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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 rise in 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. Borrowers who were students at the onset of the recession saw the largest effects on accrued debt, due to delayed graduation and lengthened enrollment spells.

JEL codes: I22, G51, H81, J24
Keywords: student loans; Great Recession; unemployment; higher education finance

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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 percent 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 from 2005 to 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 regional effect of the recession, using repeated cross-sections of each region'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 loan disbursements for first-time student borrowers. 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 useful as a way to examine how the recession impacted the loan repayment outcomes of different types of borrowers. Our results can be interpreted as the reduced form effect of the recession, stemming from the combined impact of various 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. Across regions that faced varying degrees of unemployment shock, model estimates show parallel trends pre-recession, strengthening the case for causal identification. The results show that by 2019 – almost ten years after the official end of the Great Recession – commuting zones that had faced a 1 percentage point (p.p.) higher recession unemployment still had between 7 and 8 percent higher numbers of both borrowers and balance outstanding. Regions facing higher unemployment saw more post-secondary program completions through 2019, as well as higher total numbers of borrowers in default. 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 enrollment, 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 the effects of the recession on existing borrowers' repayment outcomes.[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 p.p. 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 sharp long-term increases in loan balances and default rates, by $1,900, and 0.3 p.p. for each 1 p.p. increase in unemployment (respectively). Borrowers who had been out of school at the onset saw a similar set of impacts, but of more muted magnitude.

Our main results show that additional student loan borrowing and default both increased as a result of the economic downturn, but they cannot establish whether recession-induced borrowing was directly linked to borrower default. To shed some light on this important relationship, we conduct treatment effect heterogeneity analyses following the approaches of Card et al. (2008) and Card and Solis (2022). We find that borrowers who were students during the recession were shifted into additional borrowing and lengthened enrollment spells that resulted in eventual increases in default. This is consistent with the literature that shows the detrimental effects of first entering the labor market during recessions (Oreopoulos et al., 2012). In contrast, among borrowers who had left school five years or less prior to the onset of the recession, those who financed re-enrollment with additional student loans were slightly less likely to eventually enter default. Thus, additional borrowing seems to have protected this particular group of borrowers from the detrimental effects of the recession.

Our study expands the empirical literature on the impacts of recessions on economic well-being.

[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).

While our results do not constitute a comprehensive welfare analysis of the effect of the Great Recession (we cannot observe outcomes for individuals who do not take out federal student loans, nor any labor market outcomes), we contribute to a growing body of evidence on this topic. 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) 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,

[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.

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]

2.2 Commuting zone-level data

We use administrative records on the universe of federal student aid recipients maintained by the 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 and associated student loan payment pause).[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] Unemployment rate data at the CZ level is obtained from U.S. Bureau of Labor Statistics (2023). Figure 1 shows a map of CZs in the continental U.S., split by deciles of the Great Recession unemployment rate shock. Regional variation in the severity of the recession is readily apparent in this map, and it has been well-documented, including particularly large unemployment spikes in manufacturing

[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.

[7]These data are fully anonymized for privacy protection. 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 under count totals as it does not include federal student loan borrowers located in U.S. territories.

areas and the Sun Belt (Mian and Sufi, 2009).

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. We link student borrowers to CZs based on their residential location at the time of their first federal student loan origination.[10] For each CZ, we measure total outstanding balance, the number of borrowers outstanding, the number of borrowers and balance in default, as well as the flow of new borrowers, new loan originations, and new program completions. In the main analysis, we split out each of these variables by the sector of the institution (as defined by the combination of institution level and control). 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.

2.3 Borrower-level data

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, loan status, and repayment plan.[11].

Apart from loan servicing records, we leverage other sources from the 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 records enable measurement of post-secondary enrollment for students who received federal financial aid at any point from 1999 to the present. We observe the college of enrollment (OPEID6), as well as the time period and intensity of the enrollment spell. These reports also hold information on drop out and

[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.

[11] Repayment plan is only observed for loans held by the Department of Education, which includes Direct Loans and federally serviced FFEL loans. Loan status indicators (e.g., in-repayment, forbearance, and default) correspond to the borrower having at least one loan in that status.

graduation, which we rely on for completion outcomes. We measure indicators of the completion of any degree or program for a given borrower in a given year.

While the FSA data provides a unique opportunity to observe the universe of federal student loan borrowers, it carries some 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 (or federally-serviced FFEL) 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). We also do not observe the repayment plan for commercial FFEL borrowers. Second, federal regulation limits our ability to link individual borrower information from sources outside of the FSA, such as employment income, census demographics, or credit reporting records. We are thus confined to studying outcomes reported to the FSA, which mostly encompass loan repayment and program completion.

3 Overall Impact of the Great Recession

3.1 Descriptive Statistics

We begin with summary statistics for the CZ-level federal portfolio panel. Table 1 presents means of the cross-CZ distribution of undergraduate loan portfolio characteristics for the years 2007 and 2019, reported separately by institution sector, as defined by level (two-year and four-year colleges) and control (public, private non-profit, and private for-profit).[13] The largest share of the outstanding balance is for loans used to fund enrollment at 4-year public institutions. In 2007, the average CZ had a balance of $105 million for 4-year publics, owed by approximately 9,500 borrowers. By 2019 this had grown to $344 million among 18,600 borrowers, reflecting a large increase in both borrower take-up and mean balance per borrower. Growth in balance outstanding for public 2-

[12] In the years leading up to the recession, commercial FFEL loans composed 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.

[13] 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.

year institutions (i.e. community colleges) was even larger in percentage terms, growing four-fold over 2007-2019, from $27 million to $111 million for the mean CZ. The number of borrowers outstanding in this sector did not grow at the same pace, going from about 4,100 to 9,900 over this period. Balance growth was higher only for for-profit colleges awarding predominantly 4-year degrees; the balance in this sector grew over 500% between 2007 and 2019, from $18 million to $91 million on average.

The public 2-year and for-profit 4-year sectors also stand out in terms of student loan defaults. In 2007, about 15% and 12%, respectively, of outstanding borrowers that had attended community college and 4-year for-profit were in default. By 2019 these shares had grown to 25% and 29%, respectively. In contrast, over 2007-2019 the defaulted borrower share went from about 8-9% to 11-12% among borrowers that attended public and non-profit private 4-year institutions. A similar pattern held for the share of outstanding balance in default.

The bottom panels of Table 1 summarize entering flows for CZs' student loan portfolios, including counts of: number of new borrowers, new loan disbursements, and new defaults.[14] Additionally, we show the stock of outstanding borrowers currently enrolled, as well as completion counts, as observed in enrollment reporting records (see section 2.3 for details). Notably, the flow of new borrowers has slowed over the study period across all institutions sectors; for instance, in 2007 the average CZ saw about 1600 new public 4-year student borrowers, but this figure had decreased to 1160 in 2019, a decline of 28%.

We also report the stock of current enrollees and the flow of new degree completions. With the exception of for-profit 2-year colleges, new completions were up in 2019 relative to 2007 across all institution sectors. The increase in both completions and defaults reflects heterogeneity in outcomes between borrowers, which we explore further in section 4. For additional context, 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) CZs in Figure A2.

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

3.2 Empirical Strategy

Our goal is to estimate the Great Recession's reduced form impact on the federal student loan portfolio over time and across labor markets. We intend to capture the overall impact of the recession and its ripple effects, including the direct impact of the labor market downturn on households, 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 for education for the first time.

Figure 1 showed the wide geographic variation in the severity of the Great Recession. Yagan (2019) established this variation as a reliable source of identification for the recession's effects on local labor markets. Following this literature, we implement a generalized differences-in-differences model specification, comparing CZs based on the severity of the recessionary unemployment shock:

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

where Y_{ct} is the natural log outcome of CZ c in year t. The variable $shock_c$ measures the 2007-2009 change in unemployment in CZ c (shown in Figure 1), which we interact with year indicators over the period 2005-2019, omitting the pre-recession year, 2007. 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.[15] Due to small-cell issues, we drop the smallest 5% of CZs (in terms of total borrowers) when estimating 1. 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.

Throughout this analysis, we estimate models separately by the sector of the educational institution. In this manner, characterizing trends in borrowing resulting from the recession can shed light on the potential mechanisms behind the worsening of repayment outcomes. For example, existing

[15] 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).

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 Appendix A.

3.3 Results

Figure 2 shows OLS estimates of equation 1 for six outcomes of interest, plotting the $\hat{\beta}_t$ coefficients along with their corresponding 95% confidence intervals separately by sector of undergraduate education.[16] All outcomes are measured in log terms. Panel (a) shows the effects of the recession on new loan disbursements each year. There are no meaningful differences in the flow of disbursements prior to the Great Recession, as noted by the near-zero coefficients for the years 2008 and prior. Pre-recession coefficients for four-year for-profits are negative and marginally significant, suggesting some degree of pre-trends in this sector, but relatively small in magnitude. Across all sectors, 2009 shows a clear break in trend with divergent increases in loan disbursements. A quick rise in new disbursements is particularly pronounced for community colleges, peaking in 2012, with disbursements 13% higher for every 1 p.p. increase in recession unemployment. Effects then decline but remain positive and significant through 2019. For other sectors, the rise in disbursements is less cyclical, showing slow and steady growth until 2015, after which effects plateau and remain positive in the neighborhood of 9-10%.

Increases in enrollment and borrowing corresponded with increases in degree completions, as shown in Panel (b) of Figure 2. Starting in 2008, completions at for-profit colleges (both 4-year and 2-year) and community colleges pick up at a rapid rate. Recessionary growth in degree production peaks in 2012 for 2-year for-profits, while it continues to rise through 2015 for 4-year for-profit and community colleges, suggesting the recession had longer-term and larger impacts in these latter two sectors (perhaps due to longer enrollment spells). Unsurprisingly, the rise in recession-induced degree production is considerably slower – but still positive and significant – for the public and private 4-year sectors. The estimates indicate that in 2015, production of degrees

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

rose by 8% per unemployment point in these two sectors, relative to about 12% for 4-year for-profits and community colleges, with 2-year for-profit effects landing somewhere in the middle. By 2019 completion effects continued to be positive and significant, with full convergence across sectors. The similarity between the origination and completion estimates suggests that most recession-induced enrollment led to positive program completion outcomes.[17] Additionally, the cross-sector convergence of completion effects in 2019 may indicate that the Great Recession caused structural changes to local markets of higher education, permanently expanding take-up of post-secondary programs.

Panels (c) and (d) of Figure 2 show the estimated effect of a 1 percentage point increase in the unemployment rate on the log number of borrowers and log balance outstanding (respectively). Again, effects for four-year for-profits and community colleges are larger (and took off quicker) relative to other sectors. Their effects top out in 2016 and plateau, remaining remarkably positive and significant through 2019. In contrast, other sectors exhibit a slower but steady increase, such that by 2019 there is convergence in effect magnitude across all undergraduate sectors. In the long term our estimates suggest that, across sectors, the stock of borrowers was 6-to-9% higher in areas facing a 1 p.p. higher rate of recessionary unemployment. In terms of outstanding balance, the range of impacts across sectors was 7-to-10% per percentage point in unemployment.

The final two panels of Figure 2 examine the recession's impact on the health of the student loan portfolio, as summarized by the log number of borrowers with a loan in default (Panel (e)) and log defaulted balance (Panel (f)). Just like in the previous models, there is no indication of pre-existing trends in default leading to the onset of the recession. Stratification of effects by sector is most pronounced for borrower default. Once again, defaults for borrowers that had attended four-year for-profit colleges outpaced those at other institutions. By 2012, default effects for community colleges had caught up. Increases in borrower default for other sectors did not become significant until 2015; we estimate that borrower default increased by 2-to-3% per 1 p.p. in unemployment at public and private 4-year colleges, relative to 8% at 4-year for-profits and community colleges. Remarkably, effects for the defaulted balance are highest in the community college sector and insignificantly different from zero for 4-year publics, although these models show lower statistical

[17] In section 4.7, we provide further discussion on the relationship between enrollment, completion and default effects.

precision.

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

3.4 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. Assuming constant treatment effects across CZs, we compute the following:

$$\hat{\phi}_{cs} = \frac{\hat{\beta}_{s2019} shock_c}{\Delta Y_{cs}}, \tag{2}$$

where $\hat{\beta}_{s2019}$ is the effect estimate for sector s in 2019; $shock_c$ is the percentage point increase in unemployment that took place in CZ c over 2007-2009; and ΔY_{cs} is the actual log change in the outcome between 2007 and 2019.[18] The numerator of this expression is our model's predicted effect size according to the unemployment shock each CZ faced. Thus, the ratio $\hat{\phi}_{cs}$ measures the predicted impact on the outcome relative to the total observed log change in the outcome, generating a cross-CZ distribution of relative effect size estimates. We report the cross-CZ mean of this estimated relative effect size distribution.[19]

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. On average, 19 to 32 percent of the 2007-2019 log increase in undergraduate loan balances can be attributed to the Great Recession (first column). These effects stem from balances left unpaid as borrowers faced distressed financial situations, as well as increased borrowing. The second column presents estimates for the number of borrowers outstanding, showing larger shares; on average, between 29

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

[19] For some CZs relative effect estimates are of outlier magnitude, with implausibly large effects. We address this by winsorizing the distribution at the 1% level.

