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Who Scars the Easiest? College Quality and the Effects of Graduating into a Recession

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Graduating from college into a recession is associated with earnings losses, but less is known about how these effects vary across colleges. Using restricted-use data from the National Survey of College Graduates, we study how college quality influences the effects of graduating into worse economic conditions in the context of the Great Recession. We find that earnings losses are concentrated among graduates from relatively high-quality colleges. Key mechanisms include substitution out of the labor force and into graduate school, decreased graduate degree completion, and differences in the economic stability of fields of study between graduates of high- and low-quality colleges.

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Who Scars the Easiest? College Quality and the Effects of Graduating into a Recession*

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Abstract

Graduating from college into a recession is associated with earnings losses, but less is known about how these effects vary across colleges. Using restricted-use data from the National Survey of College Graduates, we study how college quality influences the effects of graduating into worse economic conditions in the context of the Great Recession. We find that earnings losses are concentrated among graduates from relatively high-quality colleges. Key mechanisms include substitution out of the labor force and into graduate school, decreased graduate degree completion, and differences in the economic stability of fields of study between graduates of high- and low-quality colleges.

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1 Introduction

To what extent does college quality influence the adverse effects of graduating into a recession? Economists have long been interested in the short and long-run consequences of exposure to negative economic shocks. Several papers have documented large and persistent negative labor market effects associated with graduating into a recession (e.g., Kahn (2010); Oreopoulos et al. (2012)), and other work has demonstrated that individuals graduating into a worse economy find it more difficult to match to a job that is compatible with their undergraduate field of study. However, comparatively less is known about how these effects vary over college quality. If these scarring effects are disproportionately concentrated among individuals graduating from better or worse schools, then this heterogeneity may have important implications for income inequality and inter-generational mobility. Additionally, while the existence of a college quality premium has been extensively documented in the economics literature, there has been less attention paid to whether and to what extent this premium varies over the business cycle.

We study this question in the context of the 2008 financial crash and the subsequent Great Recession using restricted-use versions of the National Surveys of College Graduates (NSCG). Several prior studies of the returns to college quality in the United States have relied on data from the National Longitudinal Surveys of Youth, which are limited both in their sample size and in that they only allow researchers to view outcomes for a select few cohorts. In contrast, the NSCG offers large sample sizes for all birth cohorts while also containing exact institutions of graduation in its restricted-use version, thus allowing us to link measures of college quality to survey respondents.

Using a fixed effects design and leveraging variation in unemployment rates at graduation across states and over time, we find that the earnings losses of entering the labor market during a recession are larger for graduates from high-quality institutions relative to their peers who graduate from lower quality colleges. We find that a one percentage point increase in the state unemployment rate decreases the annual returns of a one standard deviation increase in college quality by 384 dollars. This is roughly 10 percent of the average college quality premium we estimate across the whole time period.

We identify several mechanisms behind these results: substitution out of the labor force and into graduate school, decreased graduate degree completion, differences in the economic stability of fields of study between graduates of high- and low-quality colleges, and decreased

labor mobility. First, graduates from higher quality colleges who graduate into a recession are more likely to enroll in graduate school than those from lower quality colleges. This decreases their labor force participation and earnings while they are enrolled in graduate school but may not necessarily mean long-term earnings decreases if they see large increases in earnings upon completion of their higher degree. However, we also provide evidence that although students from higher quality college are more likely to *enroll* in graduate school in the following years, they are *less* likely to *complete* a graduate degree, suggesting that the negative earnings effects are unlikely to reverse. In fact, we find qualitatively similar results when limiting the sample to individuals who are in the labor force and not currently enrolled in graduate school or to individuals with a bachelor's degree only (and not enrolled in graduate school), although the magnitude of these results is attenuated from our main estimates. Our next main mechanism is undergraduate field of study: students from high-quality colleges are more likely to major in fields that are more adversely affected by the recession (e.g. STEM, social science) while students from lower quality colleges are more likely to major in fields that are resilient over the business cycle (e.g., education). As a final mechanism behind our earnings results, we find suggestive evidence that graduating into a recession reduces labor mobility relatively more for higher-quality college graduates.

The remainder of the paper proceeds as follows. Section 2 reviews the relevant literature and details our contribution to it. Section 3 describes our data and empirical strategy for studying our research question. Section 4 presents our results and gives a more detailed comparison of our results to related recent work, and Section 5 discusses some broader implications of our findings before concluding.

2 Literature

This paper contributes to several strands of the economics literature, most directly to the literature that studies the lingering effects of recession exposure on individual outcomes. Graduating into recessions is associated with substantially depressed earnings for at least 10 years (Kahn, 2010; Oreopoulos et al., 2012; Altonji et al., 2016). While some work has suggested that these scarring effects fade after approximately a decade, other work has found that the effects can reemerge later in life and be near-permanent (Schwandt and von Wachter, 2019; Stuart, 2020). As data availability increases, a growing literature has studied the effects of the Great Recession by leveraging spatial variation in the shocks it

induced, generally finding that the scarring effects associated with these shocks are severe (Yagan, 2018; Rinz, 2019; Rothstein, 2021).

Much work has also demonstrated that attending a high-quality college increases earnings afterward.[1] Using data from the National Longitudinal Survey of Youth (NLSY), Black et al. (2005) and Dillon and Smith (2020) show that earnings premiums from college quality appear quickly after individuals leave college and persist for up to 30 years. Hoekstra (2009) uses a regression discontinuity design with state administrative data and finds gains for white men who attend a flagship university, but little effects for other groups. Zimmerman (2014) and Smith et al. (2020) use similar strategies and finds large gain for students marginally admitted to universities in Florida and Georgia, respectively. Zimmerman finds that the largest gains are for men and free-lunch recipients, while Smith et al. finds gains across the board. How these effects vary over the business cycle, however, is largely unknown.

Our work explores many mechanisms behind the main earnings effects, many of which have been studied in previous literature. First, our work contributes to the literature on how recessions affect higher education enrollment. Barr and Turner (2013) and Long (2014) have both shown that the Great Recession led to increases in college enrollment for undergraduates. We find that these countercyclical enrollment patterns hold for graduate enrollment as well, particularly graduates from high-quality institutions. Bedard and Herman (2008) also study the effects of economic downturns on graduate school enrollment, but their time period is from 1990 to 2000 and their sample is recent graduates from science and engineering undergraduate programs. They find heterogeneous effects across sex and graduate degree type, with positive effects for men enrolling in PhD programs and for women enrolling in professional degree programs. We add to their findings by investigating how graduate school enrollment during recessions varies by undergraduate college quality. We also study a broader population of college graduates since our sample is not restricted to science and engineering students.

Next, our work relates to the literature on the relationship between labor markets conditions and major/occupation. Altonji et al. (2016) find that the negative effects of graduating into a recession are concentrated among lower-paying majors, but the effects of the Great Recession are more evenly distributed across majors than earlier recessions. We focus on

[1] In contrast, a few other papers have found limited scope for college quality to increase earnings - see Dale and Krueger (2002, 2014); Mountjoy and Hickman (2020).

broad major categories and find that STEM and social science graduates experience relatively worse effects of graduating in a worse economy, while education majors perform better. Prior work has also found that the teaching profession is more stable through recessions than other occupations (Kopelman and Rosen, 2016; Nagler et al., 2020; Deneault, 2023). Another potential mechanism is cyclical skill mismatch (i.e., when an individual is working in a field requiring different skills than the field in which they were trained). Previous literature has explored this, such as Liu et al. (2016) who find that the likelihood of skill mismatch at a worker's initial job is higher in worse economic conditions. We explore this effect and how it varies over college quality, but do not find any evidence for meaningful heterogeneity. We also investigate changes in geographical mobility as a mechanism for earning losses. Yagan (2014) found that migratory insurance, where individuals in heavily shocked areas move to more prosperous areas for economic opportunity, played a relatively small role in the Great Recession compared to earlier recessions. We find evidence that graduates of higher quality colleges are more prone to decreases in inter-state mobility, which could contribute to their larger earnings losses relative to lower quality college graduates.

Finally, our work closely relates to a small number of papers that have considered how the impacts of graduating into a recession vary by college type. Oreopoulos et al. (2012) find that Canadian college students who graduated into recessions in the early 1980s and 90s suffered smaller and less persistent earnings losses if they are graduating from generally higher-earning majors and colleges. Weinstein (2022) finds that among graduates from high-quality colleges, graduates from less elite universities have larger income losses than those of more elite universities. He highlights a decrease in employer recruiting at non-elite universities as being a potentially important mechanism. Although these two papers suggest that graduating into a recession is more detrimental for graduates of low-quality colleges, our results tell a somewhat different story and suggest that the nature of this sort of heterogeneity may be highly contextual. A deeper comparison between our work and these papers may be found in Section 4.4.

