The Short- and Long-Term Career Effects of Graduating in a Recession:

Hysteresis and Heterogeneity in the Market for College Graduates[1]

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Abstract

This paper analyzes the sources behind long-term earnings effects of graduating in a recession using a large longitudinal university-employer-employee data set. We find that students graduating in a recession start to work at lower paying employers, and partly recover through a gradual process of job mobility towards better firms. We also document that higher skilled graduates suffer less from entry in a recession because they switch to better firms quickly, while lower skilled graduates can be permanently affected by cyclical downgrading. These results point to substantial frictions in the college labor market that increase over time and differ by skill.

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1. Introduction

Increasing evidence suggests that adverse initial labor market conditions can have substantial long-term effects on earnings of college graduates.[2] In this paper, we show that an important driving force behind these patterns is a temporary reduction in the quality of jobs in recessions and an ensuing gradual reallocation process via job mobility. We also document that this pattern of cyclical downgrading affects less advantaged graduates much more than advantaged graduates, leading to substantial differences in the costs of recessions among college graduates. These findings suggest an important role for reallocation frictions in the college labor market that interact with age and skill related mobility costs.

We analyze the dynamic effects of graduating in a depressed labor market on college graduates with different educational backgrounds using an unusual match between administrative university-employee-employer data from Canada. Our data allow us to distinguish between temporary and persistent labor market shocks using 20 years of graduating cohorts over two large recessions with differential strength across ten regions.[3] College graduates are an ideal group to study the effects of initial labor market shocks because we can assess labor market conditions' effects at the time when the majority is beginning to search for full-time work. Since graduates differ little in terms of labor market experience, information on college, program, and length of study allow us to categorize our sample into more and less advantaged groups based on predicted labor market success.

Our findings paint an intricate picture of the effect of initial labor market conditions for college graduates in which very short-lived adverse labor market conditions have long-term effects, labor

[2] See, e.g., Kahn (2006), Oyer (2006, 2008), Kondo (2008). Persistent effects of cyclical fluctuations have been also found among others by Beaudry and DiNardo (1991), Baker, Gibbs, and Holmstrom (1994), Devereux (2003).

[3] Several previous studies on the persistent effects of aggregate labor market conditions have used the Panel Study of Income Dynamics (Devereux 2003) and the National Longitudinal Studies of Youth (Gardecki and Neumark 1998, Kahn 2006). While providing detailed survey information on careers and worker demographics, the small samples of these data sets do not allow controlling for cohort, state, and year effects in a flexible way, controlling for persistent correlated labor market conditions, or studying other career outcomes than wages with sufficient degree of precision. Often by necessity the range of cohorts studied is limited.

market entrants are much more affected than workers with just a few years of experience, and the size and persistence of the effect varies dramatically across the skill distribution. A typical recession – a rise in unemployment rates by five percentage points in our context – implies an initial loss in earnings of about 9 percent that halves within 5 years and finally fades to zero by 10 years. This result is robust across specifications, and arises mainly from the first unemployment rate individuals face after graduating – net of correlation with labor market shocks occurring later in workers' careers – and does not seem to be due to selective employment and graduation decisions. The persistent effects from changes in labor market conditions are much larger for individuals in the first year of their careers than for individuals already working. We also find that graduates with the lowest predicted earnings (our measure of skill) suffer larger and much more persistent earnings losses than those at the top.

These results point to an important role for initial job placement in determining long-term labor market success. We develop a model of job search that incorporates time-varying costs of mobility and comparative advantage that predicts lasting and differential effects even from very short term adverse labor market conditions. In the model, incentives to search for better employers from comparative advantage interact with search costs that increase over time due to the accumulation of firm-specific capital and aging. This leads high-skilled workers to search harder for high-wage firms than low-skilled workers and catch-up before age- or tenure-related costs become important. Some lower-skilled workers, on the other hand, never move to better firms before these costs start to bind or before they accumulate specific capital at low-wage firms.[4]

Consistent with predictions from our model for the sources of earnings losses and recovery, we find that initial labor market shocks affect job mobility and firm placement. The dynamic adjustment

[4] The model can also predict several other aspects of the recovery process observed in our data, including faster recovery in industries with high average turnover, slower catch-up within high-quality firms, and a positive experience-gradient in firm quality.

process is characterized by increased mobility across employers and industries and improvements in average firm characteristics. This pattern differs by worker type. Workers at the top of the wage-distribution catch up quickly by moving to better firms. Workers with low predicted earnings are permanently down-ranked to firms paying lower wages and consequently never catch-up. Decomposing earnings losses into their sources, we find that lasting reductions in the quality of employers can explain up to 40-50% of persistent earnings losses. At least for labor market entrants, both mobility towards better firms and recovery within firms are important margins of adjustment to labor market conditions.

Our data allows us to make several contributions to the increasing literature documenting that short-term labor market conditions can have long-term effects on workers occupational choice and earnings.[5] While several papers have documented that labor market entrants suffer long-term effects from adverse initial labor market conditions, this is the first study to provide an in depth investigation of the mechanism underlying the observed losses and recovery patterns. Our findings imply that an important part of the response of wages of labor market entrants to demand conditions derives from temporary cyclical downgrading to lower paying employers. Similarly, an important part of the recovery can be explained by stepwise reallocation of workers between firms in the presence of frictions, as predicted by models of gradual assortative matching. This process could be based on search frictions (e.g., this paper, Lentz 2007), or another source of friction such as employer learning (e.g, Gibbons, Katz, Lemieux, and Parent 2005). Our finding of important reallocation *between* firms complements influential studies finding unemployment rates have persistent effects for employment spells *within* firms, either due to long-term contracts (e.g., Beaudry

[5] This extends the existing literature documenting that luck matters for college graduates in particular graduation cohorts (Kahn 2006) and in particular occupations (e.g., Oyer 2006, 2008). More generally, luck has been found to matter for job losers (e.g., Jacobson, Lalonde, and Sullivan 1993), for young unemployed workers (e.g., Elwood 1982), or for particular birth cohorts (e.g., Freeman 1979, Welch 1979, Beaudry and DiNardo 1991, Baker, Gibbs, and Holmstrom 1994).

and DiNardo 1991, McDonald and Worswick 1999, Grant 2003) or due to job assignment and training (e.g., Gibbons and Waldman 2004, 2006).[6]

Our results confirm that these reallocation frictions appear to matter more for labor market entrants than for those with at least some experience, consistent with models of age-related frictions based on employer learning, human capital accumulation, or growing mobility costs. We are the first study to document that the initial downgrading is more severe and the ensuing recovery is more protracted for lower skilled college graduates. Thus, to explain the pattern we find age-related reallocation frictions must substantially interact with college graduates' skills. Thereby, our finding that the lowest skilled graduates appear to suffer *permanent* effects implies a role of binding age- or tenure-related frictions whose potential has only recently been explored in the literature (e.g., Gibbons and Waldman 2006).

Finally, these findings have important implications for our understanding of the role of job mobility in career development. They provide direct evidence on the role of job transitions to better firms in young workers' careers after exogenous labor market shocks, complementing existing studies typically based on correlations of job mobility and earnings (e.g., Topel and Ward 1992).

Our results also have important implications for recent strands of literature in macroeconomics. Our paper contributes to the ongoing debate whether rigid wages could help explain fluctuations of unemployment over the business cycle (e.g., Shimer 2005, Hall 2005). We provide direct evidence that wages of labor market entrants respond substantially more to aggregate fluctuations than that of already employed workers. However, our findings also imply that because of cyclical downgrading the total response *overestimates* the degree of wage flexibility. This role for a change in the decomposition of employers is reminiscent (yet opposite in effect) of the role of changes in worker decomposition for understanding cyclical wage variability by (Bils 1985, and Solon, Barsky, and

[6] Consistent with a role for contracting or job assignment, we also find an important degree of persistence of unemployment rate shocks within firms, especially for very large and high paying employers.

Parker 1994).[7] On the other hand, our finding that earnings declines within firms are persistent confirms that the response of entry wages alone may not fully capture the effect of wages on job creation even once we control for decomposition changes.

An important strand of recent literature in macroeconomics has used models of sectoral reallocation – either through job search (e.g., Krause and Lubik 2006, 2007) or mismatch (e.g., Shimer 2007, Moscarini and Vella 2008) – to model cyclical labor market dynamics. Our findings provide direct evidence in favor of such a dynamic sorting process in the wage of aggregate fluctuations. However, our results also imply that even temporary shocks can lead to persistent misallocation of workers through cyclical downgrading in affected cohorts.

Finally, our paper provides new estimates of the costs of recessions based on the long-term earnings response to observed aggregate unemployment variation. These direct estimates tend to be substantially larger than existing estimates.[8] In addition, our data shows that the cost of recessions appears to be highly unequally distributed, with the loss in the present discounted value of earnings being much larger for labor market entrants as a group and for less advantaged college graduates. Thus, our findings imply persistent increases in earnings inequality from recessions lasting up to ten years, which translates into permanent increases in inequality in the present discounted value of earnings.

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[7] The existing literature on cyclical upgrading (discussed more below) has focused mainly on job changers and is based on correlations of sector and worker characteristics over the business cycle, without much information on the ensuing adjustment process (for recent evidence from cyclicality of worker and firm effects, see Carneiro, Guimaraes, and Portugal 2009; Martins, Solon and Thomas 2009 provide an overview of the literature). Our cohort-based approach provides direct quasi-experimental evidence on the effect of unemployment rates on cyclical downgrading of labor market entrants, as well on the gradual reallocation process within affected cohorts. An advantage of our approach over existing studies is that the interpretation of our findings is less reliant on potentially strong assumptions of the process of selection of workers into sectors, firms, or jobs. Moreover, the literature's main focus has been on changes in worker decomposition across jobs, whereas our findings highlight the role of changes in firm decomposition across cohorts of graduates. Recent estimates by Martins et al. (2009) suggest that remaining within-firm variation in wages is not merely driven by changes in the decomposition of jobs.

[8] Lucas' (1987) original measure asked how much additional consumption would make a representative worker indifferent between economies with and without consumption risk. More recent papers distinguish between individuals with and without wealth holdings, or between workers on the job and those laid-off (see, e.g., Barlevy 2005). Several studies have shown that recessions have different earnings effects for different groups of workers (e.g., Hoynes 2000, Hines et al. 2002), but none were able to trace out differences in the ensuing long-run effects.

2. A Model of Job Mobility with Endogenous Search and Initial Conditions

The following section discusses an augmented model of on-the-job search that we use to organize the discussion and interpretation of our main findings, whose details are relegated to our longer working paper (Oreopoulos et al. 2008). The key mechanism in our search model is the interaction of age-related mobility costs with skill-dependent search incentives. This allows the model to yield a parsimonious explanation of persistent effects of even short-term labor market shocks for labor market entrants, why high skilled graduates catch-up more quickly, and why some graduates may never recover from their initial losses. The model also makes predictions for the role of firms and job mobility in the recovery process. Of course, we are aware that other models based on different assumptions may make similar predictions. Below, we discuss alternative interpretations and extensions of the basic model.

Despite its simplicity, our model combines several features of recent theoretical and empirical research on wage determination. First, job search has long been thought to be an integral part of young workers' careers (Topel and Ward 1992, Manning 2006). Search theory predicts that even a temporary worsening of the wage offer distribution leads workers entering the labor market in a recession to catch-up by a lengthy search process for higher paying jobs. Second, evidence suggests high-wage jobs are concentrated in particular firms and sectors.[9] A key feature of our model and empirical work is that supply of high-wage jobs appears to be pro-cyclical, leading young and less able workers to be down-ranked to low-wage firms in recessions.[10] Third, an increasing empirical literature suggests that the cost of job search increases with age, and that higher-skilled young workers are more likely to move between regions or industries in response to adverse labor market

[9] Firms and industries pay wage premiums that cannot be easily rationalized by worker characteristics (e.g., Krueger and Summers 1988, Abowd, Creecy, and Kramarz 2002).

[10] It is well-known that sectors paying higher wages have more pro-cyclical job creation, partly because of more volatile demand for their products (Okun 1973, McLaughlin and Bils 2001, Aaronson and Christopher 2004). There appears to be cyclical down-grading of young and lower skilled workers (e.g., Reynolds 1951, Reder 1955, Cutler and Katz 1991, and Hines et al. 2002). Less able workers tend to flow to larger firms and high wage sectors in booms (e.g., Vroman 1977, Albaek and Sorensen 1998, Devereux 2002).

shocks.[11] Thus, lower skilled workers may suffer more from obtaining lower quality jobs in recessions, and may have a harder time moving the longer they stay at the firm.[12] Last, models of job assignment or of long-term contracting, for example, can imply that recessions have persistent effects within firms.[13] Thus, even upon finding a job at a better employer, young workers may be affected by adverse initial labor market conditions on the new job.

We consider the case of an economy of infinitely lived, risk-neutral workers. Workers start their careers employed at one of two types of firms. High-productivity firms pay higher wages than low productivity firms. Workers are either of high or low skill, and we assume that high wage firms pay high skill workers more than low skill workers.[14] This is a key assumption that will lead to sorting of high skilled workers to high wage firms. We assume that wages are deterministic within firms and increase with job tenure.[15] Consistent with the low effect of adverse initial conditions on unemployment in our sample, there is no job destruction in this economy and jobs last until the worker quits.[16]

[11] Among others, see Blau and Robins (1990), Bloemen (2005), Wozniak (2006), Neal (1999). Among others, Mortensen (1986), Pissarides (2000), and Shimer (2004) discuss the theoretical implications of differential search intensities.
[12] In addition to differences in workers' search behavior, in the presence of rents or complementarities, firms have incentives to select the most able workers for employment, and to reduce the employment of less able workers. A cyclical process of adjustment in hiring and promotion standards has been often noted (e.g., Reder 1955). Rents can arise due to rigid pay scales as in Hall (1974), or unions, as in Solow and McDonald (1985).
[13] E.g., Prendergast (1999), Gibbons and Waldman, (2004), Harris and Holmstrom (1982), MacLeod and Malcolmson (1993). For empirical papers on within-firm wage mobility, see Baker, Gibbs, and Holmstrom (1994) and Beaudry and DiNardo (1991).
[14] This is a way of introducing the effects of comparative or absolute advantage by skill into our model and it allows us to analyze differences in the effect of initial conditions by skill groups. Also introducing wage differences by skill group at the low productivity firm would not alter our insights.
[15] Adding stochastic increases to wages on the job as function of job tenure would add complexity without affecting our main predictions (see Topel and Ward 1992, Mortensen 1988). Similarly, several key insights of the model also attain in a context of endogenous search among a continuous distribution of job offers (see, e.g., Mortensen 1986).
[16] Note that in the absence of job destruction, the fraction of those working at high productivity firms increases steadily within a cohort; however, due to the presence of age-related search costs and specific skills, our model contains an explicit behavioral mechanism limiting this tendency. Introducing job destruction into our models would imply that low-skilled workers graduating in a tight labor market initially employed at the high-wage firm may be gradually pushed down to the low-wage firms. There are also no endogenous quits into non-employment in the model.