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, on average, between 10 and 25% of the increase in undergraduate borrower default was due to the recession, with the largest shares among 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 of newly defaulted borrowers (fifth column), show larger effects for undergraduate 4-year and graduate borrowers, likely reflecting longer times 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 combined 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. Our estimates suggest that 46% of the increase in entering defaults in 2019 could still be traced back to the Great Recession (last column). These large effect estimates for long-term estimates are consistent with existing evidence of the recession's lingering effects on young workers.

4 Individual Borrower Trajectories

So far our analysis has shown that the federal student loan portfolio grew at a much faster rate in labor markets harder hit by the Great Recession. It also exhibited how the recession's effect was unequal within geography, with the growth of defaulted borrowers varying based on the type of institution attended. Given the nature of loan data, the CZ-level analysis was ideal to understand the overall effects of the recession on the portfolio, by studying the combined effect on balances from existing borrowers and from new borrowers who first appear in the data as a result of the recession.

Nevertheless, a topic of special policy interest is understanding heterogeneity in the intensive margin effects of the recession on existing borrowers. As mentioned above, there is an extensive literature documenting the "scarring effects" of the recession on young workers. We contribute new findings to this literature by documenting recessionary effects on borrowing and repayment

outcomes for a representative sample of borrowers who had first borrowed before the onset of the downturn. We use a 2% random sample of borrowers (N $\approx$ 555,000) with a positive loan balance at the end of FY 2007, keeping the borrower CZ constant over time even if the borrower moves away (see Section 2.2 for details).

Holding borrowers' geography constant is important because one limitation of the cross-sectional analysis is that it fails to 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 may introduce attenuation bias in our CZ-level estimates if there is negative selection into migration by worker skill. This would lead to areas with smaller shocks from the Great Recession appearing to have higher rates of loan origination and default.

4.1 Borrower types

Our sample definition encompasses the full range of borrowers in different stages of life; from current college freshmen who are years away from beginning repayment, to borrowers that stopped school many years ago and who may have entered default. The "scarring" literature suggests that the effect of the recession on the repayment outcomes will vary for different types of borrowers, and we want to be able to distinguish these effects from the outset.

To do so, we split our sample into three groups. The first group, Active Attachment, consists of borrowers who had loans open and were enrolled in an educational institution in 2007, composing about 32% of our sample. The Active group includes borrowers who are in their first post-secondary education spell, as well as borrowers who might have loan balances from previous spells and enrolled again in 2007. Most of these borrowers would be finishing their studies at the height of the Great Recession, or during the early years of the recovery. The second, Recent Attachment, group consists of borrowers who were not enrolled in 2007, had an outstanding balance and had last originated a loan in the five years prior (after September 2002); they are the largest group, 42% of the sample. The last, Distant Attachment, group consists of those who were not enrolled

in September 2007 and whose last student loan was originated earlier than September 2002, more than 5 years prior to the onset of the recession (making up 25% of our sample).

Table 3 shows the average characteristics of our sample for the three borrower types, measured at the end of FY 2007. Demographically, the groups are similar in terms of gender (about 60% female), but, as expected, differ in terms of 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: the Recent group was on average 33 years old, while the Distant group was 40. Loan amount, outstanding balance, and loan status also differed across borrower groups.[20] By construction, all Active borrowers had a loan in origination status, with mean total loan amount of around $19,000, with balance outstanding slightly below that, reflecting a payment rate near zero (as expected for borrowers still in school).[21] Some 16% of Active borrowers had loans in repayment at this time (3% in forbearance and 1% in default), indicating that some had already left school by the end of 2007.

About 75% of Recent borrowers had loans in repayment at the end of 2007, with mean total loan amounts near $16,000 and on average owing about 36% more than this amount, reflecting accumulated interest and up to 5 years in repayment. Recent borrowers had a 12% probability of being in forbearance and 8% in default at this time. For Distant borrowers, balances are nearly twice as large as origination amounts, suggesting repayment struggles, which are consistent with their defining characteristics. Borrowers that have fully paid down their debt are not included in this sample, leading to negative selection for the Distant borrower group. Consistent with this notion, 39% of the Distant borrowers were in default in 2007. This high default rate is driven by borrowers that have been in repayment at least 12 years, almost all of whom are in default (composing about 30% of the Distant borrower group).

4.2 Empirical Framework

Our estimating equation compares the experiences of similar borrowers who lived in different areas at the beginning of the Great Recession. Following earlier work estimating long-term impacts of

[20] We measure loan amounts for loans that had balance outstanding in 2007. This does not include originated amounts for loans fully paid off prior to 2007.

[21] Lower mean balance than mean loan amounts for the Active group likely reflects a lag in loan servicer balance reporting for borrowers with in-school status. It may also reflect that not all originated amounts had been disbursed to the borrower at the time.

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 between 2005 and 2019:

$$y_{ict} = \beta shock_c + \theta_{g(i)} + \epsilon_{ict}, \tag{3}$$

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

We control for fine-grain fixed effects $\theta_{g(i)}$, capturing a fully saturated set of groupings based on the characteristics of borrowers in 2007. These groups are defined by unique combinations of: ventiles of balance outstanding in 2007, five-year age bands, and the sector of the last institution the borrower attended. As before, sector is defined by colleges' predominant degree awarded (certificates, associate degrees, bachelor's degrees, and graduate certificates/degrees) and institutional control: public, private nonprofit, or private for-profit. In total, there are 1,865 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 (Figure A7 in the appendix), with similar results.

4.3 Results

Figure 3 shows the average effect of a 1 percentage point increase in unemployment on student loan outcomes for the three borrower groups. Each coefficient comes from a separate estimate of equation 3 for each borrower type and year; hence, there is no omitted year in these models. Estimates control for a fully interacted set of indicators for institution sector, borrower age groups, and balance before the recession. Notably, almost none of the coefficient estimates in this figure are statistically significant for years prior to 2007, suggesting an absence of pre-existing trends in

the outcomes of cities more severely impacted by the recession.

We first consider how the recession affected the take-up of additional student loans. Panel (a) of Figure 3 shows the estimated effect on the origination of new loans (on top on those the borrowers already held in late 2007).[22] Active borrowers became increasingly likely to take out new loans in cities more severely affected by the recession. These effects peaked in 2010 then began slowly fading out, but they were still large, positive and statistically significant at the end of 2015. During the 2010 peak, Active borrowers took on average about $130 (95% C.I. $50-200) in additional loans per unemployment p.p. Over the period 2008-2019, the average Active borrower had taken out about $600 in additional student loans for every percentage point increase in their area's unemployment rate. Origination effects for the Recent group are similar, albeit more muted and experiencing quicker fade-out, totaling $150 in additional loans per point over 2008-2019. For the Distant group, new origination effects are of similar magnitude to the Recent group, but they remain remarkably stable and significant through 2019, with a total of $350 in additional borrowing per unemployment point over the post-recession period.

The increase in loan take-up reflects positive effects on enrollment (Panel (b) of Figure 3). We measure enrollment using an indicator for at least quarter-time enrollment in any institution based on college financial aid office reporting; this includes any enrollment, regardless of whether it is funded by federal student loans. Active borrowers were about 0.7 p.p. more likely to be enrolled in 2009-2010 for every 1 p.p. increase in unemployment. The effect is persistent, showing a similar degree of gradual fade-out as loan origination, suggesting most of this enrollment increase was funded by federal loans. Even by 2019, Active borrowers were still substantially more likely to be enrolled, by 0.3 p.p. for each additional percentage point in the recessionary shock. Enrollment effect estimates for the Recent are generally insignificant and even negative for later years. Estimates for the Distant group are noisy, although additional robustness modeling exercises suggest noisy positive effects for these borrowers (see section 4.4 and Figure A7).

Panel (c) of Figure 3 shows effects on program completion. Completion is defined by any graduation events taking place for the borrower in the given year, according to financial aid reporting records, regardless of whether the enrollment spell leading to a completion was funded by student

[22] Appendix Figure A5 show effects on the likelihood of any new loan origination with similar patterns.

loans. For Recent and Distant borrowers, effects are noisily estimated, with none of the coefficients being statistically different from zero. For the Active group, there is a drop in completion starting in 2007, reflecting delays in completions that would have taken place in winter of 2007, or around the time of the initial stock market crash. Delayed graduation effects lasted through 2010 and faded out by 2011. Our estimates suggest that between 2007-2010, Active borrowers were 0.3 percentage point less likely to complete a credential for every 1 p.p. increase in local unemployment. Importantly, these delays in graduation may have reflected both lengthened enrollment spells as well as eventual dropout, as we cannot distinguish the two in the data. There is, however, some indication of significant increases in Active borrower completion in 2014 and 2015, suggestive of a delayed graduation mechanism.

Consistent with loan take-up and enrollment effects, borrower balances in more severely affected areas began growing at an out-sized pace, with the Active borrower group bearing the brunt of the increase in indebtedness (Figure 3 Panel (d)). By 2012, the estimated effect of a 1 p.p. increase in unemployment on loan balances was about $800 (95% C.I. $500-1,100), with near-monotonic growth, reaching $1,800 (95% C.I. $1,200-2,500) in 2019. Balances for Recent and Distant borrowers also rise monotonically as a result of the recession, but not as dramatically, reaching estimates ranging between $400 and $1,100, approximately half the size of the effects seen for Active borrowers. In Panel (e), we express these outcomes in terms of a repayment rate, defined by taking the ratio of current balance to balance in 2007, with a completely paid off balance taking a repayment rate value of one. Rising debt translated into strikingly reduced repayment rates: Active borrowers owed 12% (95% C.I. 6-17%) more in 2019 (relative to 2007) for every percentage point in the recession's unemployment shock. In contrast, effect estimates for Recent and Distant borrowers range between 6 and 10%.

Finally, Panel (f) of Figure 3 estimates the effects of the recession on the likelihood of borrower default. Defaults increased gradually, becoming significant and positive in 2009 for all three borrower groups. These effects peaked in 2013, then slowly faded out and became largely insignificant by 2019. Contrary to earlier results, the dynamics of default effect estimates are almost identical across borrower groups: we estimate that every p.p. increase in unemployment was associated with a 0.3 to 0.5 p.p. increase in the likelihood of being in default in 2013. Taking the average unemployment

increase of 4.5 p.p. nationally, these estimates suggest that, in 2013, the average Recent borrower faced a 2.25 p.p. increase in the risk of default, or a 28% increase relative to their risk of default in 2007 (see Table 3).[23]

Together, the results in Figure 3 establish three broad findings that both corroborate and help extend the empirical literature on the effects of the Great Recession. First is that, above and beyond heterogeneity in outcomes by school sector documented in Section 3, Active borrowers bore the brunt of the recession's effect of increasing loan originations, lengthening enrollment spells, delaying graduation and ultimately leading to a much higher level of indebtedness. These borrowers were in school at the onset and tended to be young, consistent with the "scarring" literature on young workers struggling most in recessionary environments. Second, while Active borrowers experienced the highest increases in balance, all borrower types experienced increased debt burdens and reduced repayment rates, which resulted in a widespread increase in the risk of default among those living in economically distressed areas. Our estimates suggest that the risk of default increased by nearly 50% for borrowers that were recently out of college in cities facing the highest unemployment shocks.[24]

Third, the pattern of results suggests that the recovery from the recession saw a divergence in loan outcomes: while default rate effects begin to fadeout in 2014, effects on balances continued to soar, tanking exposed borrowers' repayment rates monotonically through 2019. The magnitude and timing of the divergence between default and repayment rates is in line with recent work on student loan repayment trends (Darolia et al., 2024). A takeaway from this is that default rates are not a sufficient statistic to summarize the effect of an economic downturn on the health of the student loan portfolio.

Income Driven Repayment

One potential driver of the divergence in effects between default and repayment rates is the expansion of repayment plan options for borrowers struggling to make payments during this period.

[23] We present additional results on loan status indicators in Appendix Figure A5, including discretionary forbearance, which mimics the patterns of our default effect estimates. Discretionary forbearance is used by borrowers who contact their servicer to inform them they are struggling with making payments, so this suggests our default indicators are a good summary measure of borrower distress.

[24] This calculation is based on our estimates for Recent borrowers in CZs with a top 1% recessionary unemployment increase (facing at least a 7.7 p.p. increase in the unemployment rate).

