The Effect of the Great Recession on Student Loan Borrowing and Repayment*

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Abstract

We study the long-term effect of the Great Recession on federal student loan borrowing and repayment. Using detailed longitudinal data on federal student loan borrowers, we compare labor markets that faced varying degrees of unemployment severity during the economic downturn. On average, a one percentage point increase in Great Recession unemployment rates caused a 7% rise in total outstanding debt and 6% percent defaulted borrowers. Across institutional sectors, the Great Recession accounted on average for between 19-32% of the total increase in undergraduate student debt and 10-25% of the total increase in defaults. While default increases were widespread, borrowing and enrollment increases were concentrated among borrowers less than 5 years out of college. Individuals who re-enrolled due to the Recession took out more debt but were less likely to default.

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1 Introduction

Student loans are the largest form of household debt other than mortgages, and the fastest growing (Federal Reserve Bank of New York, 2023). Approximately 46 million borrowers held $1.6 trillion in federal student loan debt in 2023, a 50% growth in the number of borrowers and more than triple the total loan debt since 2007. By 2023 the average loan balance was almost $38,000, more than double what it was in 2007 (Office of Federal Student Aid, 2023b). Financial distress and default rose too: between 2015 and 2020 approximately 300,000 student loan borrowers with $6 billion in debt entered default each quarter (Office of Federal Student Aid, 2023a). The scale of the issue has driven student debt to the forefront of local, state, and national policy discussions. Recent years have seen pauses on federal loan repayment, plans for student debt forgiveness, and proposals for more generous income-driven repayment plans.

An important open question is whether, and to what extent, one cause of the current student debt "crisis" is the Great Recession and its ripple effects. An extensive literature documents that adverse labor market conditions during the recession caused lower earnings and worse occupational trajectories in the long-term for young workers (Oreopoulos et al., 2012; Rothstein, 2021; Rinz, 2022). Recessions also generally incentivize post-secondary enrollment, providing a "safe port in the storm" (Betts and McFarland, 1995; Hillman and Orians, 2013; Barrow and Davis, 2012; Long, 2014; Barr and Turner, 2015; Foote and Grosz, 2020; Acton, 2021). The Great Recession in particular also coincided with steep declines in state appropriations for public colleges and cuts to state financial aid programs (Bettinger and Williams, 2013; Monarrez et al., 2021), which in turn led to decreases in the quality and availability of public college, and increasing tuition (Gordon and Hedlund, 2016; Levine, 2023). During the same period, the federal government expanded borrowing limits, enabling larger loan volume (Black et al., 2023; Johnson et al., 2013). For-profit colleges, whose students have lower returns to post-secondary credentials and higher rates of financial distress, absorbed excess demand for higher education (Barr and Turner, 2013; Looney and Yannelis, 2015; Deming et al., 2016).

In this paper, we estimate the comprehensive reduced form effect of the Great Recession on federal student loan borrowing and repayment outcomes. We leverage detailed administrative records on

the universe of federal student loan borrowers between 2005-2019 to study the recession's impact on borrowing, enrollment persistence, repayment progress, degree completion, and loan default. Our identification strategy is based on a design that compares regions of the country that were differentially impacted by the recession (Yagan, 2019). Leveraging this geographic variation, we document impacts on both the extensive and intensive margins of enrollment, borrowing and loan repayment.

We begin with an analysis of the effect of the recession on labor markets, using repeated cross-sections of each labor market's student loan portfolio. This approach allows us to examine the overall impact of the recession over time, and in particular the extensive margin effect on new enrollment and borrowing. We conduct this analysis separately by institution sector, observing how the recession differentially affected enrollment and loan portfolio at public, private, and for-profit institutions of different levels. We then turn to an individual-level, representative panel of borrowers with outstanding student loan debt at the beginning of the Great Recession in late 2007. This borrower panel allows us to account for any effects of the recession on migration, and is also useful as a way to examine how the recession affected different types of borrowers. Our results can be interpreted as the reduced form effect of the recession, stemming from the combined impact of the several mechanisms and adjustment margins impacting student borrowing during this period.

Our findings indicate that the recession caused increased student loan borrowing and indebtedness across all sectors of post-secondary education.SAY SOMETHING ABOUT PARALLEL TRENDS We estimate that by 2019 – almost ten years after the official end of the Great Recession – commuting zones that had faced a 1 percentage point higher recession unemployment still had between 7 and 8 percent higher numbers of both borrowers and balance outstanding. Areas facing higher unemployment saw more post-secondary program completions through 2019, as well as higher total numbers of defaulted borrowers. Both the increase in completions and defaults were concentrated among those who attended community colleges and for-profit 4-year institutions. Our calculations suggest that between 10% and 25% of undergraduate borrower defaults in 2019 could still be traced back to the direct impact of the recession on college-going, federal borrowing, and subsequent labor market outcomes.

In our study of individual borrower trajectories, we sample borrowers with loan debt in 2007 and

assign them to their location during the onset of the recession, allowing us to estimate models discerning who bore the brunt of the aggregate recessionary impacts.[1] We find that increases in borrowing were concentrated among individuals who were already enrolled in college at the beginning of the recession, on average taking out approximately $100 in additional student loans per year in labor markets facing a 1 p.p. higher unemployment rate between 2010-2014, and even being 0.3 percentage points more likely to remain enrolled through 2019. Increased borrowing and longer enrollment periods led to temporary decreases in completions for this group. This group also saw long-term increases in loan balances and default rates, by $1,900, and 0.3 percentage points, respectively. People who had been out of school for less than 5 years saw a similar set of impacts, of more muted magnitude. Heterogeneity analyses indicate that the effect of the recession was larger among historically marginalized racial and ethnic groups.

MOTIVATE THIS EXERCISE BETTER We use our results to understand the relationship between enrollment and default in this sample of borrowers, following approaches by Card and Solis (2022) and Card et al. (2008). We find that borrowers who had been enrolled during the recession were more likely to default no matter if they pursued additional enrollment or took out additional loans. This is consistent with the literature that shows the detrimental effects of first entering the labor market during recessions (Oreopoulos et al., 2012). On the other hand, among borrowers who had left school at least five years before the onset of the recession, those who re-enrolled following the recession were 33 percentage points less likely to enter default. Thus, it seems that additional enrollment protected the separated borrowers who did enroll from the detrimental effects of the recession, even though overall enrollment effects were negative for this group.

Our study expands on the vast empirical literature on the impacts of recessions on economic well-being. It has been well established that recessions have long-term effects on households. Yagan (2019) shows that even by 2015 the Great Recession accounted for over half the decline in employment since 2007. This is especially true for labor market entrants: Oreopoulos et al. (2012)

[1] A potential threat to identification is that recessionary effects are heterogeneous over space, and that residential mobility may dampen geographic differences in the intensity of economic downturns (Blanchard and Katz, 1992; Yagan, 2019), depending on labor and housing market frictions (Frey, 2009; Kline and Moretti, 2013; Bricker and Bucks, 2016; Foote, 2016; Ganong and Shoag, 2017; Notowidigdo, 2020). Given the similarity in our results between the cross-sectional labor market panel and our individual-level panel that takes pre-Recession labor markets as fixed, we do not think this is a threat to our findings. Moreover, internal migration actually decreased as a result of the Great recession (Monras, 2018).

show that graduating into a typical recession leads to cumulated earnings declines of 5 percent over 10 years. We extend this knowledge by focusing on a set of new and important outcomes related to federal student loan repayment. Because of our long follow-up period, we are also able to examine how the recessionary impacts vary in the short- and long-run. Recent research has shown that recessions lead to long-term inequality in local labor market outcomes (Hershbein and Stuart, 2022). Our results suggest the existence of similar long-term effects on overall indebtedness and student loan delinquency rates for local areas severely impacted by a recession.

We also provide novel and comprehensive evidence on the impact of recessions on post-secondary enrollment and credential attainment. In theory, there are countervailing forces impacting enrollment during a recession. On the one hand, decreased family income and higher tuition may depress the likelihood of college enrollment; on the other, high unemployment reduces the opportunity cost of attending school. Our findings support existing evidence on high unemployment rates being positively associated with increased college enrollment (Long, 2004; Hillman and Orians, 2013), and extend these results to degree completion.

This paper also contributes to evidence on changes to the federal student loan system that occurred around the same time as the Great Recession, which expanded the availability and generosity of federal credit for current and prospective students. Black et al. (2023) find that the increase in federal borrowing limits led to increased borrowing and attainment among students who were likely to seek more loans. Less is known about the impacts of labor market downturns on the consumer finance of college students. Using credit bureau data, Pinto and Steinbaum (2023) find corroborating evidence of increases in student debt and worse repayment outcomes as a result of the Great Recession. We are able to expand on this work using federal administrative data that can provide a rich picture of the trajectories that borrowers took as result of the recession, track enrollment and program completion outcomes by college sector, and produce evidence on pre-recession cohorts to support parallel trends assumptions.

The rest of the paper proceeds as follows. Section 2 describes our data and provides descriptive statistics for the analysis samples. Section 3 provides aggregate-level results for a repeated cross-section of commuting zones. Next, section 4 presents results for an individual borrower-level panel. Section 5 discusses the implications of our results and concludes.

2 Background and Data

2.1 Federal student loans

Federal student loans are authorized by Title IV of the 1965 Higher Education Act. They were initially funded by the Federal Family Education Loan (FFEL) Program, in which private student loans were subsidized and guaranteed by the federal government. The FFEL program ended in 2010 and was replaced by Direct Loans issued by the U.S. Department of Education which had operated parallel to FFEL, at a smaller level, since 1994. The first Direct Loan was originated July 4, 1994 but DLs were typically only 20 to 50 percent of FFEL volume until 2008.[2] Access to funds for the Stafford Loan Program (the largest source of federal loan aid) is not linked to borrower creditworthiness. Stafford loan limits and interest rates are set by Congress and vary by type of loan (which is partly determined by student financial need) and student level.[3] Loan limits for undergraduates increased beginning in 2009.[4] Parents can borrow for the education of their children up to cost of attendance via the Parent PLUS program, but this requires a minimal credit check.[5] Graduate PLUS loans, launched in award year 2006-2007, also carry minimal underwriting and allow qualifying individuals to borrow for graduate school up to cost of attendance. Generally, schools require graduate and professional students to borrow up to the Stafford Loan graduate limits each year, before awarding Grad PLUS loans. The terms of student loan repayment plans are at the discretion of the U.S. Department of Education.[6]

[2]The private lender share of the student loan market has trended down in years, with only about 10 percent of loans are originated by private lenders (Ma and Pender, 2022).

[3]Stafford loans also have lifetime limits. Subsidized Stafford are available for students with unmet financial need, with no interest accrual while the student is enrolled. Students with no unmet need can receive unsubsidized Stafford Loans.

[4]Limit increases were enacted by the Ensuring Continued Access to Student Loans Act of 2008. Freshmen and sophomore level limits went from $2,625 to $5,500 and $3,500 to $6,500 (respectively) per academic year. For upper level undergraduates limits increased from $5,500 to $7,500.

[5]In our analysis, parent loans are assigned to students. While this choice is unlikely to affect our results as, in the event a parent defaults on both the loans they took out for their own education, and their children's loans, this would count as two separate default events in our data.

[6]Borrowers entering repayment are automatically placed in a 10-year repayment plan with payments amortized accordingly. The Department also offers extended and graduated repayment plans that make the repayment period longer, with payments still determined by an amortization formula. Additionally, borrowers can enroll in an income driven repayment (IDR) to set payments as a small share of discretionary income. Borrowers that remain in an IDR plan for 20-to-25 years have their remaining balance forgiven. There was a one-time exception during 2023-24 that provided IDR forgiveness based on time since disbursement and did not require IDR plan enrollment or on-time payments; shorter forgiveness periods were also used at that time. See Monarrez and Turner (2024) for additional details on IDR.

2.2 Data and Analysis Samples

We use administrative records on the universe of federal student aid recipients maintained by U.S. Department of Education's Federal Student Aid (FSA). Student loan servicing records report origination balance and date, school identifiers, borrower academic level, date of birth (rounded to the first day of the month), and monthly information on balance outstanding, and the current status of the loan.[7] We measure the state of the federal portfolio at the end of federal fiscal years 2005, the first year available in the data, through 2019, the year before the start of the COVID-19 pandemic.[8]

Our identification strategy relies on variation in the severity of the Great Recession across geographic areas. We define the local severity of the Great Recession as the percentage point change in the commuting-zone (CZ) unemployment rate between 2007 and 2009 (Yagan, 2019).[9] The CZ unemployment rate data is obtained from U.S. Bureau of Labor Statistics (2023). Figure 1 shows a map of CZs in the continental United States, split by deciles of the Great Recession shock. The regional variation in the severity of the Recession has been well-documented, including particularly large unemployment shocks in manufacturing areas and the Sun Belt (Mian and Sufi, 2009). We link student loan borrowers to CZs based on their residential location at the time of their first federal student loan origination.[10]

For the first part of our analysis, we leverage a panel dataset measuring the loan portfolio of each of the 741 CZs in the country. For each CZ, we measure total outstanding balance, number of total borrowers outstanding, the flow of new borrowers and new loan origination, as well as the number of borrowers and balance in default. In the main analysis we split out each of these variables by

[7] We use individual award recipient identifiers to define who is the "borrower". For parent loans, we use the student identifier to define the borrower. All variables denominated in dollars are adjusted for inflation using the CPI-U (U.S. Bureau of Labor Statistics, 2024) and reported in constant 2019 dollars.

[8] The federal fiscal year ends September 30th of the calendar year. Loan status categories include origination, grace, repayment, forbearance and default. Once a student graduates or drops from the school there is a grace period of 6 months, after which point the loan "matures" and enters repayment.

[9] Commuting zones are defined groupings of counties that approximate local labor markets. In contrast to other definitions of labor markets, such as Metropolitan Statistical Areas (MSAs), CZs cover the entire area of the 50 states and the District of Columbia (Tolbert and Sizer, 1996). Figure A1 shows that our CZ-level dataset closely replicates publicly-available aggregate trends in total balance and recipients. The CZ-level dataset is expected to slightly undercount total as it does not include federal student loan borrowers located in U.S. territories.

[10] See Appendix B for a detailed description of the procedure used to link borrowers to CZs, as well as other minutiae on data construction. The entire dataset, with outcomes through the 2023 fiscal year is available for download in the paper's website.

the sector of the institution. As such, this dataset captures both the stock and the flow of borrowers in each CZ's portfolio for the years 2005-2019, allowing us to study both extensive and intensive margin changes to the federal loan portfolio separately by institution sector.

The second part of the analysis uses a micro-level panel dataset of borrowers with loans outstanding at the end of the 2007 fiscal year, a few months prior to the onset of the recession. We draw a 2% random sample of approximately 555,000 borrowers meeting these criteria, then follow them annually through the end of 2019. Because most borrowers take out multiple loans to finance their education, we aggregate loan servicing data to the borrower level, measuring total balance outstanding, new loan origination, repayment rate, default status, and repayment plan.[11]

Apart from loan servicing records, we leverage other sources from FSA to inform our analysis. We use information from the Free Application for Federal Student Aid (FAFSA) to measure borrower gender, dependence status, and adjusted gross income, using the earliest application observed. Additionally, we employ data from the National Student Loan Data System (NSLDS) enrollment reporting records, required for colleges receiving Title IV aid. These enable us to track the post-secondary enrollment for students who received federal financial aid at any point between 1999 and the present. We observe the college of enrollment, as well as the time period and intensity of the enrollment spell. These reports also hold information on drop out and graduation, allowing us to measure program completion for borrowers in our sample.

While the FSA data provides a unique opportunity to observe the universe of federal student loan borrowers, it carries some of limitations. First, records for commercial FFEL loans, which are guaranteed but not owned by the U.S. government, have more limited information than Direct Loan records.[12] We do not observe residential location (nor repayment plan) in servicing records for commercial FFEL borrowers, so additional procedures are needed to link them to their CZ of origin (see Appendix B for details on data construction). Second, federal regulation limits our ability to link individual borrower information from sources outside of FSA, such as employment income, census demographics, or credit reporting records. This means that we are confined to studying

[11] Repayment plan is only observed for loans held by Department of Education, which includes Direct Loans and federally serviced FFEL loans.

[12] In the years leading up to the Recession commercial FFEL loans comprised nearly 80% of the portfolio. In 2008-2009 the Department of Education began the purchase of commercial loans, and is now the sole provider of new student loans via the Direct Loan program.

outcomes reported to FSA, which mostly encompass loan repayment and program completion.