Workers employed in the less productive firm search for a job in the more productive firm. We allow search effort to affect the probability of getting a job at the good firm in a proportional way.[17] Workers choose search intensity optimally given benefits and costs. Thereby, the cost of job search depends on age as workers buy a house, get married to a working spouse, get children, or more generally begin to settle down. The Canadian Census shows that these incident rates rise quickly after graduation. For example, the fraction married rises more than six-fold after graduation until age 30 to reach 68.7%, and reaches 86.3% by age 40. The rate of homeownership nearly doubles between age 25 and 35. Mobility between provinces peaks at age 26 and then declines. Mobility within province peaks at age 27, and then declines steadily after age 30. In general, these numbers corroborate results from the existing literature that mobility of college graduates is high when workers are young and declines with age.

The value functions and the optimal search intensity implied by these assumptions are derived in our longer working paper (Oreopoulos, von Wachter, and Heisz 2008). Taking derivatives of the optimal search intensity with respect to skill, age, and job tenure allows us to obtain the key inputs into our main results concerning the persistence of initial conditions. To derive the main implications of our model for the recovery process, we define a short-term negative labor market shock to be a temporary reduction in the hiring rate of high-wage employers. While a natural assumption in the context of our model, it is also compatible with our empirical evidence. We then analyze how the rate of decay after a temporary negative labor market shock varies with different parameters of the model, and obtain four core implications.

[17] This is a frequent assumption in theoretical (e.g., Pissarides 2000, Chapter 5, Mortensen 1986) and empirical (e.g., Christensen et al. 2005) work. Shimer (2004) provides a critique of the implicit complementarity between search intensity and the probability of successfully finding a job. He proposes a specification implying that workers may reduce their search intensity when the probability of success is high. This alternative formulation would have no bearing on our main results, since the overall job finding probability would still be increasing in search intensity.

Implication 1: "Time Dependent Search." Increases in age or job tenure reduce the rate of decay of a labor market shock. As workers accumulate specific human capital in the low wage firm, their benefits from search decline and they reduce their search effort. In the process, the rate of catch-up in wages due to job search declines.[18] A long literature argues that it is highly probable that workers accumulate at least some industry, occupation, or firm specific skills. Our model shows that this can lead to increases in the persistence of temporary labor market conditions. Increases in the cost of search with age as workers settle into family and working lives has a parallel effect – while search intensity is high initially, it drops off with time in the labor market.[19]

Implication 2: "Differences by Skill Group." High-skill workers catch-up faster from bad initial labor market conditions through a higher rate of mobility to the high-paying firm. This is a direct implication of our result that search intensity increases in skill levels. Another implication from our model is that increases in search costs with age have a larger negative effect on search intensity (and thus on the rate of decay) for high skilled workers. That is, if aging plays a role, the difference in search intensity between high and low skilled workers should be strong initially but decline as workers age.

Implication 3: "Catch-Up On-the-Job." Once a worker finds a job at a high-wage firm, given a concave tenure-wage profile, her earnings will continuously revert to that of similar workers already in the firm as she deterministically accumulates firm specific skills. Given typical estimates of the non-linearity of the wage-tenure profile, this process is likely to be strongest for the first few years on the job, when returns to tenure are thought to be most relevant. Note that influential models have argued that external labor market conditions affect workers' wages even on the job

[18] None of these results hinge on our assumptions of two firms and hold with continuous wage-offer distributions.
[19] Note that with a fixed intensity of search, the rate of decay would be constant. In this case, a low offer arrival rates can lead to persistent effects of shocks. Although few direct estimates of the 'rate of contact' between workers and firms exist, typical estimates in the literature suggest that convergence of mean wages would occur within 5 to 7 years after entry into the labor market (e.g., Cristensen et al. 2005). However, the rate of decay does not appear constant in our data. Moreover, if we simulate our model, at reasonable values a constant intensity of search cannot explain both the observed rate of catch-up as well as average turnover rate and experience-earnings profiles observed in the data.

because of long-term contracting or job assignment.[20] In this case, workers will be affected by initial labor market conditions even after they found a better employer (e.g., Beaudry and DiNardo 1991, Baker, Gibbs, and Holmstrom 1994).

Implication 4: "Zero Search." In our model, over time an increasing fraction of workers stop searching. If this occurs, there is no further catch-up. Given our assumptions, if search drops to zero it both occurs earlier and is more prevalent for low skilled workers. Thus, as further discussed in our longer working paper (Oreopoulos, von Wachter, and Heisz 2008), it may be that catch-up is incomplete for workers at the lower end of the skill spectrum.

We will return to these four implications in the empirical section. The key insight behind them is that the effects of initial unemployment rates lead to permanent earnings differences only if coupled with search frictions that intensify with age or job tenure. Without a distinction between 'newly minted,' flexible workers and workers settling down, nothing would prevent workers to keep seeking better jobs once they have entered the labor market. Another important insight is that these adjustment processes can differ by skill level of college graduates. Under realistic assumptions on absolute or comparative advantage, low skilled graduates are more likely to be affected by time-increasing mobility costs and to be persistently down-ranked to lower paying firms. As a result, low-skilled graduates are more likely to experience lasting effects from initial labor market conditions.

Clearly, frictions in the labor market may be of a different nature than search frictions. For example, if employers learn at differential speed about the unknown ability of high and low skilled workers (Gibbon, Katz, Lemieux, Parent 2005) while these accumulate firm or task specific human capital (Gibbons and Waldman 2006), we are likely to obtain similar observable implications. We will not provide a test between alternative approaches, though we suggest a few statistics favoring a

[20] See Harris and Holmstrom (1982) for models of implicit insurance contracts; see Gibbons and Waldman (2004) for model of variable job assignment; similarly, models of job search, wage-contracting, and renegotiation could potentially give rise to persistence of labor market conditions on the job (e.g., Cahuc, Postel-Vinay, and Robin 2006).

search interpretation of our findings at the end of the empirical section. The point is that any model explaining the recovery process we describe has to make predictions about a gradual and systematic reallocation of workers across firms that differs by skill group. In addition, to explain our finding of substantial persistence with possibly permanent effects at least some frictions have to increase with age, experience, or job tenure.

The mechanisms discussed also have important implications for macroeconomic modeling of the labor market. Several recent papers explore on-the-job search and heterogeneity among workers and firms in a general equilibrium setting to establish the degree of assortative matching (Lentz 2007, Moscarini and Vella 2008) and the implications for business cycle dynamics (Krause and Lubik 2006). Our model provides a mechanism by which the sorting and adjustment processes after a temporary shock can take a long time, both due to time-dependent mobility costs and their interaction with worker skills. This also implies that some workers are less responsive to firm wage differentials than others, weakening one channel leading towards assortative matching.

Our focus on cyclical downgrading provides an explicit mechanism by which young workers' wages are most affected by shocks. It also predicts changes in the decomposition of jobs between high and low wage firms that are relevant in interpreting observed fluctuation in entry wages. As stated above, this finding is complementary to adjustment in wages within firms focused on in other prominent analyses of the persistent effect of labor market shocks.

Finally, our model also provides an explanation why temporary labor market shocks can lead to lasting increases in earnings inequality and to larger costs of recessions for low-skilled workers. To further explore this aspect, we have conducted a simulation exercise, with two salient results (see Sensitivity Appendix V in Oreopoulos, von Wachter, and Heisz 2008). First, the larger the initial shock the more likely the age-related slow-down in search occurs before the initial effect has dissipated, especially for lower-skilled college graduates. Thus, larger recessions exhibit more lasting

increases in inequality and mismatch, something borne out in our empirical analysis. Second, the persistence due to age-related costs increases with the dispersion of firm quality. Thus, the higher the pre-existing inequality in the labor market, the bigger is the persistent rise in inequality due to initial shocks predicted by the model.

3. Empirical Strategy and Matched Data

Our data allow us to observe almost the universe of male college graduates in Canada graduating from 1976 to 1995 from the end of their first college degree for ten years into their careers. To measure the long-term effects on earnings of starting to work in a recession, our main specification exploits cyclical variation in unemployment rates for young workers at the regional level. Since our main independent variable – the rate of unemployment – varies across provinces and across cohorts, we collapse the individual level data at the level of graduation cohort (c), initial region of residence (r), and calendar year (t) and work only with the cell means $\bar{y}_{crt}$ of the log of annual earnings and other variables (weighted by the corresponding cell sizes). The cell level model on which most of the estimates in the paper are based on is

$$\bar{y}_{crt} = \alpha + \beta_e UR_{cr0} + \phi_t + \theta_r + \gamma_e + \chi_c + u_{crt} \quad (1)$$

where θ_r, χ_c, γ_e, and ϕ_t represent unrestricted fixed effects for first region of residence, year of graduation, year of potential labor market experience (e), and calendar year. The unemployment rate is measured at the time of graduation and the region of first residence (UR_{cr0}). Given the presence of experience, region, and cohort effects the main coefficients of interest β_e on the initial unemployment rates measure *changes* in experience profiles in earnings and other outcomes resulting

from province-cohort-specific variation in unemployment rates.[21] To account for group specific error-components, we cluster standard errors at the cohort-region level.

We interpret the variation in UR_{cr0} to arise from changes in aggregate labor demand that are uncorrelated with characteristics of different graduation cohorts. To make sure we pick up mainly effects occurring due to demand conditions and avoid influences from cohort-specific changes in labor supply of young workers, in our sensitivity analysis we have also used the unemployment rate for all workers as measure of initial labor market shock.[22] Remaining differences between graduation cohorts at the national level are taken out by cohort fixed effects. Below and in the Supplementary Appendix of Oreopoulos, von Wachter, and Heisz (2008) we address other potential biases (and many robustness checks, such as different specification, sample, or cohort restrictions). In particular, we conduct multiple specification and robustness checks to show that our results are unaffected by selective changes in the timing of college graduation or by selective labor force participation.

Dynamic Effects. Since the state of regional labor markets continues to influence workers' earnings even after labor market entry (e.g., Blanchflower and Oswald 1994), our basic estimate of the effect of the first unemployment rate exposure captures the average change in earnings from graduating in a recession given the *regular evolution of the regional unemployment rate faced afterwards*. In other words, it estimates the dynamic effect of the first unemployment rate plus the weighted sum

[21] As it is well-known, cohort, potential experience, and year effects cannot be identified separately without an additional restriction on cohort effects is needed. Since we are mainly interested in experience effects and in their change over the business cycle, we simply drop one additional cohort effect from the regression. We could have chosen to restrict cohort effects to sum to zero (as suggested by Deaton 1997). This alternative does not alter our estimates of the experience profile. We also have assessed the linearity assumption implicit in equation (1) by plotting and regressing the residuals of earnings and unemployment rates (from first stage regressions on province, year, and cohort dummies) by experience years. The results (shown in Appendix Figure C2) suggest that the linearity assumption is highly plausible.

[22] To assess the role of participation changes, we also replicated our results using the employment-population-ratio for 15 to 24 year olds. It appears that year-to-year variations in cyclical labor market conditions that identify our estimates in our data move at a higher frequency than age-specific population, participation, or enrollment trends. This is confirmed by Beaudry et al. (2000) show that despite increases in college enrollment rates in Canada since the 1980s the correlation between unemployment rates for young and old workers is high and it has remained stable. Although education-specific unemployment rates are too noisy for most provinces, the unemployment rate for young college educated men for the larger states, such as Ontario or Quebec, are closely correlated with the youth unemployment rate and the average unemployment rate. Similarly, changes in female labor participation are unlikely to be correlated with province-specific changes in unemployment rates.

of the effect of unemployment rates a worker faces in his career. To isolate the effect of labor market conditions at entry net of subsequent effects on earnings from exposure to a possibly prolonged recession or expansion, we have also estimated a series of models that control for the entire history of regional unemployment rates that workers experience throughout their career. This helps to distinguish the role of labor market conditions at entry (at the time when all cohorts search for work) from the effect of labor market conditions when working or entering a new firm in mid-career (as stressed for example by Beaudry and DiNardo 1991). This also allows us to assess whether the effects of aggregate unemployment rates at time of entry differ from that experienced by more mature workers.

In Section 4 we begin exploring this issue by examining whether the effect of the early unemployment rate remains stable even when we include the cohort's current unemployment rate, or when we control for current region-year fixed effects. To do so, we work with a version of the data that is collapsed at the level of graduation cohort, initial region of residence, calendar year, and region of *current* residence. We then allow for persistent effects of the aggregate unemployment rate a worker was exposed to at each experience year (e) in the relevant region (r_e), denoted by $UR_{r_e e}$. Denote the effect on earnings in experience year e from the unemployment rate at experience year 0 (1,2,3,4,…) by $\beta_{e,0}$ $(\beta_{e,1}, \beta_{e,2}, \beta_{e,3}, ...)$. Dropping the region subscripts on the unemployment rates for simplicity, the complete dynamic model we finally estimate can be written succinctly as

$$\log \overline{w}_{crt} = \phi_t + \theta_r + \chi_c + \gamma_e + \beta_{e,0}(UR_{cr0} + UR_{r_1 1})/2 + \beta_{e,1}(UR_{r_2 2} + UR_{r_3 3})/2 + ... + u_{crt} \qquad (2)$$

where we impose the restriction $\beta_{e,s} = 0 \; \forall \; s < e$. The full dynamic regression estimates the effect of the transitory component of each aggregate unemployment condition, net of its correlation with other unemployment rates affecting the worker in adjacent experience years. Due to high inter-temporal correlation of aggregate unemployment rates, it is difficult to estimate a fully unrestricted

model. Thus, as shown in equation (2), in our preferred specification we use a restricted model in which we constrain the effects of unemployment to be the same in pairwise groups of experience years. For more detail see Sensitivity Appendix II in Oreopoulos, von Wachter, and Heisz (2008).

Canadian Administrative Data Our results are based on a unique match between three large administrative data sets collected and compiled within Statistics Canada that is described in detail in the Data Appendix. The data combines administrative information on about 70% of Canadian college students and college graduates from 1976 to 1995 with longitudinal individual income tax records and firms' payroll information covering the years from 1982 to 1999.[23] The data contains exceptional information about individual students' course of study (such as type of degree, major, date of graduation), with detailed career information (e.g., annual earnings, province of residence, receipt of unemployment benefits) and information on employers. Exploiting the panel nature of our firm data, we calculate average firm size, average median wage, and total payroll at the firm level, with year fixed effects taken out. All firm characteristics in our empirical analysis refer to permanent attributes so that they remain unchanged across the worker panel (i.e., an individual's firm characteristics can change only if she moves employers).[24]

To generate a uniform sample with a common definition of labor market entry, we focus on the effect of recessions at the end of the *first* exit from college and exclude workers obtaining higher degrees from our sample.[25] As shown in Table A1 of the Supplementary Appendix in Oreopoulos, von Wachter, and Heisz (2008; hereafter called the Supplementary Appendix), even within this relatively homogeneous sample there is a high rate of drop out and high variance in college duration.

[23] The word 'college' is somewhat a misnomer in Canada because it is used usually to refer to one or two year community-level post-secondary institutions rather than degree-granting universities. In keeping with the terminology most often used, we shall refer to Canadian universities as colleges.
[24] The information is at the firm level; for simplicity, we use the terms firm, company, and employer interchangeably.
[25] Since we find early recessions do not affect the probability of obtaining a graduate degree, this does not affect our results. We have experimented with other definitions of the relevant date of labor market entry (such as last degree or last degree of continuous education), with little effect on the results. In the sensitivity analysis, we also show results using a sample that includes workers obtaining a post-graduate degree.

