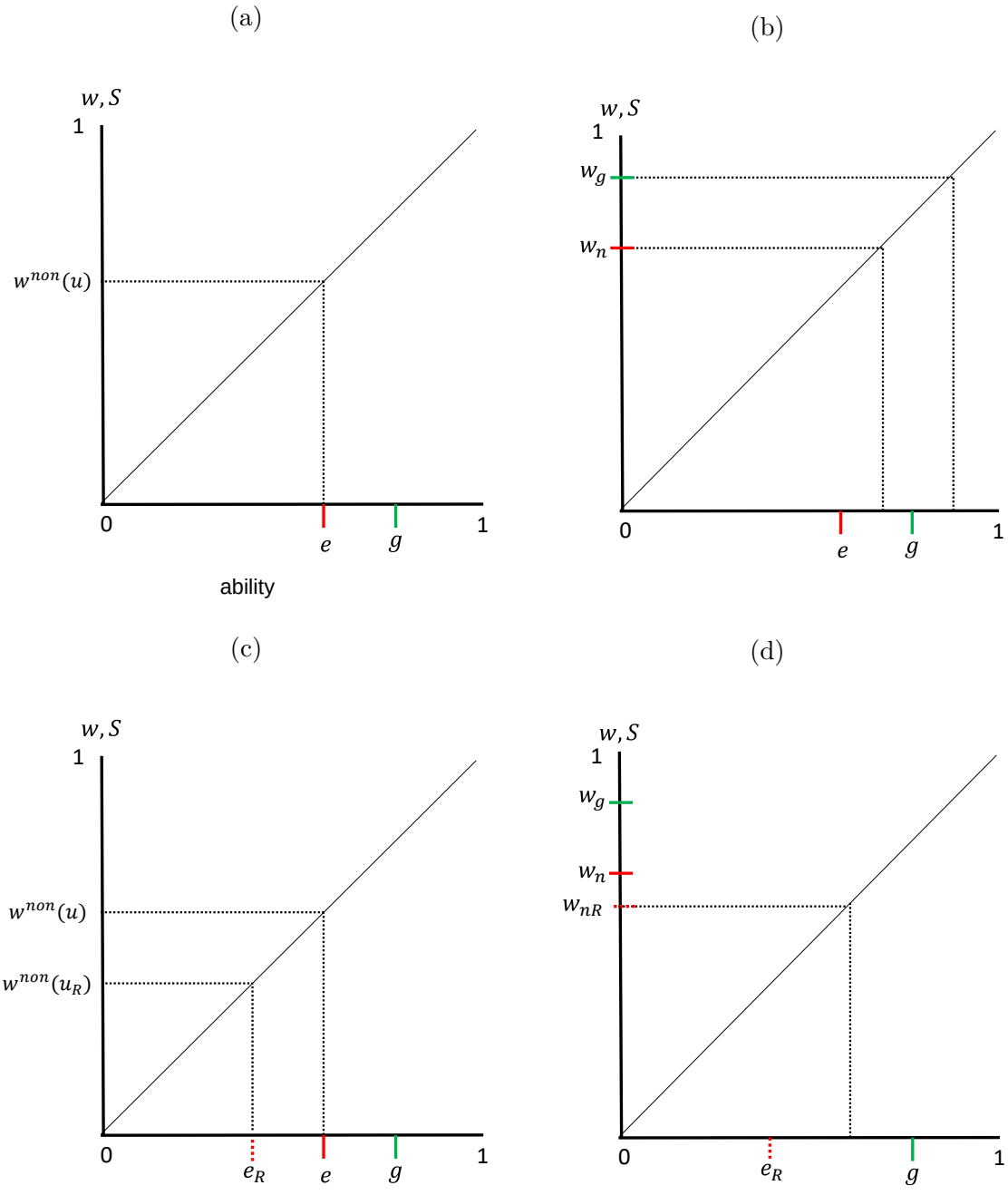
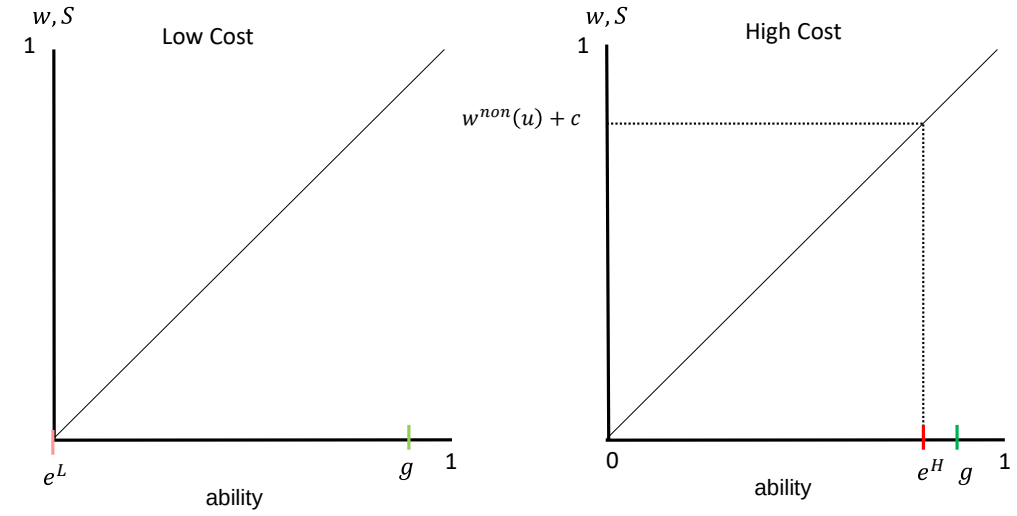