When borrowers first take out federal student loans, they are automatically placed in a standard 10-year repayment plan. However, borrowers can opt for two other types of repayment plan options. First, borrowers can choose an Extended or a Graduated repayment plan. Extended plans lengthen the repayment period to up to 25 years, amortizing (and lowering) monthly payments accordingly. Graduated repayment plans feature payments that increase every 2 years, with the aim of providing lower payments at the beginning of a borrower's repayment spell.

Second, a borrower may enroll in an Income-Driven Repayment (henceforth, IDR) plan. IDR plans set payments as a share of the borrower's discretionary income, which is calculated using the federal poverty line; if borrowers have no discretionary income their payment is set to $0. For most IDR participants, this results in monthly payments considerably lower than the standard 10-year plan, and often times payments lowered under IDR are too small to cover interest on the loan, leading to a growing balance without the borrower ever entering delinquency. IDR plans were introduced in 1994 (ICR), and have consistently expanded in 2009 (IBR), 2013 (PAYE), 2015 (REPAYE), and 2023 (SAVE). All but the most recent of IDR plan expansions raised the income exemption and lowered the share of income due – effectively lowering payments under IDR – without addressing the issue of accruing interest.

In Figure 4 we present estimates of equation 3 for annual indicators of repayment plan use, measured at the borrower level. These models restrict to a subsample of borrowers with loans serviced directly by Department of Education (known as "ED-held loans"), for whom we are able to observe repayment plan information (composing 30% of our original sample, N≈164,000). Take-up of IDR in 2007 was 9% for borrowers in the ED-held subsample, doubling to 18% in 2019.[25]

Panel (a) of Figure 4 shows estimates for take-up of the 10-year standard plan. Given that borrowers are placed in the standard plan by default, it is not surprising that effect estimates are mostly noisy and insignificant. Panel (b) presents estimates for enrollment in the Extended and Graduated plans. Here we see some indication of increased take-up among Active (and, to a lesser extent, Distant) borrowers, although effects are noisily estimated. In contrast, the estimated effect of the recession on IDR take-up for Active borrowers (Panel (c)) is positive and highly significant

[25] Table A3 presents summary statistics of our full sample of borrowers by ED-held status and borrower type. ED-held borrowers are more likely to have larger origination amounts, but they otherwise have similar observable characteristics to borrowers with commercially held loans.

beginning in 2014, with magnitude that is increasing through 2019. Our estimates suggest that in 2019 a borrower that was Active in 2007 was 0.9 p.p. (95% C.I. 0.4-1.4 p.p.) more likely to be in an IDR plan for every 1 p.p. increase in recessionary unemployment. These results suggest that the disconnection between loan default and repayment progress may have been at least partly driven by the increasing relevance of the IDR option.

4.4 Treatment Effect Heterogeneity

How did the effect of the Great Recession vary for cities that were particularly hard hit by the downturn and for borrowers of different observable characteristics?

We first examine heterogeneity in effects based on dosage of the recession's unemployment shock (appendix Figure A6). For succinctness, we present estimates for the year in which recessionary effects were at their peak, according to our estimates in Figure 3, which imposes linearity in the estimates of the recession effect.[26] In Figure A6 we show coefficient estimates from a regression of outcomes on indicators of quintiles of the cross-CZ unemployment shock distribution.[27] For most of the outcomes, effects are approximately linear based on the size of the unemployment shock. For example, Panel (a) shows that, for the Active group, the coefficient estimates for outstanding balance grow gradually for each quintile, with only the top three quintiles having statistically significant effects. On the other hand, the effect on defaults (Panel (f)) appears non-linear, and is only significant for CZs in the top two quintiles of the unemployment shock, suggesting that financial distress was concentrated in the hardest hit areas.

Next, we examine heterogeneity in the effects of the recession across various individual characteristics, including: (a) institution sector, (b) family AGI, (c) gender and (d) race/ethnicity. For conciseness, we focus on the Active borrower group and four key outcomes (measured in peak effect years): new loan amount, default, balance, and repayment rate. We estimate models separately for each subgroup, allowing for flexibility in the role of our control variables, which also means that there is no omitted group. Panel A of Table 4 shows the results by institution

[26] For balance and repayment rates, we focus on long-term outcomes (2019), for default, we look at the medium term (2013) and for enrollment and completion, we focus on the short-term after the start of the recession (2010). These years correspond with the year with the largest coefficient point estimate in Figure 3

[27] As shown 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.

sector.[28] New loan amount effects are most significant for public institutions, likely reflecting larger sample sizes in this sector, and wide variability in this outcome for other sectors. Default effects are highest in the 4-year for-profit sector (in line with the aggregate analysis in section 3), and are also significant for 2-year publics and private 4-year institutions. Balance effects are most pronounced for 4-year public and private institutions, followed by 2-year publics. Conversely, negative effects on the repayment rate are largest for 2-year publics.

In Panel B, we show how the recession differentially affected students depending on their family income, using the adjusted gross income (AGI) reported on the FAFSA.[29] Notably, additional borrowing effects were highest for borrowers coming from the lowest income families, those who made less than $10,000 per year. In contrast, default appears to be concentrated among borrowers with higher income families making at least $50,000 per year. In terms of repayment rate, we see significant negative effects of similar magnitude across the three highest AGI groups, with some indication of larger repayment effects for higher income families.

Panel C shows effects by borrower gender, which is observed in available FAFSA records. Female borrowers had larger origination and balance effects than male borrowers, indicating longer enrollment spells and/or attendance in higher-cost programs relative to male borrowers. However, effects on default and repayment rates are of similar magnitude across borrower gender.

Finally, Panel D of Table 4 shows the results by borrower race and ethnicity. These demographics are not directly observed in the loan data and are based on a race imputation procedure, as outlined by Monarrez et al. (2023).[30] The imputation generates an estimate of the probability that a borrower is of a given race, and we use these probabilities as weights to produce race-specific estimates of treatment effects. Our estimates for new loan origination indicate that higher levels of borrowing may have been concentrated among Asian and Hispanic borrowers. In terms of default, Black borrowers show the largest effect estimates, although these are noisily estimated;

[28] Appendix Tables A4 and A5 show a parallel set of estimates for Recent and Distant borrowers, respectively.

[29] We are only able to match FAFSA information for about 60% of our sample due to missing information issues that are most pronounced for borrowers with older loans. For borrowers with more than one FAFSA on file, we use the information from the earliest FAFSA available. We use nominal AGI amounts to categorize borrowers.

[30] The imputation is based on the fitted values from a multinomial logistic regression of self-reported race categories (obtained from a representative survey of borrowers matched to FSA records) on the racial breakdown of individual characteristics including: last names, first names, zip code of residence in first FAFSA, and high school of attendance. These fitted values are then extrapolated to the full borrower population.

effects for White borrowers are also significant. Balance growth effects are of similar magnitude across all racial groups. Finally, negative repayment rate effects are somewhat larger for Black and Hispanic borrowers, relative to other groups. The patterns of these results seem plausible given that, relative to White borrowers, minority borrowers tended to live in areas with moderately higher unemployment shocks (Appendix Table A6).

4.5 Mechanisms

Our results show that the recession led borrowers to increases in student loan amounts, lengthened enrollment spells, delayed graduation, higher default rates and increasing balances. But these estimates do not disentangle whether additional borrowing caused by the recession led to positive or negative financial outcomes for borrowers. Were borrowers drawn to school because of the recession more likely to face financial stress as a result? Did additional student loan borrowing help borrowers weather the distress from a depressed labor market? While these questions cannot be answered rigorously using our current design, we can conduct auxiliary analyses to provide a sense of these mechanisms.

A naive approach is to simply separate our sample into borrowers based on the decision to take on more loans (an endogenous outcome). While this split is likely to produce biased estimates, it can provide some sense of outcome differences for borrowers with and without recession-induced borrowing. Appendix Table A7 shows estimates for the split sample. These estimates show that completion delays, balance growth and plummeting repayment rates were concentrated among borrowers that took on more loans. In contrast, default effects are of similar magnitude regardless of additional borrowing. For Active and Distant borrowers, point estimates suggest that more borrowing was linked with higher rates of default, although these differences are not statistically significant. Recent borrowers are the only group for which default effect point estimates are smaller among those who borrowed more, preliminary (and imprecise) evidence that default effects may have been smaller among Recent borrowers that took on additional debt.

A more rigorous approach to assess how recessionary borrowing relates to student borrower outcomes is to understand effects on the joint distribution of additional borrowing and eventual default, akin to the method of Card and Solis (2022). To do so, we interact indicators for (1) whether

new loans were taken out after 2007, and (2) whether the borrower ever defaulted on their loans after 2008. We then use indicators for the four groups resulting from this interaction as outcomes in a linear probability model, based on our main specification (equation 3). The four possible outcome states from this grouping are: (i) borrowed more, did not default, (ii) borrowed more, eventually defaulted, (iii) did not borrow more, did not default, and (iv) did not borrow more, eventually defaulted.

Figure 5 presents these results. Each marker shows the estimated effect (along with its 95% C.I.) of a 1 percentage point higher recession unemployment shock on the probability of being in a particular situation. For the Active borrower sample, the recession caused a shift from a state of additional borrowing with no eventual default to a state with both more loans and more default; the estimates suggest that a 1 p.p. increase in unemployment leads to about a 0.5 p.p. shift in these probabilities. Among Recent and Distant borrowers, there is a clear shift out of the state of no additional borrowing and no default into all three other possibilities. While statistically insignificant, point estimates suggest that Recent borrowers were most likely to move into a state of additional borrowing with no eventual default (relative to the other three possible states), while Distant borrowers were most likely to end up in a state of default and no additional borrowing.

A third test is to assess whether patterns of treatment effect heterogeneity indicate that borrowers who borrowed more had different outcomes, akin to the approach of Card et al. (2008). To do so, we separately estimate effects for narrowly defined groups of borrowers (indexed by j), defined by unique combinations of borrower gender, family AGI, institution sector, and balance in 2007.[31] For each subgroup, we regress $NewLoanAmount_{ijct}$ on $shock_c$, restricting to 2010, the peak effect year for this outcome (as seen in Figure 3), obtaining a sub-group specific effect estimate $\hat{\psi}_j$. We do the same for other loan outcomes Y_{ijct} (focusing on the peak effect year for each outcome, see footnote 26) obtaining j-specific effects $\hat{\beta}_j$. We then estimate

$$\hat{\beta}_j = \tau_0 + \tau_1 \hat{\psi}_j + u_j, \tag{4}$$

[31] To ensure subgroup sample sizes are large enough to enable estimation, we use 3 quantiles of balance in 2007 and of first-FAFSA family AGI (where missing AGI has its own category). This results in 108 possible groupings. We only estimate models for subgroups with at least 100 observations.

where u_j is a sub-group specific error term. We present estimates of τ_1, using heteroskedasticity-robust standard errors.

Appendix Table A8 shows these results, which suggest that additional borrowing led to beneficial outcomes for Recent borrowers and detrimental ones for Active and Distant borrowers. As a check for consistence, Panel A show that groups with higher borrowing effects tended to also have larger enrollment effects; this is not mechanical, as we observe enrollment spells not funded by federal loans. Borrowing effects are most closely related to enrollment effects for Recent borrowers. Completion and borrowing effects show little association (panel B), suggesting more borrowing was not particularly predictive of the graduation increases caused by the recession. The association with default is also noisy (panel C), but it is negative and marginally significant (at the 10% confidence level) for Recent borrowers, a suggestion that this group was less likely to default when undertaking recession-induced borrowing. For Active borrowers, the default coefficient is positive but insignificant, as is the case for Distant borrowers. The sign of the borrowing effect coefficient for balance and repayment effects is as expected – with borrowing effects positively correlated with growing balances – and is statistically significant across all borrower groups. The balance model shows largest coefficients for the Active group.

The results of these three exercises are largely mutually consistent, and together they point to a complex set of mechanisms at play. For borrowers that were in school (Active) at the onset, additional borrowing induced by the hardship of the recession appears to lead to detrimental loan repayment outcomes. These borrowers saw their balances soar, repayment rates plummet, and were more likely to default when borrowing additional student loans than otherwise. In contrast, Recent borrowers that borrowed additional loans because of the recession appear to fare better, being less likely to default as a result. While speculative, these results are consistent with Recent borrowers making investments in skill improvement that helped them deal with the economic downturn, whereas Active borrowers seem to have borrowed to simply extend their ongoing enrollment spells, leading to higher debt burdens, repayment struggle and eventual default at higher rates. The evidence for borrowers who had been in repayment at least 5 years (Distant) is more mixed.