Despite the use of administrative data, there may still be some measurement error in actual graduation in our data. Thus, our main sample excludes early college dropouts to focus on a more homogenous group of workers with better measured graduation date. To do so, we calculate the difference (D) between actual and predicted graduation year (based on length of program in first or second year), and keep only workers with non-negative differences. The right columns of Appendix Table A1 show characteristics for that sample. Among the sample of workers on or above grade 89% graduate, and average duration of college is about 4 years.[26]

To assign the unemployment rate at the time of graduation, we have to choose a relevant province of residence. We settled for the province of first residence as the relevant labor market for young college graduates.[27] We impose some additional basic sample restrictions and limit the degree of missing observations on earnings. In particular, we drop workers who permanently stop filing taxes with the purpose of removing individuals who stopped being recorded annually because they left the country, obtained a new personal identification number, entered the underground economy, or their file was simply miscoded along the way. None of these restrictions affect our results.

Figure A1 in the Supplementary Appendix shows that the general experience profiles in annual earnings and job mobility for our baseline Canadian data are similar to those for the United States. In addition, we document a strong experience gradient in average size and average wages paid by employers – from year one to ten, average firm size and average firm wage increase by 34% and 24%, respectively. Male Canadian graduates tend to move to firms that on average pay more and are larger the longer they progress through the labor market.[28]

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[26] By restricting our main discussion to graduates, we are also more likely to pick up the effect of early unemployment rather than the drop out decision. Our data suggests undergraduates are unlikely to finish early or drop out because of labor market conditions. As shown below, the results hardly differ when replicated with the full sample.

[27] The alternative, province of college, gives similar results for both our basic estimates as well as our instrumental variable results.

[28] The first years of the careers of young male Canadian college graduates are characterized by steep wage growth (also documented for the U.S. by Murphy and Welch 1990), frequent job changes (Topel and Ward 1992), initially unstable labor force attachment (Ryan 2001, Gardecki and Neumark 1998), some interregional mobility (Wozniak 2006), and

Canada experienced two major recessions in the early 1980s and 1990s that increased young workers' unemployment rates for certain years by more than seven percentage points. We use this variation for our national specification.[29] Figure 1 shows the time series of annual unemployment rates at the national and provincial level. The figure displays a high degree of regional heterogeneity. During this period, an increase of unemployment rates of 5 percentage points (or about two standard deviations) describes a typical large recession.[30]

4. The Persistent Effect of Initial Labor Market Conditions on Earnings

The evolution of annual earnings in our baseline sample displays clear differences in initial level and ensuing growth of earnings by year of college graduation. This is shown in Figure 2A, which plots mean earnings by experience and year of graduation at the national level together with their entry wage at experience one (their first full year of work) and the average wage for 'mature' workers (workers with 5 to 10 years of experience). One can clearly see differences in starting wages across graduation cohorts leading to differences in average cohort earnings. The figure also shows a clear pattern of convergence. Initial differences in starting conditions appear to fade over time. Cohort effects appear to have a time-varying component, or, as noted by Beaudry and Green (2001), experience profiles vary across cohorts.

There exists a strong correlation between starting wages and initial unemployment rate conditions, which persists into higher experience years and slowly fades over time. This is shown in Figure 2B, which graphs national unemployment rates for young workers and wages at different

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frequent industry changes (McCall 1990, Neal 1995, Parent 2000). Panel C of Appendix Figure A1 and Appendix Table A5 also suggest that average firm size tends to grow with labor market experience for college graduates in the U.S., too.

[29] The picture shows unemployment rates for 15 to 24 year olds. Using unemployment rates defined for workers age 20 to 24 or for college graduates only does not substantially alter the pattern of unemployment over time or across regions, nor does it affect our results.

[30] If we regress regional unemployment rates on year and region fixed effects, the R^2 is 0.9, which is a common finding in the U.S. and other countries. The remaining variation in regional unemployment rate allows us to obtain precise estimates of the effect of province recession shocks and to include further interaction terms, such as region-specific year effects. We should stress that our results are robust for excluding large Canadian provinces such as Ontario or Quebec.

years of experience by graduation cohort (both expressed as deviations from their means across cohorts). The correlations in the figure strongly suggest that part of the initial but fading earnings differences in Figure 2A are driven by variation in initial labor market conditions.

The correlations at the national level shown in Figure 2B are also used to produce results in columns 1-2 and columns 4-5 of Table 1. The table shows the long-term effects of national unemployment rates on log real earnings, controlling for year and experience effects and linear or quadratic cohort trends. Column (1) and (4) show the shift in experience profiles due to an unemployment shock in experience year zero including a linear cohort trend for all workers with some college and those in the graduate sample ($D \geq 0$), respectively. Standard errors are clustered at the level of graduation cohort to allow for group level error terms. The results suggest a strong initial effect that persists but fades after about five years in the labor market.[31]

4.1 Main Regional Models

Our main results are drawn from regional models that include cohort effects as well as effects for initial province of residence as described in Section 3. The shifts in experience profiles due to an initial provincial unemployment shock are shown in Column 3 of Table 1 for all workers with at least some college and Column 6 for our baseline graduate sample. The initial effects are similar in size to those from the national model, but starting at experience year four the regional estimates remain more persistent, and converge to zero only after 10 experience years. Although estimates for graduates are slightly more precise (Column 6), there is little difference in the point estimates for graduates and all workers with some college (Column 3). This is apparent in Figure 3, Panel A, that plots the main coefficient estimates against potential experience. It does not appear that those with a college degree fare better than the full sample.

[31] Note that the effects in Table 1 exhibit a pattern of over-shooting in experience year 10 which is significant with quadratic cohort trends. While this has potentially interesting behavioral implications, it is not confirmed in the regional specifications, and may thus be due to the particular cyclical pattern of national unemployment rates.

The similarity between the national and regional results suggests we can exclude a strong correlation of initial unemployment rates at the national level with changing unobserved cohort characteristics. Below, we show that higher persistence in our regional results is not driven by more persistent unemployment shocks. National estimates may be more affected by measurement error problems due to mis-assignment of the relevant initial labor market shock. Inter-regional mobility is less common in Canada than in the U.S. Thus, the relevant labor market shock is at the regional level, an effect only partially absorbed by the national unemployment rate. Low regional mobility also may explain why results from the national model are not larger than the regional model.

Using the results from our main regional model, with an increase in unemployment of 5 percentage points – roughly a shift from boom to recession in our sample – annual wages are about 9 percent lower in the first year after college, still 4 percent lower after 5 years out, and about 2 percent lower 9 years out. Overall, we view the regional and national results as telling a consistent story. Graduating during a recession leads to significantly lower earnings at the beginning of an individual's labor market, but the gap converges to zero within ten years after graduation. These results are consistent with estimates from the literature on the "wage curve" in the U.S. and Canada (Blanchflower and Oswald 1994). They are also consistent with estimates by Bloom and Freeman (1989) who find that initial effects due to differences in cohort sizes fade after ten years. Similarly, Devereux (2003) finds among a sample of workers from all ages that half of a wage-shock, instrumented by local unemployment conditions, is still present after about five years. Kahn (2006) finds somewhat more persistent losses in earnings than ours, partly due to her focus on graduates entering the strong recession of the early 1980s.

Dynamic Effects. The large number of cohorts at our disposition allows us to take the existing literature a step further by distinguishing the effect of the very first unemployment rate when graduates are beginning their fulltime job search from the role of persistent conditions in the labor

market affecting them in later years. As discussed in Section 3, due to the presence of continuing exposure to adverse labor market conditions, the estimates in Column 1 represent a summary of the earnings losses the average worker can expect due to entry in a depressed labor market. To isolate the extent to which our baseline results occur primarily from the very first labor market conditions we include in our main model controls for the confounding effects of later regional unemployment rates correlated with initial labor market conditions.

We find that the majority of the effect is due to the very first unemployment 'shock' alone. This is shown in the remaining columns of Table 1. Column 2 shows the results after adding an interaction between experience and the regional unemployment rate prevalent in the relevant year and current province of residence, as well as fixed effects for current province of residence.[32] As predicted, the initial unemployment rate effect is reduced by persistence of labor market conditions, but the difference is small. As shown in the remaining columns of Table 1, the basic results are also not affected if we allow for persistent effects of other labor market conditions as discussed in Section 3. A part of the effect of initial unemployment rates is due to persistent effects of initial and continuing regional labor market conditions. This is consistent with findings of Beaudry and DiNardo (1991), McDonald and Worswick (1999), and Grant (2003) suggesting that labor market conditions may have persistent effects even for more experienced workers on the job. However, an important part of the effect of initial unemployment rates we find is driven by the initial shock young workers encounter in the labor market after graduation.

Results from the dynamic model also imply that local unemployment rates have the strongest effect on labor market entrants. To put the magnitude of the effect of initial labor market conditions into further perspective, column 7 of Table 2 shows the dynamic effect of a shock occurring at experience years two to three from the grouped model with full history controls. Panel A of Figure 4

[32] Note that since we only observe full history of province of residence for cohorts graduating 1982 onward, Table 1 uses only these cohorts

displays the corresponding coefficient estimates that are comparable to our main result in Panel A of Figure 3. To make the dynamic pattern comparable with that of the first group, the table shows coefficients relative to the time of the shock (i.e., experience zero now relates to the moment of the shock). The effect of a shock experienced at experience years 2-3 is much smaller than the effect of a shock at entry (0-1) for all experience years. Our period is too short to observe complete reversion but the point estimates are insignificant after 4-6 years. Inspection of the data leads us to believe that the dynamic effects for shocks at later experience years are small.[33] The result is notable in suggesting the greater relative importance that economic conditions have at the beginning of one's labor market career than after finding an initial job.

Sensitivity Analysis. Our overall results hold up well against a variety of sensitivity checks. Figure 4 (Panel B) addresses the question of selective timing of college graduation, which is discussed in detail in Sensitivity Appendix I of our Supplementary Appendix (Oreopoulos et al. 2008). Since most of our measures indicate insignificant effects of unemployment rates on college duration, selective timing of graduation does not appear to be an important phenomenon in our data. Not surprisingly, when we use the unemployment rate in the predicted year of graduation (based on starting year of college and typical degree-duration) as an instrument our estimates confirm the main ordinary least squares results. Although all our results carry over with the instrumental variable estimate, in what follows we report the more efficient ordinary least squares estimates.

The remaining panels of Figure 4 show two further sensitivity checks. First, Panel C shows that there are only small (and insignificant) differences in the effects when we only include workers

[33] Our sample of cohorts is small at later experience years, such that the cohort variation shown in Supplementary Appendix Figure C2 limits our ability to estimate the average dynamic effects of shocks at later experience years. "To further explore the difference between labor market entrants and workers already in the labor market, we also estimated the effects of unemployment rate conditions for workers by experience level on job mobility, regional mobility, firm quality, and unemployment (see Oreopoulos, von Wachter, and Heisz 2006, Table 6). The results confirm the exceptional effect of economic conditions at time of entry compared to workers already in the labor market.

always present with positive earnings. Panel D shows that although there are some expected differences in the effects of initial labor market conditions across cohorts (e.g., graduates entering in the strong recession of the early 1980s suffer slightly larger and more persistent effects), our results are quite similar for different groups of labor market entrants.[34]

We have also tried various other sample and specification choices, none of which substantially affected our results. Including college students who enter the labor market after a graduate degree has no effects on our results (Supplementary Appendix Figure C3, Panel B) suggesting workers do not selectively enter advanced degree programs due to unemployment. We also tried various ways of excluding workers with repeatedly missing wages, and find little effect on our results.[35] We have re-estimated all of our results using the province of college as the region for the relevant initial shock with no basic change in our results. [36] Part of the reason why regional results show more persistent effects of initial labor market conditions on wages might be that workers are 'stuck' in persistently slack regional labor markets. To address this possibility, we also included current province by current year fixed effects (shown in Supplementary Appendix Figure C1, Panel D), which barely show any differences from the main results. This is also an additional indicator that mobility towards provinces with higher wages is not a strong source of catch-up in our sample. [37]

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[34] Coefficient estimates and standard errors for Panels B-D of Figure 4 (and many other sensitivity checks) are shown in the Supplementary Appendix in Oreopoulos et al. (2008).

[35] Supplementary Appendix Figure C3, Panel A shows the results with those who permanently stop filing included.

[36] As shown in Supplementary Appendix Figure C1, Panel C the results are marginally weaker initially but as persistent. This is likely due to measurement error, since in this case the shock in the province of residence at experience year one has very strong effects. If we group experience years zero and one together, the effects are very similar. While there may be a concern about selective mobility based on the unemployment shock in the province of college, we feel the effect of measurement error due to the mis-assignment of initial province is larger. This is supported by relatively low incidence and gains from regional mobility (Oreopoulos et al. 2008, Sensitivity Appendix III).

[37] The results in Table 1 are also robust to a variety of additional sensitivity checks. First, our results do not seem to be driven by any particular measure of labor market conditions. To counter the concern that the unemployment rate for young workers may be affected by cohort characteristics, we replicated our results with the unemployment rate for all workers (Supplementary Appendix Figure C1, Panel A). We also find similar results from using the employment population rates for workers age 15 to 25 (or men only). Second, we compare the effect of average unemployment rates in experience year zero, 0 to 1, 0 to 2, and 0 to 3 (Supplementary Appendix Figure C1, Panel B). While high average unemployment in the early years tends to make the effects more persistent, it does not appear that the effects captured

Effects on Employment. If unemployment rates affect participation, part of the recovery process in earnings we find may be due to sample selection. Similarly, losses in employment could depress wages by reducing accumulation of labor market experience. Table 3 replicates the same results as in Table 1 using as outcome variables the fraction of workers claiming unemployment insurance benefits, the fraction of workers filing taxes with zero earnings, and the fraction of workers not filing taxes in a given year. The point estimates for our preferred specification are displayed in Figure 3, Panel D. The table and figure show an initially significant increase in fraction zero earnings and the fraction of unemployment insurance (UI) claimants that fades within three experience years. The effects are numerically small and become smaller and insignificant when we control for persistence of local unemployment rates (not shown). In other words, a temporary unemployment rate shock has no persistent effects on employment or participation of male college graduates.[38]

Since our sample does not contain information on time worked, we also replicated our results with the Canadian Census (see Sensitivity Appendix IV in Oreopoulos et al. 2008). Decomposing the effect of early unemployment rates on annual earnings into the effect on weeks worked and on weekly wages we find that the effect on weeks worked is short lived. The majority of the persistent effects we find is driven by a reduction in weekly earnings. Thus, neither reduction in the

in the main models are driven by periods of extended unemployment. As confirmed by the results Table 2, the driving force behind our main results is the shock in the very first years after entry into the labor market.

