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The Effect of Student Loan Payment Burdens and Nonfinancial Frictions on Borrower Outcomes*

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Abstract

Rising student loan debt and concerns over unaffordable payments provide rationale for "income-driven repayment" (IDR) plans, which aim to protect borrowers from default and resulting financial consequences by linking payments to income. We estimate the causal effect of IDR payment burdens on loan repayment and attainment for several cohorts of first-time IDR applicants using a regression discontinuity design. Borrowers who are not required to make payments see short-run reductions in delinquency and default risk, primarily due to lower costs of inattention, but these effects fade over the longer run as some borrowers become disconnected from the student loan repayment system.

JEL codes: I22, G51, G41
Keywords: student debt, inattention, income-driven repayment

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1 Introduction

Student loans make up a growing share of household debt in the United States, exceeding $1.6 trillion at the end of 2023 (Federal Reserve Bank of New York, 2024). Access to student loans can increase credit constrained students' attainment and earnings.[1] Yet, many struggle to repay their loans – approximately 15 percent of borrowers faced serious delinquency or default in 2019 (Mangrum et al., 2022) – raising concerns of adverse financial consequences for borrowers and spillovers to the broader economy.[2] To the extent that borrowers' repayment difficulties arise from budget constraints, reductions in payment burdens should improve outcomes. On the other hand, a growing body of evidence finds that borrowers fail to optimize at various junctures of the student loan borrowing and repayment pipeline.[3] As is the case with other sources of consumer debt, behavioral biases and nonfinancial frictions may also play an important role in whether borrowers stay current on their student loan payments (Agarwal et al., 2017b).

In this paper, we provide evidence on the relative importance of financial and nonmonetary factors for student loan repayment outcomes. We study borrowers who applied for an income-driven student loan repayment plan (hereafter, "IDR plan") for the first time between 2015 and 2018. IDR plans help insure borrowers against unaffordable payments when income is low by linking monthly loan payments to income, setting payments to $0 for borrowers with sufficiently low income, and providing debt forgiveness after a certain number of qualifying payments. During the time period we study, borrowers must reapply on an annual basis to maintain these benefits. We use detailed administrative data and leverage discontinuities in the relationship between IDR payments and borrowers' income to study the causal effect of eligibility for a $0 payment on debt and repayment, IDR recertification, and educational attainment. Borrowers who qualify for a $0 payment see statistically significant and economically meaningful reductions in student loan delinquency and default in the short run. At the same time, they are significantly *less* likely to

[1] See, for instance, Solis (2017), Marx and Turner (2019), Barr et al. (2021), Chu and Cuffe (2021), Card and Solis (2022), Black et al. (2023), and Gurgand et al. (2023).

[2] Payments for Department of Education held student loans were paused in March 2020, following the start of the COVID-19 pandemic, through September 2023, followed by a year-long "on-ramp" during which borrowers' loans are automatically placed in forbearance following 3 missed payments, eliminating the risk of serious delinquency or default during this period.

[3] See, for instance, Field (2009), Boatman et al. (2017), Darolia and Harper (2018), Marx and Turner (2019), Cox et al. (2020), Marx and Turner (2020), Lochner et al. (2021), and Mueller and Yannelis (2022).

reapply for IDR after their first twelve months on the program, and over the longer term, see significant *increases* in delinquency risk, suggesting that interactions between payment requirements and nonfinancial frictions may be as important as financial factors for borrowers' repayment outcomes.

Prior to the COVID-19 student loan payment pause, most IDR applicants with income below 150 percent of the Federal Poverty Line (150% FPL) qualified for a $0 payment, resulting in a discontinuous increase in the probability of not being required to make any payment. The minimum monthly student loan payment is $10, resulting in a discontinuous decrease in borrowers' monthly payment amounts at this same threshold. Our main identification strategy uses these discontinuities in a regression discontinuity design. This approach relies on the assumption that first-time IDR applicants near this threshold lack perfect control over their income. Continuity in the number of applicants and their predetermined characteristics, including loan repayment and attainment outcomes prior to submitting an IDR application, provides support for our research design.

We find that, in their first year on IDR, borrowers that qualify for a $0 payment are 18 percentage points (67 percent) less likely to be delinquent and 2.4 percentage points (60 percent) less likely to default on their student loan payments. These effects are heterogeneous, with Black borrowers, undergraduate drop outs, and those with a history of default experiencing the largest short run reductions in delinquency and default risk.