3 Data and Empirical Strategy

We use restricted-access versions of the National Survey of College Graduates (NSCG) 2010, 2013, 2015, 2017, and 2019 accessed via the Census RDC (U.S. Census Bureau, 2023). The NSCG sample is drawn from the American Community Survey and includes individuals

who have earned a bachelor's degree, reside in the United States or Puerto Rico, and are younger than 76 years old. We restrict our sample to include individuals who earned their BA between 2000 and 2012 to focus on the Great Recession while maintaining a reasonably narrow range of cohorts and ages among individuals in the sample.[2]

The restricted-use version includes information on the exact college from which respondents obtained their degrees which we link to the Integrated Postsecondary Education Data System (IPEDS) to construct the quality of the college attended (U.S. Department of Education, 2021). Following Dillon and Smith (2020), our college quality measure is an index combining the pseudo-median SAT score of entering students (midpoint of 25th and 75th percentiles), the applicant rejection rate, the student-faculty ratio, and the average salary of faculty engaged in instruction. We take the first principal component of this index and use it to calculate percentiles of our index across the enrollment-weighted distribution of four-year non-specialty colleges in the United States.[3] In our specifications, we use both a standardized version of this continuous measure and an alternative measure which includes indicators for each quality quartile.

Table 1 presents summary statistics for our sample. Linking individuals to their institutions of graduation requires that they graduate from a U.S. college, which forces us to drop any individuals in the sample that obtained their degree from an international school before moving to the U.S. We present summary statistics for our sample both with and without these dropped individuals — the restriction reduces the proportion of Asian individuals in the sample, but other variables such as income, unemployment, and rates of graduate degree attainment do not change meaningfully, suggesting that linking individuals to their exact institution of study does not inject meaningful selection into the sample. As the sample includes only those who obtained a college degree, it is not representative demographically or economically of the U.S. as a whole.

Table 2 presents summary statistics for the analysis sample, broken down by college quality quartile.[4] A few differences emerge. Demographically, the proportion of Asians increases with college quality, especially for top-quartile graduates, while earnings, graduate

[2] We note that we only observe college graduates, so our analysis may be understating the degree to which labor market outcomes vary by college quality since higher-quality colleges boost graduation rates (see Dillon and Smith (2020), among others).

[3] Also following Dillon and Smith (2020), we use 2008 as our base year and calculate our college quality index for any college that has at least two of the four proxies.

[4] Note that since quality quartiles are created before individuals in our sample are merged to them, the number of individuals in each quartile need not be the same and indeed are not due to higher-quality colleges exhibiting substantially higher graduation rates.

degree attainment, maternal education, and increase monotonically as we move up the quality distribution. Graduates of higher quality colleges are also generally more likely to move away from their state of graduation and/or state of birth.

To first understand the main effects of graduating into a worse labor market and graduating from a high-quality college, we estimate:

$$Y_{istr} = \phi_r + \gamma_s + \theta_t + \boldsymbol{\alpha}_0 \boldsymbol{X}_i + \alpha_1 U_{st} + \alpha_2 Q_i + \epsilon_{istr}, \tag{1}$$

where Y_{istr} is an outcome variable of interest for individual i who graduated in year t from a college in state s and was surveyed in year r. The specification includes survey year fixed effects ϕ_r to strip out macroeconomic trends, state fixed effects γ_s to control for differences in state means in the outcome variable, and cohort fixed effects θ_t to account for changes in outcomes common across all graduates of a particular year. Note that the combination of the survey year and cohort fixed effects controls for years of (potential) experience since graduation. We also include a vector of individual characteristics X_i, which includes indicators for race, sex, ethnicity, and mother's and father's education level. The main variables of interest are U_{st}, the unemployment rate of the state s from which individual i graduated in year of their graduation t, and Q_i, the quality of i's college of graduation. Thus, α_1 represents the effect of graduating into a labor market with a one percentage point higher unemployment rate and α_2 gives the effect of graduating from a one standard deviation higher quality college.[5] We include an error term ϵ_{istr} and cluster our standard errors at the state of graduation by cohort level.

To assess heterogeneity in the effects of the recession over college quality, we next estimate the specification:

$$Y_{istr} = \eta_r + \delta_s + \xi_t + \boldsymbol{\beta}_0 \boldsymbol{X}_i + \beta_1 U_{st} + \beta_2 Q_i + \beta_3 U_{st} Q_i + \beta_4 U_{st} \boldsymbol{X}_i + \varepsilon_{istr}. \tag{2}$$

The parameter β_3 in this specification quantifies the extent to which the impacts of graduating into a worse labor market differed for individuals based on the quality of their college of graduation. A positive sign would imply that graduates from higher-quality colleges were harmed relatively less by graduating into a bad labor market than their peers from lower-quality colleges. On the other hand, a negative sign would imply the college quality earnings premium is smaller during recessions than it is during good times.

[5] One standard deviation is equivalent to about a 30 percentile increase in the college quality distribution.

A natural question is whether the state-level unemployment rate is the most relevant measure of college graduates' labor market. In Section 4.3, we explore sensitivity of our results by using alternative unemployment rate measures. First, we employ data on where colleges' graduates locate from LinkedIn, collected by Conzelmann et al. (2022b), and find little difference in results from our baseline analysis using state-level unemployment rates (Conzelmann et al., 2022a). We also present results that use the national unemployment rate as the source of variation. An advantage of this analysis is that focuses directly on the effects of graduating into the Great Recession as opposed to being located in local labor markets that were more or less affected by it; its limitation is that it prevents us from being able to include cohort fixed effects due to immediate collinearity issues. Still, the general conclusions from this analysis confirm our main results, shown in Appendix B.

We rely on a "selection on observed variables" identification strategy to address selection into college quality. In addition to state, survey year, and cohort fixed effects, we include the following individual characteristics in $\boldsymbol{X}_i$: sex, race, ethnicity, mother's education level and father's education level. We also include the cohort fixed effects and individual controls interacted with the unemployment rate, $U_{st}\boldsymbol{X}_i$, to account for how they may have differing effects on earnings over the business cycle. The NSCG lacks information on high school grades or test scores, which are commonly used in the literature as measures of student "ability." Thus, we might be concerned that our college quality coefficients are not only capturing the effect of college quality but also the effect of inherent ability. We are comforted by the fact that our main effects of college quality are roughly similar to those of Dillon and Smith (2020), who have a much richer conditioning set including grades and test scores. However, if there is still selection into college quality based on ability, one would need to interpret our college quality results as the combination of college quality and inherent student ability. If higher-ability students are more likely to attend higher-quality colleges and are also more likely to earn more, this would mean that our coefficient is upwardly biased. In our baseline results, correcting for this would have the effect of making the negative effect we uncover stronger.

Our primary outcomes of interest are earnings and labor force participation. In our main specification, we measure earnings in levels[6] and winsorize at the 95th percentile to prevent the large right tail in earnings among college graduates from dominating our results.

[6] A prominent feature of the Great Recession is that real wages stayed fairly stable while employment collapsed. As such, we feel that ignoring zeros in earnings and wages would be ill-advised.

To measure labor force participation, we use estimate linear probability[7] models with the following indicator variables as outcomes: employed, unemployed, out of the labor force, current enrollment in graduate school, and "discouraged" (i.e., out of the labor force and not enrolled in graduate school).

4 Results

4.1 Baseline

Table 3 shows our baseline results from estimating equations (1) and (2) where the outcome is annual earnings. We do not condition on labor force participation, so individuals with zero earnings are included. The first column focuses on the separate effects of the unemployment rate and college quality on annual earnings. The estimate of U_{st} implies that a one percentage point increase in the state unemployment rate upon graduation decreases annual earnings by around 759 dollars. A one-standard deviation increase in college quality increases annual earnings by around 3,700 dollars, and the estimate is highly statistically significant. This generally aligns with Dillon and Smith (2020), who find using the NLSY-97 that a 30 percentile increase in college quality (the rough equivalent of our one standard deviation increase) for a middle-ability student increases earnings by around 4,400 dollars.[8] This alleviates our concerns about selection into college quality to some degree since Dillon and Smith (2020) includes a richer conditioning set than we have available in the NSCG, yet our estimates are very similar. We also investigate whether selection into college varied considerably over the time range we study and find little evidence to this effect; see Appendix A.

The second column of Table 3 includes the interaction term of the unemployment rate and college quality and thus gives insight into how a recession affects the returns to college quality. We find that a one percentage point increase in the unemployment rate decreases the return of a one standard deviation increase in quality by around 384 dollars, roughly 10 percent of the premium we find in the specification without the interaction. This result may be viewed graphically in Figure 1, where we estimate earnings returns to an increase in college quality separately for each graduation cohort from 2000 to 2012: the returns hold

[7] We explore the sensitivity of our results under alternative models and alternate earnings outcomes in Section 4.3.

[8] This calculation comes from the following: Table 6 of Dillon and Smith (2020) shows that for a median ability student, the average derivative of earnings with respect to college quality is 14,820 dollars (see Panel B, 5th row, 2nd column). Since college quality is measured from 0 to 1, this translates to a 30 percentile increase of 14,820*0.3 = 4,446 dollars.

roughly steady from the cohorts of 2000 to 2007 before dropping sharply in 2008 when the recession began.

The final two rows of table Table 3 use our second measure of college quality, where we include indicators for each quartile of the enrollment-weighted college quality distribution.[9] As expected, we see in column 3 that earnings are strongly increasing in college quality. This specification suggests that the college quality premium is nonlinear - while moving from the first quartile to the second quartile increases annual earnings by about 800 dollars (not statistically significant), moving from the second to third and from third to fourth quartile each increase earnings by around 4,000 dollars. The interaction terms align with our results from the continuous measure, showing that individuals who attended a higher-quality college experienced a larger earnings penalty from graduating into a recession than those who attended lower quality colleges.