3 Overall Impact of the Great Recession

3.1 Estimation

We begin by estimating the Recession's reduced form impact on the federal student loan portfolio over time and across labor markets. These reduced form estimates capture the overall impact of the Recession and its ripple effects, including the direct impact of the labor market downturn, the shock to home equity and prices, as well as strategic responses by college administrators and state agencies. Our approach allows us to study the combined extensive margin response to the economic downturn, such as the decision to attend college and borrow student loans for the first time.

While the entire country experienced a shock, there was wide variation in its severity. Yagan (2019) established this variation as a reliable approach to identify the recession's effects on local labor markets. There are 741 CZs observed between 2005 and 2019, generating a strongly balanced panel with 11,712 observations.[13]

Table 1 presents summary statistics for the undergraduate loan estimation sample, reported separately by the institution sector.[14] The top panel shows cross-sections in 2007, on the eve of the Recession, and at the end of our study period in 2019. In 2005, the average CZ had 33,400 borrowers with loans held by the government. Borrower counts grew 72% by 2015 and 80% by 2019, reflecting two large-scale trends. On the one hand is an increase in federal loan take-up during this period as more people chose to take out federal loans. However, there was a shift from commercially to publicly owned debt, as the government held an increasingly large share of student debt.[15] Similarly, the mean outstanding debt per CZ grew from $635 million in 2005 (inflation adjusted to

[13] The total number of CZs in the country is 741. Due to insufficient data, we drop the smallest 5% of CZs (in terms of total borrowers) when estimating regression models.

[14] All federal loan records have an associated college id, allowing us to categorize institutions into: (1) public 4-year, (2) public 2-year (i.e. community colleges), (3) non-profit private, and (4) for-profit private. In this analysis, we focus exclusively on borrowers with undergraduate loans only. For borrowers with multiple loans for different schools, we pick the school associated with largest outstanding balance. Appendix Table A1 shows the same summary statistics for graduate programs.

[15] Many CZs are relatively small, but there are a handful of CZs that are much larger, generating a left-skewed distribution

2019 CPI), to $2,000 million in 2019. Similar upward trends are notable for borrowers in distress, as measured by the number of defaulted borrowers and the amount of debt in default.

The bottom panel of Table 1 shows four outcomes summarizing the extensive impact of the recession on the federal portfolio, including counts of: (a) the total number of new borrowers, (b) new loan originations, (c) new degree completions, and (d) new borrower defaults.[16] An upward trend in the number of borrowers is evident, as is a corresponding rise in aggregate disbursements for the average CZ. Degree completions and default events increased as well, reflecting growth in the federal portfolio both among positively and negatively selected student borrowers. In the appendix, we provide an example deep-dive comparing the loan portfolios of the Phoenix, AZ (which saw a large unemployment spike) and San Antonio, TX (which saw a relatively low increase in unemployment) CZ's in Figure A2.

We are interested in how variation in the Great Recession's severity affected these measures of the stock of the federal loan portfolio and new flows into it. We use the following generalized differences-in-differences model specification, comparing CZs based on the severity of the recessionary shock:

$$Y_{ct} = \sum_{t=2005}^{2019} \beta_t [Shock_c * \mathbf{1}(Year = t)] + \gamma_c + \delta_t + \varepsilon_{ct} \quad (1)$$

where Y_{ct} is an annual CZ outcome measure, such as the number of new borrowers. $Shock_c$ is the 2007-2009 change in unemployment in CZ c (described in Figure 1), which we interact with year indicators over the period 2005-2019, omitting the pre-Recession year, 2007. Under the assumption of parallel trends between severely and slightly shocked CZs, the coefficient β_t captures the effect of a 1 percentage point larger change in the unemployment rate during the Recession, net of calendar year and CZ fixed effects. We use a parsimonious set of controls, CZ fixed effects γ_c capturing fixed differences in unobservable characteristics, and time effects δ_t capturing nation-wide trends in the outcome of interest.[17]

Throughout this analysis we separate the outcomes by the sector of the educational institution. Characterizing the trends in borrowing as a reaction to the Recession in this way can shed light

[16] Newly defaulted borrowers are defined as those entering student loan default for the very first time, according to available records.

[17] Inference for the model coefficient estimates is based on clustered standard errors at the CZ level, the level of treatment assignment (see Abadie et al. (2023) for a discussion of proper use of standard error clustering).

on the potential mechanisms behind the worsening of repayment outcomes. For example, existing evidence suggests that for-profit colleges, which tend to have lower returns to degree than public and non-profit privates, absorb much of the excess demand for post-secondary schooling during recessionary periods (Deming et al., 2012). On the other hand, recent work has highlighted a similar role for community colleges, noting that Recession students are likely to seek high-earnings programs(Foote and Grosz, 2020). We present aggregate results across all sectors in the Appendix.

3.2 Results

Figure 2 summarizes our estimates of equation 1 for the six outcomes of interest, plotting the $\hat{\beta}_t$ coefficients along with their corresponding 95% confidence intervals separately by sector.[18] Panel (a) shows the estimated effect of a one percentage point increase in the unemployment rate on the number of student loan borrowers. There are no meaningful differences in total borrower growth prior to the Great Recession, as noted by the near-zero coefficients for years 2008 and prior. The coefficients for four-year for-profits is negative and statistically significant, but relatively small in magnitude. Across all sectors, in 2009 there is a clear break in trend. Four-year for-profits and community colleges saw substantially larger effects than other sectors. The Recession's effects on borrower entry top out in 2011 and plateau through 2019 for four-year for-profits and community colleges, while exhibiting a steady increase for the other sectors. Panel (b) shows the effect on loan balances, with almost identical patterns.

Panel (c) of the figure shows the effects of the Recession on new borrowing each year. We find patterns that corroborate the patterns in the overall portfolio of borrowers and balances. There is a rise in new borrowing at the beginning of the Recession that is particularly pronounced for the for-profits and community colleges, while the other sectors follow suit.

Increases in enrollment and borrowing led to increases in degree completions. Starting in 2010, Panel (d) of Figure 2 shows increases in completion across all sectors, with similar variation across sectors in the magnitude of this increase. Once again, the effect rises through the beginning of the 2010s and remains relatively flat for the next decade. Here, it is important to compare the increase in completions to the increase in enrollment. It is perhaps unsurprising that aggregate increases

[18] Appendix Figure A4 shows the same results aggregated across all sectors. Appendix Table A2 shows the coefficient estimate and standard error for 2019.

in enrollment resulted in *some* increase in post-secondary degree production.

The final two panels of Figure 2 examine financial outcomes in areas hit hard by the Great Recession. Panel (e) shows that, among CZs facing higher unemployment rate spikes due to the Recession, the number of borrowers entering default on their student loans started to creep up slowly and steadily in 2010. Once again, defaults at four-year for-profits outpaces those at other institutions. By 2012 community college defaults had caught up.

Nevertheless, this rise in borrower default may have been simply an artifact of the overall portfolio growth indicated by the results above. For a closer look at the composition of the CZs federal student loan portfolios, Panel (f) shows model estimates of the total defaulted balance as the outcome. This outcome combines new defaults and borrowers exiting default. Just like in the previous models, there is no indication of pre-existing trends in the borrower default share leading to the onset of the recession. Then there is a clear divergence By 2019, the defaulted balance in all sectors was positive.

In Figure A3 we present results for graduate borrowers, separately by control of institution. The pattern of impacts is similar across our main outcomes, with borrowing increases concentrated in the private and for-profit sectors. There is some (non-statistically significant) of larger effects on defaulted balance for graduate borrowers at for-profit institutions.

3.3 Implications

How large are the Great Recession's effects on the federal student loan portfolio? Could the current student debt crisis be completely an artifact of recessionary effects?

To answer these questions, we take stock of the magnitude of the Recession's impact on balances and defaults. We first calculate the actual log increase in balances and defaults by sector from 2007 to 2019. Next, we multiply the 2019 effect estimate of each outcome by the CZ's specific percentage point increase in 2007-2009 unemployment, obtaining the models' predicted effect size for each CZ.[19] Finally, we take the ratio of the predicted log change in the outcome due to the unemployment spike and the total observed log change. This procedure generates a cross-CZ

[19] Table A2 presents the 2019 coefficient estimates used in this calculation, corresponding to the estimates in Figure 2

distribution of relative effect size estimates with a few outliers with implausibly large effects. We address this by winsorizing the distribution at the 1% level. We report the cross-CZ mean of this winsorized relative effect size estimate.

Table 2 presents the results separately by institution sector. We present relative effect estimates for all loans outstanding (balance and borrowers) and also for defaulted loans. The first column shows that, across undergraduate sectors, between 19 and 32 percent of the log increase in loan balances from 2007 to 2019 can be attributed to the Great Recession. These effects stem from balances left unpaid as borrowers faced distressed financial situations, as well as increased borrowing. The second column shows estimates for the number of borrowers outstanding, which shows larger estimates; between 29 and 54% of borrowers with non-zero balances in 2019 could be attributed to the recession.

The third and fourth columns show relative effect estimates for the log change in the stock of defaulted loans in 2019. We estimate that between 10 and 25% of the increase in undergraduate borrower default was due to the recession. The undergraduate sectors with the largest share of recessionary increases in defaults are public 2-year programs. Graduate programs also see relatively large relative effect sizes, likely due to the low baseline levels of default in this sector in 2007. Results for the flow newly defaulted borrowers (fifth column) show larger effects for undergraduate 4-year and graduate borrowers, likely reflecting longer time to default for more highly educated borrowers bearing the long-winded effects of the recession.

At the bottom of the table we present average relative effect estimates for the entire CZ loan portfolio (based on the models presented in Figure A4). We estimate that 38% of the total log increase in outstanding balance and 22% of the increase in defaults is due to the recession. When using the increase in the flow of new entering defaults as the outcome (the last column in the table), our estimates suggest that early half (46%) of the increase in entering defaults in 2019 could still be traced back to the unemployment spike of the Great Recession. These large effect estimates are in line with existing evidence of the Great Recession's had lingering 'scarring' effects on young workers.

4 Individual Borrower Trajectories

A key limitation of the cross-sectional analysis is that it does not account for migration induced by the Great Recession itself. Economic theory predicts that labor markets will adjust in the face of regional variation in economic shocks (Blanchard and Katz, 1992). The evidence for the Great Recession in particular shows only partial and perhaps limited adjustment, in large part because the downturn was caused by a housing crisis (Bricker and Bucks, 2016; Yagan, 2019; Foote, 2016). Labor market adjustment through migration would tend to introduce attenuation bias in our estimates if there is a systematic relationship between unemployment spell length, enrollment in school, federal student loan borrowing, and migration. This would lead to areas with smaller shocks from the Great Recession appearing to have higher rates of loan origination and default.

Our preferred specification accounts for Recession-induced migration by relying on a panel of borrowers. We use a 2% random sample of borrowers with a positive loan balance in at the end of FY 2007 (see Section 2.2 for details). We track the outcomes of sampled borrowers at the end of every fiscal year, between September 2005 to September 2019. Our estimation dataset keeps the borrowers' CZ constant over time even if the borrower moves away. The outcomes we examine are enrollment, completion, loan balances, and statuses including origination and default.

4.1 Borrower types

Our sample includes the full range of borrowers with any amount of loan balance. This includes current college freshmen who are years away from beginning repayment, as well as borrowers who may have entered into default many years ago. The effects of a labor market downturn will surely vary across the types of borrowers, and we want to be able to distinguish these effects from the outset.

We first split our sample into three groups. The first group, Active Attachment, consists of borrowers who were enrolled in an educational institution in September 2007. The Active Attachment group includes borrowers who are taking out loans from their first postsecondary education spell, as well as borrowers who might have loan balances from previous spells. The goal is to identify a set of borrowers who would be finishing their studies at the height of the Great Recession or

during the early years of the recovery. The other two groups consist of borrowers who were not currently enrolled in September 2007. The Recent Attachment group consists of borrowers who were not enrolled in September 2007 but last took out a loan after September 2002, five years prior. The Distant Attachment group consists of all other borrowers: those who were not enrolled and whose last loan was taken out September 2002 or earlier.

Table 3 shows summary statistics for the three groups in 2007. There are quite drastic differences across the groups, which support our decision to not examine the entire sample at once. Not surprisingly, the groups differed in age. The average age of the Active group was 26, with 34% of this group under 22 years old. The other two groups were considerably older, with the Distant group not surprisingly being approximately 5 years older on average than the Recent group.

The table also shows that total loan amounts and balances differed across the groups. The row of the table showing total loan amount includes the sum total of the loans that the borrower still had not completely paid off. If, for example, a borrower had taken out two loans but had already paid one off completely, then the total loan amount would only consist of the other. The Active group had almost twice as much loan debt as the Distant group. This could be because the Distant group had already paid off some of their loans, but it can also be because tuition had increased in the intervening years. The total loan balance held by the three groups tells a slightly different story, however. The Recent group had the highest loan balances. This makes sense since recent graduates are accumulating interest, and some of the Active group took out additional loans after September 2007.

Where the groups vary significantly is in their loan status just before the beginning of the Great Recession. By construction, everyone in the Active group is in origination, because they were still in school and not expected to already be paying off their loans. No one in the other groups is in origination, consistent with our definition. On the other hand, about 16% of the Active group borrowers had loans in repayment at this point, reflecting that some of these borrowers had loan debt from previous enrollment spells. About three quarters of the Recent group is in repayment in 2007, and about half of Distant borrowers. In terms of default, 39% of the Distant borrowers were in default. This high default rate is driven by borrowers that have been in repayment at least 12 years, (about 30% of this subgroup) almost all of whom are in default. Default rates for recently

out-of-school borrowers are closer to 8%, and essentially zero (as expected) for currently enrolled borrowers.

4.2 Individual panel estimating equation

Our main estimating equation compares the experiences of similar borrowers at the beginning of the Great Recession who lived in different areas. The idea is that two borrowers with similar loan balance, educational history, and other characteristics would have different educational and labor market trajectories depending on the severity of the downturn locally. We adopt an approach used in earlier work estimating long-term impacts of labor market shocks with individual panel data (Jacobson et al., 1993; Davis and von Wachter, 2011; Autor et al., 2014; Yagan, 2019).

We estimate the following equation separately for each year t between 2005 and 2019:

$$y_{ict} = \beta shock_c + \theta_{g(i)} + \epsilon_{ict} \tag{2}$$

where y_{ict} is a relative educational outcome for borrower i in year t, who was located in commuting zone c in late 2007. As is common in this literature, we define the relative outcome y_{ict} as $Y_{ict} - \frac{1}{2}\sum_{s=2005}^{2006} Y_{ics}$, where Y_{ict} measures the raw outcome, such that we measure deviations in the outcome relative to the borrower's average prior to the onset of the recession.(This transformation generates within-borrower estimates of equation 2, akin to the inclusion of borrower-level fixed effects.) The main outcomes we consider are loan balance, enrollment, completion, repayment rate, and default status.[20] The main treatment variable, $shock_c$, is the change in CZ unemployment rate between 2007 and 2009.

The $\theta_{g(i)}$ are fixed effects for a fully-saturated set of groupings based on the characteristics of borrowers in 2007. These groups are defined by unique combinations of the following features: ventiles of total balance, five-year age bands, and the sector of the last institution the borrower attended. Sector is defined by colleges' predominant degree awarded (certificates, associate degrees, bachelor's degrees, and graduate certificates/degrees) and institutional control: public, private

[20]We express the outcomes that are dollar values, such as loan balances, as levels rather than logs since many borrowers in our sample pay off their entire loan balances. Completion is defined by any graduation events taking place for the borrower in the given year. Enrollment denotes the student is reported to be enrolled at least quarter time in a postsecondary program in that year.

nonprofit, or private for-profit. In total, there are 2,200 groups based on unique combinations these variables. We cluster standard errors at the CZ level. As a robustness exercise we also implement a panel model that controls for individual fixed effects, with very similar results.

4.3 Effects on Take-up Variables

We first consider how the recession affected borrowers takeup of additional education and loans. Panel a) of Figure 3 shows the effect of living in a CZ with 1 percentage point higher recession severity on total loan balances. Each coefficient comes from a separate estimate of equation 2 for each group in each year, and each line corresponds to one of the three separate groups we consider based on their status in September 2007.

An important feature of the graph, for loan balances and for subsequent measures, is that there do not seem to be any substantial pre-trends. The coefficient estimates are either not statistically significant in the years prior to 2007, or statistically significant and small in magnitude.

Loan balances in more severely affected areas started growing in 2009, especially for the Active group. By 2012 the estimated effect on loan balances was $834, with a near monotonic growth through to 2019. In fact, all groups saw their loan balances rise, though the two groups of non-enrolled borrowers less so. By 2019, the Recent borrowers had $1,860 more in loan balances on average for each percentage point higher unemployment rate, and the Distant borrowers had $670 more.