[38] The effects are very similar for the sample of all workers (see Supplementary Appendix Table D1 and Figure D1). Overall, the loss in experience due to labor market entry in recessions is not very large for the average college student. These results are echoed by Kahn (2006), who finds small initial effects on hours, employment, and weeks worked for male college graduates in the U.S. after the 1982 recession. Table 3 also displays a pattern of 'overshooting' after experience year 7 for some measures; this would imply that workers who had initially higher instability become more stable later relative to their more lucky counterparts. One could think of various hypothetical explanations of such a phenomenon. However, the estimates are numerically very small and never above 0.2 percentage points.

accumulation of experience nor selective entry or exit from the earnings sample of workers of different abilities affect the main pattern of reversion we see.[39]

Effects on Regional Mobility. To explore whether entering the job market in recessions is associated with higher mobility across provinces, the last columns of Table 3 shows the effects of the unemployment rate at college exit on subsequent provincial mobility. The national unemployment rate is uncorrelated with moving to other provinces for both the full sample and graduate sample in Columns 5 to 6 respectively. For the regression models identifying regional economic shocks, however, we do observe initially increased provincial mobility for cohorts exposed to higher unemployment conditions at time of college exit. For the graduate sample, a 5 percentage point difference in the unemployment rate at entry is associated with about a .75 percentage point difference in the provincial mobility rate in the first two years. This rate is about half that for firm mobility, and drops quickly after the third year.[40] The small effect of unemployment at college exit on provincial mobility suggests that most of the pattern of catch-up in wages over time for individuals that began the labor market in a recession occurs within provinces. We also replicated our estimates separately for workers who never switch region and for movers. Those never moving, about three quarters of our sample, behave very similar as the full sample (see Appendix Figure D3). It appears that regional mobility after an adverse initial shock is not as important in Canada as in the U.S. (Wozniak 2006).

[39] Only workers in the lowest skill group have significantly *lower* propensity to become unemployed (see Figure 5, Panel D). Thus, for these workers increases in labor supply and experience accumulation may help to explain part of the process of catch-up.

[40] After the fifth year out of college, the unemployment rate at time of exit is negatively correlated with provincial mobility. Those induced to move to another province from entering the local labor market during high unemployment appear to be less likely to move thereafter. As discussed in the appendix, the benefit from moving provinces appears also to be considerably smaller and shorter lived than that of moving firms or industries.

4.2 Larger Effects for Entrants at the Bottom of the Skill and Earnings Distribution

In this section we use our data to show that college graduates with lower predicted wages, based on college background, are more adversely affected by higher unemployment rate conditions. We first use a linear regression model to predict log earnings based on college attended, program of graduation, and years of study, conditional on province of study and cohort year.[41] Since individuals are likely to be sorted into colleges, these estimates will capture both differences in innate ability as well as differences in college quality.[42] We then group individuals into quintiles based on these predicted wages.

Our results imply that those college graduates with the lowest predicted annual earnings are most affected by higher initial unemployment conditions and experience permanent earnings losses. Figure 5 shows the same coefficients for the effects of the initial unemployment rate on log earnings, job mobility, individual's firm's log median earnings, and employment as in the baseline model, but for regression models estimated separately for the first, third, and fifth predicted wage quintiles (this figure corresponds to Figure 3, Panel A for the full sample). Table 4 summarizes the key structure of losses by quintile and compares them to results for the full sample. For exposition, the table displays three parameter estimates for the initial dip, first recovery, and final fade of earnings losses in an approach mirroring that of Jacobson, Lalonde, and Sullivan (1993, Table 2). As apparent from the table and figure, those with the lowest predicted annual earnings are most affected by higher initial unemployment conditions and experience permanent earnings losses.

[41] A similar approach to assess college quality is followed by Betts, Ferrall, and Finnie (forthcoming), who use the same college data and information on wages after graduation as we do. After analyzing majors and colleges separately, in our final specification we interact major and college dummies. Differences by major or college in itself are as expected (e.g., humanities graduates do worst, then come social sciences, economists and engineers are in the middle range, see Supplementary Appendix Figure G1), but too broad to yield a prediction of individual earnings capacity. This exercise is done for the graduate sample only, since it is conceptually harder to assign college quality for drop-outs.

[42] This is discussed extensively in Black and Smith (2004), Black, Kermit, and Smith (2005), or Dale and Krueger (2002). An advantage of our data relative to the literature on college quality in the U.S. is that we have access to earnings histories. Using similar data to ours, Betts et al. (forthcoming) find that the effects of observable measures of college quality on earnings are small.

Earnings one year into the labor market are about 15 percent lower from a 5 percentage point increase in the initial unemployment rate, and, in this case, remain about 7.5 percent lower even after 10 years. The top quintile's earnings are on average about 7.5 percent lower in the first year after a five point increase in unemployment rates, but the gap falls to less than 2 percent after only 4 years.

Overall Costs of Recessions. The longitudinal data allows us to obtain a direct measure of the cost of recessions that is a useful complement to measures in the literature based on the standard deviations of earnings. Figure 6 graphs the percentage decline in the present discounted value of annual earnings by deciles of the predicted earnings distribution. We discount earnings at an interest rate of five percent and only include the first ten years of earnings in our calculation. This assumes that the difference in annual earnings has decayed after ten years. We thus understate the loss for less advantaged workers whose earnings have not fully recovered by that time. Given the short time horizon we use, we view our calculations merely as indicative of the full life-time loss in earnings.

Figure 6 has two key messages. First, there is an important gradient in the cost of recessions in predicted earnings – those individuals with lower earnings capacity face four to five times the cost of recessions than the most advantaged workers. The least advantaged appear to bear most of the costs of recessions. Second, the losses from starting to work in a recession as measured by actual changes in the present discounted values of earnings or utility losses are high even for the more able workers. In particular, for the median worker in our sample they are much higher than what is typically found in the literature.[43] Given the short time horizon we use, it should be borne in mind that we are likely

[43] The median worker in our sample loses about 22,000 Canadian Dollars (in 2005 prices), about 6% of the present discounted value of earnings in the first ten years in the labor market. This compares to average annual earnings in the first experience year for the median worker of about 25,000 Canadian Dollars (in 2005 prices). In Oreopoulos et al. (2006), we also show the fraction increase in annual earnings a worker would require to be indifferent between a noisy earnings path and an alternative stable path using a constant relative risk aversion utility function. This corresponds conceptually to the original Lucas measure. The results convey the same message as Figure 6. We find that an uncertain stream of earnings had to be increased by about 7% for the median worker in our sample to be of equal utility as a comparable certain path. The typical estimate in the literature is below 1%. Some studies, such as Storesletten, Telmer, and Yaron (2001) or Krusel and Smith (1999) find effects comparable to ours for households with no wealth.

to *understate* the life-time loss for less advantaged workers whose earnings exhibit no signs of further recovery after ten years.

5. Predicted and Actual Mechanisms of Recovery

The foregoing results draw a complex picture of the effect of initial labor market conditions for college graduates in which very short-lived adverse labor market conditions have long-term effects, labor market entrants are much more affected than workers with just a few years of experience, and the size and persistence of the effect varies dramatically across the skill distribution. To understand the potential mechanisms behind these findings, in Section 2 we described a search model with comparative advantage and time-dependent search costs that could explain these findings. In this section we contrast predictions of the model for the channels of recovery after an adverse initial labor market shock with the actually observed patterns of job mobility and firm quality in our data.

The predictions from our model outlined in Section 2 hold up well when compared with our empirical results. In our stylized model, an initial shock consists of a temporary shift in the number of job openings at high productivity firms. Besides being a convenient modeling decision, this also turns out to capture important features of our data. Figure 3, Panel C, and Table 5 show that graduates in our data entering the labor market during times of high unemployment are more likely begin work at lower quality employers.[45]

[45] High wage sectors have more pro-cyclical employment (e.g., Bils and McLaughlin 2001), and we find a corresponding pattern for firms. Typical high wage and pro-cyclical industries are durable goods manufacturing and construction. Typical low wage, less pro-cyclical sectors are retail trade or personal services. At the firm level, the patterns may arise due to changes in demand for products of different quality, differences in the costs of job creation, or because of changes in product market competition.

Figure 3 also shows that after an initial downranking, firm quality improves quickly in the first 3-5 years in the labor market when job mobility is higher than average.[46] As the effect of initial unemployment on job mobility declines (Panel B of Figure 3), improvements in firm quality visibly slow down (Panel C). Reversion in firm quality continues, but at a reduced rate. These results confirm that in the presence of age or tenure related search costs, the catch-up process appears to occur in two phases (*Implication 1*). In the first phase of catch-up, workers experience rapid improvements in the quality of their employers through job mobility. This phase lasts four to five years. Improvement in employer quality is largely absent in the second phase, where reversion appears to occur within firm type (*Implication 3*).[47]

Also consistent with our model, the results in Figure 5 indicate important differences in catch-up for workers with different skill levels (*Implication 2*). High skilled workers experience large temporary increases in rates of job mobility and completely close the gap in employer quality within four years (Figure 5). Medium skilled workers experience above-average job mobility and increases in firm quality within the first four years, too, but do not fully close the gap.[50] College graduates at

[46] As found in the U.S. by Topel and Ward (1992), we find that job mobility in Canada is on average very productive in the first ten years of workers' careers. The positive association job changes and wage changes strengthens for workers graduating in a recession; if we calibrate the magnitude of the effects of job change or improvements in firm quality, we find that 40-50% percent of earnings losses could be explained by productive job mobility. This is discussed in detail in an earlier working paper version (Oreopoulos et al. 2006, Sections 4.3 and 4.4, Table 5). Table 5 also reports effects on the propensity of change among 2-digit industry classes. In addition to job shopping workers also actively search for a match with the 'right' industry (e.g., Neal 1995 or McCall 1990). Note that we find a similar pattern of cyclical downgrading towards low-wage industries as we find for low-wage firms (see Supplementary Appendix Table E3 in Oreopoulos et al. 2008), but that downgrading also occurs within industries.

[47] Note that all of these findings also hold when we use unemployment rate fluctuations at the national level (see Supplementary Appendix Table D4 for job mobility and Table E2 for firm quality).

[50] A few qualifications of this interpretation are in order. First, it appears that for middle-skilled workers catch-up occurs partly through further job changes within given firm types. As discussed in the section 3, it is straightforward to add such continuing job mobility within 'sectors' to our model but leave this to future research. Second, we will see below that catch-up in the second phase could be partly driven by the persistent effect of external labor market conditions. As discussed, allowing for such an effect would be a useful extension of our model that is left for future research.

the bottom of the skill distribution experience little increases in job mobility and improvement in firm quality in the years after graduation, but instead are permanently down graded to lower-paying employers and sectors (*Implication 4*). For these workers, catch-up within firms is particularly important.

What's behind the catch-up process? The foregoing suggests that initial down-ranking to low-wage employers and gradual improvements in firm quality play a key role in explaining persistent earnings effects in our data. To assess the magnitude of alternative channels underlying the catch-up process, we added controls for a cohort's average firm quality and current and lagged regional unemployment rates in a regression of average log annual wages to our cell-level regression. Since recessions do not appear to affect the timing of graduation or labor force participation in our data, the inclusion of cell-level variables allows decomposing the persistent effect of the initial unemployment rate on earnings into the part explained by differences and changes in firm quality, by persistent effects of unemployment rates, and by other factors.

Figure 7, Panel A shows the effect of initial unemployment rates in years 0-1 in the labor market on earnings.[51] The second line from below shows the remaining effect of initial unemployment rates once we condition for average employer quality in a given cell. The figure suggests that an important part of the earnings difference (about 40-50%) is explained by reductions in firm quality. As predicted by the model, differences in firm quality matter especially in the first years after entry. We then add the *current* unemployment rate to the model, interacted with labor market experience to allow for persistent effects (as in Column 6, Table 2). Once we add persistent effects of further labor market conditions, the long-term effect of initial unemployment fades completely in the fifth year in the labor market. Thus, temporary reductions in firm quality – a key channel emphasized by our model – *plus* continuing exposure to adverse labor market conditions

[51] The coefficient estimates are contained in Supplementary Appendix Table I1. Appendix Table I2 shows that the same results hold separately within skill group, but are more pronounced for the medium skilled workers.

correlated with the effect at entry – as implied by models of contracting or job assignment – explain a large fraction of the earnings losses we find.

Discussion. The available evidence suggests that mobility towards better employers is an important channel through which catch-up after an adverse initial start occurs. Differences in job mobility can also explain the heterogeneity in responses of earnings and firm quality we find. This has implications for our understanding of the role of job mobility in workers' careers and in the adjustment of the labor market to cyclical shocks. Overall, the results support an environment in which heterogeneous workers gradually search for jobs at better firms, but recovery is slowed due to accumulation of specific capital and increases in the cost of mobility as workers age. Thereby, an important feature of our model is that these adjustment processes can differ by workers' skill level. Under realistic assumptions on comparative advantage, low skilled workers are more likely to be affected by time-increasing mobility costs and to be persistently down-ranked to lower paying firms. As a result, low-skilled workers are more likely to experience permanent effects from initial labor market conditions. Another key insight of our model is that effects of initial unemployment rates lead to *permanent* earnings differences only if coupled with search frictions that intensify with age. Without a distinction between 'newly minted,' flexible workers and workers settling down, nothing would prevent workers to keep seeking better jobs once they have entered the labor market.

While a model based on search frictions yields a parsimonious explanations of the findings, as discussed in Section 2 other modeling approaches could yield similar predictions. For example, a neo-classical model of gradual sorting in which employers learn about workers' ability at differential speeds (Gibbons, Katz, Lemieux, and Parent 2005) and provide different degrees of training (Gibbons and Waldman 2006) may explain some of the patterns we find. As we have emphasized, in either case it is the interaction of frictions with experience- and skill-related incentives to job mobility that is a key mechanisms to generate our findings. It is beyond the scope of the paper to

test between these models. Instead, in the remainder of this section, we briefly sketch additional empirical results that are consistent with a role of search-related frictions in the recovery process.

Additional Implications. Our model predicts that a higher 'natural' rate of arrival of job offers increase the speed of decay of initial conditions. To assess this prediction, we have constructed mean turnover rates in 2-digit industries (calculated over a period of more than 15 years) as imperfect proxy of the mean rate of offer arrival at the industry level. We then compared the dynamics of earnings losses in industries with differences in average turnover rates (Figure 7, Panel B). As predicted by the model, the results show that the decay of earnings losses is significantly faster in sectors that have higher average turnover rates.[52]

Second, if an important source of reversion of earnings losses is driven by differences in firm quality, the earnings loss for recession graduates that are lucky to find a first job at a high wage firm should be minimal. Unfortunately, this prediction is hard to assess directly because different types of workers will start at high wage firms in recessions and in booms. If we nevertheless include a fixed effect for a worker's first employer in our model, about half of the earnings loss can be explained (Figure 7, Panel C).[53] The result offers further evidence that search effort and initial luck are important sources of reversion of adverse conditions at labor market entry.

Third, once workers have obtained a job at a high quality employer, we observe that the rate of catch-up slows significantly compared to workers whose first employer pays high average wages

[52] A simulation exercise contained in Sensitivity Appendix V (Oreopoulos et al. 2008) highlights additional predictions from the model relating to firm-hiring rates that help understand the pattern in our data. First, the fact that high skilled workers appear to do better initially suggests that their hiring rate at good firms falls less in recessions. Second, the large observed discrepancy in the rate of catch-up between high and low skilled workers is unlikely due to differences in search intensity alone, suggesting that steady state hiring rates at good firms (p) appear to be higher for high skilled workers.

[53] Coefficients estimates and standard errors for Figure 7 are contained in Supplementary Appendix Tables F. Figure 7, Panel C, also shows results for the interaction of initial firm fixed effects and experience effects. The results suggest that find firm-specific experience profiles do not explain an important part of earnings losses. Note that since comparative advantage and sorting implies that average ability of workers starting to work at high wage firms in a recession should be higher than that of workers starting in the same firm in booms, the results in Figure 7, Panel C, tends to overstate the importance of the first employer.