Table 4 shows our main results for labor force participation. Binary variables are scaled by 100 so that effects can be interpreted as percentage point changes. We see in column 1 that employment sharply decreases during a downturn for individuals who attended higher quality colleges. The effect of a one standard deviation increase in college quality when the state unemployment rate is one percentage point higher is a 0.32 percentage point decrease in the probability of being employed. Column 2 shows that this is driven by individuals dropping out of the labor force rather than shifting into unemployment. The last two columns show that graduating from college during an economic downturn increases the probability of being enrolled in graduate school, and this effect is amplified for students who have graduated from high-quality colleges, especially those in the top quartile. In fact, the increased probability of being currently enrolled is roughly equal to the decrease in labor force participation. Moving back to column 3, we show the effects of being "discouraged," which we define as being out of the labor force and not enrolled. The interaction term between college quality and the unemployment rate at graduation is positive but statistically insignificant. For employed individuals, we additionally explore how the effect of graduating in a recession varies by college quality for their number of hours worked. Column 5 shows that, unlike the large extensive margin effects on labor force participation, the change in hours conditional on being employed does not vary much over the college quality distribution. Among the employed, we also investigate the probability of working in one's field

[9] We prefer this to a subgroup analysis because the latter involves the generation of multiple smaller samples and implicit samples, which can make passing disclosure review from U.S. Census highly cumbersome.

of study, but do not find any evidence that the probability of working outside one's field during a recession varies by college quality.[10]

4.2 Mechanisms and Heterogeneity

Given the results from Oreopoulos et al. (2012) and Weinstein (2022) that found that individuals from more selective colleges fared better when graduating into adverse labor market conditions, the nature of the heterogeneity we find may be surprising. We next aim to unpack the mechanisms driving our results so as to justify them and better situate them in the previous literature.

The results displayed in Table 4 suggest that substitution from labor force participation to graduate school enrollment may be an important driver of our earnings results. However, if graduates from high quality colleges who enroll in graduate school earn higher returns from their graduate degrees upon completion, they may eventually end up outearning their peers from lower quality colleges who did not enroll in graduate school. Next, we further delve into the graduate school enrollment results and investigate whether the higher enrollment is leading to higher graduate degree attainment.[11] We also break down our "ever enrolled" results by degree type (Master's, PhD, or professional).

Table 5 shows the results. We concentrate on the quartiles college quality measure, since the result from Table 4 showed that the interaction effect of the unemployment rate at graduation and college quality on being "currently enrolled" was driven by graduates from the top quality quartile. The first column shows that relative to bottom quality quartile college graduates, graduates from the top quality quartile who graduated into a labor market with a one percentage point higher unemployment rate were 0.88 percentage points more likely to have ever enrolled in any graduate program. This effect is driven by enrollment in PhD programs and professional programs (e.g., law school, medical school).

Next, we examine the effect of graduating in a recession on the probability of completing a graduate degree. In Table 6, we include one observation for each individual and estimate

[10] The NSCG includes a question asking respondents, "To what extent was your work on your principle job related to your highest degree?" Option responses are closely related, somewhat related, and not related. We count responses of "not related" as working outside one's field.

[11] The NSCG is a panel survey for some respondents who respond in multiple waves, but in this analysis we include only one observation per person. We define respondents as "ever enrolled" if we observed them as currently enrolled at least once when responding to the survey. This measure will miss some respondents who complete their graduate degrees before they are surveyed, but we choose it since we are also interested in drop out from graduate school. We have no way of knowing if an individual enrolled in graduate school before dropping out if we do not observe them enrolling in the first place. Thus, we would be introducing bias by counting an individual who we observe with a graduate degree (but not enrolled) as "ever enrolled" but not counting an individual who enrolled and dropped out before we observe them.

whether they hold any graduate degree by the last time we observe them (unconditional on us ever observing them as being enrolled). We find that relative to bottom quality quartile college graduates, although graduates from high quality colleges are more likely to enroll in graduate school if they graduated into a worse labor market, they are *less* likely to hold a completed degree. This suggests that individuals from high quality colleges who graduate into a recession are likely to drop out of their graduate program before completing it and therefore that our main finding of earnings losses from graduating into a recession being concentrated among graduates from high quality colleges is unlikely to be reversed over time. Additionally, since these results are not conditional on being observed as enrolled, this is likely a combination of negative selection of students into graduate school during a recession, as well as an increased probability of dropout among students who would have pursued graduate school absent the recession.

The second mechanism that we uncover for our negative earnings effects is field of study. First, we show that there are differences in major choice across colleges that vary by the college's quality. Table 7 shows the percentage of each college quality quartiles' graduates who graduate with degrees in five broad major categories: STEM (i.e., science, technology, engineering, and math), social sciences, health, education, and business. Graduates from high quality colleges are much more likely to major in STEM: 28 percent of graduates from the top quartile choose a STEM major, compared to just 13 percent of graduates from the bottom quartile. High quality college graduates are also more likely to complete majors in the social sciences. On the other hand, graduates from lower quality colleges are more likely to major in health and business. They are also much more likely to major in education: bottom quartile graduates are over three times as likely to major in education as top quartile graduates.

These differences in majors have implications for how graduates from different colleges will fare when graduating into a worse labor market, since some majors are much more stable over the business cycle than others. In Table 8, we show how the returns to these majors vary with the unemployment rate that students face at graduation. In this specification, we do not include the interaction term of college quality with the unemployment rate, but rather include an interaction term of the unemployment rate with each major group.[12] Table 8 shows that while the earnings of individuals who major in STEM and social sciences tend to decline when the unemployment rate is higher, individuals who major in education

[12] We sill include the main effect of college quality to capture averages differences in earnings across colleges.

actually earn more if they graduated into a labor market with a higher unemployment rate. Thus, part of the reason that we find stronger earnings losses from graduating into a recession among individuals who attended high quality colleges is because graduates from high quality college tend to major in subjects that are more sensitive to fluctuations in the business cycle.

Next, we explore heterogeneity in our results by sex.[13] Table 9 show results for separately estimating equation (2) for men and women. We find that the negative earnings effects of graduating into a recession for graduates from high quality colleges are stronger for women. We find that a one percentage point increase in the state unemployment rate decreases the returns to a one standard deviation increase in college quality by over 550 dollars for women, but only around eighty dollars for men.[14] We also examine differences between men and women in graduate degree enrollment and attainment. It appears that the positive effects we find for graduate enrollment are driven by women, while the negative effects for degree attainment are driven by men.

Finally, we investigate the interaction between college quality and economic conditions upon graduation on labor mobility. College graduates (particularly those from high-quality colleges) are highly geographically mobile, and this propensity to move for higher-paying jobs is an important recent driver of the college earnings premium (Diamond, 2016). However, research has indicated that the Great Recession depressed labor mobility, which offers another potential mechanism behind our main results. Table 11 probes this issue, and we find suggestive evidence that higher quality college graduates are less likely to move out of the state of their college by the time they are observed when they graduate into a worse labor market. The effects appear to be stronger for men: men from third and fourth quartile schools who experience a one percentage point higher unemployment rate upon graduation are each about two percentage points less likely to migrate, relative to men from bottom quality quartile colleges.

Taken together, our investigation points to several mechanisms behind our main result that earnings losses from recessions are relatively higher for graduates from higher quality colleges. First, graduates from high quality colleges substitute out of the labor force and into graduate school when they experience a worse labor market upon graduation. However,

[13] In additional analyses for which we have not disclosed the precise point estimates, we studied whether our results varied meaningfully by Census region (Northeast, Midwest, South, East) or race and ethnicity and found little evidence for either.

[14] However, we cannot reject the null that the estimates for men and women are equal to each other.

they are unlikely to complete these graduate degrees and are ultimately less likely to hold an advanced degree if they graduated into a recession. Second, graduates from lower quality colleges tend to major in fields that are more resilient to recessions. Finally, graduating into a recession may decrease labor mobility for high-quality college graduates, especially for men.

4.3 Robustness

We also estimate specifications where we restrict the sample to individuals with only a BA (i.e., those who have not obtained and are not currently enrolled in any graduate school) or to those who are both in the labor force and not currently enrolled in any graduate school. We do not prefer these specifications since they condition on endogenous variables, but still find them valuable in understanding how much of our main result is coming through labor force participation/graduate school enrollment. Results are presented in the first four columns of Table 12. We find qualitatively similar results to our main findings, although the estimates are smaller and often not statistically significant.

The final two columns of Table 12 address the question of what the most relevant labor market is for college graduates. We use "Grads on the Go" data, provided by Conzelmann et al. (2022b). For each college, they collect data from LinkedIn on where its graduates locate and provide the fraction of each college's graduates that live in each state. We use this data to construct college-specific unemployment rates for each year by multiplying each state's unemployment rate (in the relevant year of graduation) by the college's share of graduates residing in that state.[15] Results are very similar to our baseline specification using state-level unemployment rates.

In Table 13, we also experiment with measuring earnings in logs as well as log-plus-1 to avoid dropping zeros. We also include results where we use hourly wages, measured as total earnings divided by hours worked in the previous year, as the dependent variables instead of annual earnings. For our main binary outcomes, we additionally present average marginal effects from probit models (rather than the baseline linear probabilty models) in Table 14. In all cases our results hold qualitatively.