There are two ways that loan balances could rise. Borrowers could take on more debt, or they could be neglecting to pay down their prior loan balances. This is an important topic to disentangle, and we return to it in even more depth in section 4.7. Panel (b) of Figure 3, however, shows the estimated effect on additional loans taken out in the prior calendar year. For each percentage point increase in unemployment, we find that the Active group took on average about $100 in additional loans per year between 2010 and 2014, the first years following the recession, and this additional borrowing slowly faded out by 2019. The other two groups, who had not been enrolled at the onset of the recession, saw a similar though less extreme pattern, with increases in borrowing starting at the beginning of the recession and declining slowly. Panel (a) of Appendix Figure A5 shows the effects on total loan amount. While the patterns are almost identical to the patterns for loan

balances, the magnitudes are smaller, which suggests that a portion of the effects we observe on loan balances come from decreases in repayment.

The increase in loan amount reflects effects on enrollment (Panel (c) of Figure 3). Borrowers who were students in 2007 were about 0.7 ppt more likely to be enrolled in 2009 for every 1 p.p. increase in the unemployment rate. The effect is persistent and remarkably stable. Even by 2019, these borrowers were still substantially more likely to be enrolled, by 0.3 percentage points for each additional percentage point in the recessionary shock. Enrollment effects for the Recent group are negative and significant, and indistinguishable from zero for the Distant group.

4.4 Effects on Completion and Loan Repayment Outcomes

Figure 4 shows results on outcomes related to completion and loan repayment outcomes. Panel (a) shows the effect of the recession on completion in each calendar year. For the Active group, the immediate aftermath of the recession led to precipitous declines in completion in areas hardest hit by the recession. Given that all students in this group were enrolled in 2007, this result is consistent with delayed graduation or dropout within the enrollment spell that began prior to the recession. These negative completion effects fade out by 2011, indicating that this decline in completion was temporary. However, subsequent increases in completion for the Active group do not seem to fully makeup for these early loses, suggesting increased dropout. There are no discernible effects on completion for the other two borrower subgroups, in line with earlier results on enrollment.

Panel (b) of Figure 4 shows the effects of the recession on repayment rates. We define the repayment rate as the fraction of the borrower's September 2007 balance that has been paid off: a completely paid off loan would take a value of one. Steep declines in repayment rates are evident across the three groups. This means that borrowers in areas that were more affected by the recession were more likely to have more debt by 2019 as before. The magnitude of the effects is striking. Borrowers in the Active group owed 12% more in 2019 than 2007 for every percentage point in the recession shock. This is perhaps not surprising given the increases in borrowing for this group. A decline in the repayment rate could mean that borrowers are struggling to repay their loans, or it could mean additional borrowing.

Panel (c) helps disentangle these mechanisms by estimating the effects of the recession on the

likelihood of borrower default. Here, there are positive effects of the regional recession severity on default for all groups, beginning almost immediately following the onset of the recession. For all three groups defaults increased gradually starting in 2008 and leveled off by the end of the recession and the beginning of the 2010s. There are no statistically significant differences across groups in this regard.

4.5 Robustness and Sensitivity

Our results are robust to several alternative specifications. Our preferred approach follows the convention in the literature on individual adjustment to economic shocks by estimating equation 2. This specification separately estimates an effect for each calendar year, using an outcome that is subtracts the pre-recession mean. Our results are similar, however, when using a more straightforward and conventional model that takes advantage of the panel structure of the data and accounts for individual fixed effects. That is, our estimates are robust to specifications of the form:

$$y_{ict} = \sum_{t=2005}^{2019} \beta_t [Shock_c * (Year = t)] + \xi_i + \delta_t + u_{ict} \tag{3}$$

The results are similar to our preferred estimates. Appendix Figure A6 shows the results for the main outcomes. They are somewhat different in magnitude because the estimates of equation 3 are expressed in reference to the omitted year 2007, while our main approach estimates the effect each year. Nevertheless, the pattern of the trajectory of the results are similar, and the magnitudes are qualitatively quite similar.

We believe it is important to separate the full sample of borrowers with any loan balance in 2007 into three separate groups: those who were enrolled (Active group), those who had only recently left school (Recent group), and those who had left school longer ago (Distant). Appendix Figure A7 validates our thinking. We separately estimate our main specification individually by the number of years since last enrollment. Borrowers in year zero were enrolled in 2007, and we top-code borrowers who had last enrolled more than 20 years ago. The figures show that the three groups that we have defined, divided by vertical dashed lines, have seen different effects. Borrowers who were enrolled in 2007, for example, saw the largest effects on loan balances. This effect declined

but was still positive and statistically significant for borrowers who had last enrolled within 5 years of 2007, and were less likely to br statistically significant for cohorts of borrowers who had last enrolled earlier. A similar pattern exists for the effect on post recession enrollment, shown in panel (b).

Equation 2 assumes that the effects of the recession are linear in the change in the unemployment rate that the CZ experienced. Figure A8 shows that the estimates may, in fact, not be linear. The figure plots the effects in 2019 for each quintile of shock size, relative to the bottom quintile of CZs.[21] For most of the outcomes, to the extent that there is an effect for the group the effect looks linear in shock size. For example, panel a) shows that, for the Active group, the coefficient estimate on loan balance is slightly higher for each quintile, with only the top two quintiles having statistically significant effects. The enrollment effect, in panel c), is positive and statistically significant for the Active group for only the top two quintiles. Similarly, the effect on defaults is only present for the top quintile, suggesting the recession predominantly led borrowers in the hardest hit areas into financial distress.

4.6 Heterogeneity

We examine heterogeneity in effects of the Great recession across various individual characteristics. We begin with an analysis of how the recession affected borrowers of different races and ethnicities. Although we do not directly observe race or ethnicity in the data, we impute it. Our imputation algorithm uses a representative survey of federally aided postsecondary students that includes self-reports of race and ethnicity, which we link to our administrative data. We use the combined data to construct a flexible classification model that can be used to impute race and ethnicity categories to the full federal aid recipient population.[22] Appendix Table A4 shows that minority (Black, Asian, and Hispanic) borrowers lived in areas that had a larger Great recession shock.

Figure 5 shows the effects of the recession on borrowers of different races and ethnicities, focusing here only on the Active group, who had been enrolled at the onset of the downturn. Because each

[21] As shown earlier in the Figure 1 map, the five quintiles correspond to 2007-2009 unemployment rate increases of up to 2.1 percentage points, 2.1-3.2 percentage points, 3.2-4.1 percentage points, 4.1-5.6 percentage points, and above 5.6 percentage points.

[22] The imputation is based on the fitted values from a multinomial logistic regression of self reported race categories on the racial breakdown of individual characteristics including: last names, first names, zip code of residence in first FAFSA, and high school of attendance. See Monarrez et al. (2023) for more details on racial imputation.

individual is assigned a set of probabilities for each race or ethnicity, these are merely estimates of equation 2 weighted by these probabilities.

Overall, a few patterns stand out. Black and White borrowers took on almost identical amounts of additional debt due to the recession, and their balances grew by similar amounts as well. On the other hand, Hispanic borrowers took on slightly more debt, driven by slightly higher rates of enrollment in the years following the recession. One particularly striking result, albeit noisily estimated, is that Black borrowers were less likely to complete programs and much more likely to default as a result of the recession. These differences in enrollment and additional debt accumulation cannot explain the differences in the effects of the recession on default between Black and White borrowers.

Table 4 examines heterogeneity race and additional borrower characteristics. For simplicity, we focus on four key outcomes–any post-2008 enrollment, total balance in 2019, the repayment rate in 2019, and any post-2008 default– and only for the Active group. Appendix Tables A6 and A7 show these outcomes for the additional two groups. Models are estimated separately for each subgroup, such that there is no omitted group. Panel A of the table shows the results for race and ethnicity. This table mirrors much of what was discussed earlier. Borrowers of all races and ethnicities had similar rates of college-going and additional loans after 2008. Default effects are only significant for White borrowers, although this is largely an artifact of statistical power.

Panel B shows how the recession differentially affected students depending on their income, measured as the adjusted gross income (AGI) reported on the FAFSA. We find that effects on enrollment were relatively similar across student income, though slightly lower for the borrowers with the highest incomes. Perhaps not surprisingly borrowers with higher AGI took on fewer additional loans, likely because they were able to pay out of pocket for a larger share of the cost of their education. Default, though, was concentrated among the top two quartiles of AGI. Borrowers with the largest and smallest incomes were substantially less likely to enter default. Effects on paydown rates were similar across income bins.

Panel C of Table 4 splits out the borrowers by their student loan balance in 2007, before the recession. These roughly correspond to quartiles of the distribution. We find that the effects of the

recession on enrollment did not vary by initial balance. Borrowers with higher balances prior to the recession had somewhat higher effects on additional borrowing than borrowers with $2,500-$10,000 in balances. Borrowers with in both the lowest and highest initial balance bins saw larger effects on default, relative to those with median levels of debt.

The last panel of the table (panel D) splits the group by the predominant institution they were attending prior to the recession. Enrollment effects were highest for students who had previously attended two-year colleges either public or for-profit. Effects on additional loan balances were highest for the four-year colleges. The largest long-term default rates were seen among students who had attended public 2-year and private 4-year colleges. Declines in loan paydown rates were statistically significant for public 2-year, public 4-year, private 4-year borrowers.

4.7 Distinguishing Between Effects of New Enrollment and Old Loans

One of our starkest findings is the scale to which loan balances rise and repayment rates decline in hard-hit areas. However, it is important to understand the source of these effects. Loan balances could increase due to enrollment and new loans, or they could increase due to a lack of repayment. Likewise, since we define repayment rates relative to loan balances in 2007, an increase in loans due to enrollment would dramatically decrease repayment rates. Understanding whether the effects come from additional enrollment or from a decline in payment is crucial to understanding the effects of the Great recession and the financial health of borrowers in hard-hit areas.

A naive approach is to simply separate our main sample into borrowers who took on additional loans after the recession and those who did not. The idea here is to hone in on the loan balances and repayment rates of borrowers who never took on additional loans: any changes would necessarily come from a lack of repayment. Appendix Table A5 shows the effects in 2019 for the three groups, split by whether they took on additional loans. We find that, for all three groups with no additional loans, loan balances increased by a modest amount. Likewise, the repayment rate also declined for all three groups. Borrowers in the Recent and Distant group who did not take out more loans saw positive and statistically significant effects on default. This is suggestive evidence of borrowers who did not re-enroll being the ones who suffered. Of course, this approach is naive since it conditions on an outcome: additional borrowing itself is affected by the recession.

A second approach follows Card et al. (2008). The goal is to determine whether the people for whom the recession led to re-enrollment are also the people who saw larger effects on repayment rates and loan balances. To do this, we separately estimate equation 2 for many subgroups. We identify subgroups based on our original three groups—Active, Recent, and Distant— as well as by educational attainment, age, quartiles of loan balance, and quartiles of AGI, all defined in 2007. In total we have 192 possible subgroups for each of our three main groups, though we omit subgroups with fewer than 100 borrowers.[23] We then regress the group-level estimates for each particular loan outcome on the group-level estimates for enrollment.

Table 5 shows these results, for enrollment and loan outcomes measured in 2019. Not surprisingly, there is a large, positive, and statistically significant relationship between enrollment and total loan amount, and a negative relationship with repayment rates. However, we find different relationships between enrollment and default status. For the Active group the coefficient is positive, implying that additional enrollment leads to default, though the relationship is not statistically significant. This is suggestive evidence that the Active group became more likely to default no matter their subsequent education trajectory. The relationship is smaller and not statistically significant for the Recent group, however. We find a negative, large, and statistically significant relationship for the Distant group, which suggests that borrowers who went back to school after at least five years away took on more debt but were also better able to pay it back. This is perhaps evidence that, to the extent the Distant group re-enrolled, they were more likely to seek retraining opportunities. We note, however, that the overall effect of the recession on enrollment for this group was negligible.

Our third approach to understanding the interaction between additional enrollment, loan balances, and default, follows Card and Solis (2022). We categorize all borrowers in the sample into four groups, based on whether they took out additional loans at any point after 2008, and whether they were in default by 2019. We then use these four groups as outcomes in our main regression. Appendix Figure A9 shows these results. Each set of results shows the effect of a one percentage point higher recession unemployment shock on likelihood of being in a particular group. For example, we find a statistically significant and negative effect on enrolled students having neither additional loans nor a default by 2019. Instead, for enrolled students, we find that they were more

[23] Some subgroups are nonexistent. For example, several of the 192 subgroups for our groups of Recent and Distant borrowers should consist of borrowers who are currently enrolled, which is impossible.

likely to have a default, with and without further loans.

4.8 Income Driven Repayment

One of the key policies that expanded at the same time as the Great Recession was income-driven repayment (IDR). The plans, under which borrowers have lower loan payments, are meant to help protect borrowers from delinquency and default. The first IDR plan was introduced in 1994, but plans were expanded in 2009, 2013 (PAYE), and 2015 (REPAYE).

The top panel of Table 6 shows the effect of the Great recession on any enrollment in IDR by 2019 across the three groups.[24] We limit the sample to the subset of borrowers who had any loans held by the Department of Education, and drop borrowers who only had commercial Federal Family Education Loans (FFEL).[25] The effects on IDR enrollment was largest among the Active group, though the Recent group also enrolled. These results are not surprising given the purpose of IDR expansion was to help alleviate borrowers' debt burden.

A lingering question, then, is whether IDR helped borrowers avoid default. Prior research has found that borrowers only enroll in these plans for a limited time (Monarrez and Turner, 2024), which limits the ability of IDR to protect borrowers against default on a multi-year loan. We estimate the effect of IDR on default in a parallel manner as our analysis of educational enrollment and default. We follow Card et al. (2008) and relate many estimates of the recessionary impact on IDR and the effect on default. Panel B of Table 6 shows these results. None of the coefficients is statistically significant. This provides further evidence that IDR as implemented during this period may help borrowers make loan payments over a short period of time, but did not help to avoid default over the long run.

[24] Appendix Figure A10 shows the trajectories of these three groups over time by plotting the year-by-year coefficients estimates for IDR, as well as standard repayment plans and the extended graduated plan.

[25] Appendix Table A3 shows summary statistics in September 2007 for borrowers who did and did not have ED-held loans. The groups are similar in the amount of borrowing and their loan status, though the group of borrowers with ED-held loans only is smaller.

5 Conclusion

In this paper we show the lingering and ripple effects of the Great Recession on the educational landscape almost two decades later. We leverage regional variation in the severity of the Recession, and use rich detailed administrative data that allows us to examine the educational and financial experiences of students over time.

We show that, as a result of the Recession, labor markets saw substantial increases in borrowing, as residents were induced to enroll in college. This mirrors a prior literature that documents that educational enrollment is countercyclical (Betts and McFarland, 1995; Barrow and Davis, 2012; Long, 2014). We also find, however, that financial distress also increased as a result of this increased borrowing, with defaults increasing by 6% for each percentage point increase in the severity of the Recession. Our findings suggest that 5-14% of the nationwide defaults in 2019 are attributable to the Great Recession.

We also study a sample of borrowers with positive loan balances in 2007 as they weathered the effects of the Great Recession over the next 15 years. Their experiences varied dramatically according to their educational status; borrowers who had been enrolled as the market crashed were the hardest hit. These borrowers were most likely to re-enroll or stay enrolled in college, but were also more likely to default on their loans later on. These findings add new nuance to prior work on the detrimental effects of entering the labor market during a Recession (Oreopoulos et al., 2012; Rothstein, 2021; Rinz, 2022). We find that enrolling in college was not enough to protect these borrowers, on average, from defaulting on their loans. On the other hand, borrowers who were not enrolled at the onset of the Recession were able to avoid default by going back to school.

Taken together, our findings show that the effects of the largest economic downturn in generations still lingers 15 years later. For many borrowers exposed to the Great Recession, their current financial situation, as well as the educational decisions they may make in the present day, are still in large part driven by the severity of the recession in their hometowns. Our results also have application for policymakers. We show that, while educational enrollment can be a "safe port in a storm" for many, this is not the case especially for students graduating college in the middle of an economic crisis.

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Appendix B: Data Appendix

We use U.S. Department of Education administrative records reported in Federal Student Aid's Enterprise Data Warehouse (EDWA), which houses detailed records on Title IV aid recipients. EDWA tracks all disbursements of grant and loan aid, as well as loan balance records from the National Student Loan Data System (NSLDS), which are provided by loan servicers. Additionally, EDWA includes individual FAFSA application data, as well as enrollment verification reports that colleges submit to NSLDS as part of the requirements for Title-IV aid eligibility. EDWA was first launched in 2014. The quality of the data is highest for this year and onward. Because older records were retroactively populated by FSA, they are more likely to be incomplete and represent the history of the portfolio as reported in 2014.