(Figure 7, Panel D). This is consistent with the structure of the model by which the nature of catch-up changes once workers enter high productivity firms. If the worker starts at a low paying employer, job search is more intense, leading to a high rate of catch-up. Catch-up slows once the worker enters a high-wage firm, and is driven (in the model) by faster accumulation of specific skills, or (in an extension) by additional job offers by firms of the same type. Given the large differences in average employer quality on the one hand and rather small consensus estimates of the returns to tenure on the other hand, it is not surprising that this second phase is slower.[54]

Finally, the model is consistent with the general patterns of career development of college graduates in Canada. In particular, our search model predicts that with rising experience an increasing proportion of workers is employed at high-wage firms. We find evidence of this with positive concave experience profiles in firm-size and average firm-wages (Supplementary Appendix Figure A1). Improvements in firm quality can explain an important part of initial earnings growth in Canada, and similar trends appear in US data (Oreopoulos et al. 2008).

6. Conclusion

We have estimated the long term effects of entering the labor market in a recession for a large sample of Canadian men leaving college whose earnings, employers, and career outcomes are tracked for ten years. Using an unusually large number of cohorts, we find that the average worker graduating college in a recession faces earnings losses that are very persistent but not permanent. However, a key contribution of our paper is to show that the average estimates mask complex patterns in the timing and heterogeneity of the effects. Controlling for unemployment rate conditions after the first year of labor market entry, we conclude that an important part of the wage

[54] Even if workers continued to search, once at a large firm they are less likely to obtain a better job match. Again, the probability of starting to work at a 'high quality' employer may be correlated with workers' ability, and the degree of selectivity might be affected by early unemployment rates. To address this problem, we have included control functions in the fraction of workers starting to work at 'high quality' firms. Similarly, we have included average fathers' income as control function. Neither strategy affects our results (results available upon request). Since young workers' earnings may not be entirely a function of their ability (due for example to the presence of employer learning), including worker fixed effects or working with changes in earnings is not an ideal strategy to deal with this problem.

deficit can be attributed to the unemployment rate variation in the very first year after leaving school. We also find that the effects of recession shocks are strongest for young workers, while workers with a couple of years of labor market experience are less affected. In addition, we find that college graduates at the bottom of the wage and ability distribution have larger and more persistent losses, while the effects at the top are small and short lived. Our estimates of how the path of earnings declines suggests that the present discounted value of losses in annual earning could be three to four times larger for the least advantaged to the most advantaged workers, indicating that even within the group of college graduates there is a large degree of heterogeneity in the costs of recessions.

Another key contribution of our study is the analysis of the mechanisms behind these persistent and heterogeneous effects of short-term labor market shocks. We find that recessions initially lead workers to start at less attractive employers. An important part of earnings catch-up occurs by workers moving to higher-paying firms, especially in the first years after the shock. These patterns are much more pronounced for more advantaged college graduates, while less advantaged graduates recover at much slower speeds, if at all, from the initial downgrading to lower paying employers. To interpret these findings we developed an augmented search model that explains how even very short term labor market shocks can have lasting and differential effects. The importance of mobility towards better firms and the differences between more and less advantaged workers we find support an important role for job search that is influenced by comparative advantage and evolving search frictions. Lack of job search or lower offer rates from high-wage firms could explain why the least advantaged are permanently down-ranked to lower wage firms.

Our findings have important implication for the micro- and macroeconomic modeling of the labor market. Our results provide direct evidence that short term shocks can lead to cyclical downgrading with an ensuing gradual process of reallocation through job mobility. Thereby, we

quantify an important channel in many labor and macro models of the labor market. However, we also show that the adjustment process can take a long time. We also show that the earnings of labor market entrants are affected most by short-term labor market shocks, partly because mobility towards better firms is more important in early careers. Among others, this implies that observed cyclical fluctuations in entry wages are partly driven by changes in employer decomposition. Finally, we show that less advantaged college graduates are most affected by recessions, in part due to differential degree and persistence of cyclical downgrading.

Finally, our model's emphasis of the role of job search does not preclude contributions of other relevant mechanisms explaining the catch-up process, such as gradual reallocation through employer learning. We have also emphasized a potential role of recovery on-the-job due to contracting (e.g., Beaudry and DiNardo 1991) or job assignment (e.g., Gibbons and Waldman 2006). Some of these mechanisms could be integrated into the model, but we leave an explicit theoretical and empirical analysis to future work. To further examine the implications of our results for economic efficiency, it would also be important to embed our model in a general equilibrium framework that explicitly accounts for the hiring decisions and wage setting of firms and the ensuing sorting process. Last, by focusing on male college graduates we have left out other groups of workers – such as high school graduates and women – that could be important in determining the overall response of the labor market to cyclical shocks.

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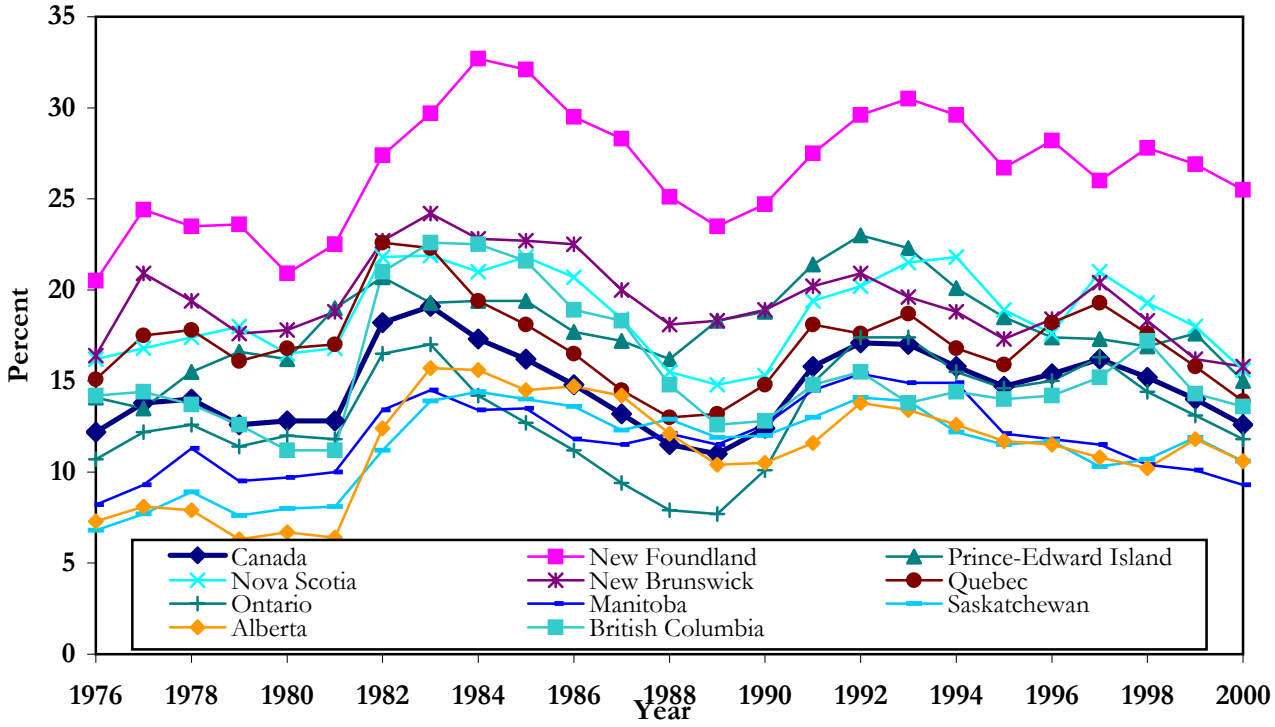
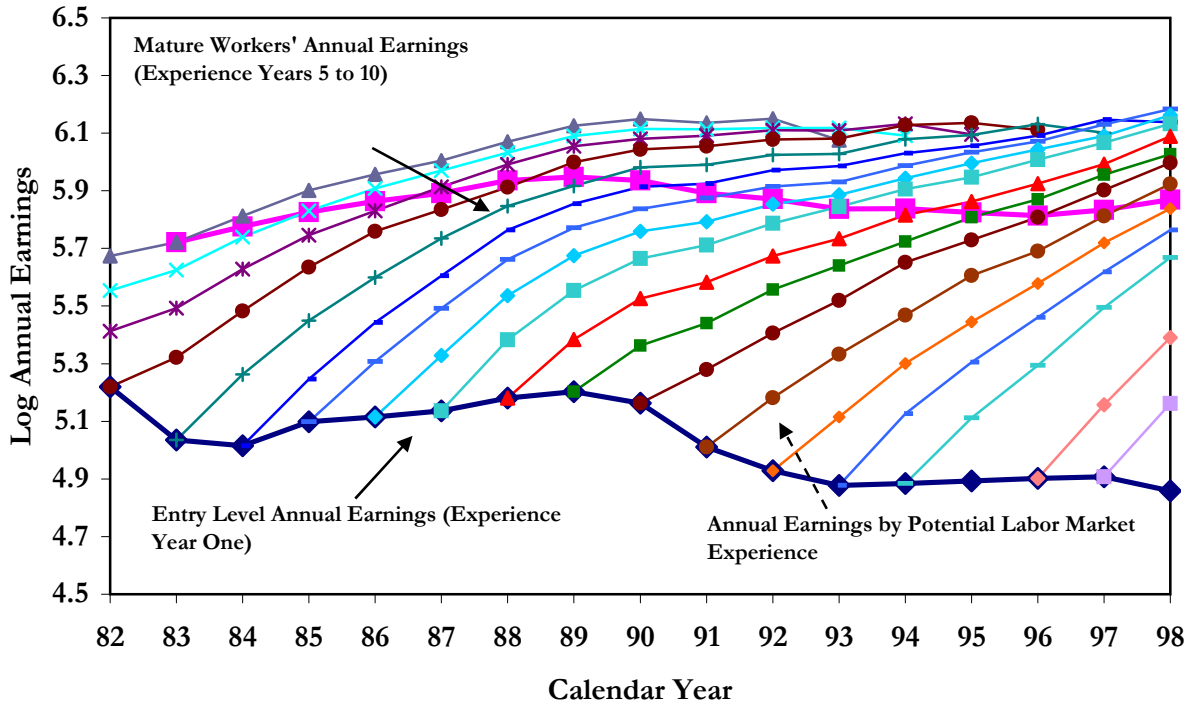
Figure 1: Unemployment Rates Ages 15-24 for Canada and Provinces 1976-2000



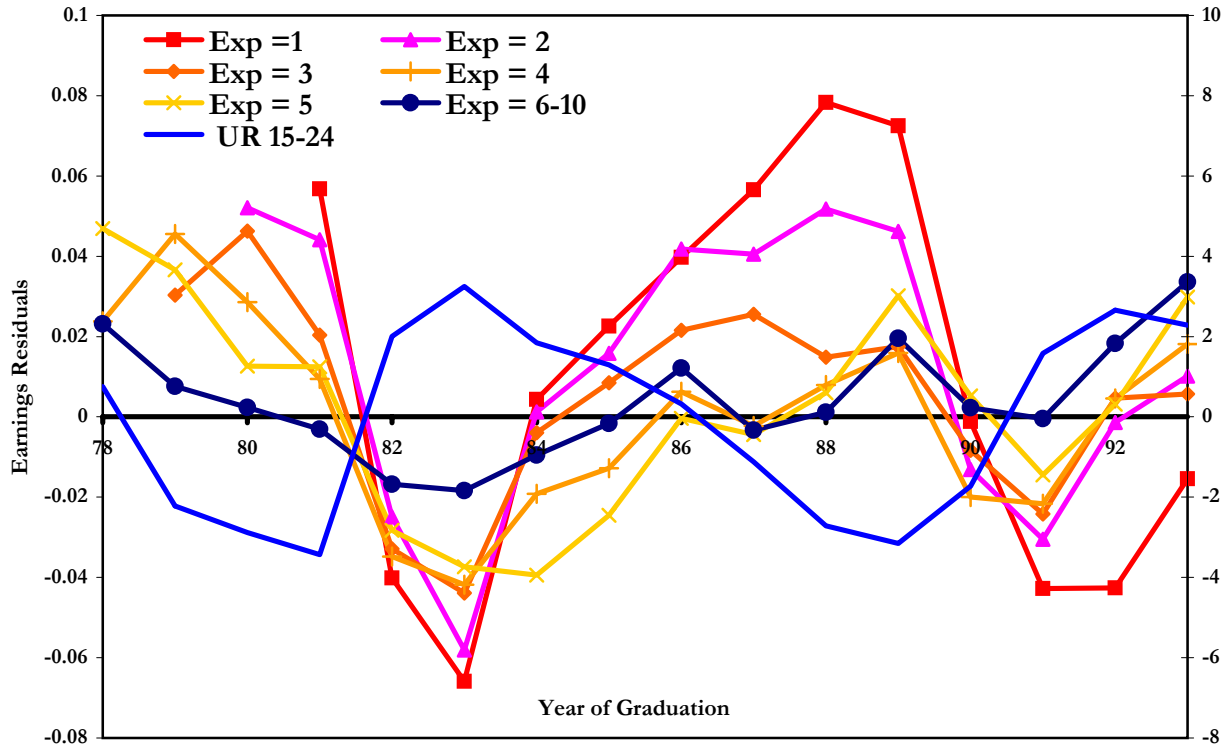
Source: Statistics Canada

Figure 2A: Mature and Entry Level Earnings and Experience Profiles by Graduation Year



Notes: The figure plots average log annual earnings profiles by year of degree completion for our baseline sample (all males in our administrative data that began a full-time undergraduate program at a post-secondary school institution in Canada between the ages of 17 and 20 from 1976 to 1995). See text and data appendix for more details.

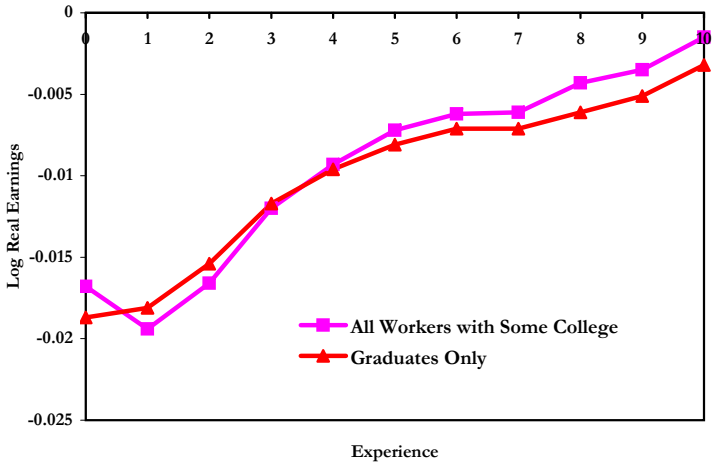
Figure 2B: Earnings By Experience Year For Cohorts Entering Labor Market 1978 to 1993



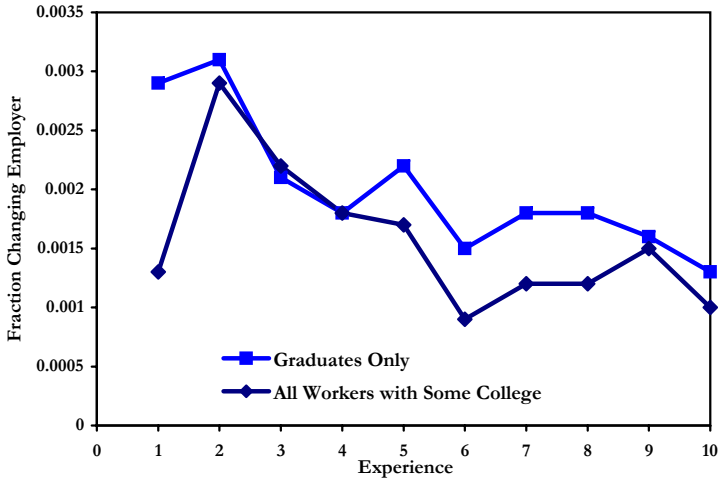
Notes: The figure is constructed by first regressing log earnings from the baseline sample on fixed effects for year of college completion. The figure plots the average residuals from this regression for different years of experience. The figure also shows the national 15 to 24 year-old unemployment rate matched to the year of college completion (these values are from Statistics Canada). See text for more details.