At the same time, borrowers that initially qualify for a $0 payment engage less with the student loan system in their first year on IDR. For instance, despite the potential interest-related benefits from signing up for automatic payments, these borrowers are significantly less likely to sign-up for "auto-debit", which grants a 0.25 percentage point interest rate reduction. Consistent with $0 payments leading borrowers to become disconnected with the student loan system, they also were less likely to recertify and remain on an IDR plan one year after their initial application.[4] The drop in IDR participation is shortly followed by significant increases in monthly payments and repayment difficulties. We estimate that approximately 93 percent of the short run fall in delinquencies and 100 percent of the reduction in defaults are due to a shift in timing rather than

[4]The drop in recertification for borrowers who initially qualified for a $0 payment could indicate that they saw sufficient income growth that linking their payments to income through IDR would no longer provide a benefit. Yet income growth would need to be discontinuously larger for borrowers who initially qualified for a $0 payment compared to those above this threshold to explain the discontinuity in IDR reapplications. In this case, we should expect to see similar or continued improvements in repayment outcomes for this group instead of worsening repayment outcomes.

a longer-term drop.

We also test whether initial eligibility for a $0 payment affects further postsecondary enrollment, degree receipt, or outstanding debt for up to 3.5 years after a borrower's initial application. We find some evidence of small but significant reductions in reenrollment during the first 12 months on IDR but no longer run effects. Estimated effects on degree receipt and outstanding debt are small and statistically insignificant in the short and longer run.

The IDR payment schedule includes both a discontinuity and kink in monthly payments. We test whether the effect of a marginal reduction in monthly payments is statistically distinguishable using these two sources of identifying variation. Across outcomes, we can reject this hypothesis, suggesting that the effect of a $0 payment operates through more than just the reduction in scheduled monthly payments. We propose a simple model in which eligibility for a $0 payment affects borrower outcomes through two channels. First, borrowers experience a relaxation of their budget constraint due to lower monthly payments. Second, in the short run, eligibility for a $0 payment also relaxes nonfinancial constraints, namely borrowers' need to attend to the requirement of submitting a payment each month. Under the assumption of additive separability and locally constant "inattention" effects, we use a combined regression discontinuity-regression kink design to separately identify the effect of lower payments from the effect of not being required to make any payment for a year.

We estimate that most of the short run benefits of initial eligibility for a $0 payment come from reducing the consequences of inattention to payment obligations rather than through relaxing borrowers' budget constraints. Over the longer term, reducing the consequences of inattention appears to increase reapplication-related frictions, with negative consequences for borrowers. These findings suggest that pausing payment obligations provides insurance to struggling borrowers against immediate financial consequences, but when paired with the annual reapplication requirement, may increase some borrowers' risk of longer run financial distress.

Our paper contributes to the broad literature examining the importance of psychological and behavioral factors for households' financial decisions.[5] Past studies provide evidence that inattention

[5]See DellaVigna (2009); Agarwal et al. (2017b) and Beshears et al. (2018) for reviews.

affects decisions related to other types of consumer debt, such as mortgage refinancing (e.g., Keys et al., 2016; Andersen et al., 2020) and credit card payments and penalties (e.g., Agarwal et al., 2008; Medina, 2021), as well as savings decisions (e.g., Karlan et al., 2016; Chetty et al., 2014). We provide evidence that the cost of inattention is high for student loan borrowers, especially those who likely dropped out before earning a degree, which aligns with research showing that individuals with lower educational attainment and financial literacy are more likely to make financial decisions or exhibit behaviors consistent with inattention (e.g., Agarwal et al., 2017a; Olafsson and Pagel, 2017; Stango and Zinman, 2023). In line with research showing that individuals' "stock" of attention is affected by interactions with consumer finance products (e.g., Stango and Zinman, 2014), our results suggest that in the case of student loans, relaxing the requirement to make a monthly payment involves a trade-off between reducing inattention costs in the short run and potentially higher longer run costs when borrowers fail attend to recertification requirements.