B.1 CZ panel

The CZ-level panel dataset of the federal student loan portfolio is constructed as follows. We pull a file containing all ED-Held and commercial FFEL loans with open status and outstanding balance at the end of fiscal years 2005-2019 (N ranges between 75 and 200 million for each year). We assign borrowers to a CZ based on their residential location at the time when they first took out federal student loans. For loans held by the Department (e.g. Direct Loans and federally-serviced FFEL loans, commonly grouped under the term "ED-held loans"), EDWA records detailed information on the borrowers' address, making this exercise straightforward. However, for commercial FFEL loans (which comprised most of the portfolio in the early 2000's and for which the federal government simply serves as guarantor), borrower addresses are not reported in EDWA.

To link as many borrowers as possible to a CZ, we first assign ED-held loans to the CZ associated with the borrowers' residential zip code of their earliest origination on file (present in loan servicing records). If this returns no match (which is the case for all commercial FFEL loans), we use the postal code recorded in the earliest FAFSA on file for the borrower (the EDWA database on FAFSA applications begins in 2004). If this approach also fails to find a match, we use the location of the college associated with the borrower's earliest student loan on file. For consolidation loans, we use FSA's consolidation linking framework to assign these loans to a college (and location, in case all the above procedures fail to find a match). The finalized loan dataset has a 97% match rate to CZs. A feature of this procedure is that borrowers (and their associated debt) cannot be assigned to more than one CZ, even in the event that they move.

We also assign loans to a college sector. To do so, we use data on institution control and predominant degree from College Scorecard (2024), as well as student academic level reported in loan servicing records (which are used to determine loan amount limits). For example, Public 2-year is defined by loans with undergraduate academic level and institution identifiers with predominantly 2-year degree status; while for-profit graduate sector is defined by loans for graduate students at institutions with proprietary control. If a student has loans open at more than one college sector,

their balances are allowed to be split into multiple sectors, all within the same CZ.

After this step is complete, we collapse the loan level file to the CZ-year level (N = 741 per year), and the CZ-sector-year level. We measure total outstanding balance, counts of distinct borrowers, new origination, new borrowers (those whose first origination took place within a given federal fiscal year), total borrowers in default, total borrowers newly defaulted, as well as total balance in default.

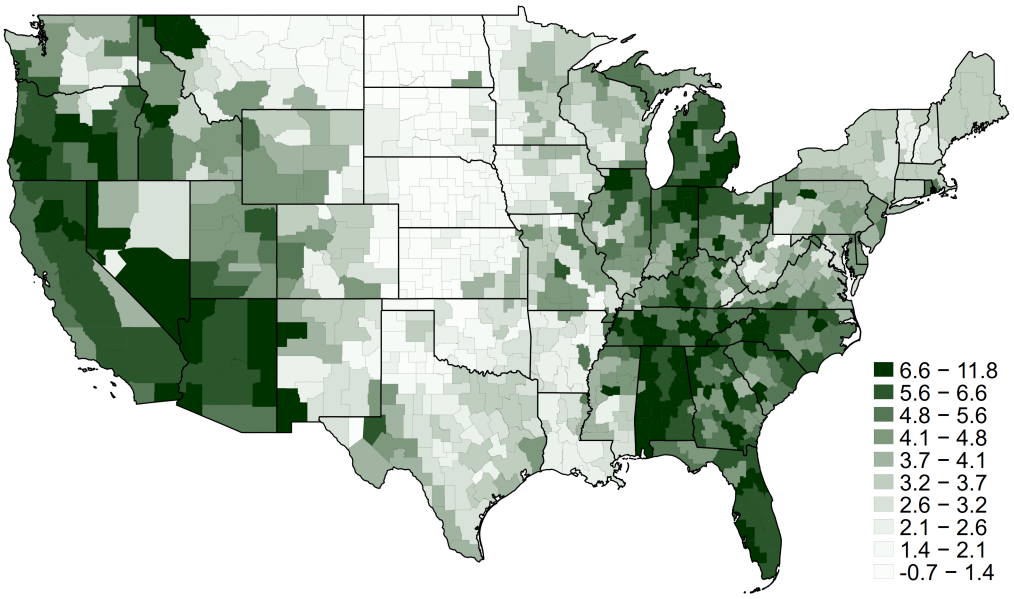
B.2 Borrower panel

The borrower level longitudinal dataset is constructed as follows. We first pull the combined federal student loan outstanding portfolio (ED-held + commercial FFEL) for the end of FY 2007. We next assign CZ to borrowers based on the same procedure as the CZ panel. Then, we randomly sample 2% of borrowers from the set of loans matched to a CZ, resulting in N $\approx$ 555,000 sampled borrowers. We construct cross-sectional variables for this borrower sample, including borrower date of birth (rounded to the first day of the month), maximum academic level (according to loan servicing records), enrollment status at the end of FY 2007, and most recent college borrowed for. We assign borrowers to a college sector based on the information from their most recent student loan and their maximum academic level observed in loan records.

Next, we pull information on outstanding balance and loan status (including fully paid loans) for the 2% borrower sample for the end of each fiscal year 2005-2019. For borrowers with ED-held loans, we collect information on repayment plan, which we group into three categories: standard 10-year, extended/graduated, and income-driven repayment (IDR). Borrowers are reported as enrolled if they are reported to be enrolled at least quater-time by college financial aid offices, as required by the Department for all institutions receiving Title IV aid. We record a borrower as defaulted if they have at least one loan in an active default status; this may overstate Direct Loan and ED-serviced FFEL defaults, as seen in Figure A1. This is because the default status goes in at 270 days delinquent, while a borrower is able to pay off the missed payments, or cure the delinquency with a forbearance, or change repayment plans, or consolidate (which by itself cures the delinquencies on the old loans) until 360 days delinquent, which is the "date of default" used for regulatory (and analytic) purposes and thus the most closely-vetted. There are also temporal distortions, in that defaults defined by loan status are shifted into different quarters or even fiscal years (this was the primary purpose of the change in definition of default in 1998). Borrowers who defaulted then paid their loans off (or out of default) are not counted as defaulted borrowers.

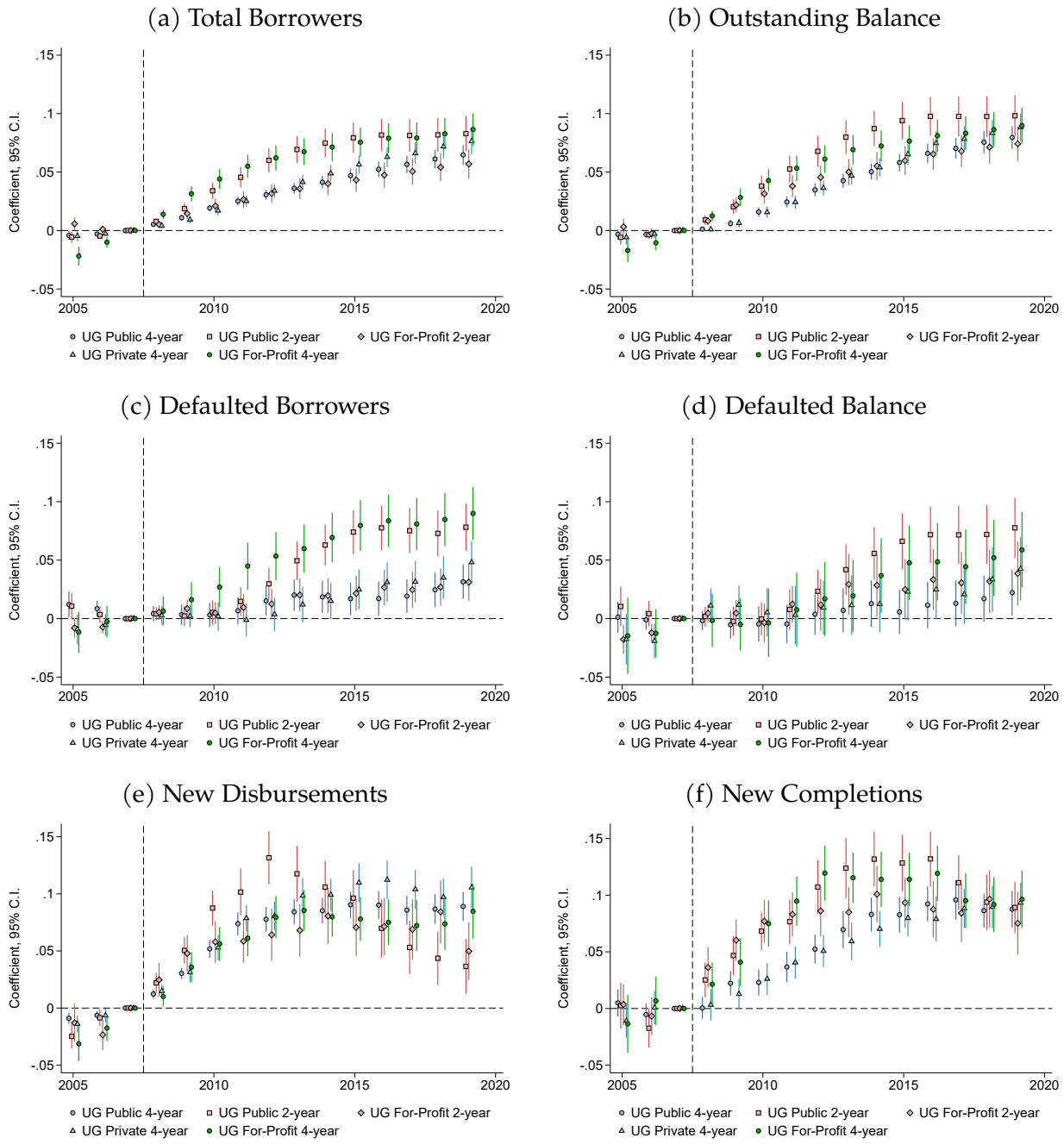
Figures and Tables

Figure 1: Regional Variation in Severity of Great Recession



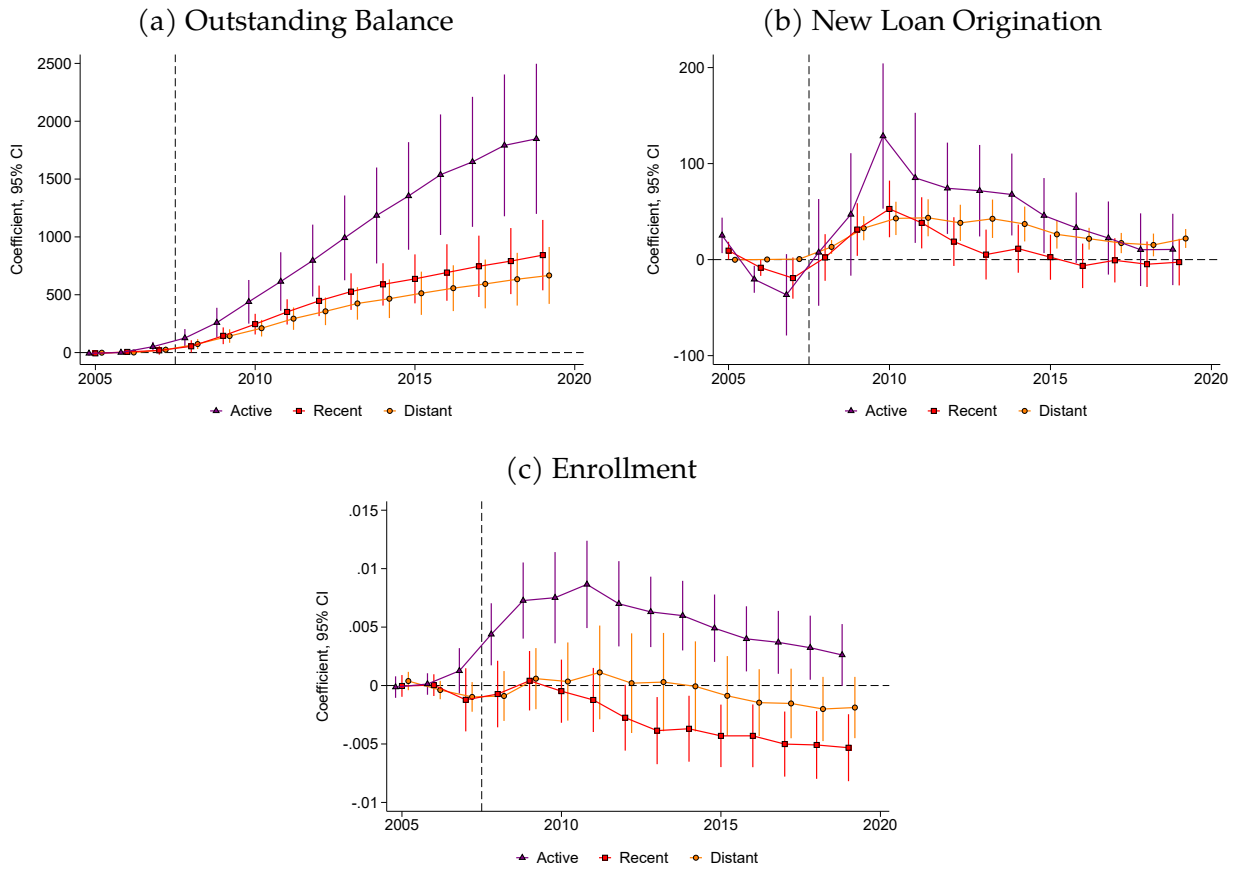
Note: Commuting zone level data. Choropleth shows deciles of the change in the CZ unemployment rate (measured in percentage points) between 2007-2009, using BLS LAUS data.

Figure 2: CZ-level impacts of a 1p.p. increase in unemployment on undergraduate student loan outcomes, by institution sector



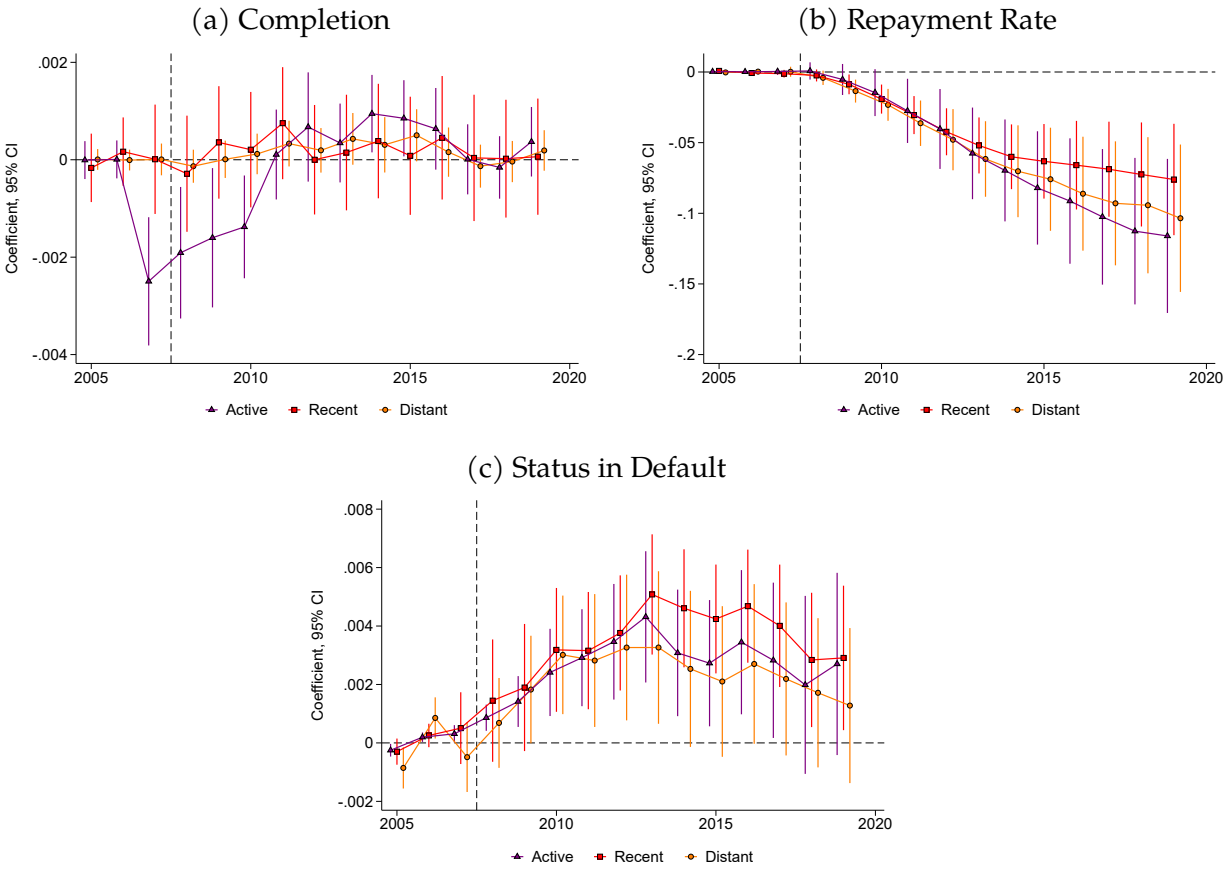
Note: Plots show OLS coefficient estimates from equation (1) in the main text, estimated on a CZ-level panel for the years 2005-2019, separately by institution sector. Institution sector is defined by a combination of institution predominant degree, control, and borrowers' academic level. All outcomes are expressed in logs. In panel (a) the outcome is total borrowers outstanding; panel (b) uses total outstanding balance. Defaulted borrowers (c) and defaulted balance (d) are defined by loan status codes available for both ED-held and commercial loans. See Appendix B for a discussion of potential overstatement of default rates for DL and Ed-Held loans. New loan disbursements (e) includes all new loans among existing and new borrowers. Completions (f) are measured using NSLDS enrollment reporting records and are not program specific. All dollar figures are in millions of dollars, adjusted for inflation using the CPI-U and presented in 2019 terms. Standard errors are clustered at the commuting zone level.