4.6 Robustness and Sensitivity

Individual FE models

We check for robustness to alternative specifications. Our preferred approach follows the convention in the literature on individual adjustment to economic shocks by estimating equation 3. This specification separately estimates an effect for each calendar year, using a de-meaned outcome that subtracts the pre-recession mean outcome for each borrower. This produces a non-standard within-borrower estimator of the recession's impacts. Consider instead the standard within-borrower model that exploits the panel structure of the data with the inclusion of individual fixed effects:

$$Y_{ict} = \sum_{t=2005}^{2019} \beta_t [Shock_c * (Year = t)] + \xi_i + \delta_t + u_{ict}, \tag{5}$$

where the year 2007 is the omitted category and standard errors clustered at the CZ-level. Appendix Figure A7 shows the results for our main set of outcomes (parallel to Figure 3). The trajectory of effect point estimates – as well as their approximate magnitude – is similar across the two specifications, an encouraging sign that our identification strategy is robust to alternative specifications. Nevertheless, the individual FE estimates for the Active borrower group in the enrollment and balance models show some evidence of pre-trends, which is likely driven by the fact that many of them borrowed for the first time in 2007.

Borrower type definitions

The borrower-level analysis focuses on three distinct borrower groups, defined based on time since last loan origination as of 2007. We focused on borrowers that had a loan originated in 2007 (Active), those that last originated in 2002 (Recent), and those that had last taken out a loan prior to 2002 (Distant). These choices are to an extent arbitrary; therefore, we conduct a robustness analysis to assess the sensitivity of our results to these definitions. Appendix Figure A8 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 10 years ago. The figures show that the three groups that we have defined, divided by vertical dashed lines, have seen different effects. Active borrowers who

were enrolled in 2007, for example, saw the significantly larger effects on additional loans and loan balances. Effects on repayment rates were insignificant for borrowers with 3 to 4 years since last origination (representing 33% of Recent borrowers), unlike most other borrower groups. In terms of default, the estimated effect is nearly zero for borrowers that originated last in 2002 (representing 43% of Distant borrowers), likely driven by their pre-existing elevated rates of default.

5 Conclusion

In this paper, we provide a summary of the effects of the Great Recession on the federal student loan portfolio and the outcomes of individual student borrowers. To estimate causal effects, we leverage uniquely rich administrative records, as well as regional variation in the severity of the recession, allowing us to draw comparisons between borrowers living cities faring different levels of unemployment at the height of the downturn in 2009.

We show that, as a result of the recession, commuting zones saw substantial increases in student loan disbursements, as residents were induced to enroll in college. This is consistent with prior literature documenting that enrollment in institutions of post-secondary education is partly driven by countercyclical mechanisms (Betts and McFarland, 1995; Barrow and Davis, 2012; Long, 2014). Our findings show that the federal portfolio grew in all dimensions, with increases in balances, total borrowers, degrees awarded, as well as loans in default. Increases in borrower default were particularly pronounced in community colleges and for-profit institutions focused on 4-year degrees. In sum, our findings suggest that absent the recession, total balance outstanding on federal student loans would be about a third lower. This has important policy implications, suggesting that the noted increase in student debt that has worried many is in large part due to the harms of a temporary macroeconomic downturn.

In the second part of our study, we focus on the trajectory of borrowers that already had student loans at the onset of the recession. This allows us to document the recession's effects on borrowers' repayment outcomes. We find that borrowers that had originated loans in 2007 and were students at the onset of the recession faced the worst impacts. The evidence is consistent with the recession causing delayed graduation and lengthened enrollment spells, which were accompanied by

sharp increases in debt, plummeting repayment rates, higher rates of default, as well as increased enrollment in income-driven repayment plans. Among borrowers that had not originated loans in years prior to 2007, the recession also had marked, albeit more muted, impacts on loan outcomes. Interestingly, our results also suggest that borrowing as a result of the recession had positive repayment outcomes for borrowers that had been about 5 years out of college at the onset. 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 lengthened enrollment in college may have led to worse financial outcomes for these young borrowers.

Our summary of the Great Recession's effects take into account a multiplicity of mechanisms leading to increases in student loan origination and default. This includes increases in tuition by financially distressed institutions, decreases in state appropriations for higher education, increased enrollment by separated workers, as well as concurrent increases in federal student loan lending. Understanding the reduced form effect of the recession by pooling the combined effects of this multiplicity of mechanisms is useful for policymakers concerned with the overall impact of a recession. Nevertheless, we hope future work disentangles the different roles of these various channels to provide a better understanding of higher education markets during bad economic times.

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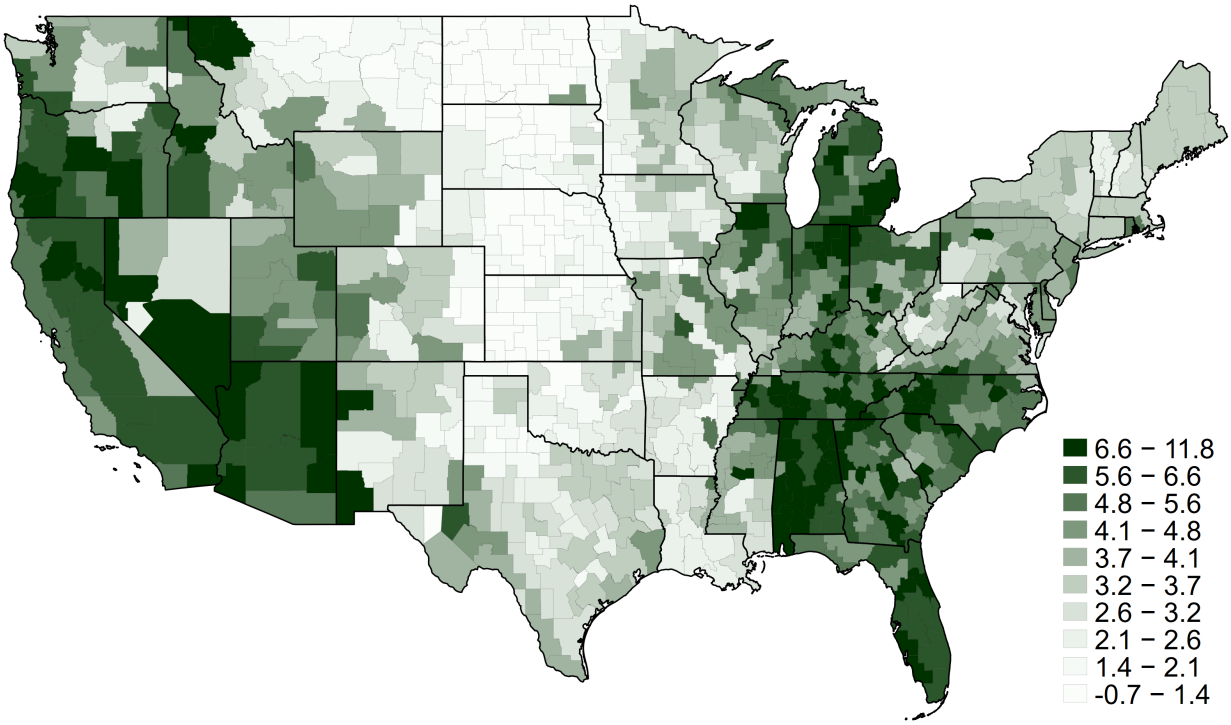
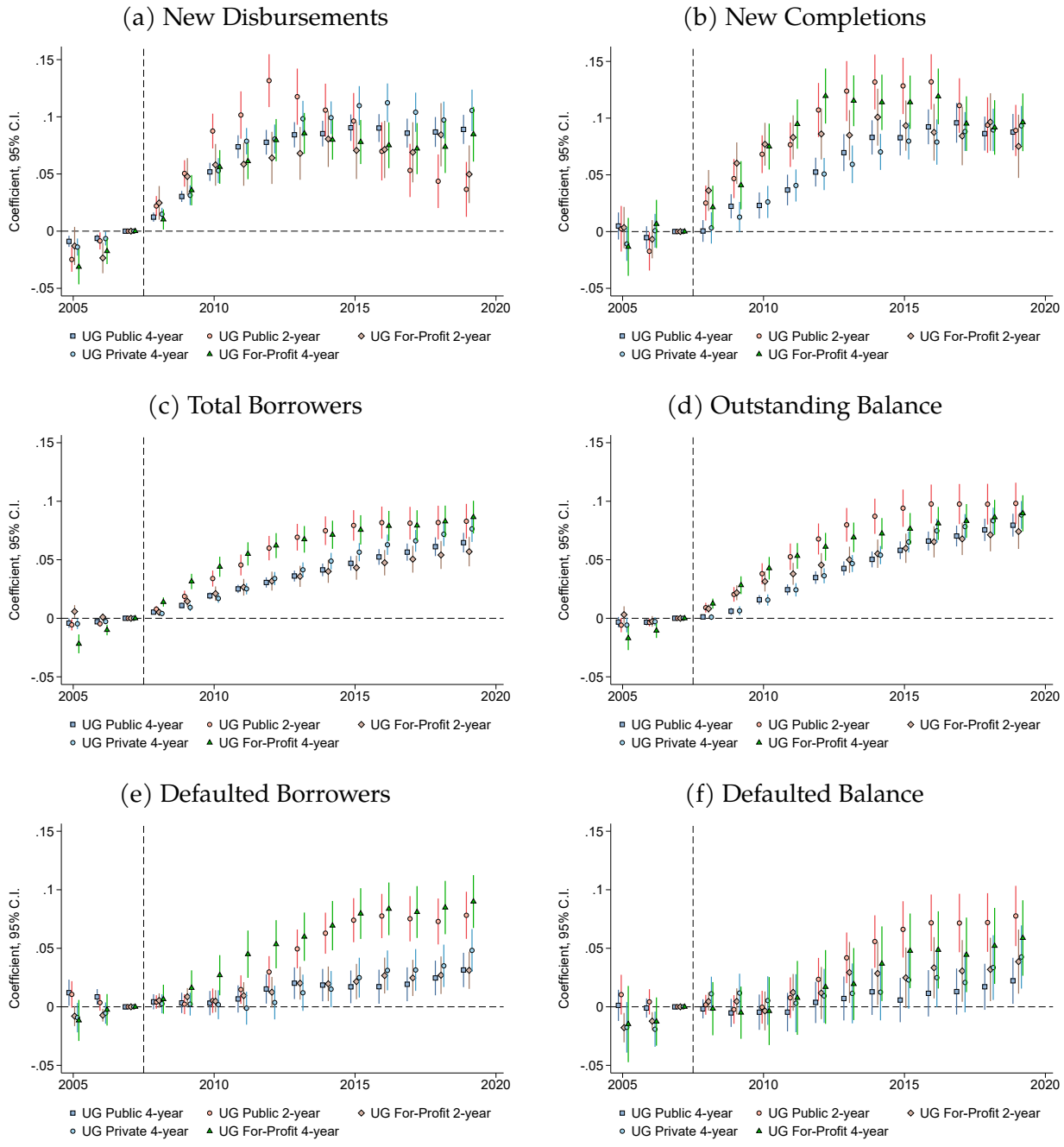
Figures and Tables

Figure 1: Regional Variation in Severity of Great Recession



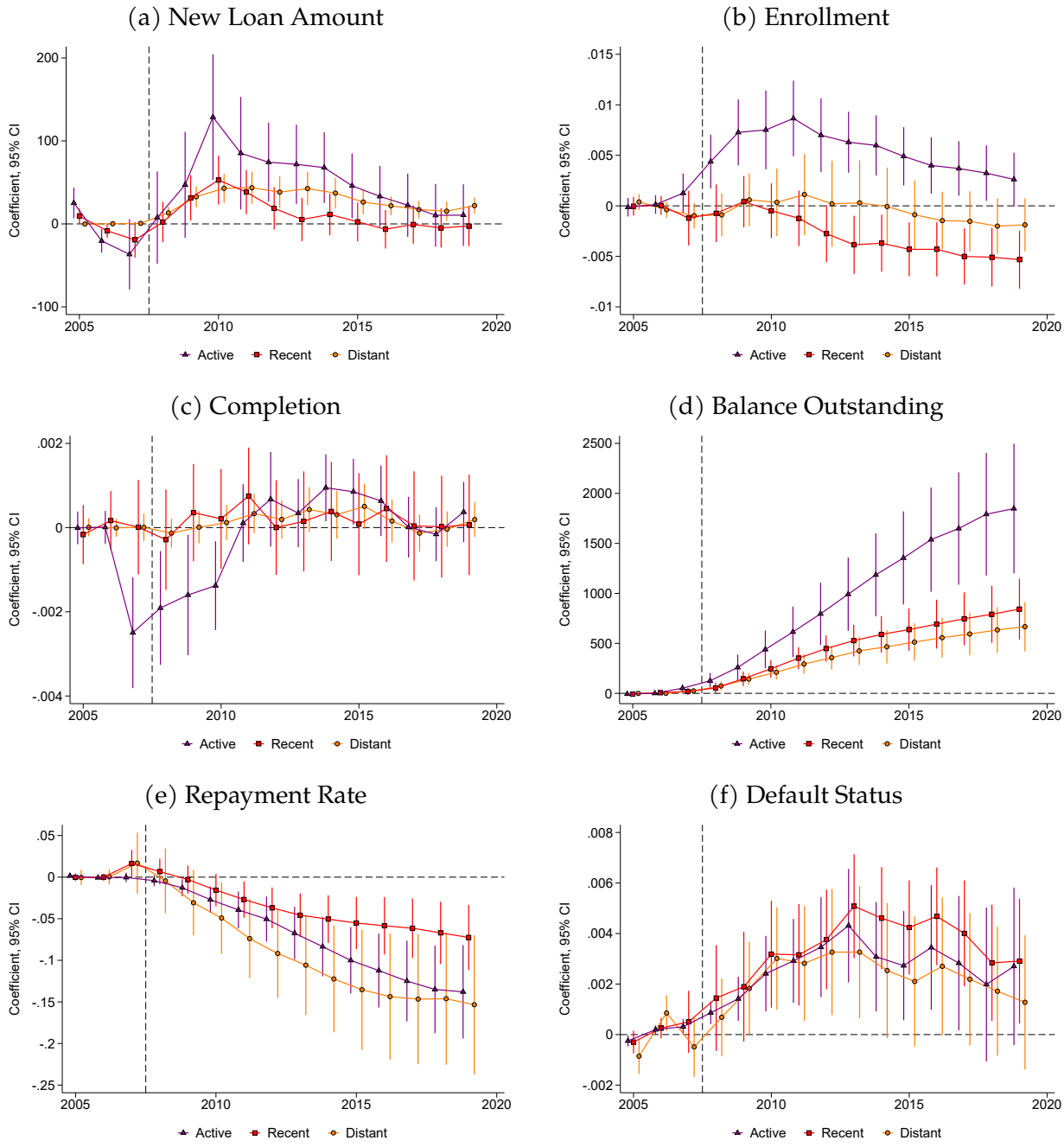
Note: Commuting zone level data. Choropleth shows deciles of the change in the CZ unemployment rate (measured in percentage points) during 2007-2009, using BLS LAUS data.