Figure 3: The Persistent Effects of Unemployment in the Year of Graduation on Earnings, Job Mobility, and Firm Outcomes (Graduation Cohorts 1976-1995)

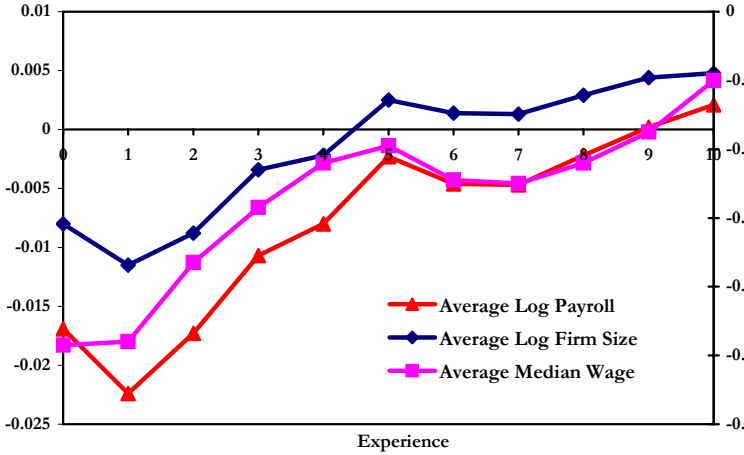
Panel A: Log Real Annual Earnings



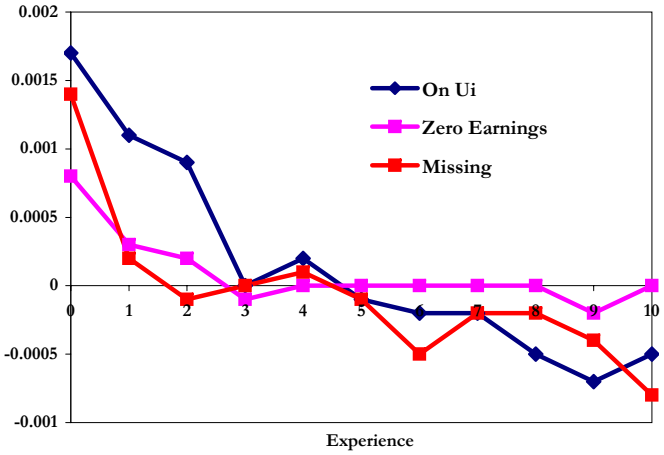
Panel B: Probability of Annual Change in Employers



Panel C: Average Firm 'Quality', Graduates Only



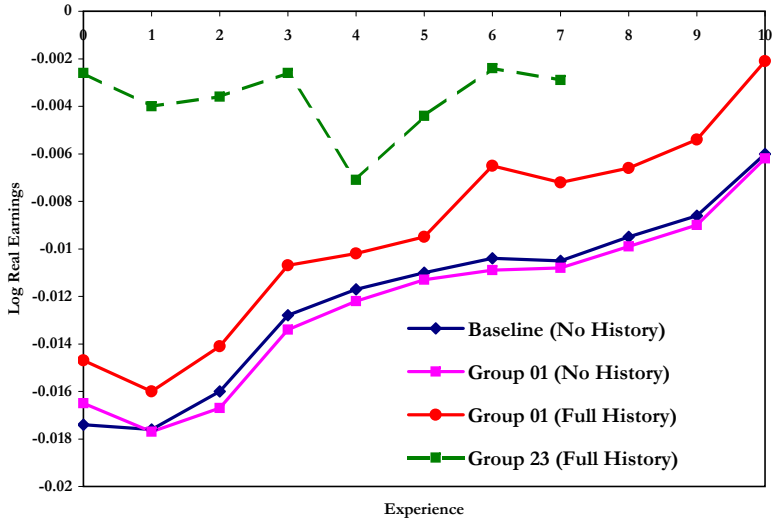
Panel D: Fraction not Working, Graduates Only



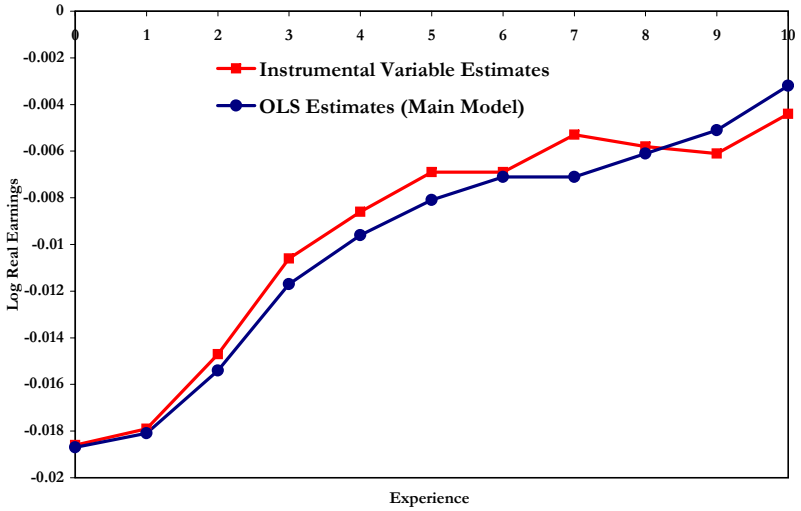
Notes: The figures show coefficients from regressing specified outcome variables on regional unemployment rates at the end of college completion interacted with experience dummies, controlling for effects for cohort of graduation, experience, and region of first residence (equation 4 in the paper). Panel A and B are based on the sample of all 17 to 20 year olds who started a college program in the data and our main sample of only college graduates. Panel A shows coefficient estimates with log annual earnings as the outcome variable. Panel B shows coefficient estimates using a dummy variable for whether an individual was classified working in a different firm as the one indicated in the previous year as the outcome variable. Panel C and D only show results based on our main sample of college graduates. Panel C shows coefficient estimates using measures of current firm quality as the outcome of interest: the employer's average log total payroll (averaged across all years in the dataset), average log employee size, and average median log wage. Panel D shows coefficient estimates for employment status measures: dummy variables for whether receiving any unemployment insurance in a given year, whether recorded as having zero earnings, or whether not recorded as filing a tax return in a given year. See text for more details.

Figure 4: Selected Results from Sensitivity Analysis, Graduates Only (Effect of Further Unemployment Shocks, Selective Graduation, Selective Participation, Cohort Differences)

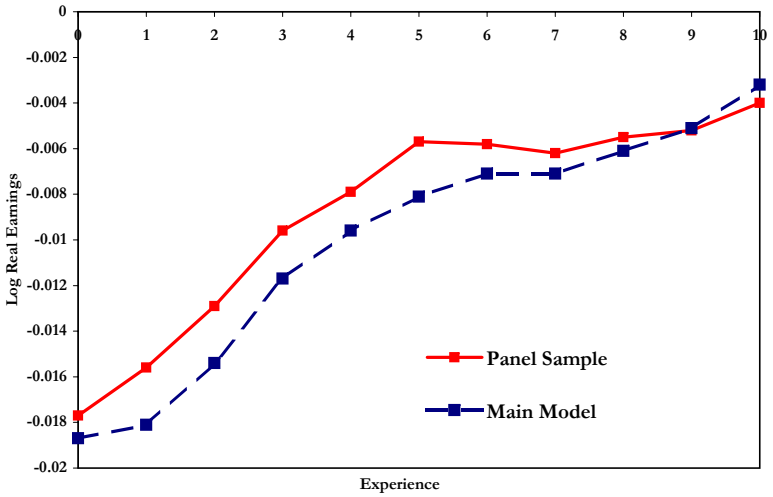
Panel A: Effect of Unemployment Rate at Time of Graduation on Earnings Controlling for Dynamic Effects of Further Unemployment Shocks (by Experience Groups)



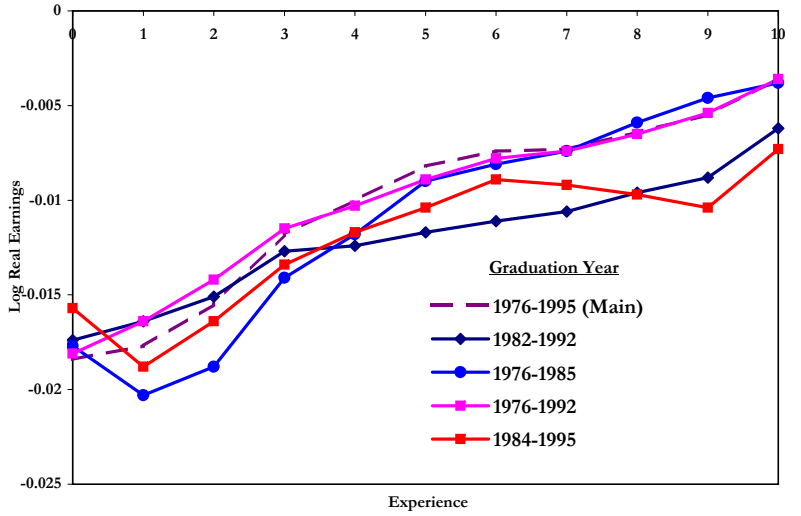
Panel B: Effect of Unemployment Rate at Time of Graduation Instrumenting with Unemployment at Time of Predicted Graduation



Panel C: Effect of Unemployment Rate at Time of Graduation for Workers with Positive Earnings Each Period



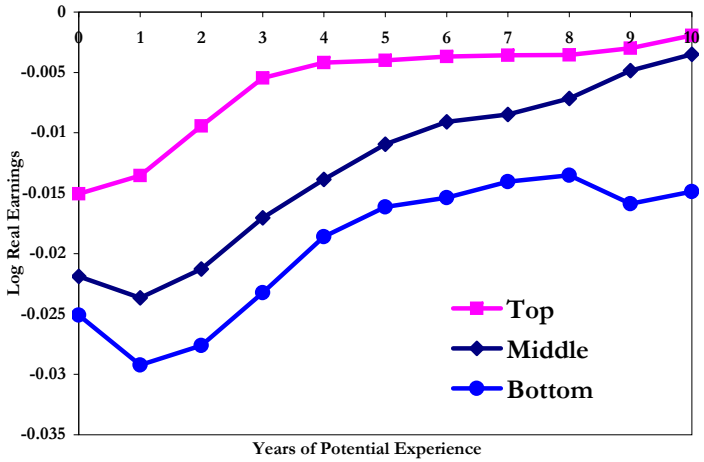
Panel D: Effect of Unemployment Rate at Time of Graduation on Earnings for Different Groups of Graduation Cohorts



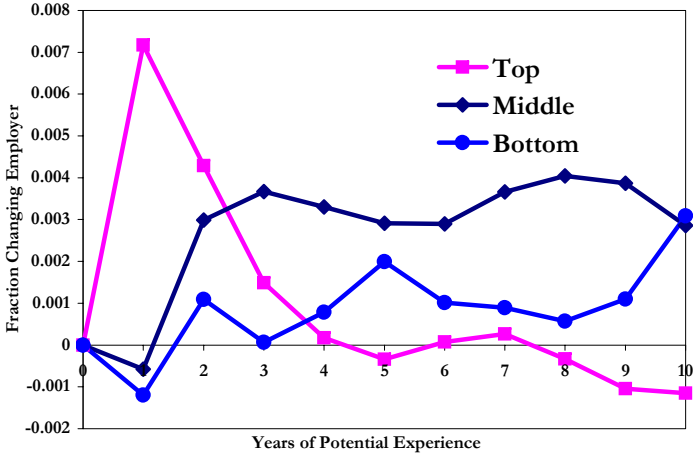
Notes: The figures show coefficients from regressing specified outcome variables on regional unemployment rates at the end of college completion, controlling for effect for year of graduation, experience, and province of first residence (equation 4 in the paper). Panel A displays coefficients from Table 2 columns 1, 5, 6, and 7. Panel B compares baseline coefficient estimates with those using predicted unemployment rate at completion based on time of entry and program length as instrumental variables. Panel C compares baseline coefficient estimates with those from the sample with individuals having positive earnings in every year since college completion. Panel D compares baseline coefficient estimates that use the sample of graduates between 1976 and 1995 with various other, smaller, cohort samples. See text and Supplementary Appendix for more details.

Figure 5: Changes of Earnings, Job Mobility, Firm Quality, and Employment due to Entering the Labor Market in a Recession for Workers with Different Predicted Earnings (Graduates Only)

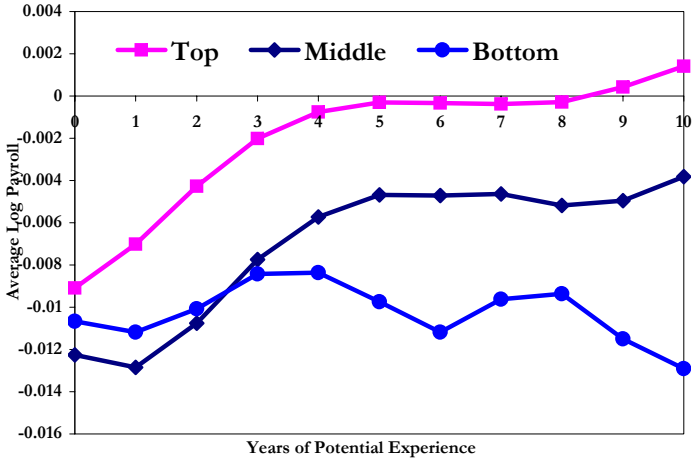
Panel A: Log Real Annual Earnings



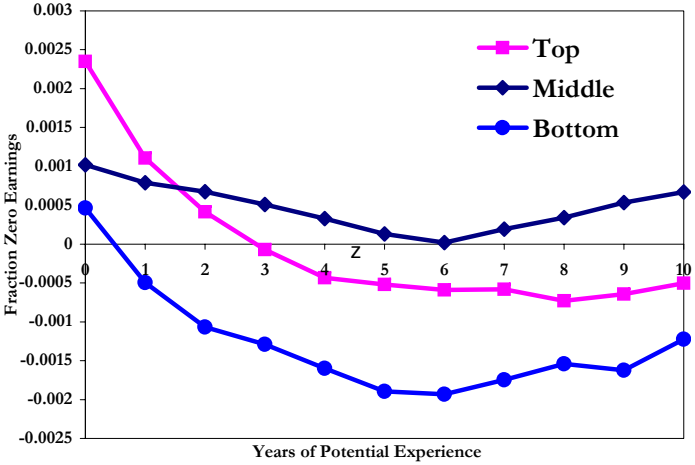
Panel B: Probability of Annual Change in Employers