Figure 3: Borrower-level impact of a 1 p.p. increase in unemployment rate on outstanding balance, loan origination, and enrollment



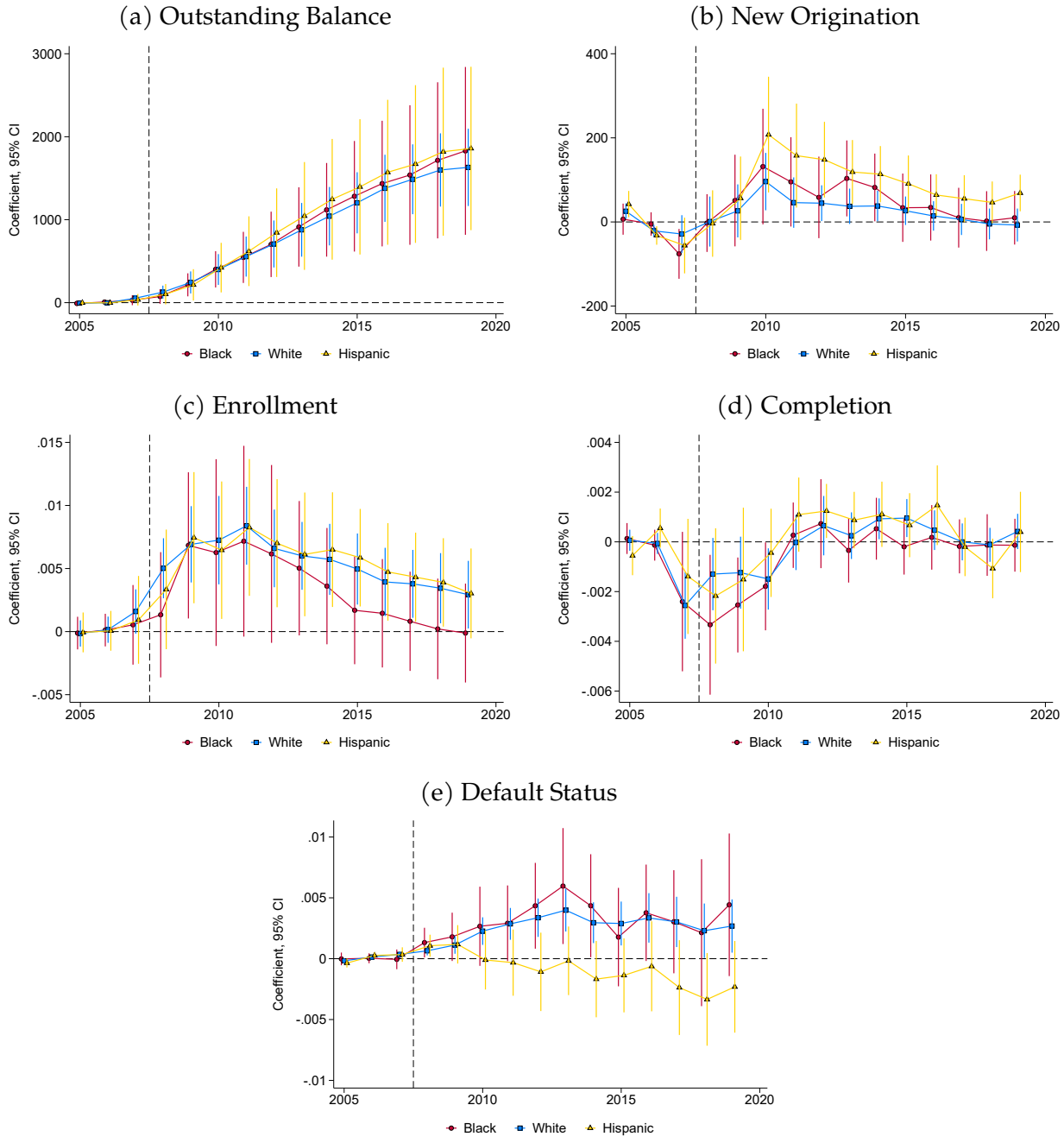
Note: Plots show OLS coefficient estimates of equation (2) in the text, using a longitudinal panel of borrowers, based on a 2% sample of borrowers with open federal student loans at the beginning of 2007. Coefficients are estimated separately by year. Active borrowers are those enrolled during the year in question. Recent borrowers are those with loan maturity dates (i.e. repayment entry dates) within 5 years of 2007. Distant borrowers had loan maturities more than 5 years after 2007.

Figure 4: Impacts on Completion, Repayment Rate, and Default



Note: Plot shows OLS coefficient estimates of equation (2) in the text, using a longitudinal panel of borrowers, based on a 2% sample of borrowers with open federal student loans at the beginning of 2007. Coefficients are estimated separately by year. Active borrowers are those enrolled during the year in question. Recent borrowers are those with loan maturity dates (i.e. repayment entry dates) within 5 years of 2007. Distant borrowers had loan maturities more than 5 years after 2007.

Figure 5: Impacts of the Great Recession for Active borrower group, by Imputed Race and Ethnicity



Note: Plot shows OLS coefficient estimates of equation (2) in the text, using a longitudinal panel of borrowers, based on a 2% sample of borrowers with open federal student loans at the beginning of 2007. Coefficients are estimated separately by year, using weights equal to the predicted probability that a borrower is from a given racial/ethnic group, which are derived from an imputation method. See text for additional details. Active borrowers are those enrolled during the year in question. Recent borrowers are those with loan maturity dates (i.e. repayment entry dates) within 5 years of 2007. Distant borrowers had loan maturities more than 5 years after 2007.

Table 1: Mean characteristics of CZ-level federal student loan portfolio. Undergraduate borrowers.

	Public 2yr		For-profit 2yr		Public 4yr		Private 4yr		For-profit 4yr	
	2007	2019	2007	2019	2007	2019	2007	2019	2007	2019
Portfolio summary										
Oustanding balance	27	111	31	94	105	344	59	197	18	91
Total borrowers	4137	9907	4306	7890	9466	18610	5086	9842	1552	4503
Defaulted balance	4	25	7	30	9	38	6	22	2	21
Defaulted borrowers	603	2432	968	2669	761	2099	439	1159	188	1313
Entering flows										
New borrowers	691	413	724	356	1602	1166	981	612	355	133
New disbursements	7	7	8	5	31	33	20	20	6	5
New defaults	134	366	222	388	158	410	90	244	61	188
Enrollment reporting										
Current enrollees	2126	2990	1339	1443	5352	6975	2829	3652	840	1079
New completions	181	287	332	271	586	885	328	451	71	90
Observations	740	741	741	740	741	741	741	741	739	741

Note: Dollar figures are in millions, adjusted for inflation using the CPI-U and presented in 2019 terms. Borrower counts are measured in thousands. Commuting zone level data on federal student loan portfolio. Institution sector is defined by a combination of institution predominant degree, control, and student academic level. New defaults counts the number of borrowers entering default for the first time.

Table 2: Average Percent of 2007-2019 Log Change in Outstanding Portfolio Attributable to Great Recession.

	Total Debt		Defaulted Debt		New Defaults
	Balance	*Borrowers*	*Balance*	*Borrowers*	
Undergraduate Two-year					
Public	32.4	54.3	17.2	24.7	42.5
For-profit	26	37.6	8.9	10.1	28.3
Undergraduate Four-year					
Public	31.9	53.5	5.9	12.4	43.7
Private	32.3	59.7	11.6	18.7	45.2
For-profit	18.8	29.2	7.4	14.4	39.3
Graduate					
Public	13.3	21	17.9	34.3	54
Private	17	21.7	26.4	31.2	40
For-profit	12.5	14.8	16.9	23.4	28.1
Overall	37.7	58.7	13.9	21.5	46.2

Note: Table reports the mean share of the observed change in CZ-level outstanding portfolio that is attributable to the Great Recession according to estimates of equation 2 in the main text. For each outcome, the 2019 coefficient estimate is multiplied by the CZ's percentage point increase in 2007-2009 unemployment, divided by the CZ's observed 2007-2019 log change in total balances/borrowers, and then winsorized at the 1% level separately by institution sector. The table shows the cross-CZ mean of this relative effect size estimate.

Table 3: Average Characteristics of Borrower Panel Sample in September 2007, by Postsecondary Attachment

	Active	Recent	Distant
Female	0.61	0.61	0.66
Age	26	33	40
Total Loan Amount	19,100	15,800	6,500
Total Balance	18,400	21,500	12,200
Loan Status			
Origination	1.00	0.00	0.00
Repayment	0.16	0.75	0.52
Forbearance	0.03	0.12	0.07
Default	0.01	0.08	0.39
Observations	179,600	234,100	141,500

Note: Table shows means for the borrower level sample (2% random sample of borrowers with loans open in September 2007). Active borrowers are those enrolled during the year in question. Recent borrowers are those with loan maturity dates (i.e. repayment entry dates) within 5 years of 2007. Distant borrowers had loan maturities more than 5 years before 2007.

Table 4: Heterogeneity in Long-Run Effects of Great Recession, Active Group

	Enrollment	Balance	Default	Paydown Rate
A. Race / Ethnicity				
White	0.005***	1630.601***	0.006***	-0.100***
	(0.001)	(237.607)	(0.002)	(0.020)
Black	0.007**	1829.273***	0.007	-0.106**
	(0.002)	(516.058)	(0.004)	(0.041)
Hispanic	0.008***	1858.480***	-0.005	-0.128*
	(0.002)	(502.391)	(0.003)	(0.055)
Asian/PI	0.008***	1685.735***	0.002	-0.072
	(0.002)	(442.952)	(0.004)	(0.044)
B. AGI				
Less than $10,000$	0.009***	2207.202***	0.002	-0.115***
	(0.002)	(376.007)	(0.004)	(0.026)
$10,000-25,000$	0.008**	1927.280***	0.003	-0.120**
	(0.002)	(460.668)	(0.003)	(0.038)
$25,000-50,000$	0.007***	1898.624***	0.004	-0.108*
	(0.002)	(440.876)	(0.003)	(0.045)
More than $50,000$	0.005**	1436.822***	0.007***	-0.115**
	(0.001)	(339.925)	(0.002)	(0.035)
C. Balance in 2007				
Less than $2,500$	0.007**	-40.524	0.009**	0.180
	(0.002)	(413.550)	(0.003)	(0.269)
$2,500-10,000$	0.006***	1223.372***	0.004	-0.214***
	(0.001)	(287.271)	(0.003)	(0.051)
$10,000-20,000$	0.006**	1394.947***	0.004	-0.093***
	(0.002)	(361.015)	(0.003)	(0.027)
More than $20,000$	0.007**	2881.166***	0.007**	-0.072***
	(0.003)	(486.058)	(0.002)	(0.016)
D. Institution Sector				
Public 2-Year	0.013***	1678.273***	0.010***	-0.157***
	(0.003)	(261.086)	(0.003)	(0.043)
For-Profit 2-Year	0.013**	394.474	0.000	-0.032
	(0.004)	(429.914)	(0.004)	(0.048)
Public 4-Year	0.004*	1987.361***	0.003	-0.157***
	(0.002)	(358.014)	(0.003)	(0.042)
Private 4-Year	0.004	1564.571**	0.013***	-0.125*
	(0.002)	(494.125)	(0.004)	(0.051)
For-Profit 4-Year	0.005	487.693	0.002	0.002
	(0.004)	(735.308)	(0.005)	(0.047)

Note: Table shows the 2019 OLS coefficient estimate of equation (2) in the text, using a longitudinal panel of borrowers, based on a 2% sample of borrowers with open federal student loans at the beginning of 2007. Coefficients are estimated separately by year. Active borrowers are those enrolled during the year in question. Recent borrowers are those with loan maturity dates (i.e. repayment entry dates) within 5 years of 2007. Distant borrowers had loan maturities more than 5 years after 2007. Results by race in panel A use weights equal to the predicted probability that a borrower is from a given racial/ethnic group, which are derived from an imputation method. See text for additional details. Panel B separates borrowers by their loan balance in 2007. Panel C separates borrowers by the AGI on their most recent pre-2007 FAFSA. Panel D separates borrowers by the control of the predominant institution they attended prior to 2007.

Table 5: Effects of Any Enrollment After 2008 on Loan Outcomes

	Active	Recent	Distant
A. Any Default			
Post-2008 Enrollment	39536.9***	31473.7***	32481.2***
	(6815.8)	(3164.3)	(5570.7)
r2	0.199	0.367	0.335
B. Repayment Rate			
Post-2008 Enrollment	-3.045***	-4.349***	-13.14**
	(0.821)	(0.638)	(4.461)
r2	0.0257	0.106	0.266
C. Any Default			
Post-2008 Enrollment	0.0470	0.00289	-0.327**
	(0.0539)	(0.0445)	(0.104)
r2	0.00344	0.0000268	0.136

Note: Table shows coefficients from a regression of effect estimates by narrowly defined group. Groups are defined by quartiles of loan balance in 2007, quartiles of AGI in 2007, educational attainment, and five-year age bins. Coefficients from estimates on total loan amount, repayment rate, or default are then regressed on coefficients of regressions on enrollment. This is similar to Card, Dobkin, Maestas (2008) Table 5. See text for details.

Table 6: The Great Recession, IDR Enrollment, and Default

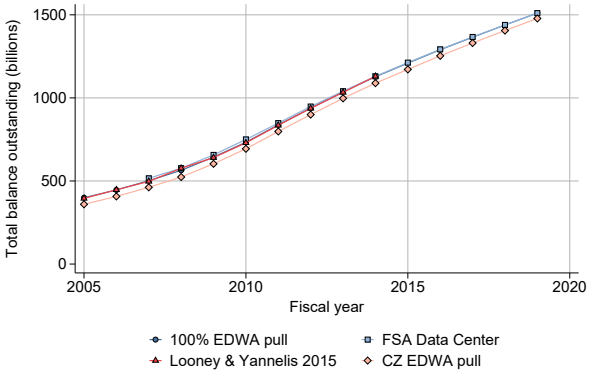
	Active	Recent	Distant
A. Great Recession Impact on IDR Enrollment			
Great Recession Shock	0.0125***	0.0053**	0.0006
	(0.002)	(0.002)	(0.001)
B. Long-Run Effect of IDR Enrollment on Default			
IDR Enrollment	0.0392	0.00296	-0.103
	(0.0299)	(0.0284)	(0.0981)

Note: Panel A shows the main results of the effect of the Great Recession shock on IDR enrollment by 2019. Panel B shows coefficients from a regression of effect estimates by narrowly defined group. Groups are defined by quartiles of loan balance in 2007, quartiles of AGI in 2007, educational attainment, and five-year age bins. Coefficients from estimates on total loan amount, repayment rate, or default are then regressed on coefficients of regressions on enrollment. This is similar to Card, Dobkin, Maestas (2008) Table 5. See text for details.