Figure 5: Extended model, idiosyncratic costs

(a)



(b)

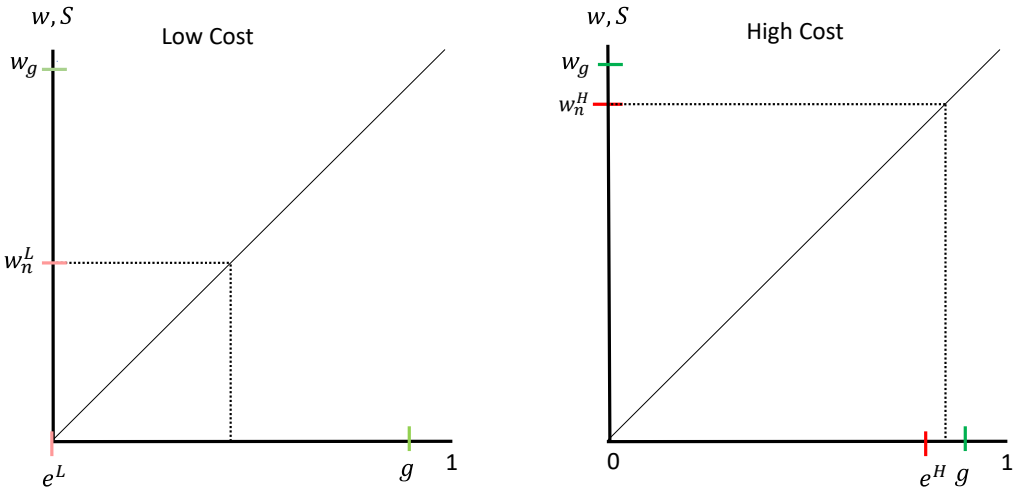
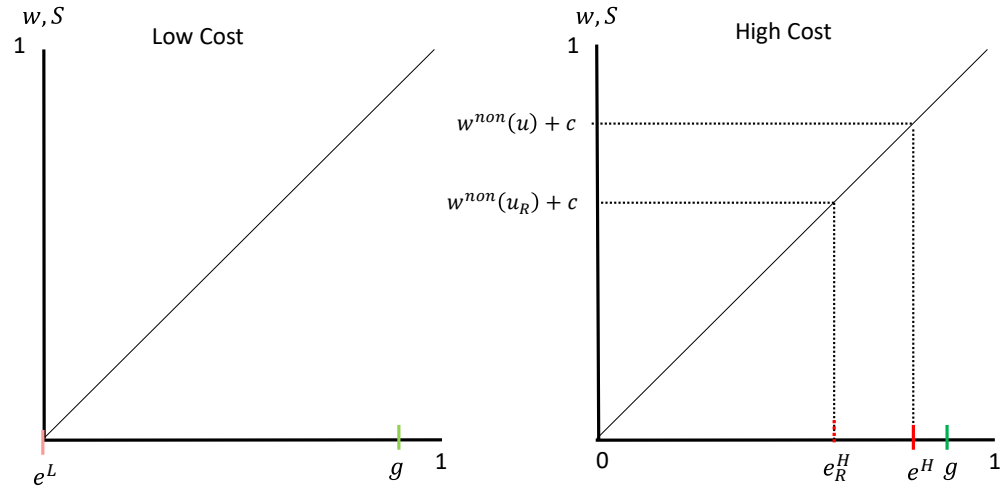