Despite increased enrollment in IDR plans, from around 10 percent of borrowers in repayment in 2013 to just over 30 percent in 2019, take-up among borrowers who could benefit still lags (Gunn et al., 2021; Collier et al., 2022). Potential explanations include the requirement to actively opt into applying (Cox et al., 2020), application complexity (Mueller and Yannelis, 2022), and the framing of costs and benefits (Abraham et al., 2020).[6] We show that, even among borrowers who successfully navigated the initial IDR application process, complexity and opt-in requirements may still make it challenging to comply with annual recertification requirements. Our paper also contributes to the limited empirical evidence on the causal effects of IDR on borrower outcomes. Herbst (2023) shows that among older cohorts of borrowers who struggle with making payments, IDR take-up reduces the risk of student loan default and improves other measures of financial well-being in the short-term.[7] Our results also suggest that borrowers do benefit from lower payments on IDR in their first year on the program while also highlighting the importance of looking at repayment

[6] Lochner et al. (2021) provide evidence that nonmonetary costs associated with applying for IDR in Canada also play an important role in eligible borrowers' enrollment in the program. A broader literature shows that behavioral/psychological factors can play a major role in educational investment decisions (See Lavecchia et al. (2016), Damgaard and Nielsen (2018), and Page and Nurshatayeva (2022) for reviews). In the case of student loans, borrowers may make sub-optimal borrowing decisions due to self-control issues (Cadena and Keys, 2013), loan aversion (Boatman et al., 2017), salience of available options (Marx and Turner, 2019), and information overload (Marx and Turner, 2020).

[7] A few papers study IDR options (referred to as "income contingent loans" in Australia and the United Kingdom where enrollment is universal and payments are automatically deduced from borrowers' paychecks. Although linking loan payments to income imposes a higher effective marginal tax rate on earnings, research finds small (de Silva, 2023) or no labor supply response (Chapman and Leigh, 2009; Britton and Gruber, 2020).

and recertification outcomes over the longer term. Finally, several theoretical examinations of optimal student loan repayment schemes conclude that linking payments to income is generally welfare improving.[8] Our findings illustrate the importance of incorporating administrative costs and behavioral biases like inattention into these theoretical models.

Options that lower repayment burdens may also have effects beyond the borrower's own circumstances if their financial or labor market decisions are affected by student debt obligations. Rothstein and Rouse (2011) provide evidence that early career liquidity constraints lead college completers with undergraduate student debt to select into higher paying but less socially valuable occupations.[9] There is also evidence that — holding constant attainment — higher student debt burdens may reduce job satisfaction (Luo and Mongey, 2019), graduate school attendance (Chakrabarti et al., 2022; Folch and Mazzone, 2022), entrepreneurship (Krishnan and Wang, 2019), homeownership (Mezza et al., 2020), and marriage (Gicheva, 2016; Sieg and Wang, 2018). If these negative effects are at least in part caused by repayment burdens, then, in theory, increased IDR take-up could mitigate these costs to borrowers and the economy. Indeed, Mueller and Yannelis (2019) provide evidence consistent with the availability of IDR plans muting the negative effects of housing price shocks on financial well-being during the Great Recession. Our findings, however, show the trade-off between the short run benefits from eliminating the need to make payments and the longer run costs imposed by the complexity of IDR program requirements.

2 Federal Student Loans and Repayment

Publicly provided student loans are intended to solve a classic market failure by offering credit to young adults who would otherwise be un(der)served by private credit markets. Because human capital cannot serve as collateral, prospective students who wish to borrow to finance high-return, human-capital investments may not be able to do so. But not all borrowers who have high returns in expectation will realize the benefits of these investments, either due to idiosyncratic risk (e.g., a need to drop out before completing their program) or aggregate shocks (e.g., the Great Recession).

[8] See, for instance, Gary-Bobo and Trannoy (2015), Findeisen and Sachs (2016), Lochner and Monge-Naranjo (2016), Athreya et al. (2021), Ji (2021), and Matsuda and Mazur (2022).

[9] Similarly, Hampole (2022) finds that undergraduate students exposed to "no loans" policies choose majors that tend to result in lower initial earnings and greater earnings growth with corresponding changes in labor market outcomes.

IDR options provide insurance against these shocks by linking loan payments to income.