We also assess whether our results are sensitive to our measure of college quality by using each individual sub-index of college quality (faculty-student ratios, rejection rates,

[15]Note that the timing of the college's shares in each location is slightly misaligned with the timing of our sample: the LinkedIn data uses graduates from 2010 to 2015.

faculty salaries and test scores) as our measure of college quality instead. While we were not able to disclose the point estimates of this exercise, the sign and statistical significance of our estimates do not change relative to the baseline results when using any individual component. We also run specifications with the Barron's selectivity categories, although we note that the Barron's categories capture a different sort of heterogeneity than our main quality measure - they provide several small categories at the top of the quality distribution but group together around three quarters of the sample into one category for the lower/middle parts of the distribution. Still, the qualitative results from this exercise match our baseline results, although the estimates are not statistically different from each other.

As a final test, we also use coarser measures of time and recession severity to construct a 2X2 difference-in-difference setup to address potential lingering concerns about our baseline identification strategy. Our first difference is before/after the recession in 2008, and our second difference is based on the change in the state unemployment rate between 2007 and 2009, as in Yagan (2018). We characterize states as receiving a "bad shock" if the unemployment rate change is above the median. Table 15 show our results. The first column shows that relative to bottom quality quartile graduates, individuals who graduated after the recession from a top quartile college in a state with a bad recession shock earn around 6,000 dollars less than those in a state with a less severe recession shock, after accounting for the earnings differences between these states before the recession.

4.4 Comparison to Other Studies

In this section, we take a more detailed look at explanations for differences in our results from two other studies that have considered how the effects of graduating into a recession vary across types of colleges. Oreopoulos et al. (2012) find that Canadian college students who graduated into a recession suffered smaller and less persistent earnings losses if they graduated from generally higher-earning majors and colleges. Several important differences between the setting and methods of Oreopoulos et al. (2012) and our work are worth highlighting: in addition to focusing on an earlier time period (graduates from 1976 to 1995 as opposed to 2000-2012) in a different country, the authors restrict their sample to only men with strictly positive earnings and no graduate degrees, thus missing any effects on women as well as considerably reducing the role that substitution from the labor force

toward further education can play in their analysis.[16]

The setting in Weinstein (2022) is closer to ours, as he also uses variation from the Great Recession in the United States. However, there are several methodological differences that lead to our seemingly opposing results. The first is a difference in college quality/selectivity measures. Weinstein (2022) uses Barron's categories, which provide a high degree of detail at the top of the distribution but little variation in the middle and bottom of the distribution. The entirety of the top two categories that Weinstein uses (Ivy Plus and Barron's Tier 1 (Elite)), along with 95 percent of students in his third category (Barron's Tier 2 (Highly Selective)) fall within our top quality quartile. Meanwhile, his fourth category (Barron's Tiers 3-5), which is used as the base category in his analysis, spans all four of our quality quartiles.[17] Thus, we make broader comparisons across the college quality distribution while Weinstein's comparison is more akin to elite universities versus the rest of the distribution. In our view, this distinction allows our papers to be quite complementary to one another.

Second, we use different earnings measures. Our primary earnings measure is mean earnings in levels, which we choose to capture endogenous differences in labor force participation, while Weinstein's main measure is the log of each college's median income after restricting to positive earners, which may understate the role of substitution out of the labor force into graduate education in a similar manner to Oreopoulos et al. (2012). Third, the (implicit) weighting differs between our sample and Weinstein's. After applying the NSCG's sampling weights, our student-level data is nationally representative of bachelor's degree holders, so our results represent the mean impact across all college graduates. Weinstein's data is institution-level, so smaller universities carry more weight per student.

Since Weinstein uses public-use mobility report card data, we are able to directly show how these three differences affect results. When we use Weinstein's specification and data but change the college quality measure from Barron's categories to our quartiles measure, use mean earnings as the outcome variable, and weight by institution size, we broadly replicate our results. Details can be found in Appendix C.

[16] It is also worth acknowledging that the authors assess the robustness of their results to including workers with graduate degrees and find little change, and the authors do not find significant impacts on labor force participation. However, the importance and prevalence of graduate degrees increased considerably between the 1980s and the 2000s, which provides another potential explanation for why substitution out of the labor force into graduate education plays a larger role in our analysis.

[17] Specifically, 29 percent of students in Barron's Tiers 3-5 fall in our bottom quality quartile, while 32, 30, and 8 percent fall in our second, third, and top quartiles, respectively.

5 Conclusion

Graduating into a recession is associated with losses in earnings, but less is known about how these effects vary based on where an individual graduated from. We study how college quality influences the effects of graduating into an economic downturn in the context of the Great Recession. Using restricted-use data from the National Survey of College Graduates, we find that graduation into worse economic conditions is associated with earnings losses that are concentrated among graduates from relatively high-quality colleges. We identify several mechanisms behind these results: first, graduates from high-quality colleges who graduate during a worse labor market are more likely to exit the labor force and enroll in graduate school. However, they are *less* likely to earn graduate degrees, implying increased levels of dropout both for marginal enrollees as well as those who would have enrolled absent the recession. Second, relative to lower-quality college graduates, graduates from high-quality colleges tend to major in fields that are more sensitive to business cycle fluctuations, so a recession affects the earnings of graduates from high-quality college more. Third, labor mobility appears to decrease for students from high-quality college when they graduate in a downturn. These findings suggest that who stands to lose the most from graduating into a recession may be more subject to context than previously thought.

These findings also may have considerable implications for how the Great Recession impacted the economic mobility for those who graduated into it. The backgrounds of students varies considerably over the college quality distribution: more than 10% of students in bottom-quartile colleges had parents in the bottom quintile in the national income distribution, while the corresponding statistic for students in top-quartile colleges was less than 5% — further, the proportion of students in these colleges with parents in the top income percentile was 0.8% and 7.7%, respectively.[18] Thus, the heterogeneity we find suggests a potential leveling of the playing field for individuals who graduated into the recession, at least among college graduates. Further investigations into how our results evolve as time passes will likely be worthwhile.

[18] These statistics obtained from using our measures of college quality in conjunction with college mobility report cards from Chetty et al. (2020).

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6 Tables and Figures

Table 1: Summary Statistics

Variable	Mean/SD	Mean/SD
Age	34.65	34.36
	(8.14)	(8.01)
Asian	0.11	0.08
	(0.32)	(0.27)
Black	0.11	0.11
	(0.31)	(0.31)
White	0.79	0.83
	(0.41)	(0.37)
Hispanic	0.11	0.09
	(0.31)	(0.29)
Married	0.64	0.64
	(0.48)	(0.48)
Has MA	0.25	0.24
	(0.43)	(0.43)
Has Professional Degree	0.04	0.05
	(0.20)	(0.21)
Has PHD	0.02	0.02
	(0.14)	(0.13)
Mother college dummy	0.40	0.41
	(0.49)	(0.49)
STEM BA	0.21	0.19
	(0.41)	(0.39)
Undergraduate Loans ($1,000s)	10.34	10.38
	(19.82)	(19.43)
Total Income ($1,000s)	54.97	50.69
	(45.36)	(35.16)
Unemployed	0.03	0.03
	(0.18)	(0.17)
Not in Labor Force	0.08	0.08
	(0.28)	(0.27)
Currently Enrolled in Graduate Program	0.11	0.11
	(0.31)	(0.31)
Currently Enrolled in MA	0.06	0.06
	(0.23)	(0.23)
Currently Enrolled in Prof. Degree	0.01	0.01
	(0.10)	(0.10)
Currently Enrolled in PHD	0.02	0.01
	(0.13)	(0.12)
Moved from State of Graduation	0.41	0.36
	(0.49)	(0.48)
Moved from State of Birth	0.53	0.50
	(0.50)	(0.50)
Has Children	0.45	0.44
	(0.50)	(0.50)
Sample	Whole	Analysis
Observations	173,000	144,000

Notes: Data from 2010, 2013, 2015, 2017, and 2019 Waves of the National Survey of College Graduates; see text for details. Analysis sample contains individuals with undergraduate institutions that can be linked to IPEDS data. Cell counts rounded following disclosure avoidance protocols.