Figure 6: Extended model: Change in the unemployment rate

(a)



(b)

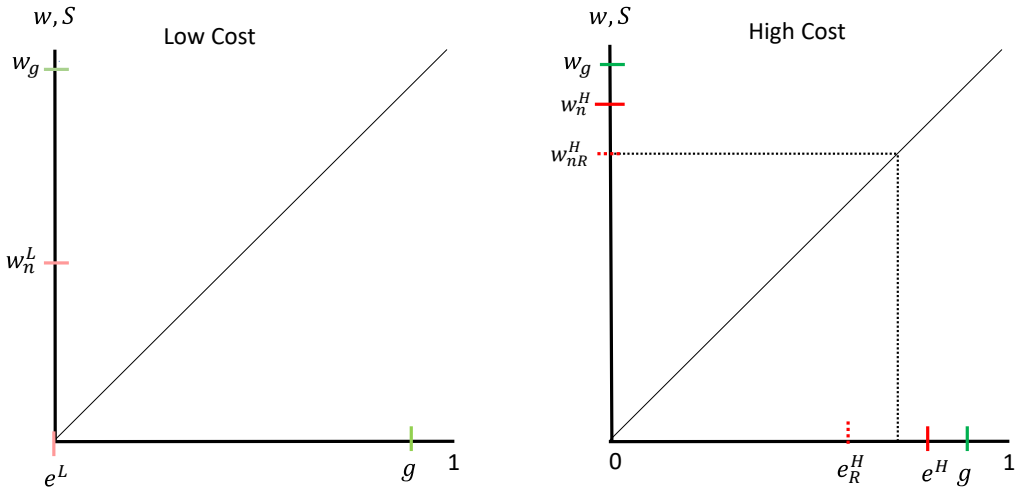
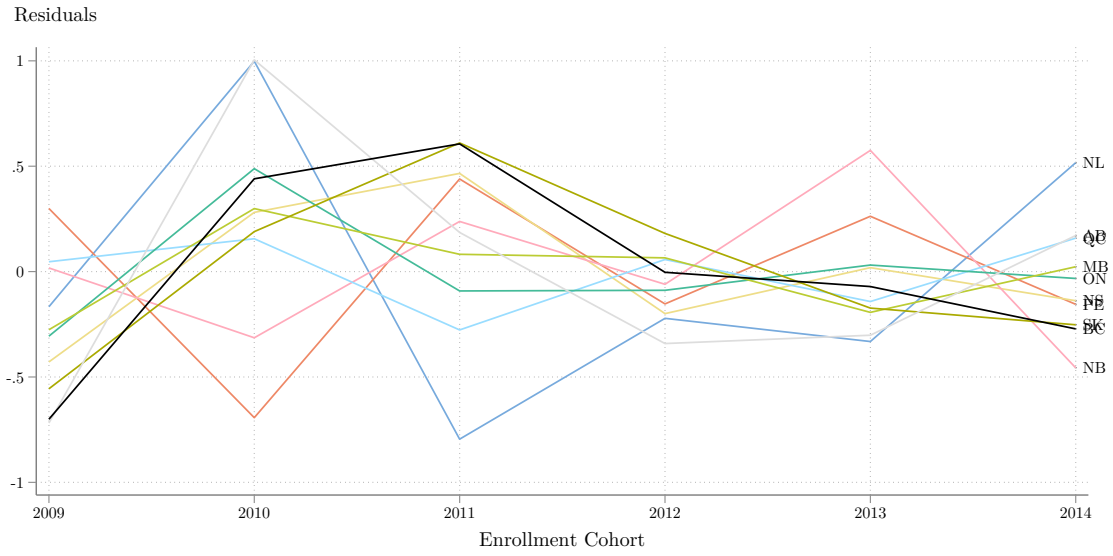


Figure A.1: Detrended Regional Variation in the Unemployment Rate



Note: Detrended provincial unemployment rates, using linear trend. Own calculations.