2.1 Federal student loans

Student loans comprise one of the largest sources of debt for U.S. consumers, second only to outstanding mortgage liabilities (Federal Reserve Bank of New York, 2024). The vast majority of student loans are issued directly by the federal government.[10] To borrow from federal student loan programs, students must complete a Free Application for Federal Student Aid (FAFSA), but access to funds from the main source of loan aid – the Stafford Loan Program – is not otherwise rationed or linked to creditworthiness. Federal student loan terms, such as limits and interest rates, are set by legislation and only vary by type of loan and student level.[11]

Over the last 15 years, total outstanding federal student loan debt more than doubled in inflation-adjusted terms, and the number of borrowers with outstanding federal student loans likewise increased from approximately 28 million to 44 million (Appendix Figure A.1). The number of borrowers has leveled off in recent years, but outstanding debt continued to rise through 2020.

2.2 Student loan repayment options

Historically, most borrowers repaid their loans through the "standard" 10-year plan characterized by fixed monthly payments and interest amortization over 10 years. This plan remains the "default" option in that borrowers who do not actively choose another plan are automatically enrolled in it. Options for borrowers with higher balances allow interest amortization and repayment to extend up to 25 years in the "extended" repayment plan and for payments to increase over time on a set schedule in the "graduated" repayment plan. Conditional on choosing a standard, extended, or

[10] Prior to the Great Recession, 15-to-25 percent of annual loan disbursements came from non-federal sources, but this share fell precipitously between 2008-09 and 2009-10 to 7 percent as many private lenders exited student loan markets (Consumer Financial Protection Bureau, 2012; Ma and Pender, 2022).

[11] There are three main federal loan programs: Stafford, Parent PLUS, and Grad PLUS. Stafford Loans are available to both undergraduate and graduate students, Grad PLUS Loans are limited to graduate students, and only parents of dependent students can borrow through the Parent PLUS Loan program. Annual Stafford Loan limits for undergraduates vary with dependency status and level (i.e., freshman, sophomore, upper level), while lifetime limits only vary with dependency status. Annual and lifetime Stafford Loan limits for graduate students only depend on whether the borrower is enrolled in a designated health program. Parent PLUS and Grad PLUS Loans do not have lifetime limits, and annual borrowing is only limited by cost of attendance. For undergraduates, the composition of Stafford Loans depends on a student's unmet need. Subsidized Stafford Loans do not accrue interest, while the student is enrolled but are only available to students with unmet need. Students with no unmet need can still receive unsubsidized Stafford Loans as long as their full cost of attendance is not covered by other forms of financial aid. See Hegji (2021) for additional details.

graduated repayment plan, monthly payments are increasing in the amount borrowed and interest rate. In contrast, monthly payments in IDR plans are determined by a borrower's income and family size. Specifically, payments are set as a percentage of "discretionary income" — defined as income relative to some multiple of the FPL — with the percentage ranging from 10 to 20 percent. Any balance remaining after a set period of time — 20 to 25 years — is forgiven. Importantly, borrowers must apply for IDR and provide documentation of their income and family size every year.[12]

As more generous IDR options were introduced in 2014 and 2015, take-up increased. The share of borrowers in an IDR plan grew rapidly over this period, from around 10 percent in 2013-Q3 to over 30 percent in 2019-Q4 (Appendix Figure A.2). In contrast, the share of borrowers in fixed payment plans (standard/extended) fell from just over 70 percent to 50 percent over the same period. Trends in student loan debt being repaid in IDR and fixed payment plans follow a similar pattern, with the share in IDR plans increasing from 20 to 50 percent (Appendix Figure A.3).[13]

Borrowers in IDR plans tend to have higher balances. In 2018, borrowers on an IDR plan had a mean balance of $60,000, whereas borrowers in other repayment plans had a mean balance of only $26,000. IDR users also tend to have low income. Among borrowers on an IDR plan in 2018, the average income was approximately $27,000 and 36 percent qualified for a $0 payment.

In addition to IDR, borrowers have other options available to reduce or stop payments, namely forbearance and deferrals. When payments are unaffordable, a borrower can contact their loan servicer and request a discretionary forbearance to temporarily pause payments. Deferrals are limited to specific circumstances (e.g., in school, military service). Most forbearances and deferrals do not stop the accumulation of interest and do not count as payments contributing to eventual loan forgiveness in IDR. Further, unpaid interest is capitalized into outstanding principal when a borrower exits a forbearance spell. Thus, borrowers are faced with an intertemporal trade-off when

[12] For the cohorts and years we examine, there were four IDR options: income-contingent repayment (ICR), income-based repayment (IBR), pay as you earn (PAYE), and revised pay as you earn (REPAYE). Appendix B provides additional details on the differences in IDR options. Borrowers could choose among these plans when applying or indicate that their servicer should select the IDR plan with the lowest payment. Because payments under REPAYE and PAYE/new IBR are the same, in practice, borrowers who selected this option were placed in REPAYE if they only had undergraduate loans and PAYE/new IBR if they had debt from graduate school.