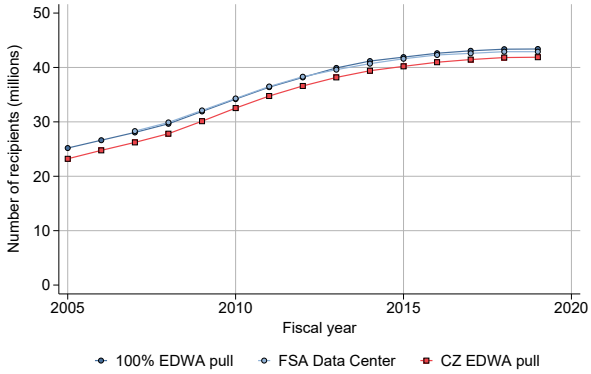
Appendix A: Additional Figures and Tables

Figure A1: Validation of CZ-level Student Loan Portfolio Dataset

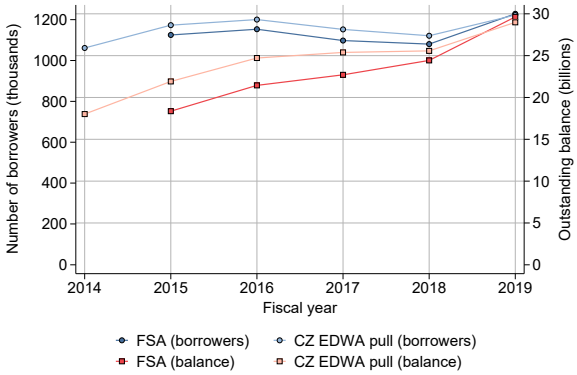
(a) Total Outstanding Balance



(b) Total Recipients

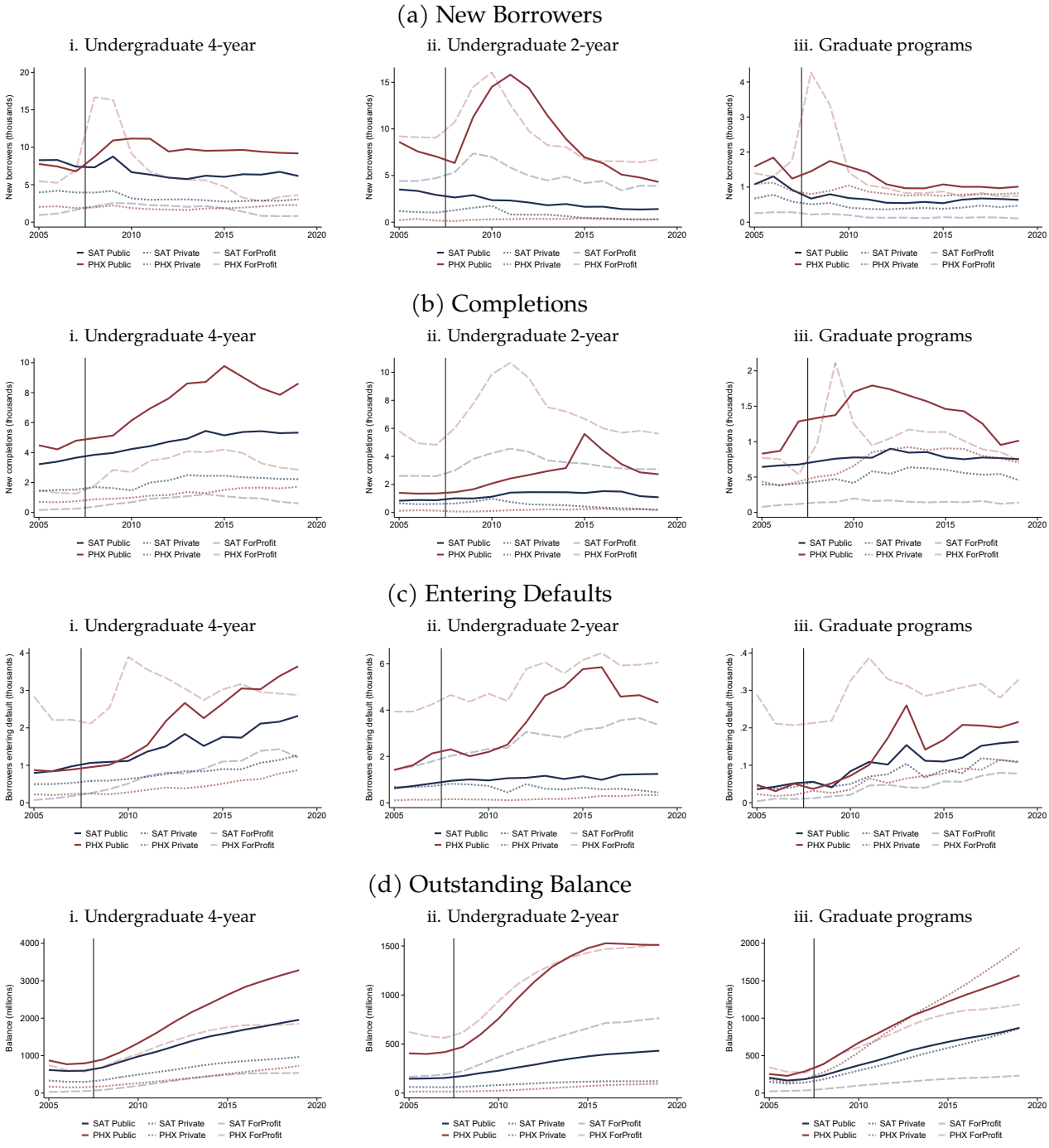


(c) Entering Defaults



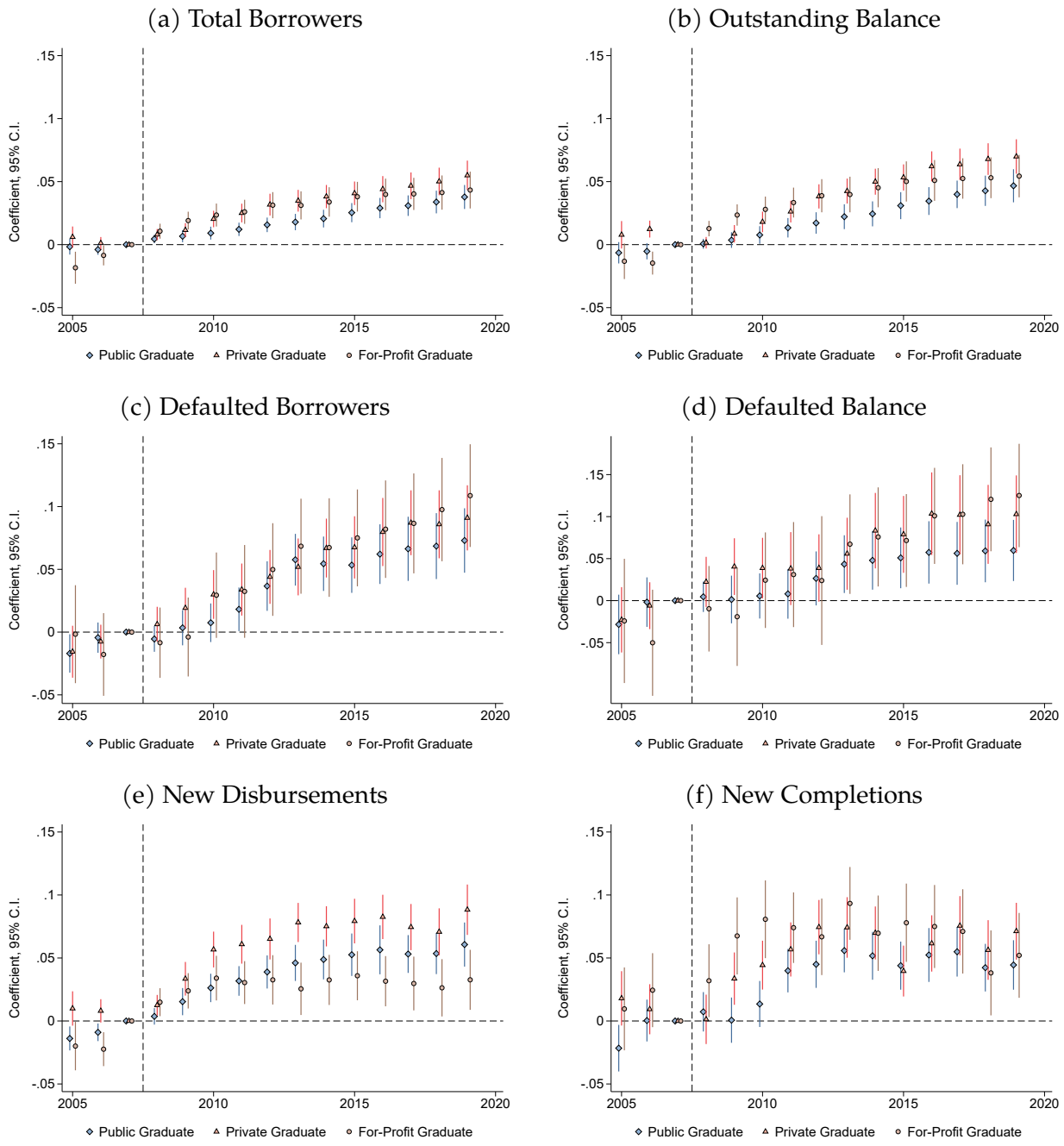
Note: Panel (a) shows total outstanding debt on federal student loans from four sources. 100% EDWA pull is calculated by the authors using all EDWA data on outstanding DL and FFEL loans. CZ EDWA pull is the same as the 100% EDWA pull but it restricts to loans we were able to match to a CZ for analysis. FSA Data Center data is obtained from Portfolio Summary. Looney and Yannelis (2015) data on outstanding debt comes from Table 1 column 2. Panel b shows total number of recipients (students) in the 100% EDWA pull, FSA Data Center Portfolio Summary table, and the CZ EDWA pull. Panel c shows total numbers of borrowers and outstanding balances entering default in the CZ-matched dataset (which includes DL and FFEL loans), versus FSA Data Center's DL Entering Defaults table. We report borrowers as defaulted if they have at least one loan in an active default status; this may overstate Direct Loan and ED-serviced FFEL defaults, see Appendix B.2 for a detailed discussion.

Figure A2: Comparison of San Antonio and Phoenix student loan portfolio, by institution sector



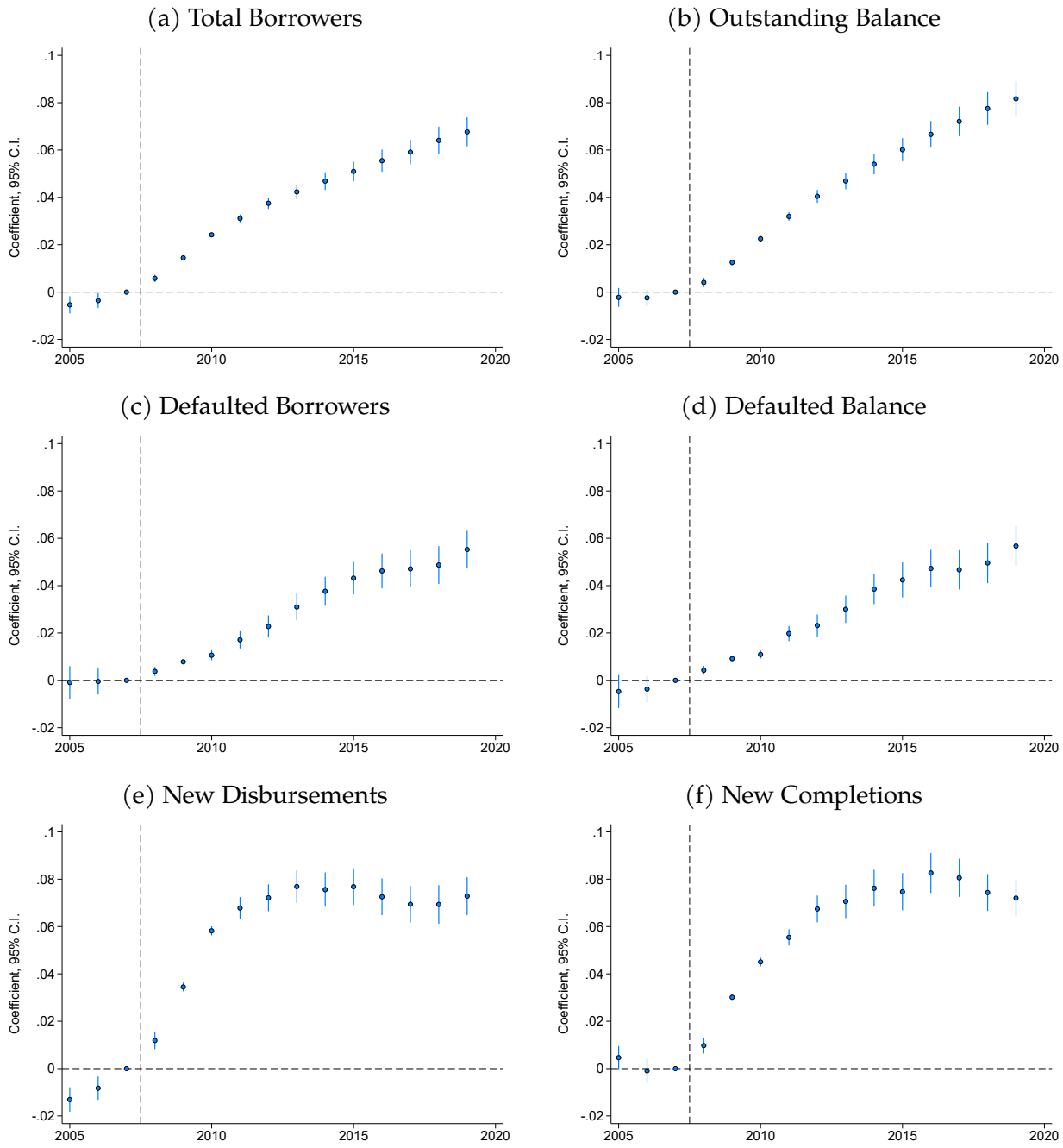
Note: Plots show average student loan portfolio characteristics for the San Antonio (SAT) and Phoenix (PHX) commuting zones, by student grade level (undergraduate and graduate) and institution sector (defined based on institution predominant degree and control). Completions are not necessarily in the grade or sector observed. Outstanding balance

Figure A3: CZ-level impacts of a 1 p.p. increase in unemployment on graduate borrower outcomes



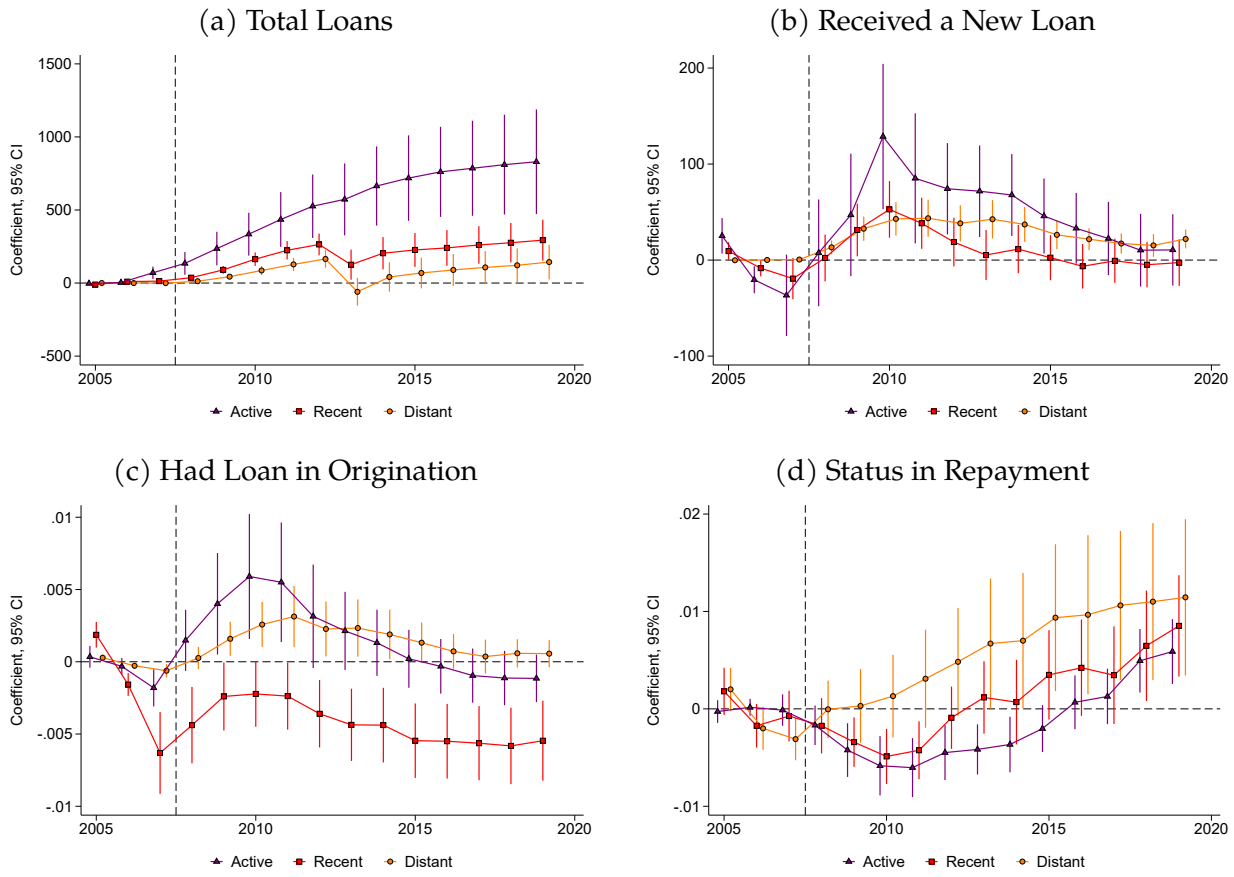
Note: Plots show OLS coefficient estimates from equation (1) in the main text, estimated on a CZ-level panel for the years 2005-2019 specific to graduate student borrowers and split by institution control. All outcomes are expressed in logs. In panel (a) the outcome is total borrowers outstanding; panel (b) uses total outstanding balance. Defaulted borrowers (c) and defaulted balance (d) are defined by loan status codes available for both ED-held and commercial loans. New loan disbursements (e) includes all new loans among existing and new borrowers. Completions (f) are measured using NSLDS enrollment reporting records and are not program specific.All dollar figures are in millions of dollars, adjusted for inflation using the CPI-U and presented in 2019 terms. Standard errors are clustered at the commuting zone level.