Figure 2: The Effect of the Great Recession on the Undergraduate Student Loan Portfolio, by Sector



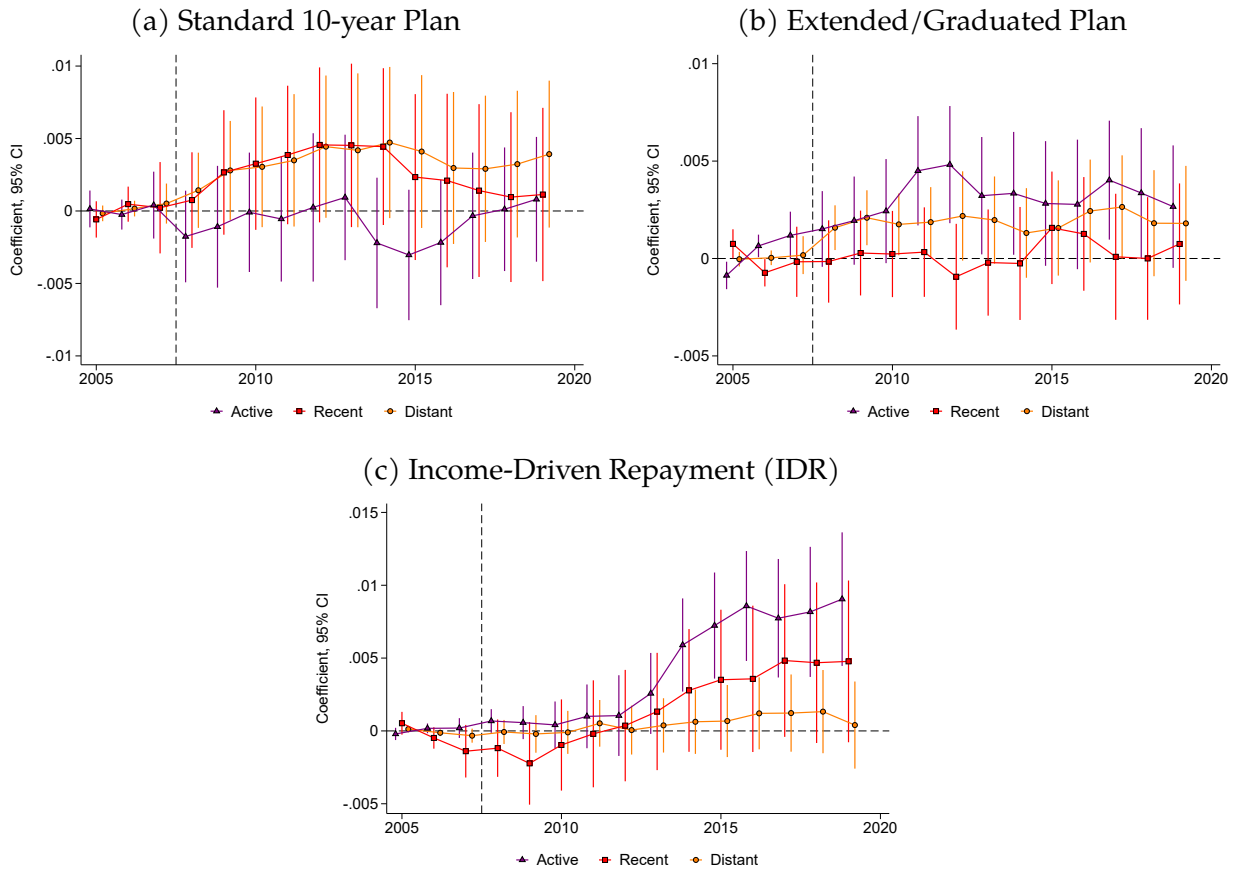
Note: Plots show OLS coefficient estimates from equation (1) in the main text, estimated on a CZ-level panel for the years 2005-2019, separately by institution sector. Institution sector is defined by a combination of institution predominant degree, control, and borrowers' academic level. All outcomes are expressed in logs. In panel (a) the outcome is total new loan disbursements including all new loans among existing and new borrowers; panel (b) uses total new program completions measured using NSLDS enrollment reporting records and are not program specific. Panel (c) shows total borrowers outstanding and (d) shows total balance. Defaulted borrowers (e) and defaulted balance (f) 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 loan. Standard errors are clustered at the commuting zone level.

Figure 3: The Effect of the Great Recession on Borrowers, by Post-Secondary Attachment Group



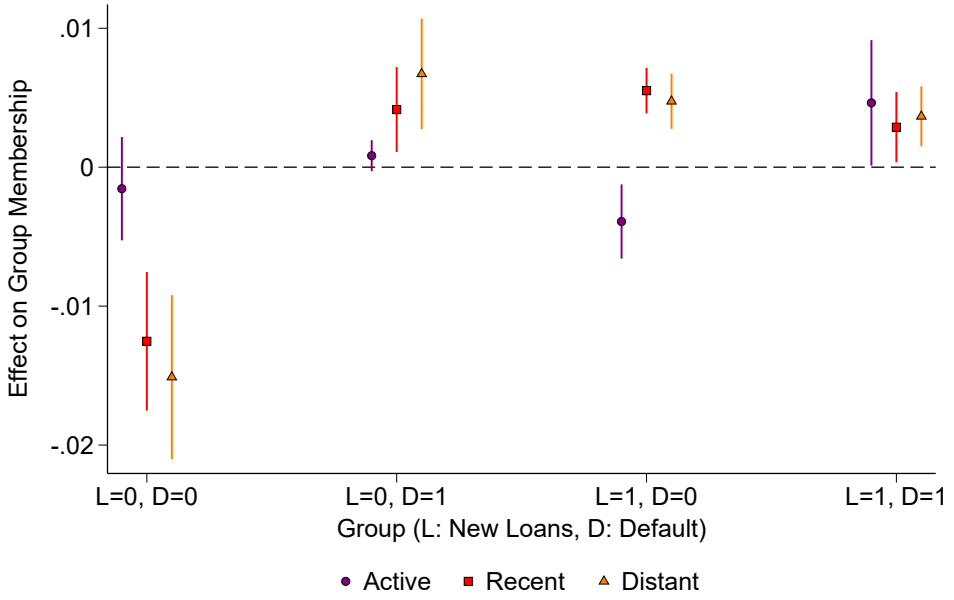
Note: Plots show OLS coefficient estimates of equation (2) in the text, based on a 2% sample of borrowers with open federal student loans in late 2007. Coefficients are estimated separately by year. Active borrowers are those enrolled during the year in question. Recent borrowers are those with loan maturity dates (i.e., repayment entry dates) within 5 years of 2007. Enrollment (b) is measured using NSLDS enrollment reporting records and is not program or institution-specific. Distant borrowers had loan maturities more than 5 years after 2007. Loan disbursement (a) and balance (d) are in dollars, adjusted for inflation using the CPI-U and presented in 2019 terms. Repayment rate (e) is defined based on starting balance in 2007. Standard errors are clustered at the commuting zone level.

Figure 4: The Effect of Great Recession on Borrower Choice of Repayment Plan (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 in late 2007. Outcomes measure participation in a repayment plan (defined as a borrower with any open loan in a given plan), which is only observed for borrowers with loans held by the Department of Education. See text for details on each type of repayment plan.

Figure 5: Effect on the Joint Distribution of Additional Borrowing and Eventual Default



Note: Plot shows OLS coefficient estimates of equation (2) in the text, based on a 2% sample of borrowers with open federal student loans in late 2007. The outcomes are indicators for four possible states: (i) did not borrow after 2007 and did not default in 2008-2019 ($L = 0, D = 0$); (ii) did not borrow after 2007 and defaulted during 2008-2019 ($L = 0, D = 1$); (iii) borrowed after 2007 and did not default in 2008-2019 ($L = 1, D = 0$); and (iv) borrowed after 2007 and defaulted during 2008-2019 ($L = 1, D = 1$). Standard errors are clustered at the commuting zone level.

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: Commuting zone level data on federal student loan portfolio. Dollar figures are in millions, adjusted for inflation using the CPI-U and presented in 2019 terms. Borrower counts are in raw numbers. 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: Mean Characteristics of Borrower Panel in 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 in 2007			
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. Loan amounts correspond to loans that had balance outstanding in 2007. This does not include originated amounts for loans fully paid off prior to 2007.

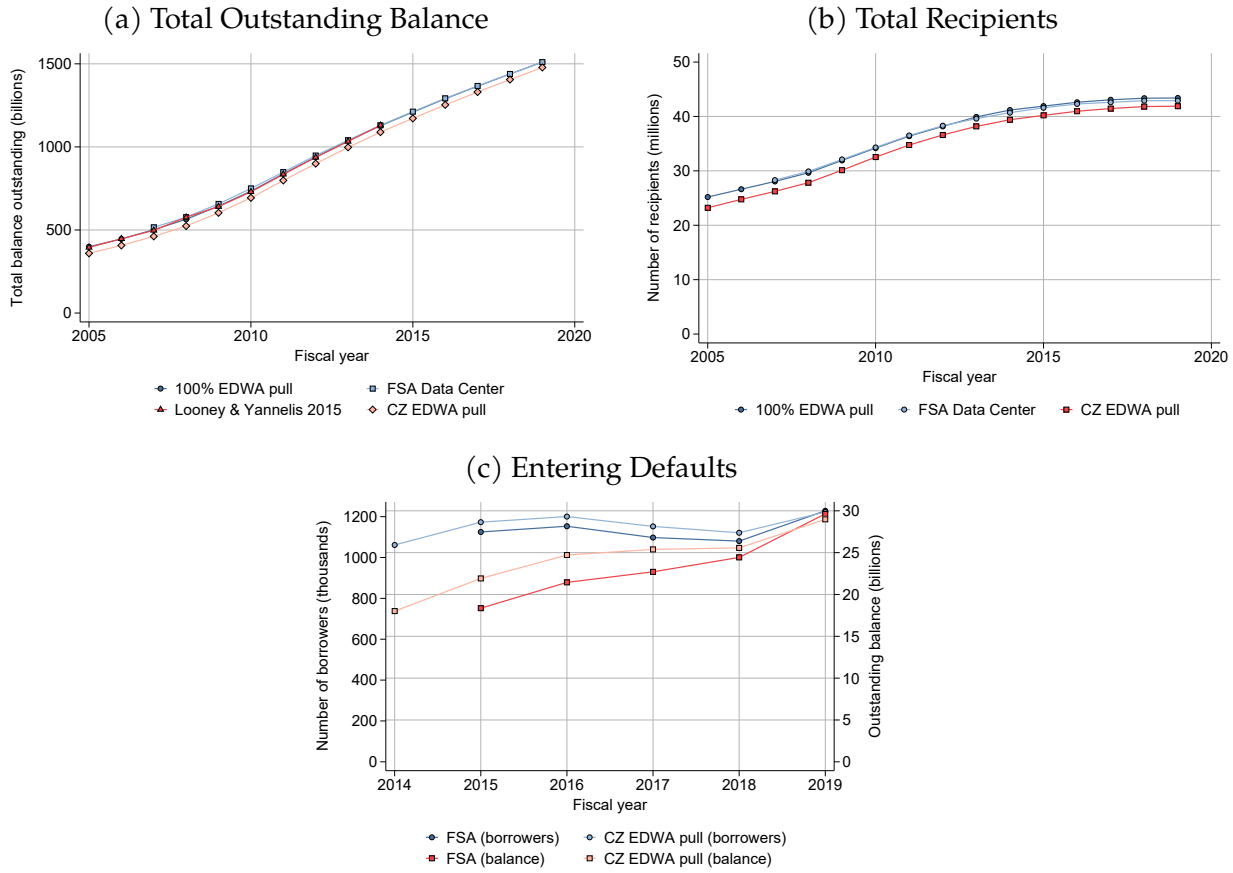
Table 4: Heterogeneity in Effects of Great Recession, Active Group