[13] Appendix Figures A.2 and A.3 are based on data from the Federal Student Aid Data Center and are limited to borrowers with Direct Loans. Information on repayment plans for borrowers with other types of federal loans is not available on the Data Center.

deciding to enter forbearance: $0 payments in the near term at the expense of higher expected lifetime payments.

3 Data, Sample, and Descriptive Statistics

To study the loan repayment outcomes of IDR program applicants, we leverage administrative records from Federal Student Aid (FSA).[14] FSA began systematically storing IDR application data in 2014.[15] IDR applications collect all information required for determining eligibility and payments – most importantly, annual income and family size. All variables denominated in dollars are adjusted for inflation using the CPI-U (Bureau of Labor Statistics, 2023) and reported in constant 2022 dollars.

Using servicing records of the federally held student loan portfolio, we measure the evolution of borrowers' outcomes over time on a monthly basis, including total principal and accrued interest, repayment plan, scheduled monthly payment, and loan repayment status (e.g., whether the loan is current, in forbearance, in a deferral, delinquent, or in default).[16] We observe borrowers' outcomes up to 46 months after their initial IDR application, but exclude months after March 2020 (the start of the COVID-19 pandemic payment pause). These data are also used to capture borrowers' baseline characteristics at the time of initial IDR application submission, including whether the borrower had ever defaulted prior to applying for IDR, the length of time in repayment, and outstanding debt.

Further, we observe enrollment reports from all colleges participating in federal student aid programs, which we use to construct postsecondary enrollment spells for IDR applicants, including the level of enrollment and institution attended, and graduation. We use these data to determine

[14] Unless otherwise stated, the tables and figures referenced are using these data.

[15] In earlier years, application data were only stored in PDF scans of paper applications.

[16] We do not observe repayment plans for borrowers who only have loans from the commercial Federal Family Education Loan (FFEL) Program but do observe commercial FFEL balances. These borrowers held less than 7 percent of outstanding federal student loan debt as of 2023-Q3 (U.S. Department of Education, 2023). The FFEL Program operated in parallel with the Direct Loan Program until it was discontinued in 2010. FFEL loans were provided by private banks but guaranteed by the federal government with essentially the same terms from the borrower's perspective (e.g., interest rates, origination fees, borrowing limits). More recent IDR plans, however, exclude FFEL loans (see Appendix B). The U.S. Department of Education was authorized to purchase a portion of FFEL loans in 2009 and 2010 through the 2008 Ensuring Continued Access to Student Loans Act, totalling approximately $110 billion as of 2011 (U.S. Department of Education, 2011). Most students with FFEL loans can also consolidate their debt into a Direct Consolidation Loan.

a borrower's highest level of attainment when they first apply for IDR and to measure the effects of IDR payments on the likelihood of reenrollment and receipt of additional degrees after initial entry into the IDR program.

From borrowers' previous federal student aid applications, we observe many demographic characteristics, including gender, age as of first IDR application, and family income.[17] Borrowers were not asked to report their race/ethnicity during the period we study. Instead, we use predicted probabilities of belonging to one of the major racial/ethnic groups (Monarrez and Matsudaira, 2023).[18]

3.1 Analysis Sample

We focus on borrowers who first applied for IDR in 2015 through 2018.[19] We also exclude from our analysis sample borrowers with loans serviced by a particular (unidentified) servicer, due to issues with this servicer's reporting of scheduled payments in the initial months on IDR (see Appendix C for additional details). Because the assignment of borrowers to servicers is essentially random, this only serves to reduce the size of our analysis sample and the precision of our estimates. Our results are robust to keeping borrowers with this servicer in the main analysis sample (available upon request).