Table 2: Summary Statistics by College Quality

Variable	Mean/SD	Mean/SD	Mean/SD	Mean/SD
Quality Quartile	1	2	3	4
Age	36.60	35.34	33.73	32.61
	(9.25)	(8.88)	(7.25)	(6.37)
Asian	0.04	0.05	0.06	0.15
	(0.19)	(0.21)	(0.23)	(0.35)
Black	0.14	0.13	0.10	0.07
	(0.34)	(0.34)	(0.30)	(0.25)
White	0.83	0.83	0.86	0.81
	(0.37)	(0.37)	(0.35)	(0.39)
Hispanic	0.09	0.09	0.10	0.09
	(0.29)	(0.28)	(0.30)	(0.29)
Married	0.67	0.65	0.64	0.60
	(0.47)	(0.48)	(0.48)	(0.49)
Has MA	0.22	0.24	0.23	0.26
	(0.41)	(0.43)	(0.42)	(0.44)
Has Professional Degree	0.02	0.02	0.04	0.09
	(0.13)	(0.14)	(0.19)	(0.29)
Has PHD	0.01	0.01	0.01	0.03
	(0.08)	(0.11)	(0.11)	(0.17)
Mother college dummy	0.28	0.32	0.43	0.57
	(0.45)	(0.47)	(0.49)	(0.50)
STEM BA	0.13	0.15	0.18	0.28
	(0.34)	(0.35)	(0.39)	(0.45)
Undergraduate Loans (1000s)	12.98	11.48	9.55	8.48
	(21.29)	(19.71)	(18.68)	(18.28)
Total Income (1000s)	44.64	46.63	51.32	57.51
	(30.92)	(32.23)	(34.46)	(39.26)
Hourly Wage	22.85	23.95	25.88	28.57
	(16.61)	(17.41)	(18.08)	(20.06)
Unemployed	0.03	0.03	0.03	0.03
	(0.16)	(0.17)	(0.18)	(0.17)
Not in Labor Force	0.08	0.08	0.07	0.08
	(0.27)	(0.27)	(0.25)	(0.27)
Currently Enrolled in Graduate Program	0.09	0.09	0.10	0.13
	(0.29)	(0.29)	(0.30)	(0.33)
Currently Enrolled in MA	0.06	0.05	0.06	0.06
	(0.24)	(0.22)	(0.23)	(0.23)
Currently Enrolled in Prof. Degree	0.00	0.00	0.01	0.02
	(0.07)	(0.07)	(0.09)	(0.15)
Currently Enrolled in PHD	0.01	0.01	0.01	0.02
	(0.10)	(0.10)	(0.11)	(0.15)
Moved from State of Graduation	0.33	0.29	0.33	0.46
	(0.47)	(0.45)	(0.47)	(0.50)
Moved from State of Birth	0.44	0.45	0.50	0.57
	(0.50)	(0.50)	(0.50)	(0.49)
Has Children	0.53	0.46	0.43	0.37
	(0.50)	(0.50)	(0.50)	(0.48)
Observations	20000	28000	35000	60000

Notes: Data from 2010, 2013, 2015, 2017, and 2019 Waves of the National Survey of College Graduates; see text for details. Analysis sample contains individuals with undergraduate institutions that can be linked to IPEDS data. College quality defined following Dillon and Smith (2020). Cell counts rounded following disclosure avoidance protocols.

Table 3: Results for Earnings

VARIABLES	(1) Earnings	(2) Earnings	(3) Earnings	(4) Earnings
UR at Graduation	-759.1*	353.8	-759.5*	961.5
	(417.3)	(1,979)	(417.0)	(2,031)
College Quality Q2			801.7	2,093
			(935.7)	(2,911)
College Quality Q3			4,763***	9,410***
			(986.6)	(3,166)
College Quality Q4			8,797***	15,750***
			(1,041)	(3,067)
CQ Q2 X UR				-229.6
				(427.6)
CQ Q3 X UR				-760.3
				(472.1)
CQ Q4 X UR				-1,138**
				(463.7)
CQ (SD)	3,684***	6,037***		
	(382.7)	(1,150)		
CQ (SD) X UR		-383.9**		
		(177.8)		
Observations	144000	144000	144000	144000
R-squared	0.164	0.168	0.163	0.167

Notes: Standard errors clustered at the cohort-by-state-of-graduation level are in parentheses. Table reports estimate of Equations (1) and (2). Data from 2010, 2013, 2015, 2017 and 2019 Waves of the National Survey of College Graduates; see text for details. College quality defined following Dillon and Smith (2020). Controls include fixed effects for survey year, state, and cohort; indicators for race, sex, and parental education; and cohort FEs, race, sex, and parental education indicators interacted with the unemployment rate.

Table 4: Results for Employment Variables

VARIABLES	Employed	NILF	Discouraged	Hours	Work Outside Field	Enrolled	Enrolled
UR at Graduation	-1.364	-0.827	-0.787	56.37**	-0.244	0.424	0.0944
	(1.538)	(1.461)	(1.352)	(26.45)	(1.800)	(1.035)	(1.038)
CQ (SD)	1.747*	-2.124***	-1.354*	37.39*	-0.857	-0.547	
	(0.946)	(0.801)	(0.756)	(19.89)	(1.296)	(0.677)	
CQ (SD) X UR at Graduation	-0.321**	0.352***	0.113	-0.534	-0.134	0.357***	
	(0.151)	(0.122)	(0.114)	(3.143)	(0.202)	(0.112)	
College Quality Q2							-0.908
							(2.119)
College Quality Q3							-0.000939
							(2.339)
College Quality Q4							-0.872
							(2.015)
CQ Q2 X UR							0.166
							(0.334)
CQ Q3 X UR							0.213
							(0.411)
CQ Q4 X UR							0.808**
							(0.329)
Observations	144000	144000	144000	131000	131000	144000	144000
R-squared	0.026	0.032	0.045	0.054	0.017	0.044	0.044

Notes: Standard errors clustered at the cohort-by-state-of-graduation level are in parentheses. Table reports estimate of Equation (2). Data from 2010, 2013, 2015, 2017 and 2019 Waves of the National Survey of College Graduates; see text for details. College quality defined following Dillon and Smith (2020). Controls include fixed effects for survey year, state, and cohort; indicators for race, sex, and parental education; and cohort FEs, race, sex, and parental education indicators interacted with the unemployment rate. NILF: not in labor force. Enrolled: currently enrolled in any graduate program. Discouraged: not in the labor force and not enrolled in any graduate program. Work Outside Field: indicator variable for respondent working outside their field of undergraduate study.

Table 5: Ever Observed Enrolled Results

VARIABLES	(1) Any	(2) MA	(3) PHD	(4) Professional
UR at Graduation	-0.158	0.180	-0.239	-0.0625
	(0.684)	(0.592)	(0.191)	(0.194)
CQ Q2	-0.259	-0.146	0.713	-0.182
	(3.472)	(2.994)	(0.916)	(0.607)
CQ Q3	2.259	3.516	-0.220	-0.905
	(3.829)	(2.943)	(0.959)	(1.072)
CQ Q4	-0.876	0.994	-0.348	-1.976*
	(3.336)	(2.720)	(0.981)	(1.060)
CQ Q2 X UR at Graduation	-0.0450	-0.293	-0.0643	0.0149
	(0.542)	(0.494)	(0.122)	(0.0981)
CQ Q3 X UR at Graduation	-0.165	-0.753	0.110	0.239
	(0.641)	(0.499)	(0.138)	(0.176)
CQ Q4 X UR at Graduation	0.881*	-0.260	0.348**	0.689***
	(0.523)	(0.433)	(0.150)	(0.180)
Observations	75000	75000	75000	75000
R-squared	0.034	0.025	0.009	0.028

Notes: Standard errors clustered at the cohort-by-state-of-graduation level are in parentheses. Table reports estimate of Equation (2). Data from 2010, 2013, 2015, 2017 and 2019 Waves of the National Survey of College Graduates; see text for details. College quality defined following Dillon and Smith (2020). Controls include fixed effects for survey year, state, and cohort; indicators for race, sex, and parental education; and cohort FEs, race, sex, and parental education indicators interacted with the unemployment rate. Column headers indicate which type of postgraduate enrollment variable is considered in the given regression.

Table 6: Degree Attainment Results

VARIABLES	(1) Any	(2) MA	(3) PHD	(4) Professional
UR at Graduation	2.503	2.636	-0.0152	-0.118
	(1.778)	(1.816)	(0.396)	(0.713)
CQ Q2	4.382	2.366	0.970*	1.046
	(4.029)	(3.873)	(0.573)	(1.025)
CQ Q3	2.933	1.853	1.212**	-0.132
	(3.901)	(3.670)	(0.599)	(1.617)
CQ Q4	20.26***	5.842*	3.349***	11.07***
	(3.701)	(3.516)	(0.622)	(1.705)
CQ Q2 X UR at Graduation	-0.431	-0.244	-0.101	-0.0860
	(0.630)	(0.610)	(0.0932)	(0.132)
CQ Q3 X UR at Graduation	0.0677	-0.145	-0.108	0.321
	(0.600)	(0.569)	(0.0951)	(0.268)
CQ Q4 X UR at Graduation	-1.347**	-0.383	-0.243***	-0.721***
	(0.530)	(0.518)	(0.0903)	(0.231)
Observations	75000	75000	75000	75000
R-squared	0.068	0.039	0.022	0.045

Notes: Standard errors clustered at the cohort-by-state-of-graduation level are in parentheses. Table reports estimate of Equation (2). Data from 2010, 2013, 2015, 2017 and 2019 Waves of the National Survey of College Graduates; see text for details. College quality defined following Dillon and Smith (2020). Controls include fixed effects for survey year, state, and cohort; indicators for race, sex, and parental education; and cohort FEs, race, sex, and parental education indicators interacted with the unemployment rate. Column headers indicate which type of postgraduate enrollment variable is considered in the given regression.

Table 7: Major Choice by College Quality

Variable	Mean/SD	Mean/SD	Mean/SD	Mean/SD
Quality Quartile	1	2	3	4
STEM BA	0.13	0.15	0.18	0.28
	(0.34)	(0.35)	(0.39)	(0.45)
Soc Sci BA	0.12	0.14	0.18	0.25
	(0.33)	(0.35)	(0.38)	(0.43)
Health BA	0.08	0.08	0.06	0.05
	(0.27)	(0.27)	(0.24)	(0.21)
Education BA	0.14	0.12	0.09	0.04
	(0.35)	(0.33)	(0.28)	(0.18)
Business BA	0.26	0.23	0.21	0.13
	(0.44)	(0.42)	(0.41)	(0.34)
Observations	20000	28000	35000	60000

Notes: Data from 2010, 2013, 2015, 2017, and 2019 Waves of the National Survey of College Graduates; see text for details. Analysis sample contains individuals with undergraduate institutions that can be linked to IPEDS data. College quality defined following Dillon and Smith (2020). Cell counts rounded following disclosure avoidance protocols.