Figure A4: CZ-level impacts of a 1 p.p. increase in unemployment on student loan outcomes



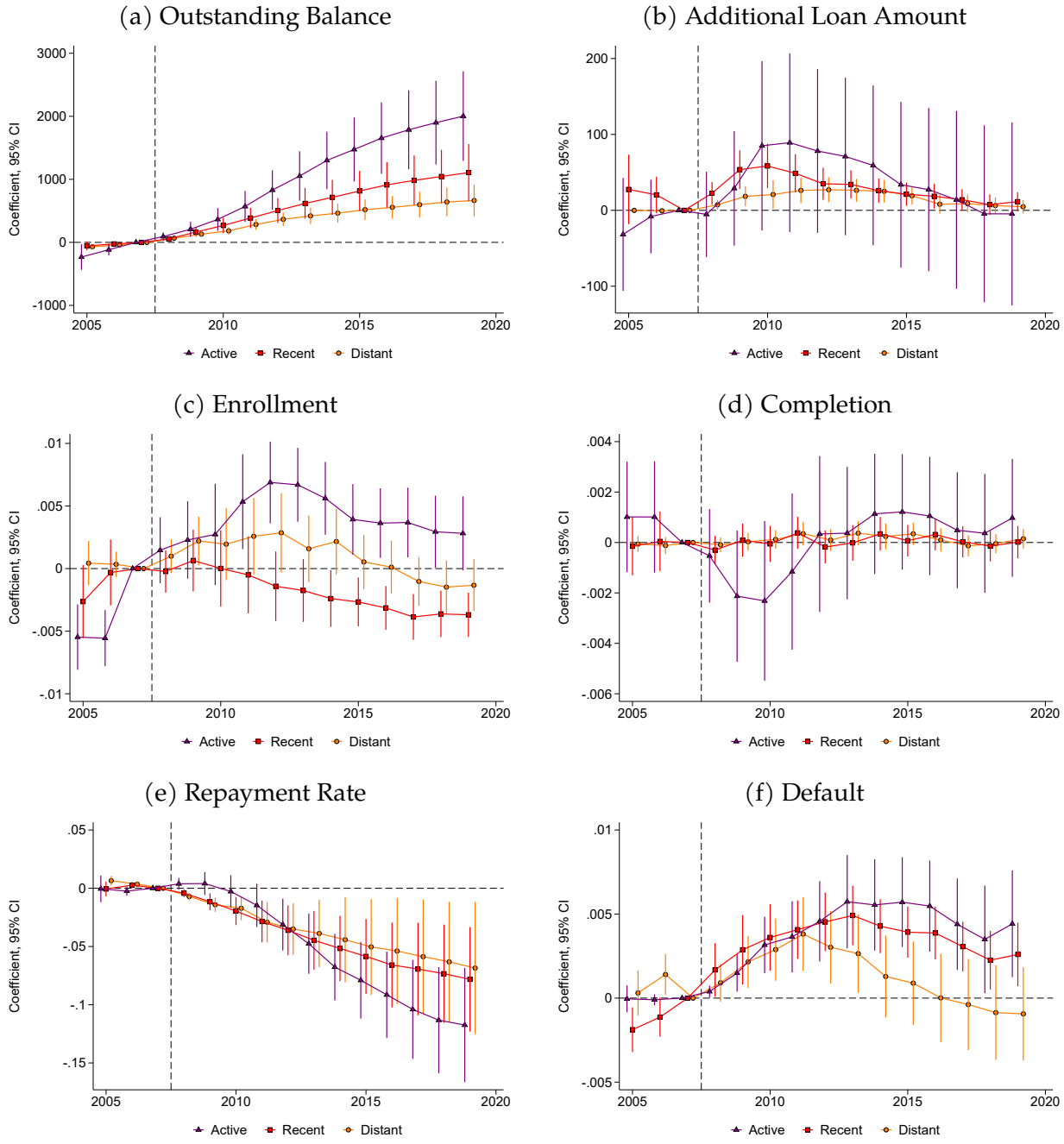
Note: Plot shows OLS coefficient estimates from equation (1) in the main text, estimated on a CZ-level panel for the years 2005-2019. All outcomes are expressed in logs. In panel (a) the outcome is total borrowers outstanding; panel (b) uses total outstanding balance. Defaulted borrowers (c) and defaulted balance (d) are defined by loan status codes available for both ED-held and commercial loans. New loan disbursements (e) includes all new loans among existing and new borrowers. Completions (f) are measured using NSLDS enrollment reporting records and are not program specific.All dollar figures are in millions of dollars, adjusted for inflation using the CPI-U and presented in 2019 terms. Standard errors are clustered at the commuting zone level.

Figure A5: Borrower-level Impacts on Total Loan Amount, Receipt of New Loan, Origination, and Status in Repayment, by Post-secondary Attachments



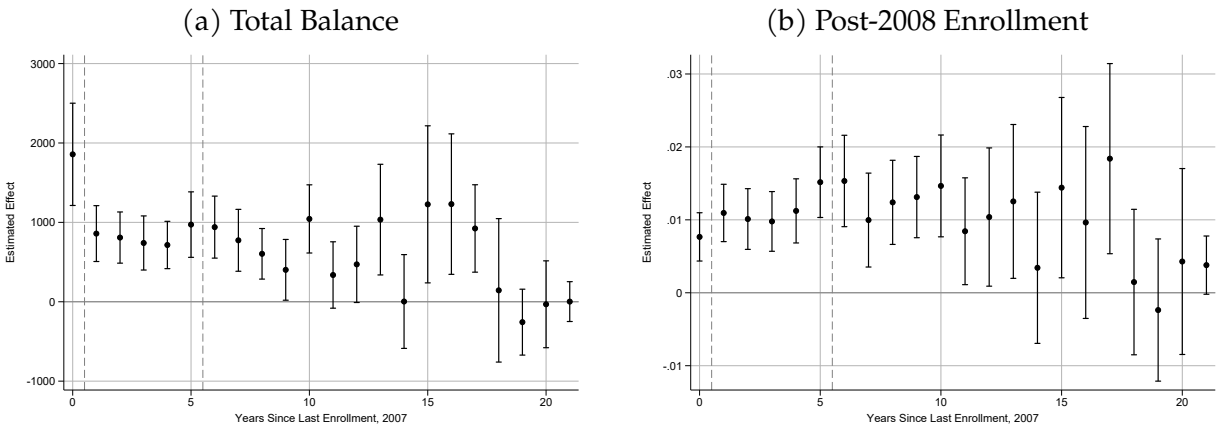
Note: Plots show OLS coefficient estimates of equation (2) in the text, using a longitudinal panel of borrowers, based on a 2% sample of borrowers with open federal student loans at the beginning of 2007. Coefficients are estimated separately by year. Active borrowers are those enrolled during the year in question. Recent borrowers are those with loan maturity dates (i.e. repayment entry dates) within 5 years of 2007. Distant borrowers had loan maturities more than 5 years after 2007.

Figure A6: Borrower-Level Impacts Estimated with Individual Fixed Effects



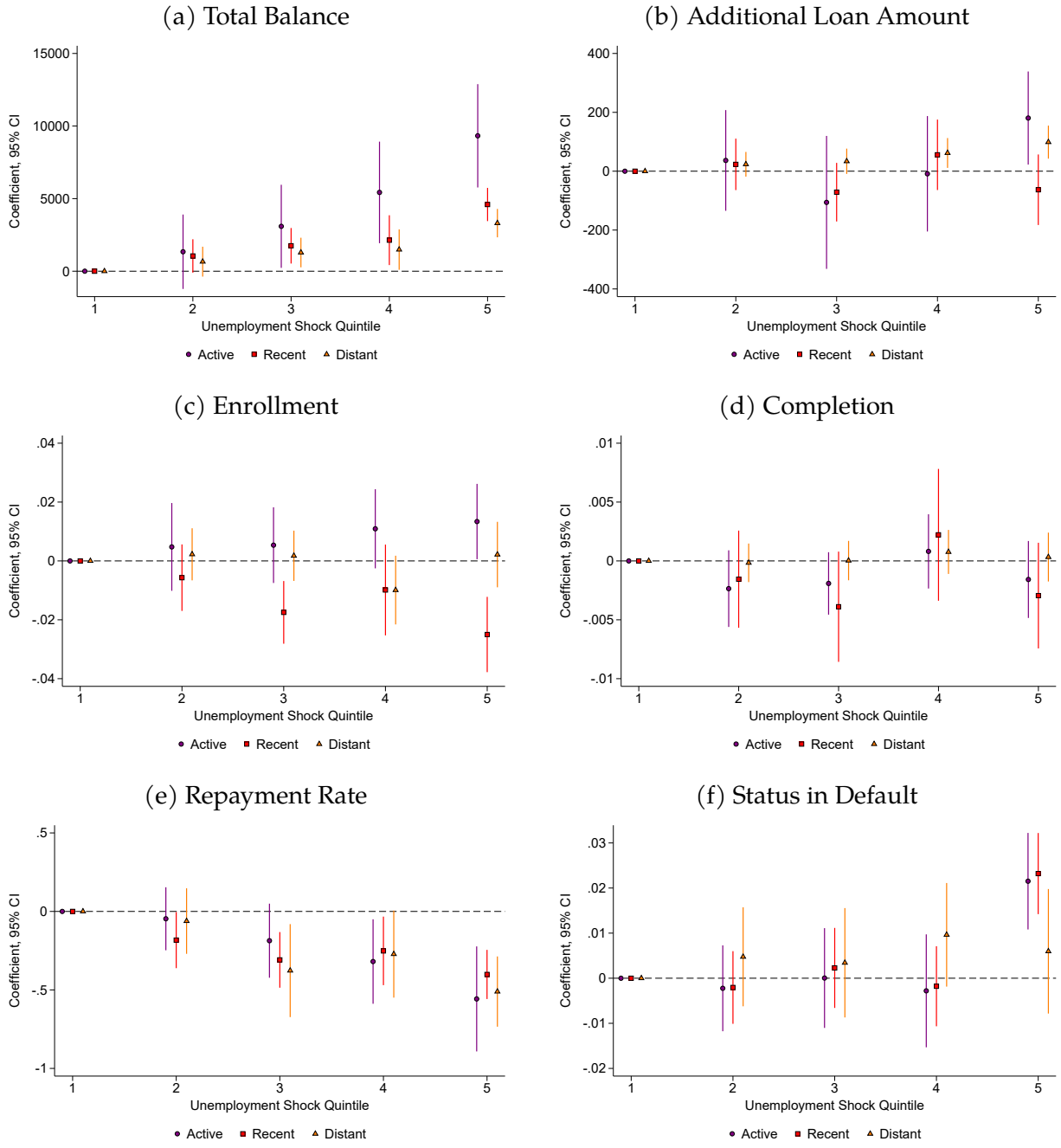
Note: Plots show OLS coefficient estimates of equation (2) in the text, using a longitudinal panel of borrowers, based on a 2% sample of borrowers with open federal student loans at the beginning of 2007. Instead of the main independent variable of interest entering linear in the equation we estimate coefficients corresponding to quintiles of the unemployment rate shock. Coefficients are estimated separately by year. Active borrowers are those enrolled during the year in question. Recent borrowers are those with loan maturity dates (i.e. repayment entry dates) within 5 years of 2007. Distant borrowers had loan maturities more than 5 years after 2007.

Figure A7: Impacts on Total Balance and Post-2008 Enrollment, by Years Since Last Enrolled in 2007



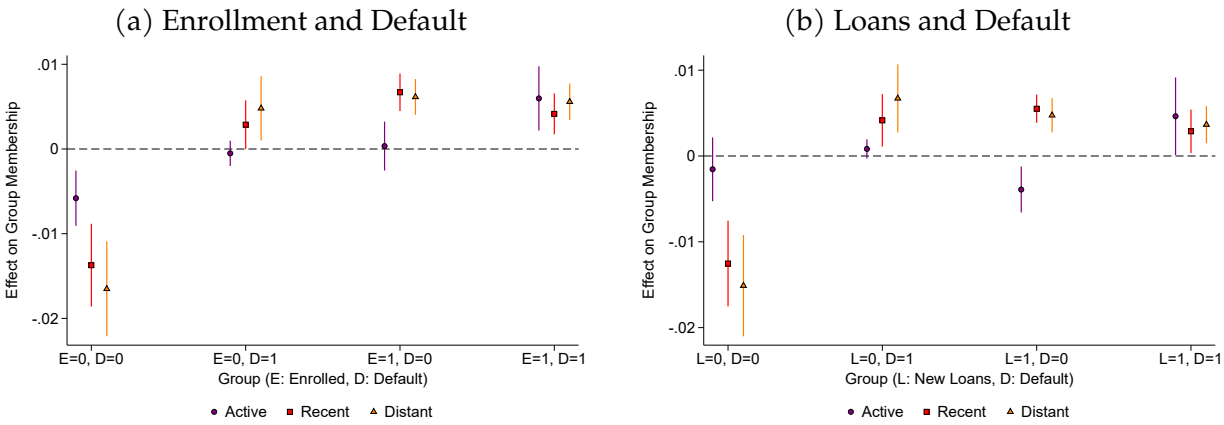
Note: Plots show OLS coefficient estimates of equation (2) in the text, using a longitudinal panel of borrowers, based on a 2% sample of borrowers with open federal student loans at the beginning of 2007. Coefficients are estimated separately by year. The horizontal axis corresponds to the number of years prior to 2007 that the borrower last took out a loan. The first group, at year 0, corresponds to borrowers who had loans in origination in 2007. The two vertical dashed bars correspond to the groupings of the Active, Recent, and Distant groups we discuss in the text.