Panel C: Average Firm 'Quality', Graduates Only

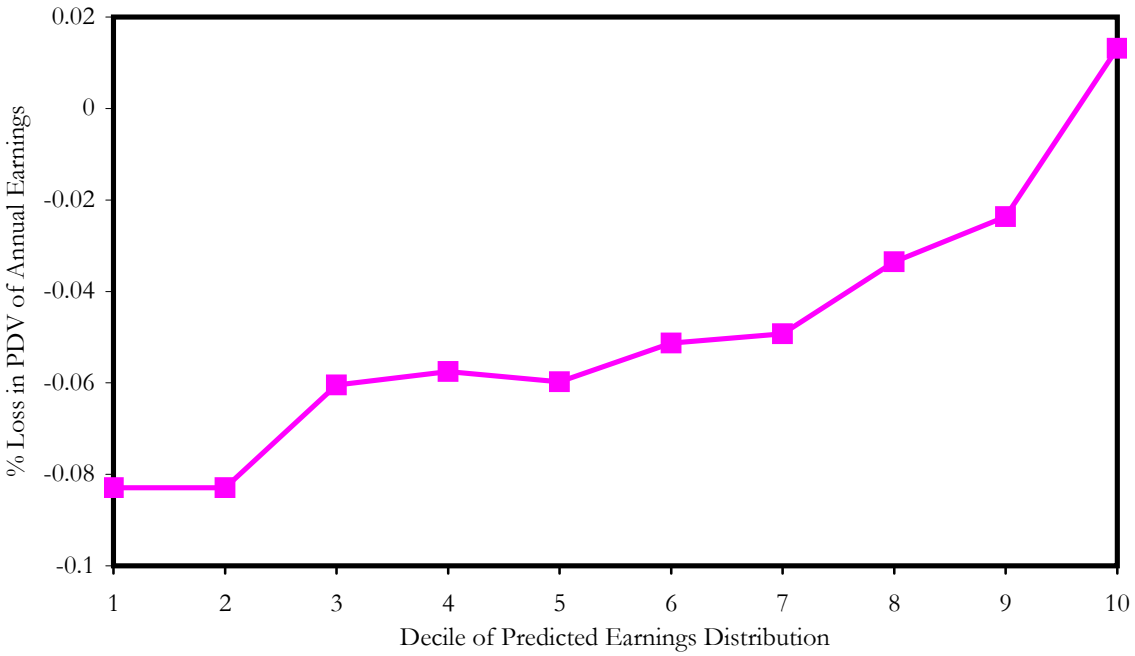


Panel D: Fraction Filing With Zero Annual Earnings



Notes: The figures show coefficients from regressing specified outcome variables on regional unemployment rates at the end of college completion, controlling for effects for year of graduation, experience, and province of first residence (equation 4 in the paper). The samples are divided into predicted skill groups, based on program of study and college (see text for more details). Panel A shows coefficient estimates with log annual earnings as the outcome variable. Panel B shows coefficient estimates using a dummy variable for whether an individual was classified working in a different firm as the one indicated in the previous year as the outcome variable. Panel C shows coefficient estimates using the employer's average log total payroll (averaged across all years in the dataset) as a measure for firm quality. Panel D shows coefficient estimates for whether recorded as having zero earnings or whether not recorded as filing a tax return in a given year.

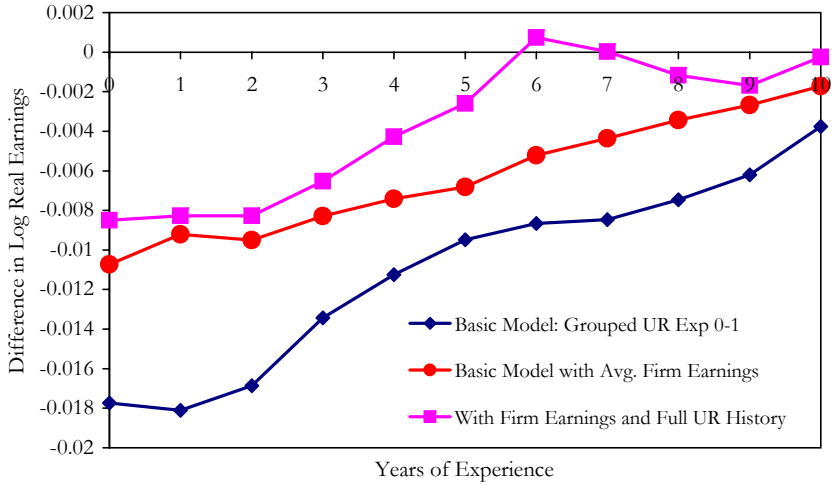
Figure 6: Heterogeneity of Losses from Graduating in a Recession as Measured by Approximate Loss in Present Discounted Value of Earnings



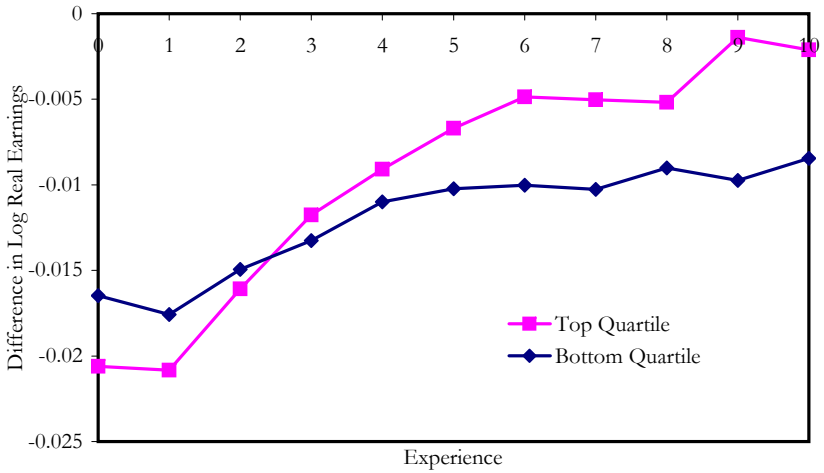
Notes: The figure shows the percentage loss in the present discounted value of annual earnings in the first ten years after graduation due to graduation in a recession by deciles of the distribution of predicted earnings, assuming an interest rate of five percent. and that losses fade after 10 years in the labor market. Please see text for details. The numbers have been smoothed by a moving average.

Figure 7: The Effect of Entering the Labor Market in a Recession for Workers for Alternative Specifications (Graduates Only)

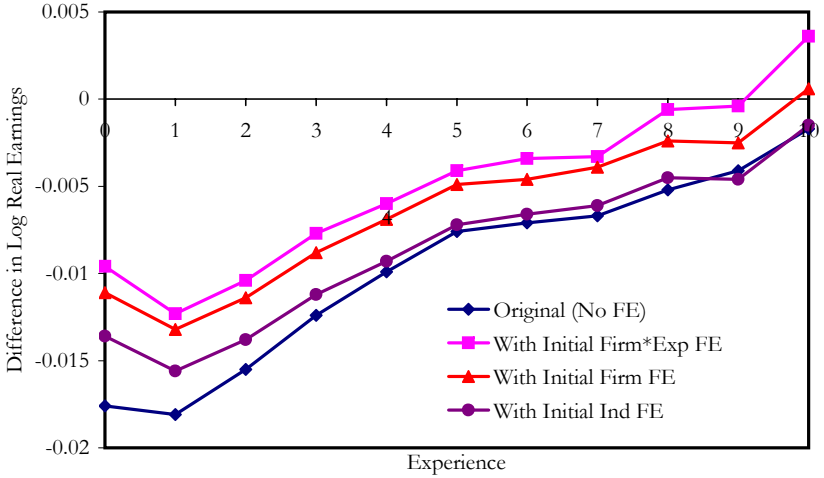
Panel A: Sources of Catch-Up After Early Unemployment Exposure, Cell Level Models



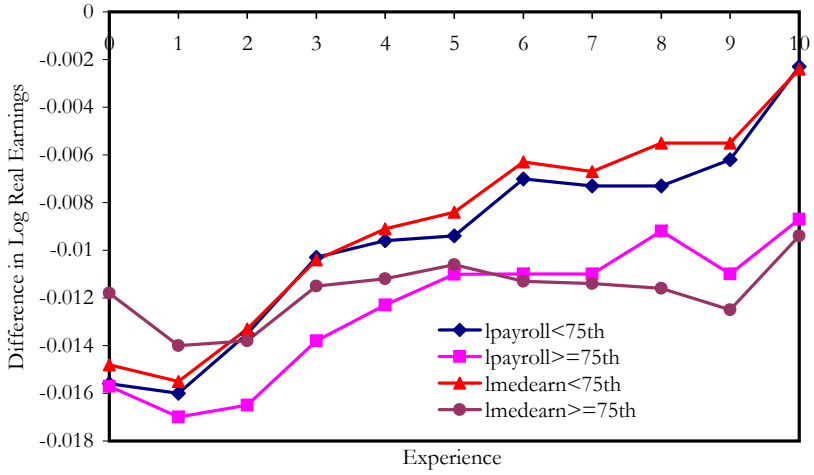
Panel B: Differences in Effect of Initial Unemployment Rate by Quartile of Average Industry Turnover Rate



Panel C: Effect of Initial Unemployment Rate Controlling for First Firm and Industry Fixed Effects Interacted With Experience



Panel D: Effect of Initial Unemployment Rate by Average Quality of First Employer (Above/Below 75th Percentile)



Notes: Panel A shows coefficients on initial unemployment rate interacted with year since graduation for a model where the effect of unemployment in the first two experience years are grouped together (UR Exp 0-1) controlling for effects for year of graduation , experience, and province of first residence for workers graduating from 1982 to 1995; the figure also shows the same coefficients when average firm quality at the experience-graduation cohort-first province level interacted with experience was added as regressor; as well as the same coefficient when in addition the history of unemployment shocks was allowed to have persistent effects. Please see text for details. Panel B shows coefficients on initial unemployment rate interacted with year since graduation when fixed effect for initial employer, initial industry, or interactions of initial employer fixed effects with experience profiles are added to our main model. Panel C shows shows coefficients on initial unemployment rate interacted with year since graduation and interacted with whether initial employer's log payroll (lpayroll) or log median earnings (lmedaern) were above or below its 75th percentile (sorted at the worker level). Panel D shows coefficients on initial unemployment rate interacted with year since graduation for models run separately for workers employed in industries with average turnover rates in the top or bottom quartiles. Turnover rates were calculated as the fraction of workers at a firm in a given year not working at the same firm the previous year, averaged across years and across 3-digit industry category.

Table 1: Effect of Unemployment Rate at time of Graduation on Log Real Earnings by Potential Experience

	Specification					
National/Regional	**National**	**National**	**Regional**	**National**	**National**	**Regional**
Trend	**Linear**	**Quadratic**	**NA**	**Linear**	**Quadratic**	**NA**
D>=0?	**No**	**No**	**No**	**Yes**	**Yes**	**Yes**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Experience Year						
0	-0.021	-0.0224	-0.0168	-0.0231	-0.0232	-0.0187
	[0.0047]***	[0.0039]***	[0.0026]***	[0.0037]***	[0.0036]***	[0.0024]***
1	-0.0177	-0.0187	-0.0194	-0.0168	-0.0169	-0.0181
	[0.0052]***	[0.0028]***	[0.0024]***	[0.0049]***	[0.0026]***	[0.0021]***
2	-0.0128	-0.0137	-0.0166	-0.0116	-0.012	-0.0154
	[0.0033]***	[0.0026]***	[0.0022]***	[0.0030]***	[0.0021]***	[0.0019]***
3	-0.0084	-0.0089	-0.012	-0.006	-0.0066	-0.0117
	[0.0022]***	[0.0022]***	[0.0021]***	[0.0022]**	[0.0015]***	[0.0017]***
4	-0.0061	-0.006	-0.0093	-0.0036	-0.004	-0.0096
	[0.0025]**	[0.0027]**	[0.0020]***	[0.0028]	[0.0021]*	[0.0016]***
5	-0.0065	-0.0055	-0.0072	-0.0035	-0.0032	-0.0081
	[0.0029]**	[0.0020]**	[0.0019]***	[0.0024]	[0.0015]**	[0.0016]***
6	-0.0027	-0.0023	-0.0062	-0.0018	-0.0012	-0.0071
	[0.0032]	[0.0020]	[0.0020]***	[0.0027]	[0.0018]	[0.0017]***
7	-0.003	-0.0027	-0.0061	-0.0019	-0.001	-0.0071
	[0.0043]	[0.0023]	[0.0020]***	[0.0034]	[0.0018]	[0.0017]***
8	-0.0001	0.0002	-0.0043	-0.0008	0.0006	-0.0061
	[0.0049]	[0.0028]	[0.0019]**	[0.0034]	[0.0016]	[0.0017]***
9	0.0035	0.0038	-0.0035	0.0021	0.0038	-0.0051
	[0.0047]	[0.0027]	[0.0019]*	[0.0033]	[0.0017]**	[0.0017]***
10	0.0066	0.0051	-0.0015	0.0047	0.0049	-0.0032
	[0.0048]	[0.0028]*	[0.0020]	[0.0034]	[0.0022]**	[0.0017]*
Constant	7.3951	-3.6341	8.8017	7.673	-2.0294	9.0456
	[0.2571]***	[2.3916]	[0.1012]***	[0.2095]***	[0.8040]**	[0.0668]***
N	14407	14407	14407	8679	8679	8679
R-squared	0.76	0.77	0.8	0.93	0.93	0.95

Notes: The sample includes males in Canada leaving university between 1976 and 1995 (see the data appendix). 'D' indicates the difference between the actual year left and the predicted year of graduation based on year of entry and program. Sample sizes reflect cell sample sizes after collapsing the micro data by graduation cohort, province of residence in each year of graduation, and experience year. The national model regresses log annual earnings on the youth unemployment rate in the country at the year of college exit, interacted with experience years 0 to 10, plus experience fixed effects, and a linear or quadratic graduation cohort trend. The regional model regresses log annual earnings on the youth unemployment rate in the province of first residence, interacted with experience years 0 to 10, plus province of first residence fixed effects, experience fixed effects, and year of graduation fixed effects (see equation 4 in the text). The coefficients shown are the unemployment rate at college exit and experience interactions. Standard errors clustered at the first province cohort level are in square brackets. One, two, and three asterix indicates statistical significance at the 10 percent, 5 percent, and 1 percent levels respectively. See text for more details.