Table 8: Earnings Results: Heterogeneity by Field

VARIABLES	(1) Earnings	(2) Earnings	(3) Earnings	(4) Earnings	(5) Earnings
UR at Graduation	264.5	450.2	386.4	17.01	342.6
	(1,964)	(1,957)	(1,951)	(1,938)	(1,986)
CQ (SD)	3,277***	3,962***	3,781***	3,442***	4,046***
	(386.0)	(384.9)	(382.3)	(382.4)	(384.8)
STEM BA	11,150***				
	(1,928)				
STEM BA X UR	-491.0*				
	(285.7)				
Soc Sci BA		-931.3			
		(1,814)			
Soc Sci BA X UR		-712.4***			
		(267.7)			
Health BA			9,603***		
			(3,395)		
Health BA X UR			53.42		
			(493.1)		
Education BA				-15,820***	
				(3,031)	
Education BA X UR				1,280***	
				(450.0)	
Business BA					9,416***
					(2,924)
Business BA X UR					-276.5
					(444.9)
Observations	144000	144000	144000	144000	144000
R-squared	0.175	0.171	0.172	0.172	0.175

Notes: Standard errors clustered at the cohort-by-state-of-graduation level are in parentheses. Table reports estimate of Equation (2). Data from 2010, 2013, 2015, 2017 and 2019 Waves of the National Survey of College Graduates; see text for details. College quality defined following Dillon and Smith (2020). Controls include fixed effects for survey year, state, and cohort; indicators for race, sex, and parental education; and cohort FEs, race, sex, and parental education indicators interacted with the unemployment rate.

Table 9: Earnings Results: Heterogeneity by Sex

VARIABLES	(1) Earnings	(2) Earnings
UR at Graduation	2,397	-2,430
	(2,971)	(2,394)
CQ (SD)	4,844***	6,705***
	(1,713)	(1,380)
CQ (SD) X UR at Graduation	-80.20	-557.7***
	(258.9)	(205.7)
Observations	69000	75000
R-squared	0.157	0.107
Sample	Male	Female

Notes: Standard errors clustered at the cohort-by-state-of-graduation level are in parentheses. Table reports estimate of Equation (2). Data from 2010, 2013, 2015, 2017 and 2019 Waves of the National Survey of College Graduates; see text for details. College quality defined following Dillon and Smith (2020). Controls include fixed effects for survey year, state, and cohort; indicators for race, sex, and parental education; and cohort FEs, race, sex, and parental education indicators interacted with the unemployment rate.

Table 10: Enrollment and Degree Attainment Results by Sex

VARIABLES	(1) Ever Enrolled	(2) Ever Enrolled	(3) Grad Degree	(4) Grad Degree
UR at Graduation	0.644	-0.819	1.767*	0.440
	(0.938)	(0.938)	(1.022)	(1.016)
CQ Q2	2.533	-3.239	9.124*	0.899
	(4.647)	(4.891)	(5.343)	(5.859)
CQ Q3	8.657*	-3.567	7.425	-1.479
	(4.806)	(5.846)	(5.391)	(5.499)
CQ Q4	4.145	-4.955	27.59***	16.31***
	(4.191)	(4.997)	(5.343)	(4.846)
CQ Q2 X UR at Graduation	-0.835	0.572	-1.770**	0.479
	(0.744)	(0.769)	(0.795)	(0.935)
CQ Q3 X UR at Graduation	-1.409*	0.849	-1.077	1.106
	(0.750)	(0.973)	(0.833)	(0.845)
CQ Q4 X UR at Graduation	-0.161	1.624**	-2.575***	-0.475
	(0.677)	(0.796)	(0.798)	(0.696)
Sample	Male	Female	Male	Female
Observations	36000	39000	36000	39000
R-squared	0.039	0.039	0.061	0.070

Notes: Standard errors clustered at the cohort-by-state-of-graduation level are in parentheses. Table reports estimate of Equation (2). Data from 2010, 2013, 2015, 2017 and 2019 Waves of the National Survey of College Graduates; see text for details. College quality defined following Dillon and Smith (2020). Controls include fixed effects for survey year, state, and cohort; indicators for race, sex, and parental education; and cohort FEs, race, sex, and parental education indicators interacted with the unemployment rate. Column headers indicate which type of postgraduate enrollment variable is considered in the given regression.

Table 11: Migration Results

VARIABLES	(1) Migration	(2) Migration	(3) Migration
UR at Graduation	5.941***	5.427*	6.103**
	(1.992)	(3.023)	(2.468)
CQ Q2	0.281	-0.973	1.474
	(5.270)	(7.608)	(6.393)
CQ Q3	5.554	8.044	4.011
	(5.131)	(7.465)	(6.291)
CQ Q4	18.57***	22.23***	15.62**
	(4.768)	(6.934)	(6.543)
CQ Q2 X UR at Graduation	-0.733	-0.935	-0.649
	(0.801)	(1.122)	(1.014)
CQ Q3 X UR at Graduation	-1.155	-2.119*	-0.533
	(0.774)	(1.125)	(0.976)
CQ Q4 X UR at Graduation	-1.111	-1.956*	-0.455
	(0.716)	(1.044)	(1.006)
Sample	All	Male	Female
Observations	144000	69000	75000
R-squared	0.113	0.114	0.125

Notes: Standard errors clustered at the cohort-by-state-of-graduation level are in parentheses. Table reports estimate of Equation (2). Data from 2010, 2013, 2015, 2017 and 2019 Waves of the National Survey of College Graduates; see text for details. College quality defined following Dillon and Smith (2020). Controls include fixed effects for survey year, state, and cohort; indicators for race, sex, and parental education; and cohort FEs, race, sex, and parental education indicators interacted with the unemployment rate. Migration indicates respondent living in a state other than the state in which they obtained their first BA.

Table 12: Robustness of Results

VARIABLES	(1) Earnings	(2) Enrolled	(3) Earnings	(4) Earnings	(5) Earnings	(6) Earnings
UR at Graduation	-584.9	94.57	1,281	1,735	405.7	1,145
	(2,697)	(2,714)	(1,869)	(1,958)	(1,314)	(1,371)
CQ Q2		1,727		1,742		2,732
		(3,650)		(2,921)		(3,101)
CQ Q3		11,900***		10,230***		9,014***
		(3,668)		(3,170)		(3,371)
CQ Q4		12,300***		16,140***		15,760***
		(3,918)		(2,970)		(3,300)
CQ Q2 x UR at Graduation		-250.5		-122.8		-286.0
		(535.3)		(415.7)		(447.0)
CQ Q3 x UR at Graduation		-1,152**		-744.5		-635.5
		(535.6)		(469.6)		(494.9)
CQ Q4 x UR at Graduation		-775.5		-777.1*		-1,069**
		(578.0)		(442.1)		(490.2)
CQ (SD)	5,012***		6,440***		5,861***	
	(1,430)		(1,094)		(1,246)	
CQ (SD) X UR at Graduation	-278.4		-277.0*		-317.2*	
	(214.5)		(163.5)		(188.9)	
Observations	81000	81000	116000	116000	142000	142000
Sample	BA only	BA only	LF, not enr	LF, not enr	Baseline	Baseline
UR Measure	Baseline	Baseline	Baseline	Baseline	GOTG	GOTG
R-squared	0.163	0.163	0.202	0.202	0.169	0.169

Notes: Standard errors clustered at the cohort-by-state-of-graduation level are in parentheses. Table reports estimate of Equation (2). Data from 2010, 2013, 2015, 2017 and 2019 Waves of the National Survey of College Graduates; see text for details. College quality defined following Dillon and Smith (2020). Controls include fixed effects for survey year, state, and cohort; indicators for race, sex, and parental education; and cohort FEs, race, sex, and parental education indicators interacted with the unemployment rate. Enrolled: currently enrolled in any graduate program. BA only: excludes individuals who hold a graduate degree or are currently enrolled in a graduate program. LF, not enr: includes only individuals who are in the labor force and not enrolled in graduate school. GOTG: unemployment rate measured from Graduates On The Go data.

Table 13: Alternate Earnings Results

VARIABLES	(1) Log(Earnings)	(2) Log(Earnings+1)	(3) Wage	(4) Log(Wage)	(5) Log(Wage+1)
UR at Graduation	0.0250	-0.128	-0.778	-0.0141	-0.0564
	(0.0402)	(0.181)	(1.060)	(0.0396)	(0.0636)
CQ (SD)	0.109***	0.232**	3.159***	0.0992***	0.125***
	(0.0240)	(0.107)	(0.558)	(0.0205)	(0.0362)
UR at Graduation X CQ	-0.00686*	-0.0328*	-0.258***	-0.00684**	-0.0137**
	(0.00366)	(0.0171)	(0.0824)	(0.00301)	(0.00564)
Observations	131000	144000	144000	131000	144000
R-squared	0.138	0.041	0.121	0.132	0.065

Notes: Standard errors clustered at the cohort-by-state-of-graduation level are in parentheses. Table reports estimate of Equation (2). Data from 2010, 2013, 2015, 2017 and 2019 Waves of the National Survey of College Graduates; see text for details. College quality defined following Dillon and Smith (2020). Controls include fixed effects for survey year, state, and cohort; indicators for race, sex, and parental education; and cohort FEs, race, sex, and parental education indicators interacted with the unemployment rate.