	New Loans in 2010	Default in 2013	Balance in 2019	Repayment Rate in 2019
A. Institution Sector				
Public 2-Year	153.128	0.005	1697.052	-0.163
	(41.189)	(0.002)	(262.577)	(0.038)
For-Profit 2-Year	-46.010	0.000	330.836	-0.029
	(76.322)	(0.004)	(439.864)	(0.050)
Public 4-Year	187.092	0.003	2027.688	-0.161
	(47.328)	(0.001)	(363.081)	(0.036)
Private 4-Year	78.630	0.006	2315.546	-0.134
	(67.246)	(0.002)	(566.016)	(0.043)
For-Profit 4-Year	-66.431	0.008	409.085	-0.020
	(151.765)	(0.003)	(792.644)	(0.051)
B. Family AGI				
Less than $10,000	190.969	0.002	2207.202	-0.118
	(60.464)	(0.002)	(376.007)	(0.025)
$10,000-$25,000	100.124	0.003	1927.280	-0.133
	(62.086)	(0.002)	(460.668)	(0.037)
$25,000-$50,000	154.656	0.004	1898.624	-0.118
	(61.540)	(0.002)	(440.876)	(0.043)
More than $50,000	105.358	0.005	1436.822	-0.154
	(58.824)	(0.001)	(339.925)	(0.039)
C. Gender				
Female	192.088	0.004	2113.976	-0.135
	(48.943)	(0.001)	(366.247)	(0.031)
Male	23.102	0.005	1379.587	-0.131
	(48.562)	(0.001)	(328.093)	(0.034)
D. Race / Ethnicity				
White	95.973	0.004	1630.601	-0.121
	(34.810)	(0.001)	(237.607)	(0.022)
Black	131.766	0.006	1829.273	-0.128
	(70.126)	(0.002)	(516.058)	(0.043)
Hispanic	207.747	-0.000	1858.480	-0.142
	(70.202)	(0.001)	(502.391)	(0.055)
Asian/PI	215.502	0.003	1685.735	-0.115
	(85.667)	(0.002)	(442.952)	(0.042)

Note: Table shows the 2019 OLS coefficient estimate of equation (2) in the text, based on a 2% sample of borrowers with open federal student loans at the beginning of 2007. We show coefficient estimates for 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. Panel A separates borrowers by the control and predominant level of the institution they attended prior to 2007 (according to their largest loan origination). Panel B separates borrowers by the AGI on their first FAFSA on record. Panel C separates borrowers by gender, as observed in the borrower's first FAFSA on record. Results by race in Panel D use weights equal to the predicted probability that a borrower is from a given racial/ethnic group, which are derived from a race imputation method based on borrower name and geography (as well as other characteristics). See text for additional details.

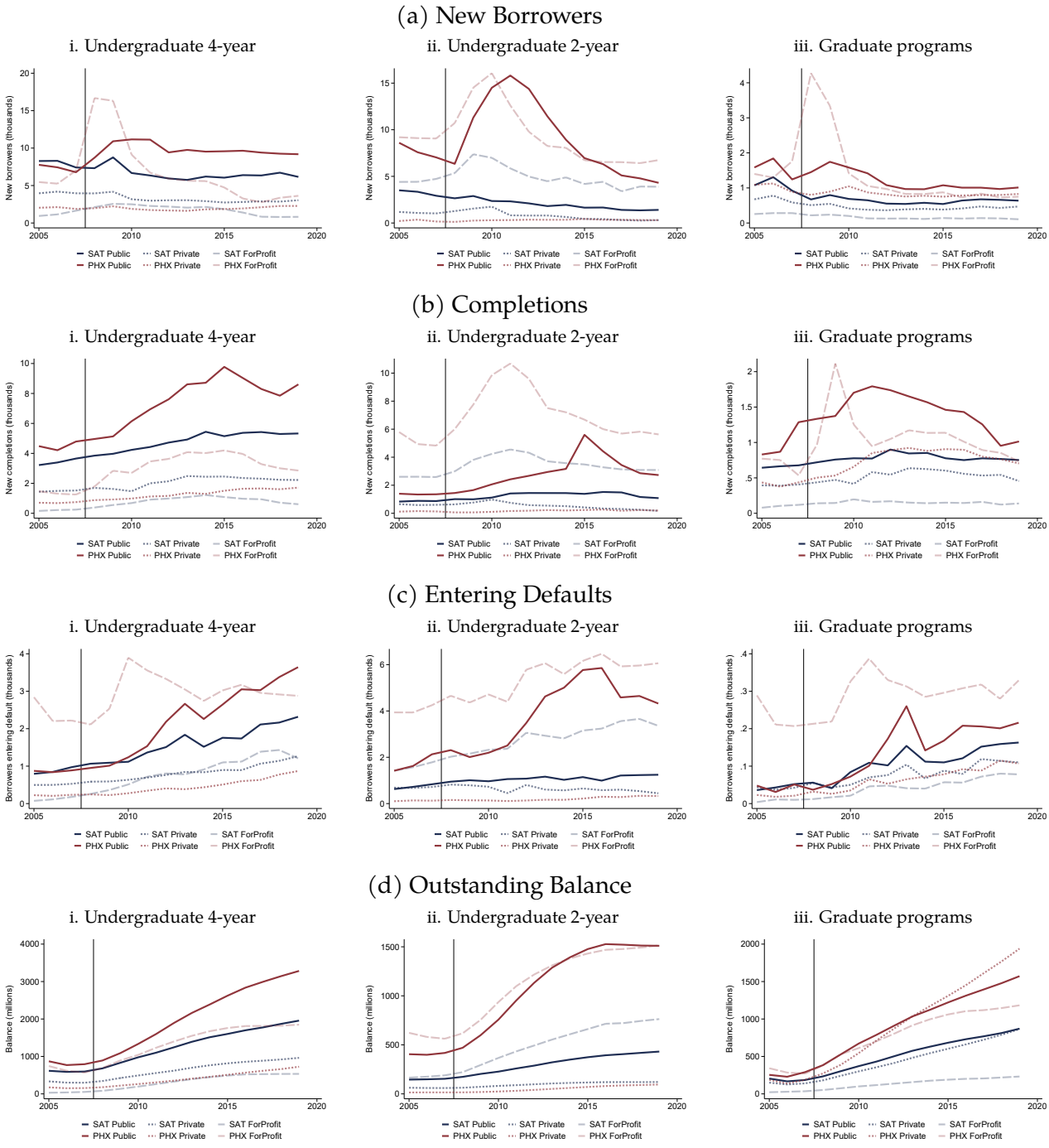
Appendix A: Additional Figures and Tables

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



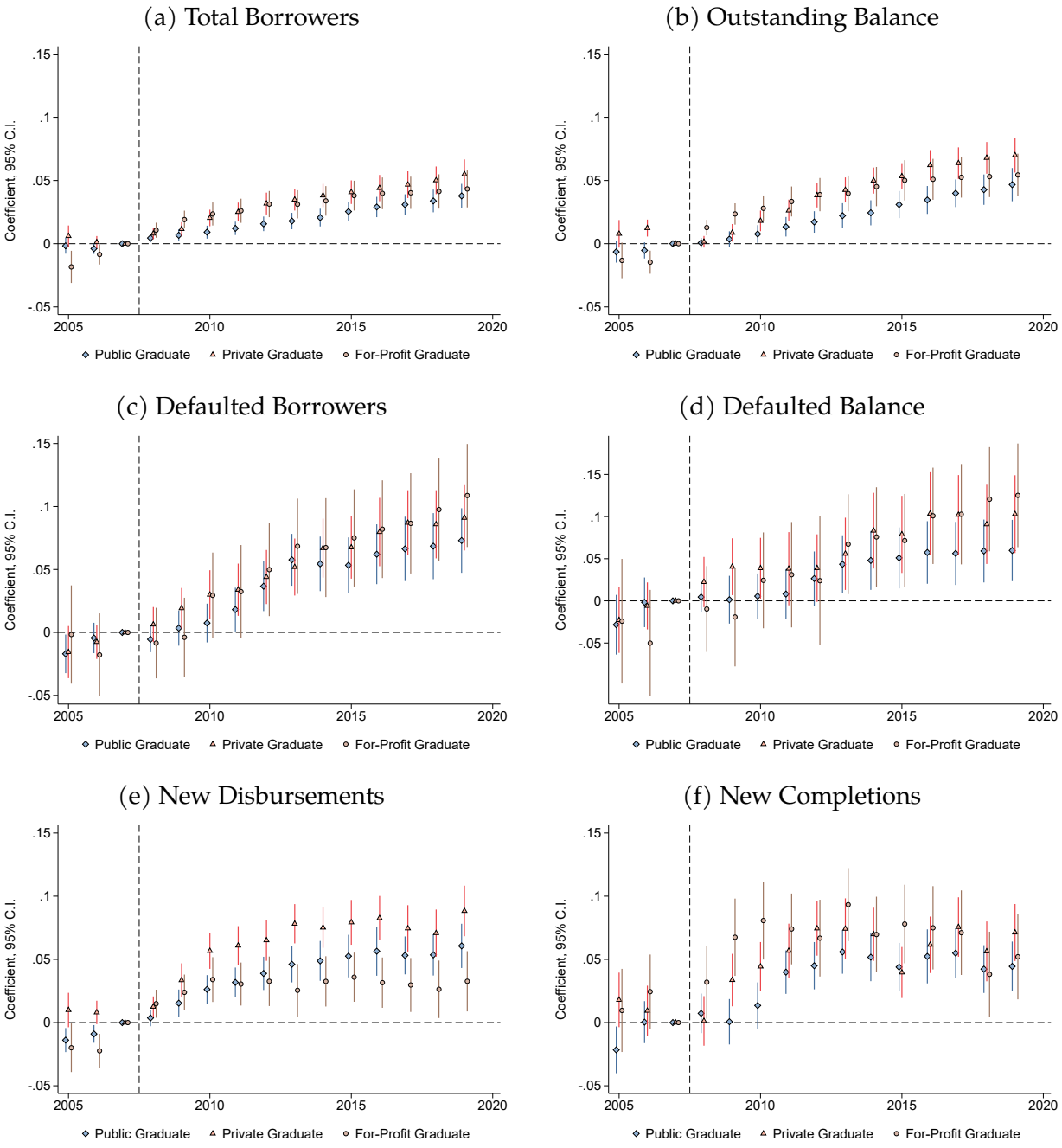
Note: Panel (a) shows total outstanding debt on federal student loans from four sources. The 100% EDWA pull is calculated by the authors using all EDWA data on outstanding DL and FFEL loans. CZ EDWA pull is the same as the 100% EDWA pull but it restricts to loans we were able to match to a CZ for analysis. 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, the 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 the 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