Figure A8: 2019 Borrower-level Impacts of the Recession by Shock Quintile



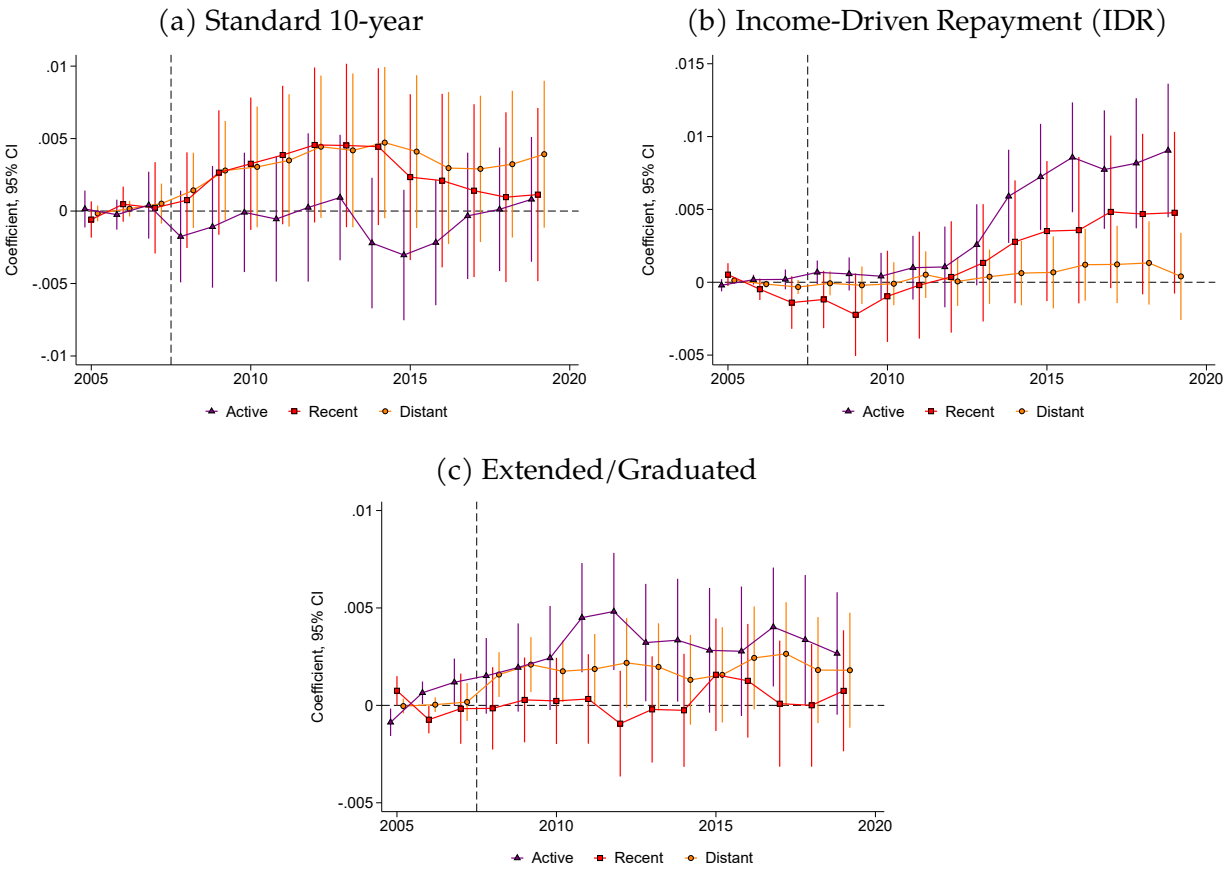
Note: Plots show OLS coefficient estimates of equation (2) in the text, using a longitudinal panel of borrowers, based on a 2% sample of borrowers with open federal student loans at the beginning of 2007. Instead of the main independent variable of interest entering linear in the equation we estimate coefficients corresponding to quintiles of the unemployment rate shock. Coefficients are estimated separately by year. Active borrowers are those enrolled during the year in question. Recent borrowers are those with loan maturity dates (i.e. repayment entry dates) within 5 years of 2007. Distant borrowers had loan maturities more than 5 years after 2007.

Figure A9: Effect on Joint Distribution of Enrollment, Additional Loans, and Default



Note: Plots show OLS coefficient estimates of equation (2) in the text, using a longitudinal panel of borrowers, based on a 2% sample of borrowers with open federal student loans at the beginning of 2007. Active borrowers are those enrolled during the year in question. Recent borrowers are those with loan maturity dates (i.e. repayment entry dates) within 5 years of 2007. Distant borrowers had loan maturities more than 5 years after 2007. The outcomes of the regression in panel a) are dummies for whether the borrower ever enrolled after 2007 (E) and whether they ever defaulted after 2007 (D). THe outcomes of the regression in panel b) are dummies for whether the borrower took out additional loans after 2007 (L) and whether they ever defaulted after 2007 (D).

Figure A10: Impact on Repayment Plan Enrollment, ED-Held Loans Only



Note: Plots show OLS coefficient estimates of equation (2) in the text, using a longitudinal panel of borrowers, based on a 2% sample of borrowers with open federal student loans at the beginning of 2007. Active borrowers are those enrolled during the year in question. Recent borrowers are those with loan maturity dates (i.e. repayment entry dates) within 5 years of 2007. Distant borrowers had loan maturities more than 5 years after 2007. The outcomes of the regression in panel a) are dummies for whether the borrower ever enrolled after 2007 (E) and whether they ever defaulted after 2007 (D). THe outcomes of the regression in panel b) are dummies for whether the borrower took out additional loans after 2007 (L) and whether they ever defaulted after 2007 (D).

Table A1: Mean characteristics of CZ-level federal student loan portfolio. Graduate borrowers.

	Public		Private		For-profit	
	2007	2019	2007	2019	2007	2019
Portfolio summary						
Oustanding balance	32	148	35	199	9	51
Total borrowers	1274	3036	1129	3096	319	1043
Defaulted balance	2	8	3	10	0	5
Defaulted borrowers	62	160	57	167	14	97
New flows						
New borrowers	157	96	181	104	55	21
New disbursements	15	18	18	26	5	5
New defaults	7	21	7	23	4	14
Enrollment reporting						
Current enrollees	885	1166	797	1223	243	387
New completions	117	113	107	114	23	23
Observations	741	740	741	741	722	738

Note: Dollar figures are in millions, adjusted for inflation using the CPI-U and presented in 2019 terms. Borrower counts are measured in thousands. Commuting zone level data on federal student loan portfolio. Institution sector is defined by a combination of institution predominant degree, control, and student academic level. New defaults counts the number of borrowers entering default for the first time.

Table A2: CZ-level effect of a 1 p.p. increase in 2007-2009 unemployment on 2019 portfolio.

	UG Two-year		UG Four-year			Graduate		
	(1) Pub	(2) FP	(3) Pub	(4) Priv	(5) FP	(6) Pub	(7) Priv	(8) FP
Outstanding balance	0.10***	0.07***	0.08***	0.09***	0.09***	0.05***	0.07***	0.05***
	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Total recipients	0.08***	0.06***	0.06***	0.08***	0.09***	0.04***	0.05***	0.04***
	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)
Defaulted balance	0.08***	0.04**	0.02*	0.04**	0.06***	0.06**	0.10***	0.13***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.03)
Defaulted borrowers	0.08***	0.03***	0.03***	0.05***	0.09***	0.07***	0.09***	0.11***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
New disbursements	0.04**	0.05***	0.09***	0.11***	0.08***	0.06***	0.09***	0.03**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
New recipients	0.02	0.04**	0.07***	0.08***	0.06***	0.01	0.05***	-0.04
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
New completions	0.09***	0.08***	0.09***	0.09***	0.10***	0.04***	0.07***	0.05**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
New defaults	0.09***	0.05***	0.08***	0.09***	0.11***	0.13***	0.10***	0.09**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.03)

Note: Table shows OLS coefficient estimates for year 2019 in equation (1) in the main text, estimated on a CZ-level panel for the years 2005-2019, separately by the college sector and student grade level. All outcomes are expressed in logs. Standard errors are clustered at the CZ-level in all specifications.

Table A3: Summary Statistics of Borrower Panel Sample, September 2007, by Postsecondary Attachment and Whether Held Any ED-Held Loans

	Had ED-Held Loans			No ED-Held Loans		
	Active	Recent	Distant	Active	Recent	Distant
Age	26.8	32.9	41.1	26.3	33.1	38.5
Total Loan Amount	15654.8	14932.8	6876.1	10782.1	15711.1	6230.0
Total Balance	17493.0	19958.8	11924.2	14483.1	21973.1	12879.5
In Forbearance	0.044	0.16	0.095	0.024	0.091	0.066
In Repayment	0.21	0.59	0.37	0.17	0.67	0.63
In Origination	0.91	0.22	0.0066	0.89	0.20	0.0026
In Default	0.018	0.12	0.53	0.0044	0.036	0.26

Note: Table shows OLS coefficient estimates of equation (2) in the text, using a longitudinal panel of borrowers, based on a 2% sample of borrowers with open federal student loans at the beginning of 2007. Coefficients are estimated separately by year. Active borrowers are those enrolled during the year in question. Recent borrowers are those with loan maturity dates (i.e. repayment entry dates) within 5 years of 2007. Distant borrowers had loan maturities more than 5 years after 2007. The table separates the sample by whether the borrowers took on additional borrowing after 2007 or not.

Table A4: Great Recession Shock by Race

	White	Black	Hispanic	Asian/PI
Median Shock	4.10	4.59	4.55	4.59
Mean Shock	4.44	4.64	4.62	4.63
Fraction in Top Shock Quartile	0.26	0.35	0.27	0.32

Note: Table shows mean and median unemployment rate in 2007-2009 for the borrower level sample (2% random sample of borrowers with loans open in September 2007), as well as the fraction living in CZ's in the top quartile of the unemployment rate change. The results use weights equal to the predicted probability that a borrower is from a given racial/ethnic group, which are derived from an imputation method. See text for additional details

Table A5: Estimated Effects by Whether Took Out More Loans After 2008

	Active		Recent		Distant	
	No Loans	More Loans	No Loans	More Loans	No Loans	More Loans
Total Balance	174.94	2479.29	360.44	1308.93	366.72	495.57
	(111.52)	(405.48)	(103.48)	(241.21)	(67.23)	(335.40)
Repayment Rate	-0.008	-0.173	-0.021	-0.171	-0.031	-0.151
	(0.012)	(0.037)	(0.007)	(0.052)	(0.012)	(0.112)
Currently in Default	0.001	0.004	0.003	0.001	0.001	0.004
	(0.002)	(0.002)	(0.001)	(0.002)	(0.001)	(0.003)
Any Default	0.005	0.005	0.008	0.002	0.010	-0.005
	(0.003)	(0.002)	(0.003)	(0.004)	(0.002)	(0.004)

Note: Table shows OLS coefficient estimates of equation (2) in the text, using a longitudinal panel of borrowers, based on a 2% sample of borrowers with open federal student loans at the beginning of 2007. Coefficients are estimated separately by year. Active borrowers are those enrolled during the year in question. Recent borrowers are those with loan maturity dates (i.e. repayment entry dates) within 5 years of 2007. Distant borrowers had loan maturities more than 5 years after 2007. The table separates the sample by whether the borrowers took on additional borrowing after 2007 or not.

Table A6: Heterogeneity in Effects of Great Recession by Characteristics in 2007, Recent Group

	Enrollment	Balance	Default	Paydown Rate
A. Race / Ethnicity				
White	0.009***	743.356***	0.007***	-0.072***
	(0.001)	(116.210)	(0.002)	(0.016)
Black	0.010***	890.662**	0.005	-0.107**
	(0.003)	(279.340)	(0.004)	(0.040)
Hispanic	0.010***	780.647***	-0.002	-0.033
	(0.003)	(147.208)	(0.003)	(0.040)
Asian/PI	0.011***	715.076***	0.004	-0.086***
	(0.003)	(182.325)	(0.003)	(0.020)
B. AGI				
Less than $10,000$	0.009***	595.928**	-0.001	-0.044
	(0.002)	(187.618)	(0.003)	(0.041)
$10,000-25,000$	0.010***	839.863***	0.004	-0.062
	(0.002)	(184.478)	(0.004)	(0.038)
$25,000-50,000$	0.012***	1011.477***	0.007*	-0.097**
	(0.003)	(231.027)	(0.003)	(0.031)
More than $50,000$	0.007**	628.856***	0.007***	-0.083***
	(0.003)	(155.288)	(0.002)	(0.022)
C. Balance in 2007				
Less than $2,500$	0.012***	436.270***	0.004	-0.216*
	(0.003)	(128.837)	(0.003)	(0.088)
$2,500-10,000$	0.010***	561.804***	0.008**	-0.078**
	(0.002)	(122.287)	(0.003)	(0.024)
$10,000-20,000$	0.010***	603.294***	0.007**	-0.049***
	(0.002)	(136.049)	(0.002)	(0.012)
More than $20,000$	0.012***	1555.428***	0.007**	-0.030
	(0.002)	(342.554)	(0.003)	(0.024)
D. Institution Sector				
Public 2-Year	0.017***	728.088***	0.010**	-0.182***
	(0.003)	(147.217)	(0.004)	(0.044)
For-Profit 2-Year	0.004	-94.365	0.003	0.048
	(0.004)	(236.630)	(0.003)	(0.061)
Public 4-Year	0.012***	1069.810***	-0.008*	-0.149***
	(0.003)	(218.108)	(0.004)	(0.038)
Private 4-Year	0.009**	1088.947***	0.021**	-0.125**
	(0.003)	(281.026)	(0.008)	(0.040)
For-Profit 4-Year	0.001	168.919	0.005	-0.042
	(0.005)	(289.984)	(0.005)	(0.089)

Note: Table shows 2019 OLS coefficient estimates of equation (2) in the text, using a longitudinal panel of borrowers, based on a 2% sample of borrowers with open federal student loans at the beginning of 2007. Coefficients are estimated separately by year. Active borrowers are those enrolled during the year in question. Recent borrowers are those with loan maturity dates (i.e. repayment entry dates) within 5 years of 2007. Distant borrowers had loan maturities more than 5 years after 2007. Results by race in panel A use weights equal to the predicted probability that a borrower is from a given racial/ethnic group, which are derived from an imputation method. See text for additional details. Panel B separates borrowers by their loan balance in 2007. Panel C separates borrowers by the AGI on their most recent pre-2007 FAFSA. Panel D separates borrowers by the control of the predominant institution they attended prior to 2007.

Table A7: Heterogeneity in Effects of Great Recession by Characteristics in 2007, Distant Group

	Enrollment	Balance	Default	Paydown Rate
A. Race / Ethnicity				
White	0.009***	618.841***	0.007**	-0.088*
	(0.002)	(145.293)	(0.002)	(0.039)
Black	0.008*	742.000**	0.012***	-0.074
	(0.004)	(285.610)	(0.004)	(0.097)
Hispanic	0.010*	425.436*	0.000	-0.003
	(0.004)	(196.600)	(0.002)	(0.051)
Asian/PI	0.008**	447.318*	0.006	-0.064
	(0.003)	(225.486)	(0.003)	(0.040)
B. AGI				
Less than $10,000$	0.008	418.060	0.006	-0.170
	(0.007)	(483.769)	(0.006)	(0.175)
$10,000-25,000$	0.006	503.091	0.007	-0.039
	(0.008)	(540.207)	(0.006)	(0.156)
$25,000-50,000$	0.015*	428.294	0.011	-0.188
	(0.007)	(599.384)	(0.009)	(0.180)
More than $50,000$	0.003	-1742.089*	-0.021**	0.352*
	(0.009)	(782.288)	(0.007)	(0.174)
C. Balance in 2007				
Less than $2,500$	0.014***	391.465***	0.013***	-0.129**
	(0.003)	(105.166)	(0.003)	(0.046)
$2,500-10,000$	0.010***	477.684***	0.008*	-0.078***
	(0.002)	(102.176)	(0.003)	(0.022)
$10,000-20,000$	0.013***	853.200***	0.007*	-0.083**
	(0.002)	(159.052)	(0.004)	(0.027)
More than $20,000$	0.012***	1482.889***	0.015***	-0.175
	(0.002)	(382.335)	(0.003)	(0.142)
D. Institution Sector				
Public 2-Year	0.017***	510.081***	0.010**	-0.198***
	(0.003)	(142.783)	(0.004)	(0.049)
For-Profit 2-Year	0.004	45.190	-0.001	0.012
	(0.004)	(157.375)	(0.003)	(0.042)
Public 4-Year	0.017***	740.189***	0.002	-0.149***
	(0.003)	(161.786)	(0.003)	(0.033)
Private 4-Year	0.013***	661.479***	0.018***	-0.111**
	(0.003)	(187.303)	(0.005)	(0.035)
For-Profit 4-Year	0.007	112.342	-0.002	-0.054
	(0.011)	(477.170)	(0.014)	(0.102)

Note: Table shows 2019 OLS coefficient estimates of equation (2) in the text, using a longitudinal panel of borrowers, based on a 2% sample of borrowers with open federal student loans at the beginning of 2007. Coefficients are estimated separately by year. Active borrowers are those enrolled during the year in question. Recent borrowers are those with loan maturity dates (i.e. repayment entry dates) within 5 years of 2007. Distant borrowers had loan maturities more than 5 years after 2007. Results by race in panel A use weights equal to the predicted probability that a borrower is from a given racial/ethnic group, which are derived from an imputation method. See text for additional details. Panel B separates borrowers by their loan balance in 2007. Panel C separates borrowers by the AGI on their most recent pre-2007 FAFSA. Panel D separates borrowers by the control of the predominant institution they attended prior to 2007.