Table 14: Probit Results

VARIABLES	(1) Employed	(2) NILF	(3) Discouraged	(4) Enrolled
UR at Graduation	-0.00564	0.00243	0.000677	-0.00150
	(0.00492)	(0.00406)	(0.00386)	(0.00366)
CQ (SD)	0.0158*	-0.0191**	-0.0104	0.00167
	(0.00921)	(0.00750)	(0.00694)	(0.00661)
UR at Graduation X CQ	-0.00296**	0.00320***	0.000551	0.00217**
	(0.00147)	(0.00116)	(0.00111)	(0.000980)
Observations	144000	144000	144000	144000

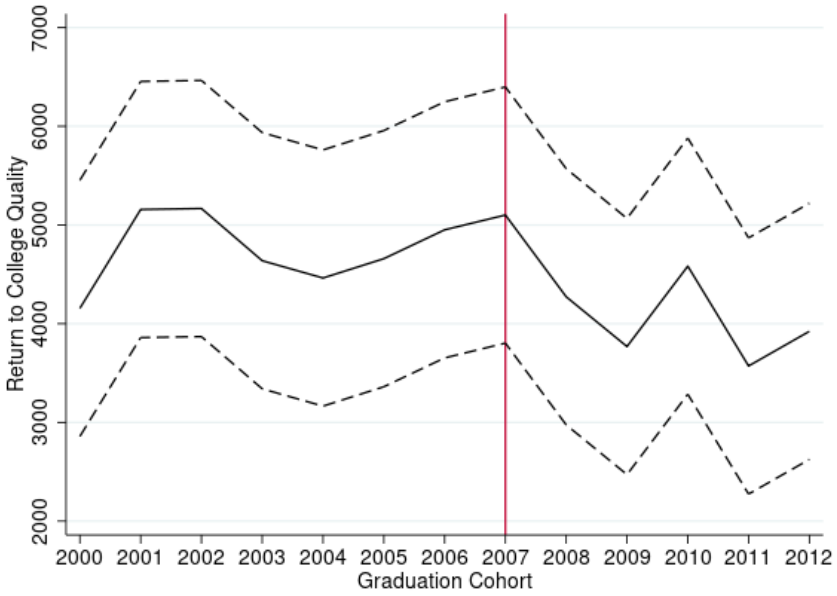
Notes: Standard errors clustered at the cohort-by-state-of-graduation level are in parentheses. Table reports estimate of Equation (2). Data from 2010, 2013, 2015, 2017 and 2019 Waves of the National Survey of College Graduates; see text for details. College quality defined following Dillon and Smith (2020). Controls include fixed effects for survey year, state, and cohort; indicators for race, sex, and parental education; and cohort FEs, race, sex, and parental education indicators interacted with the unemployment rate. NILF: not in labor force. Enrolled: currently enrolled in any graduate program. Discouraged: not in the labor force and not enrolled in any graduate program.

Table 15: Difference-in-Differences Specification Results

VARIABLES	(1) Earnings	(2) Log(Earnings)	(3) Log(Earnings + 1)	(4) NILF	(5) Enrolled
Bad Shock X Post	1,882	0.0101	0.252	-0.0112	-0.0106
	(2,132)	(0.0498)	(0.215)	(0.0161)	(0.0167)
CQ Q2	982.1	0.0306	0.0298	-0.000145	-0.00221
	(1,026)	(0.0242)	(0.110)	(0.00913)	(0.00783)
CQ Q3	5,160***	0.101***	0.157	-0.0114	0.0121
	(1,068)	(0.0231)	(0.111)	(0.00856)	(0.00764)
CQ Q4	9,695***	0.168***	0.125	-0.00456	0.0344***
	(1,114)	(0.0245)	(0.115)	(0.00889)	(0.00796)
Bad Shock X Post X CQ Q2	-1,677	-0.0597	-0.162	-0.00257	0.0231
	(2,369)	(0.0584)	(0.242)	(0.0181)	(0.0211)
Bad Shock X Post X CQ Q3	-2,630	-0.0437	-0.150	0.0122	0.00855
	(2,493)	(0.0555)	(0.248)	(0.0197)	(0.0236)
Bad Shock X Post X CQ Q4	-5,915**	-0.0819	-0.437*	0.0410**	0.0428**
	(2,334)	(0.0552)	(0.241)	(0.0172)	(0.0188)
Observations	144000	131000	144000	144000	144000
R-squared	0.164	0.134	0.038	0.029	0.041

Notes: Standard errors clustered at the cohort-by-state-of-graduation level are in parentheses. Table reports estimate of Equation (2). Data from 2010, 2013, 2015, 2017 and 2019 Waves of the National Survey of College Graduates; see text for details. College quality defined following Dillon and Smith (2020). Bad Shock is an indicator for graduating from a college in a state with an above median decline in the unemployment rate from 2007 and 2009. Post is an indicator for graduating in 2008 or later. Controls include state, cohort, and survey year fixed effects, race and sex indicators, and indicators for parental education. NILF: not in labor force. Enrolled: currently enrolled in any graduate program. Discouraged: not in the labor force and not enrolled in any graduate program.

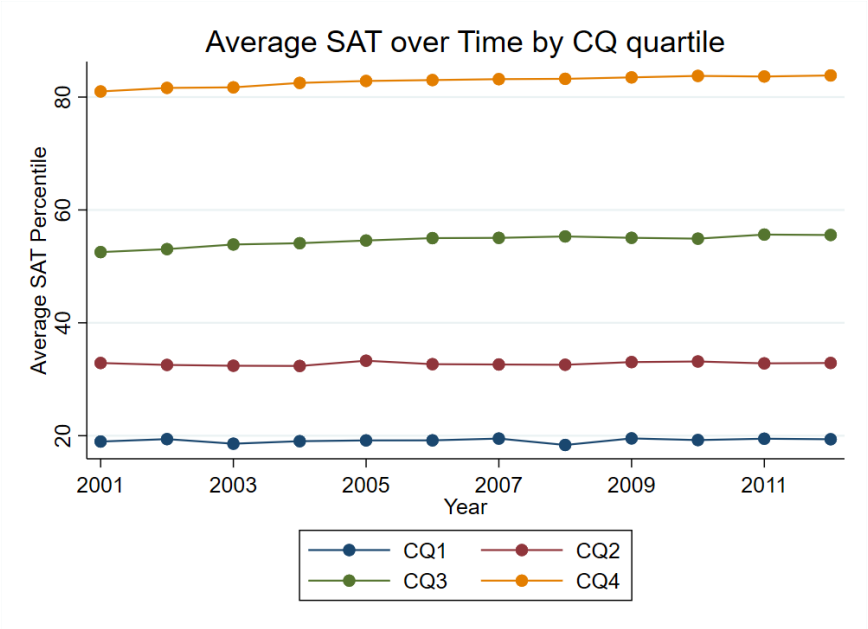
Figure 1: College Quality Returns by Graduation Cohort

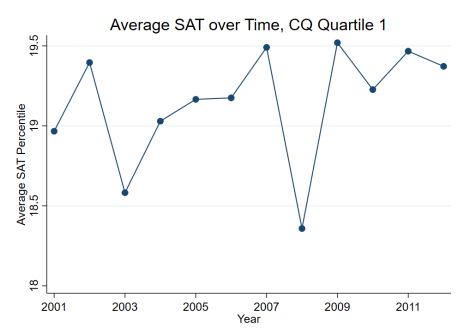


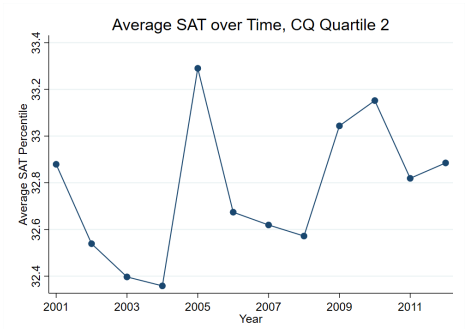
Notes: Standard errors clustered at the cohort-by-state-of-graduation level; dotted lines represent 95% confidence intervals. Table reports estimate of Equation (2). Data from 2010, 2013, 2015, 2017 and 2019 Waves of the National Survey of College Graduates; see text for details. College quality defined following Dillon and Smith (2020). Controls include fixed effects for survey year, state, and cohort, as well as race and sex indicators, and indicators for parental education.