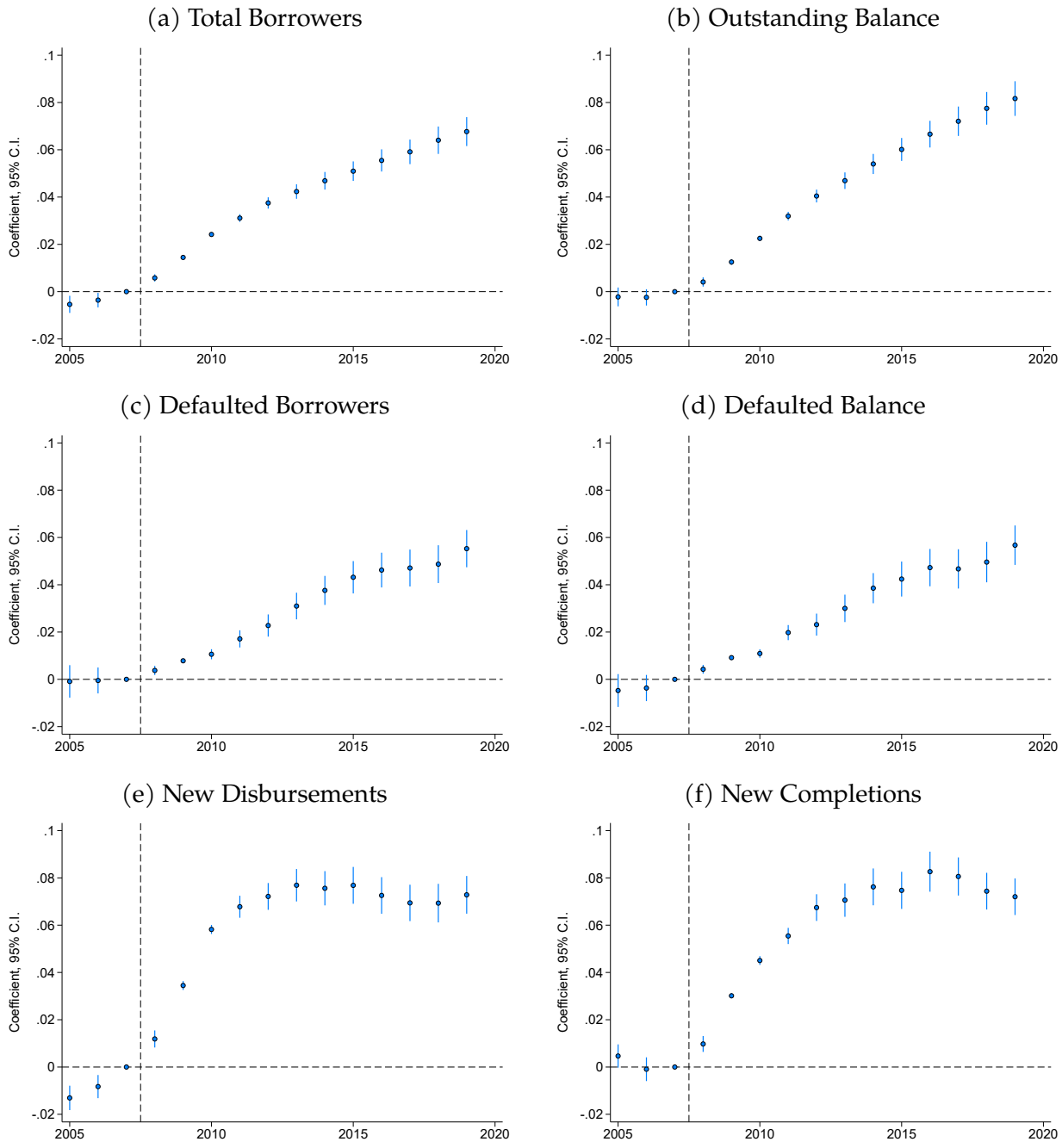
Note: Plots show student loan portfolio characteristics for the San Antonio (SAT) and Phoenix (PHX) commuting zones, by student grade level (undergraduate and graduate) and institution sector (defined based on institution predominant degree and control). Loans are assigned to the first geography they are observed in, see Appendix B for details. Completions are not necessarily in the grade or sector observed. Outstanding balance is measured in millions of dollars and adjusted for inflation using the CPI-U and presented in 2019 terms.

Figure A3: Effect of the Great Recession on Graduate-Level Student Loan Portfolio



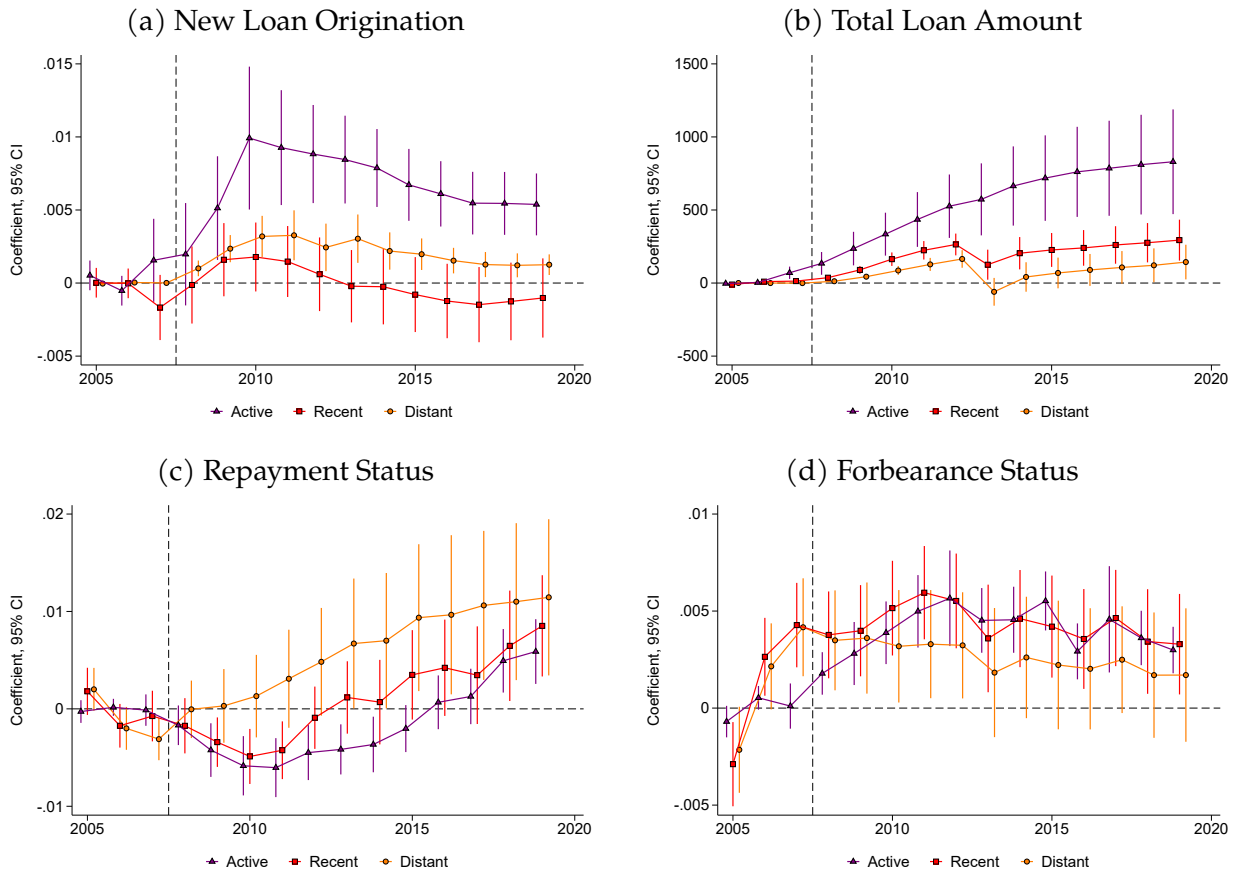
Note: Plots show OLS coefficient estimates from equation (1) in the main text, estimated on a CZ-level panel for the years 2005-2019 specific to graduate student borrowers and split by institution control. All outcomes are expressed in logs. In panel (a) the outcome is total borrowers outstanding; panel (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: Effect of the Great Recession on Student Loan Portfolio



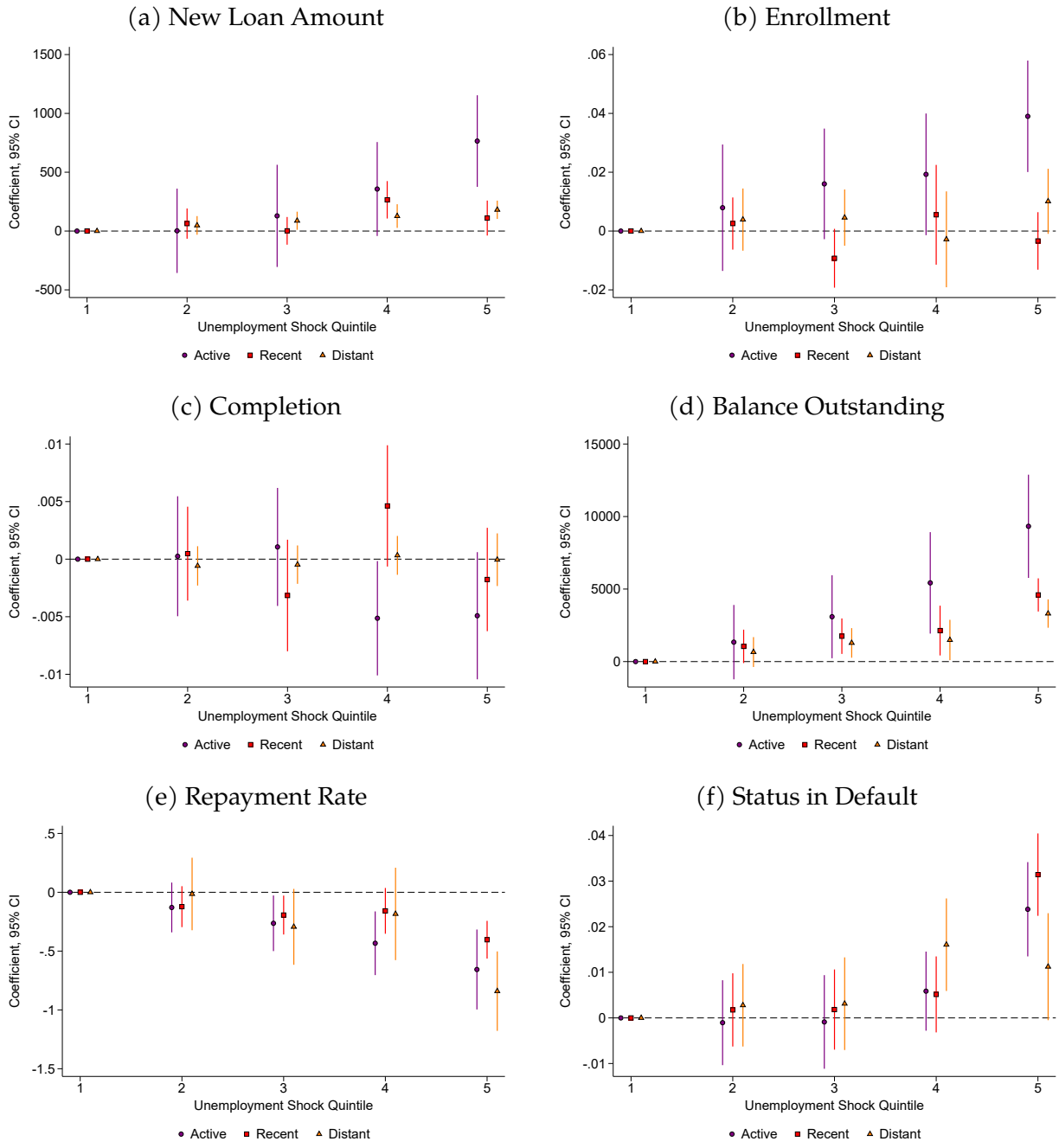
Note: Plot shows OLS coefficient estimates from equation (1) in the main text, estimated on a CZ-level panel for the years 2005-2019. All outcomes are expressed in logs. In panel (a) the outcome is total borrowers outstanding; panel (b) uses total outstanding balance. Defaulted borrowers (c) and defaulted 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 Loan Amount, Repayment and Forbearance Status, by Post-Secondary Attachment