Table 2: Effect of Unemployment Rate at time of Graduation With Controls for UR History, Basic and Grouped Model - Graduate Sample, Regional Model, Cohorts 1982-1995

Coefficient Shown	Specification						
	Effect of UR at Experience Year Zero				Effect of Average UR in Experience Years 0-1		Effect of Avg. UR in Exp. Years 2-3 Controlling for Full UR History
Model	Baseline: No Controls for UR History	Controlling for Current UR*Exp	Controlling for UR History in Exp=1,2,3	Controlling for Full UR History	No Controls for UR History	Controlling for Full UR History	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Experience Year							
0	-0.0174	-0.0184	-0.0173	-0.0159	-0.0165	-0.0147	---
	[0.0028]***	[0.0028]***	[0.0027]***	[0.0028]***	[0.0030]***	[0.0031]***	---
1	-0.0176	-0.0178	-0.017	-0.0172	-0.0177	-0.016	---
	[0.0024]***	[0.0047]***	[0.0044]***	[0.0048]***	[0.0025]***	[0.0026]***	---
2	-0.016	-0.0142	-0.014	-0.0121	-0.0167	-0.0141	-0.0026
	[0.0021]***	[0.0025]***	[0.0041]***	[0.0041]***	[0.0020]***	[0.0025]***	[0.0025]
3	-0.0128	-0.0117	-0.0087	-0.0094	-0.0134	-0.0107	-0.004
	[0.0019]***	[0.0020]***	[0.0037]**	[0.0035]***	[0.0018]***	[0.0024]***	[0.0024]*
4	-0.0117	-0.0113	-0.0063	-0.008	-0.0122	-0.0102	-0.0036
	[0.0018]***	[0.0019]***	[0.0039]	[0.0038]**	[0.0018]***	[0.0024]***	[0.0030]
5	-0.011	-0.0108	-0.0076	-0.0082	-0.0113	-0.0095	-0.0026
	[0.0018]***	[0.0018]***	[0.0046]	[0.0043]*	[0.0016]***	[0.0026]***	[0.0041]
6	-0.0104	-0.0102	-0.008	-0.0076	-0.0109	-0.0065	-0.0071
	[0.0019]***	[0.0019]***	[0.0055]	[0.0048]	[0.0018]***	[0.0030]**	[0.0043]
7	-0.0105	-0.0105	-0.0104	-0.0099	-0.0108	-0.0072	-0.0044
	[0.0019]***	[0.0019]***	[0.0049]**	[0.0046]**	[0.0019]***	[0.0032]**	[0.0041]
8	-0.0095	-0.0095	-0.0067	-0.0049	-0.0099	-0.0066	-0.0024
	[0.0019]***	[0.0019]***	[0.0050]	[0.0043]	[0.0020]***	[0.0029]**	[0.0040]
9	-0.0086	-0.0085	-0.0103	-0.0091	-0.009	-0.0054	-0.0029
	[0.0019]***	[0.0019]***	[0.0051]**	[0.0038]**	[0.0020]***	[0.0032]*	[0.0045]
10	-0.006	-0.0054	-0.0125	-0.0115	-0.0062	-0.0021	-0.0032
	[0.0021]***	[0.0021]***	[0.0055]**	[0.0050]**	[0.0023]***	[0.0039]	[0.0051]
Constant	9.2257	9.2636	9.2633	9.2379	9.2195	9.2031	---
	[0.0982]***	[0.1023]***	[0.0969]***	[0.1034]***	[0.1040]***	[0.1102]***	---
N	7536	7536	7536	6994	7536	7299	---
R^2	0.96	0.96	0.96	0.97	0.96	0.96	---

Notes: The sample includes males in Canada graduating university (with D>=0) between 1982 and 1995 (see the data appendix). Sample sizes reflect cell sample sizes after collapsing the micro data by graduation cohort, province of residence in each year of graduation, and experience year. As in Table 1, Column 6, all models regress the log annual earnings on the youth unemployment rate in the province of first residence (the columns indicate whether this rate is averaged over the first 0-1 or 2-3 years), interacted with experience years 0 to 10, plus province of first residence fixed effects, experience fixed effects, and year of graduation fixed effects. All models all include fixed effects for the current province of residence. The columns indicate additional controls for experience interacted with later unemployment rates. Column 2 includes the unemployment rate in the current province of residence interacted with experience as additional controls. Column 3 includes the unemployment rate in the province of residence of experience year 1, 2, and 3 interacted with experience. Column 4, 6, and 7 do the same for unemployment rates encountered in all ten experience years we consider. Standard errors clustered at the first province cohort level are in square brackets. One, two, and three asterix indicates statistical significance at the 10 percent, 5 percent, and 1 percent levels respectively. See text for more details.

Table 3: Effect of Unemployment Rate at time of Graduation on Labor Force Participation and Province Mobility - Graduate Sample

	Specification						
Nat./Reg.	**Regional**			**National**		**Regional**	
Outcome	**Fraction Zero Earnings**	**Fraction Not in Sample**	**Fraction on UI**	**Fraction Changed Province**	**Fraction Left First Province**	**Fraction Changed Province**	**Fraction Left First Province**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Experience Year							
0	0.0008	0.0014	0.0017			-	-
	[0.0001]***	[0.0005]***	[0.0003]***			-	-
1	0.0003	0.0002	0.0011	0	0.0007	0.0023	0.001
	[0.0001]***	[0.0003]	[0.0002]***	[0.0003]	[0.0005]	[0.0004]***	[0.0010]
2	0.0002	-0.0001	0.0009	0.0001	0.0003	0.0014	0.0029
	[0.0001]**	[0.0003]	[0.0002]***	[0.0002]	[0.0006]	[0.0002]***	[0.0008]***
3	-0.0001	0	0	0	-0.0001	0.0008	0.0036
	[0.0001]	[0.0003]	[0.0002]	[0.0002]	[0.0005]	[0.0002]***	[0.0008]***
4	0	0.0001	0.0002	0	-0.0005	0.0001	0.0039
	[0.0001]	[0.0002]	[0.0001]	[0.0002]	[0.0005]	[0.0002]	[0.0008]***
5	0	-0.0001	-0.0001	-0.0001	-0.0007	-0.0003	0.0038
	[0.0001]	[0.0003]	[0.0002]	[0.0002]	[0.0006]	[0.0002]	[0.0008]***
6	0	-0.0005	-0.0002	0.0002	-0.0005	-0.0004	0.0036
	[0.0001]	[0.0003]*	[0.0002]	[0.0002]	[0.0006]	[0.0002]*	[0.0008]***
7	0	-0.0002	-0.0002	-0.0003	-0.0008	-0.0008	0.0035
	[0.0001]	[0.0002]	[0.0002]	[0.0002]*	[0.0005]	[0.0002]***	[0.0008]***
8	0	-0.0002	-0.0005	-0.0001	-0.0003	-0.0008	0.0034
	[0.0001]	[0.0003]	[0.0002]***	[0.0003]	[0.0008]	[0.0003]***	[0.0008]***
9	-0.0002	-0.0004	-0.0007	0.0001	-0.0003	-0.0008	0.0031
	[0.0001]***	[0.0002]*	[0.0002]***	[0.0002]	[0.0009]	[0.0003]***	[0.0008]***
10	0	-0.0008	-0.0005	0	-0.0005	-0.0006	0.0031
	[0.0001]	[0.0003]***	[0.0002]***	[0.0002]	[0.0008]	[0.0003]**	[0.0009]***
Constant	-0.0032	0.0227	0.0162	0.006	-0.0399	0.0227	0.0305
	[0.0025]	[0.0118]*	[0.0072]**	[0.0097]	[0.0315]	[0.0068]***	[0.0307]
N	8679	8679	8679	5909	5942	5909	5942
R^2	0.2	0.39	0.34	0.08	0.14	0.4	0.71

Notes: Columns indicate outcome variable used as the dependent variable. The models in columns 1-3 and 6-7 regresses these outcomes on the youth unemployment rate in the province of first residence, interacted with experience years 0 to 10, plus province of first residence fixed effects, experience fixed effects, and year of graduation fixed effects. Model 4-5 do not include first province of residence effects and use the national rate of youth unemployment. The coefficients shown are the unemployment rate at college exit and experience interactions. Standard errors clustered at the first province cohort level are in square brackets. One, two, and three asterix indicates statistical significance at the 10 percent, 5 percent, and 1 percent levels respectively. See text for more details.

Table 4: Heterogeneity in Initial Loss and Reversion by Worker Groups (Graduates Only)

Outcome Variable	Effect of UR at Graduation by Year Since Graduation	All Graduates	Position in Distribution of Predicted Annual Earnings at Time of Graduation		
			Bottom Quintile	Middle Quintile	Top Quintile
		(1)	(2)	(3)	(4)
Annual Earnings	**Drop**	-0.0183	-0.0282	-0.0240	-0.0134
	(Dummy Year 0-1)	(0000)***	(0000)***	(0000)***	(0000)***
	Slope	0.0020	0.0021	0.0025	0.0019
	(Slope Year 2-6)	(0000)***	(0.0021)	(0.0025)	(0.0019)
	Fade	0.0015	0.0016	0.0021	0.0012
	(Slope Year 7-10)	(0000)***	(0000)***	(0000)***	(0000)***
Average Firm Median Log Earnings	**Drop**	-0.0093	-0.0098	-0.0125	-0.0074
		(0000)***	(0000)***	(0000)***	(0000)***
	Slope	0.0010	-0.0001	0.0014	0.0014
		(0000)***	-(0.0001)	(0.0014)	(0.0014)
	Fade	0.0007	-0.0001	0.0009	0.0009
		(0000)***	(0000)***	(0000)***	(0000)***
Average Firm Employment	**Drop**	-0.0102	-0.0078	-0.0162	-0.0073
		(0000)***	(0000)***	(0001)***	(0000)***
	Slope	0.0021	0.0004	0.0006	0.0036
		(0000)***	(0.0004)	(0.0006)	(0.0036)
	Fade	0.0016	-0.0009	0.0008	0.0033
		(0000)***	(0000)***	(0000)***	(0000)***
Fraction Changed Employer	**Drop**	0.0032	0.0012	0.0025	0.0043
		(0000)***	(0000)***	(0000)***	(0000)***
	Slope	0.0002	-0.0002	0.0004	0.0003
		(0000)***	-(0.0002)	(0.0004)	(0.0003)
	Fade	0.0001	0.0002	0.0005	-0.0001
		(0000)***	(0000)***	(0000)***	(0.0000)
Fraction Left 1st Employer	**Drop**	0.0030	-0.0010	0.0011	0.0066
		(0000)***	(0000)***	(0000)***	(0000)***
	Slope	-0.0002	0.0005	0.0004	-0.0013
		(0000)***	(0.0005)	(0.0004)	-(0.0013)
	Fade	-0.0001	0.0003	0.0003	-0.0008
		(0000)***	(0000)***	(0000)***	(0000)***
Fraction Zero Earnings	**Drop**	0.0012	-0.0002	0.0009	0.0014
		(0000)***	(0000)***	(0000)***	(0000)***
	Slope	-0.0003	-0.0003	-0.0001	-0.0004
		(0000)***	-(0.0003)	-(0.0001)	-(0.0004)
	Fade	-0.0002	-0.0002	0.0000	-0.0002
		(0000)***	(0000)***	(0.0000)	(0000)***

Notes: Coefficients from separate regression models of outcomes listed in the first column on DROP, SLOPE, and FADE parameterization of effect of unemployment rate at graduation, controlling for effects for year of graduation, experience, and province of first residence. The initial loss (DROP) is the effect of unemployment at graduation at experience zero and one, the first phase of the catch up (SLOPE) is the coefficient on the interaction of UR with linear experience for experience years two to six, and the second phase (FADE) of the catch up is same interaction for experience years seven to ten. Column 1 shows the results for the full sample of college graduates, whereas columns 2-4 show the results separately for college graduates in the first, third, and fifth quintile of predicted earnings at the time of graduation. Standard errors clustered at the first province cohort level are in square brackets. One, two, and three asterix indicates statistical significance at the 10 percent, 5 percent, and 1 percent levels respectively. See text for more details.

Table 5: Effect of Unemployment Rate at time of Graduation on Job and Industry Mobility and Average Employer Characteristics - Graduates Only

Outcome	Specification							
	Fraction Changed Firm	Fraction Changed Industry	Fraction Left First Firm	Fraction Left First Industry	Log Firm Size	Fraction Firm Size > 1000	Average Median Firm Wage	Average Log Firm Payroll
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Experience Year								
0	-	-	-	-	-0.008	-0.0016	-0.0097	-0.0169
	-	-	-	-	[0.0050]	[0.0008]*	[0.0014]***	[0.0058]***
1	0.0029	0.0021	0.0038	0.0025	-0.0115	-0.002	-0.0096	-0.0224
	[0.0008]***	[0.0007]***	[0.0010]***	[0.0011]**	[0.0049]**	[0.0009]**	[0.0011]***	[0.0055]***
2	0.0031	0.0034	0.0046	0.0041	-0.0088	-0.002	-0.0073	-0.0173
	[0.0007]***	[0.0006]***	[0.0011]***	[0.0011]***	[0.0050]*	[0.0008]**	[0.0011]***	[0.0056]***
3	0.0021	0.0023	0.0049	0.0045	-0.0034	-0.0012	-0.0057	-0.0107
	[0.0007]***	[0.0006]***	[0.0009]***	[0.0009]***	[0.0047]	[0.0008]	[0.0010]***	[0.0052]**
4	0.0018	0.0015	0.0052	0.0046	-0.0022	-0.0009	-0.0044	-0.008
	[0.0006]***	[0.0006]**	[0.0009]***	[0.0009]***	[0.0048]	[0.0008]	[0.0011]***	[0.0054]
5	0.0022	0.0019	0.0043	0.0039	0.0025	-0.0003	-0.0039	-0.0023
	[0.0005]***	[0.0005]***	[0.0010]***	[0.0010]***	[0.0051]	[0.0009]	[0.0012]***	[0.0057]
6	0.0015	0.0011	0.0043	0.004	0.0014	-0.0005	-0.0049	-0.0046
	[0.0005]***	[0.0005]**	[0.0010]***	[0.0010]***	[0.0050]	[0.0009]	[0.0012]***	[0.0056]
7	0.0018	0.002	0.0041	0.0039	0.0013	-0.0007	-0.005	-0.0047
	[0.0006]***	[0.0006]***	[0.0011]***	[0.0010]***	[0.0054]	[0.0009]	[0.0012]***	[0.0060]
8	0.0018	0.002	0.0044	0.0042	0.0029	-0.0003	-0.0044	-0.0022
	[0.0008]**	[0.0007]***	[0.0011]***	[0.0010]***	[0.0054]	[0.0009]	[0.0011]***	[0.0060]
9	0.0016	0.002	0.0047	0.0052	0.0044	0.0001	-0.0035	0.0002
	[0.0010]	[0.0009]**	[0.0010]***	[0.0010]***	[0.0055]	[0.0009]	[0.0011]***	[0.0063]
10	0.0013	0.0015	0.005	0.0055	0.0048	0.0002	-0.002	0.0021
	[0.0011]	[0.0011]	[0.0010]***	[0.0010]***	[0.0068]	[0.0010]	[0.0015]	[0.0077]
Constant	0.3407	0.3151	0.1391	0.523	8.1745	0.719	0.8069	7.2971
	[0.0184]***	[0.0187]***	[0.0428]***	[0.0403]***	[0.1953]***	[0.0283]***	[0.0368]***	[0.2203]***
N	5871	5871	5863	5861	8435	8435	8435	8435
R^2	0.8	0.79	0.86	0.77	0.53	0.47	0.75	0.6

Notes: Columns indicate the firm or industry mobility variable used as the dependent variable. Each model regresses these outcomes on the youth unemployment rate in the province of first residence, interacted with experience years 0 to 10, plus province of first residence fixed effects, experience fixed effects, and year of graduation fixed effects. The coefficients shown are the unemployment rate at college exit and experience interactions. The coefficients shown are the unemployment rate at college exit and experience interactions. Standard errors clustered at the first province cohort level are in square brackets. One, two, and three asterix indicates statistical significance at the 10 percent, 5 percent, and 1 percent levels respectively. See text for more details.