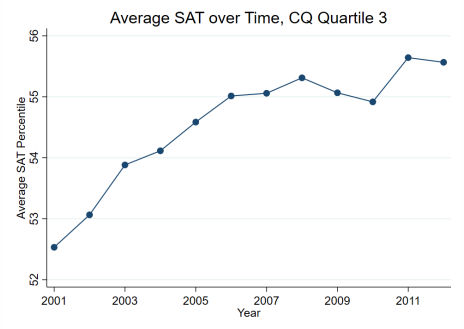
A Selection into College, 2000-2012

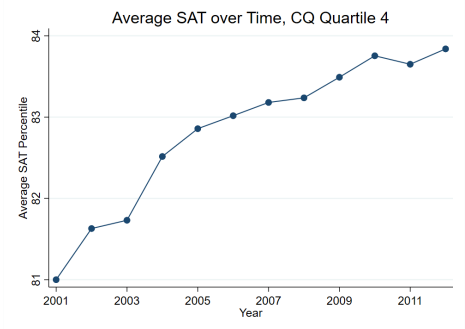
The following graphs show the mean of the 25th and 75th percentile of SAT scores of entering students over time, by college quality quartile as defined in section 3. Although there is some variation over our time period, it is relatively small and does not appear to be systematically related to the business cycle.











B Results for National-Level Unemployment Rate Specification

Table 16: Results for Earnings

VARIABLES	(1) Earnings	(2) Earnings	(3) Earnings	(4) Earnings
UR at Graduation	-213.6	-230.8	-220.5	987.4**
	(280.5)	(278.9)	(281.5)	(415.2)
College Quality Q2			1,175	5,009
			(1,024)	(3,479)
College Quality Q3			5,297***	15,070***
			(1,085)	(3,694)
College Quality Q4			9,823***	24,280***
			(1,159)	(3,616)
CQ Q2 X UR				-595.0
				(484.4)
CQ Q3 X UR				-1,521***
				(519.3)
CQ Q4 X UR				-2,253***
				(514.5)
CQ (SD)	4,109***	9,471***		
	(431.3)	(1,327)		
CQ (SD) X UR		-836.4***		
		(194.6)		
Observations	126000	126000	126000	126000
R-squared	0.172	0.174	0.171	0.173

Notes: Standard errors clustered at the cohort-by-state-of-graduation level are in parentheses. Table reports estimate of Equations (1) and (2). Data from 2013, 2015, 2017 and 2019 Waves of the National Survey of College Graduates; see text for details. College quality defined following Dillon and Smith (2020). Controls include race and sex indicators, indicators for parental education, indicators for a STEM undergraduate degree, state fixed effects, and a quartic polynomial in experience.

Table 17: Results for Employment Variables

VARIABLES	Employed	NILF	Unemployed	Enrolled	Discouraged	Hours	Work Outside Field
UR at Graduation	-0.200	0.028	0.172*	0.629***	0.093	-6.828	0.160
	(0.216)	(0.189)	(0.102)	(0.192)	(0.177)	(5.234)	(0.350)
CQ (SD)	2.734***	-3.120***	0.386	-1.380*	-1.767**	37.58*	-0.407
	(1.023)	(0.903)	(0.544)	(0.742)	(0.872)	(21.16)	(1.462)
UR at Graduation X CQ (SD)	-0.427***	0.484***	-0.057	0.431***	0.180	-0.618	-0.095
	(0.156)	(0.130)	(0.089)	(0.123)	(0.123)	(3.205)	(0.225)
Observations	126000	126000	126000	126000	126000	116000	116000
R-squared	0.025	0.031	0.011	0.040	0.042	0.058	0.019

Notes: Standard errors clustered at the cohort-by-state-of-graduation level are in parentheses. Table reports estimate of Equation (1) and (2). Data from 2013, 2015, 2017 and 2019 Waves of the National Survey of College Graduates; see text for details. College quality defined following Dillon and Smith (2020). Controls include race and sex indicators, indicators for parental education, indicators for a STEM undergraduate degree, state fixed effects, and a quartic polynomial in experience. NILF: not in labor force. Enrolled: currently enrolled in any graduate program. Discouraged: not in the labor force and not enrolled in any graduate program. Work Outside Field: indicator variable for respondent working outside their field of undergraduate study.

C Weinstein (2022) Replication and Comparison

To illuminate why our results differ from those of Weinstein (2022), we conduct an exercise where we use the same data (mobility report card) and specification as Weinstein but change the college quality measure from Barron's categories to our quartiles measure, use mean earnings as the outcome variable, and weight by institution size. Specifically, we replicate the following triple-difference event specification,

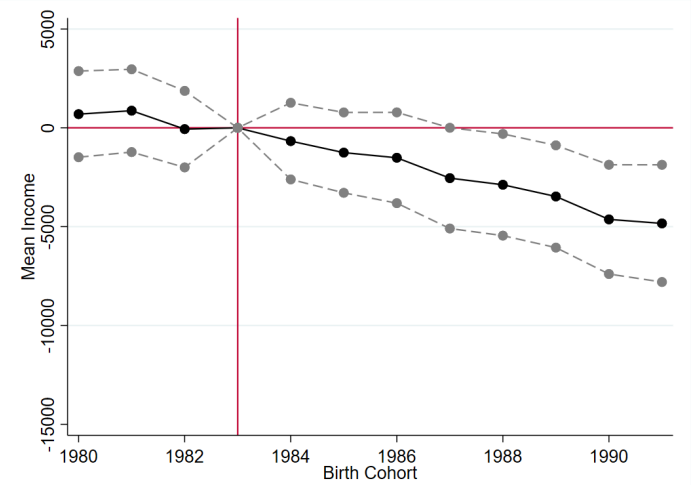
$$Y_{j_{ks}t} = \kappa_j + \beta_{st} + \gamma_{kt} + \lambda_{kt} Cohort_t * \quad CollegeQuality_j * SevereRecession_{j_{ks}} + \rho_{kt} Cohort_t * Z_{jt} * SevereRecession_{j_{ks}} + X_{jt}\delta + u_{jt}$$

where $Y_{j_{ks}t}$ is income measured in 2014 for graduates of university j, in birth cohort t, where university j is in college quality group k and commuting zone s. κ_j are university fixed effects, β_{st} are birth cohort-commuting zone fixed effects, and γ_{kt} are birth cohort-college quality group fixed effects. $SevereRecession_{j_{ks}}$ is an indicator for college j being located in a commuting zone with an above-median change in the unemployment rate between 2007 and 2009. Z_{jt} and X_{jt} are university-level controls for fraction of female students, log of students in the cohort, and several parental income variables. This specification is exactly the same as Weinstein's, except we have changed the outcome to mean earnings, changed the college quality measure to our quartiles measure, and weighted by institution size.

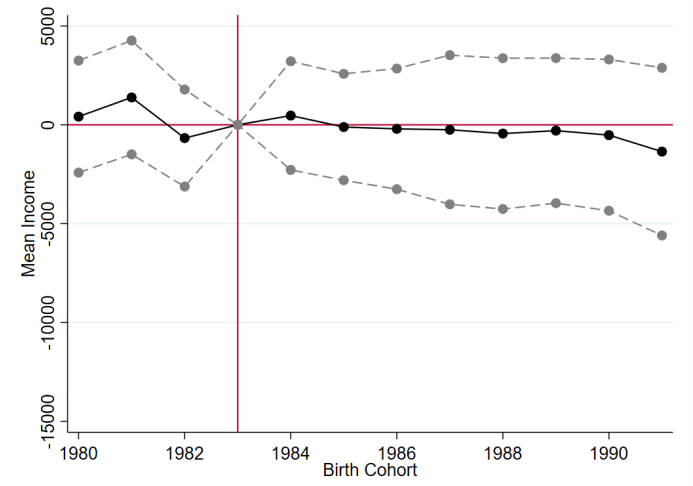
Figure 3 shows the results, where the bottom quality quartile is the omitted category. The interpretation for subfigure (c) is the following: for birth cohorts who would have graduated after the Great Recession, the difference in mean incomes between graduates from the top quality quartile and same-CZ bottom quality quartile is an additional 5 to 8 thousand dollars less in high-recession shock versus low-recession shock CZs relative to the 1983 (base, following Weinstein) cohort.

Figure 3: Recession Effects by College Quality, Relative to College Quality Quartile 1: Triple Differences Model

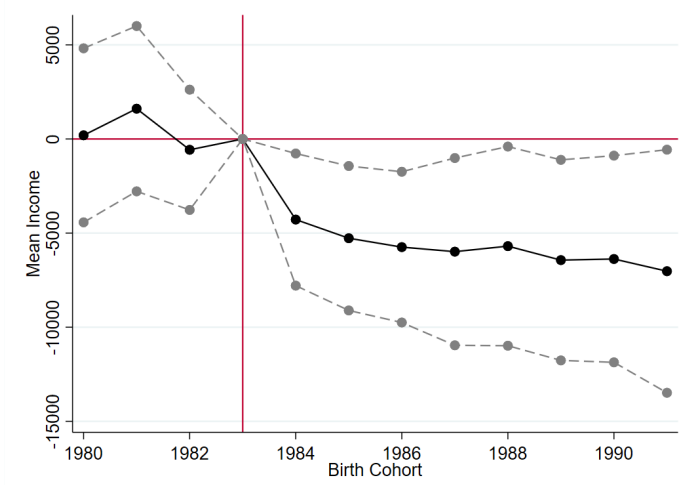
(a) College Quality Quartile 2



(b) College Quality Quartile 3



(c) College Quality Quartile 4



Notes: This figure reproduces Figure 2 of Weinstein (2022) after (i) changing from Barron's tiers to our college quality measure, (ii) changing from log median income of positive earners to mean income, and (iii) weighting by institution size. The bottom quality quartile is the omitted category.