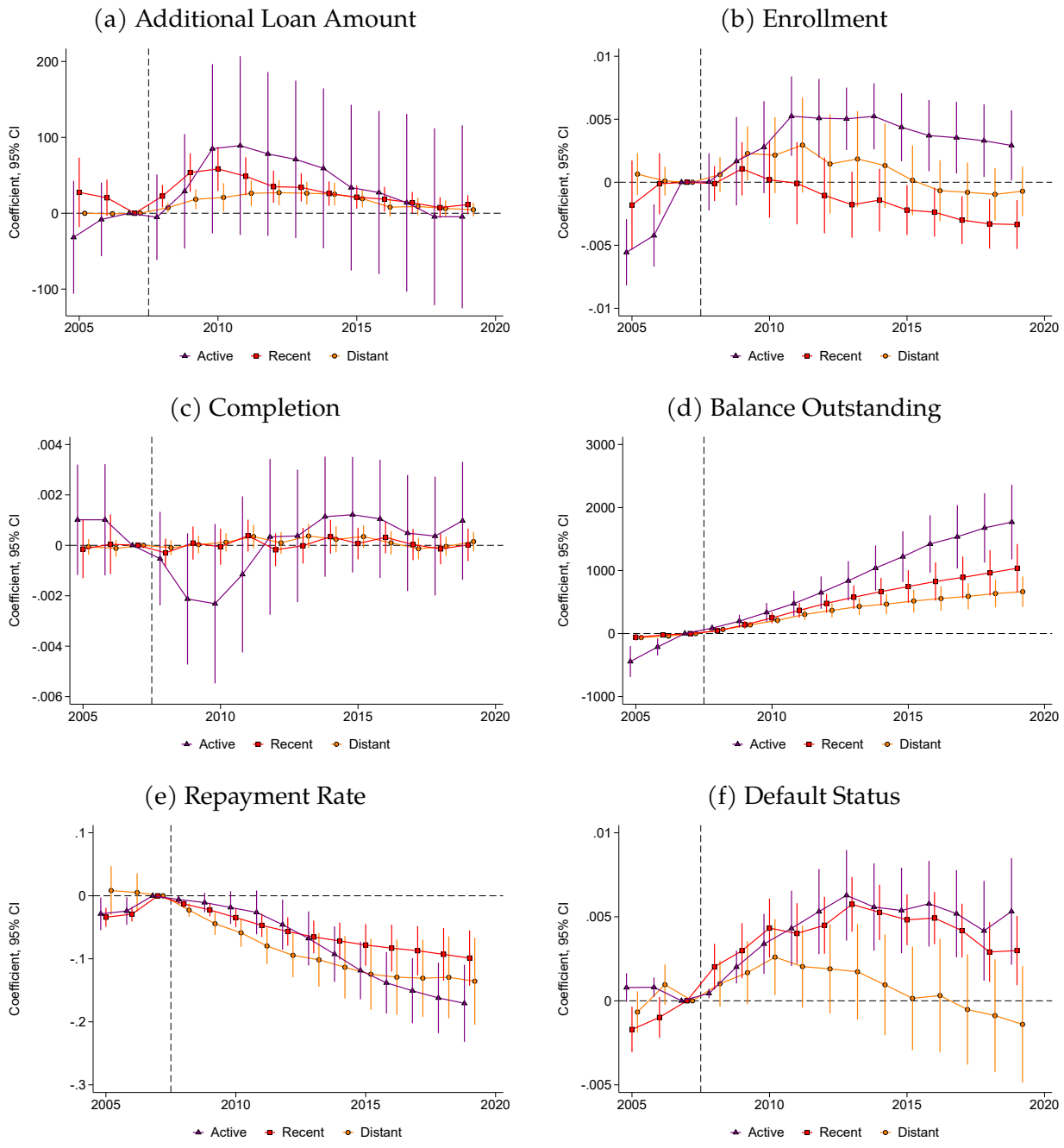
Note: Plots show OLS coefficient estimates of equation (2) in the text, using a longitudinal panel of borrowers, based on a 2% sample of borrowers with open federal student loans at the beginning of 2007. Coefficients are estimated separately by year. Active borrowers are those enrolled during the year 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: 2019 Borrower-Level Impacts of the Recession by Shock Quintile



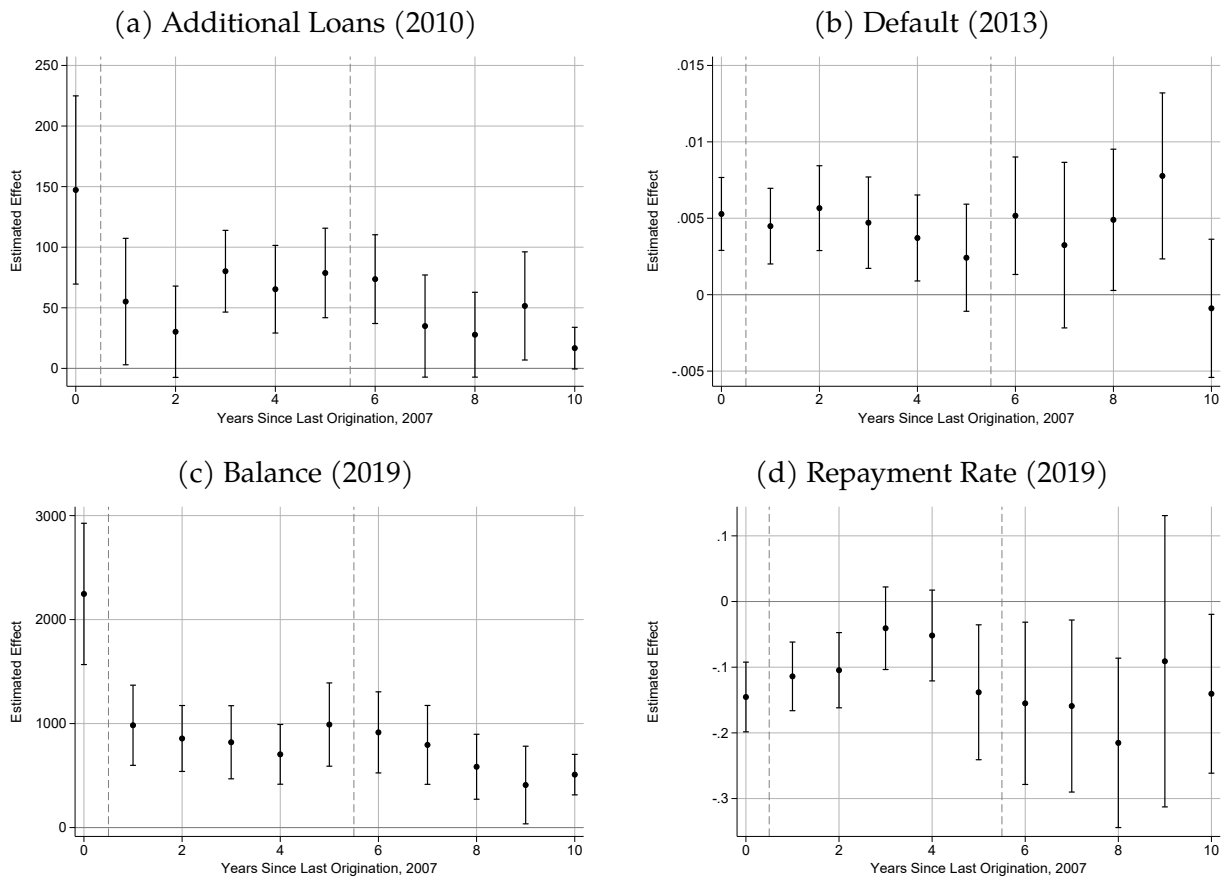
Note: Plots show OLS coefficient estimates of equation (2) in the text, based on a 2% sample of borrowers with open federal student loans in late 2007. Instead of the main independent variable of interest entering linear in the equation we estimate coefficients corresponding to quintiles of the unemployment 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. Standard errors are clustered at the CZ-level.

Figure A7: Borrower-Level Impacts Estimated with Individual Fixed Effects



Note: Plots show OLS coefficient estimates of equation (3) based on a 2% sample of borrowers with open federal student loans at the beginning of 2007. 2007 is the omitted year. Standard errors are clustered at the CZ-level.

Figure A8: Borrower-level Impacts, by Years Since Last Origination as of 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.

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. 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.

Table A4: Heterogeneity in Effects of Great Recession by Characteristics in 2007, Recent Group

	New Loans in 2010	Default in 2013	Balance in 2019	Repayment Rate in 2019
A. Institution Sector				
Public 2-Year	30.680	0.004	938.481	-0.230
	(19.620)	(0.002)	(146.523)	(0.047)
For-Profit 2-Year	34.020	0.008	-54.646	0.072
	(19.096)	(0.002)	(224.668)	(0.056)
Public 4-Year	102.220	0.003	1124.292	-0.091
	(20.693)	(0.001)	(185.454)	(0.021)
Private 4-Year	-19.175	0.007	1102.029	-0.078
	(34.001)	(0.002)	(294.374)	(0.021)
For-Profit 4-Year	92.196	0.003	95.950	0.074
	(78.522)	(0.005)	(478.401)	(0.060)
B. Family AGI				
Less than $10,000	129.086	0.002	595.928	-0.034
	(30.775)	(0.002)	(187.618)	(0.034)
$10,000-$25,000	111.930	0.006	839.863	-0.068
	(25.068)	(0.002)	(184.478)	(0.040)
$25,000-$50,000	80.451	0.005	1011.477	-0.067
	(32.482)	(0.002)	(231.027)	(0.038)
More than $50,000	35.353	0.004	628.856	-0.083
	(32.998)	(0.001)	(155.288)	(0.030)
C. Gender				
Female	69.694	0.004	855.593	-0.041
	(24.087)	(0.001)	(196.573)	(0.032)
Male	115.992	0.004	596.522	-0.091
	(22.123)	(0.001)	(129.509)	(0.023)
D. Race / Ethnicity				
White	58.645	0.005	743.356	-0.067
	(16.269)	(0.001)	(116.210)	(0.018)
Black	96.746	0.004	890.662	-0.092
	(29.546)	(0.002)	(279.340)	(0.040)
Hispanic	79.782	0.005	780.647	-0.046
	(20.190)	(0.001)	(147.208)	(0.032)
Asian/PI	122.830	0.004	715.076	-0.073
	(28.822)	(0.001)	(182.325)	(0.025)

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 A5: Heterogeneity in Effects of Great Recession by Characteristics in 2007, Distant Group

	New Loans in 2010	Default in 2013	Balance in 2019	Repayment Rate in 2019
A. Institution Sector				
Public 2-Year	56.012	0.002	561.663	-0.355
	(16.584)	(0.003)	(125.831)	(0.075)
For-Profit 2-Year	19.464	0.007	63.728	0.036
	(12.807)	(0.003)	(130.223)	(0.075)
Public 4-Year	74.334	0.002	982.102	-0.183
	(14.148)	(0.002)	(160.740)	(0.056)
Private 4-Year	7.708	0.001	884.812	-0.203
	(16.444)	(0.002)	(249.051)	(0.061)
For-Profit 4-Year	-9.441	0.011	-27.823	0.026
	(43.560)	(0.006)	(664.632)	(0.157)
B. Family AGI				
Less than $10,000	-8.609	0.004	418.060	0.226
	(75.021)	(0.007)	(483.769)	(0.251)
$10,000-$25,000	29.010	-0.000	503.091	-0.096
	(76.126)	(0.006)	(540.207)	(0.239)
$25,000-$50,000	-24.203	0.004	428.294	-0.144
	(77.196)	(0.006)	(599.384)	(0.330)
More than $50,000	-70.366	0.004	-1742.089	0.435
	(136.892)	(0.005)	(782.288)	(0.420)
C. Gender				
Female	22.318	0.002	572.910	-0.066
	(51.226)	(0.004)	(394.018)	(0.219)
Male	-35.023	-0.001	-121.283	0.111
	(79.590)	(0.005)	(427.684)	(0.185)
D. Race / Ethnicity				
White	42.090	0.003	618.841	-0.145
	(14.922)	(0.002)	(145.293)	(0.057)
Black	57.565	0.005	742.000	-0.234
	(30.061)	(0.003)	(285.610)	(0.096)
Hispanic	45.710	0.005	425.436	0.104
	(18.116)	(0.003)	(196.600)	(0.097)
Asian/PI	65.621	0.004	447.318	-0.038
	(35.482)	(0.002)	(225.486)	(0.067)

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 A6: 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 CZs 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 A7: 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
Completion	-.0004	-.0017	-.0004	-.0002	-.0002	-.0014
	(.0006)	(.0008)	(.0007)	(.0011)	(.0002)	(.0014)
Currently in Default	.0033	.0046	.0056	.0043	.0039	.0043
	(.0017)	(.0012)	(.0012)	(.0014)	(.0012)	(.0036)
Total Balance	389.3	2420	312.2	1024	273.6	828.3
	(126.8)	(380.3)	(94.04)	(259.4)	(64.81)	(357.4)
Repayment Rate	-.0125	-.1796	-.0101	-.0995	-.0126	-.2536
	(.007)	(.0372)	(.0092)	(.0518)	(.0205)	(.1216)

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 A8: Relationship between Borrowing Effects and Loan Outcome Effects

	Active	Recent	Distant
A. Enrollment Effect			
Borrowing Effect	0.136	0.432	0.173
	(0.0609)	(0.0737)	(0.109)
N	103	102	35
R^2	0.0883	0.374	0.0407
B. Completion Effect			
Borrowing Effect	0.0118	0.0539	-0.0408
	(0.0270)	(0.0316)	(0.0573)
N	104	102	39
R^2	0.00274	0.0279	0.0200
C. Default Status Effect			
Borrowing Effect	0.0528	-0.0645	0.0105
	(0.0431)	(0.0381)	(0.0847)
N	104	102	39
R^2	0.0274	0.0163	0.000200
D. Balance Effect			
Borrowing Effect	3.604	1.903	2.296
	(0.507)	(0.540)	(0.685)
N	104	102	38
R^2	0.394	0.149	0.171
E. Repayment Rate Effect			
Borrowing Effect	-1.813	-0.847	-3.690
	(0.335)	(0.358)	(1.605)
N	104	102	38
R^2	0.143	0.0318	0.0555

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.

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 the 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 the 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 loans 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 composed most of the portfolio in the early 2000s 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 the 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 CZs 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 quarter-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.