Our analysis sample is defined by applicants' discretionary income, or the distance between an applicant's AGI and the 150% FPL threshold. We use the full set of first-time IDR applicants to calculate the optimal bandwidth for regression discontinuity estimates of effects on our main repayment outcomes, following Calonico et al. (2014b) (hereafter, CCT).[20] We report results using a fixed bandwidth, equal to the median CCT optimal bandwidth across outcomes, rounded to the

[17] We use a borrower's first FAFSA to measure family adjusted gross income (AGI). For most traditional-aged undergraduate entrants, this will be their parents' income. Thus, this measure should be viewed as a proxy for family socioeconomic status rather than the borrower's own income during repayment.

[18] Race/ethnicity probabilities are predicted using the coefficients in a multinomial logistic regression model of self-reported race in the 2016 National Postsecondary Student Aid Study as a function of demographics associated with characteristics of borrowers, including their first and last name, zip code on first FAFSA, high school, and college. Analyses by race and ethnicity are conducted using the predicted probabilities as weights, an approach that has been shown to provide an underestimate of outcome gaps by race (Elzayn et al., 2023).

[19] Although our data contain applications from 2014, the measure of discretionary income constructed from the elements provided does not yield any discontinuity in the probability of a $0 payment or payment amount at the $0 discretionary income threshold, suggesting that household size, marital status, household income, or some combination of these factors is not accurately reported.

[20] We implement the bandwidth selection procedure with the `rdbwselect` Stata routine (Calonico et al. 2014a).

nearest \$50 (\$4,350). For all of our analyses, we fix the running variable to discretionary income from a borrower's first IDR application.

3.2 Characteristics of first-time IDR applicants

Table 1 presents summary statistics for the full set of first-time IDR applicants and applicants in our main analysis sample. Prior to submitting their first IDR application, borrowers in our main analysis sample had \$44,082 in outstanding debt, on average, and relatively low income (\$27,717). Average household size was approximately 2 and only 7 percent of applicants were married. Just under one in 5 applicants had borrowed for graduate studies. Most first-time IDR applicants entered repayment recently, 68 percent within the two years prior to submitting their first IDR application. The share of applicants in our sample who previously defaulted on their student loan payments is relatively high at 17 percent. Around 61 percent of applicants were classified as dependent students when they first received federal student aid and came from families with an income of \$55,292, on average. Characteristics of the population of first-time IDR applicants are relatively similar to our analysis sample, although the population is slightly less advantaged, with higher debt balances and lower incomes.

Panel A of Figure 1 shows the share of all first-time applicants in an IDR plan by months elapsed since their initial application. Patterns are similar if we limit these analyses to borrowers in the main analysis sample (available upon request). Most applicants (about 89 percent) are approved and enroll in the program within 6 months of their application, and only a small share ultimately do not enroll (due to incomplete, withdrawn, or rejected applications). Approximately 12 months after initial application submission, there is a stark drop in IDR participation, with under 50 percent of initial applicants remaining on an IDR plan at the 18-month mark. The large drop in IDR participation is consistent with Herbst (2023), who finds that approximately 50 percent of borrowers who entered an IDR plan after missing payments remained on the plan one year later.[21]

Figure 1, Panel B shows the number of IDR recertification applications over the same time period. Recertification application submission rates are highly cyclical, corresponding closely with the annual recertification requirement, reaching their peak near the 12-month mark, and waning over the

[21] Conkling and Gibbs (2019) estimate a higher IDR persistence rate of around 70 percent for a broader set of borrowers, but among borrowers who initially had a \$0 payment, only around half remained on IDR after a year.

next two years. These patterns motivate our delineation between the short and longer run effects of borrowers' initial IDR payments, including the decision to reapply for IDR after a borrower's initial 12 months of lower payments have passed.

4 Research Design

Our main identification strategy leverages the discontinuity in the relationship between discretionary income and IDR payments to identify the causal effects of payment obligations on borrower outcomes via a regression discontinuity (RD) design. At the 150% FPL threshold, the IDR payment formula results in a discontinuous decrease in monthly payments and a discontinuous increase in the probability of a $0 scheduled payment. Most, but not all, applicants are approved for IDR (Figure 1), so our design will be fuzzy and estimates can be interpreted as intent-to-treat effects.

4.1 Identifying variation

In non-IDR repayment plans, scheduled monthly payments depend on the amount borrowed, the interest rate, and the repayment term. These factors may be correlated with unobservable borrower characteristics that also influence debt repayment outcomes, making it unlikely that a naïve regression of outcomes on scheduled payments will recover causal effects. Likewise, outside of IDR, the requirement to make payments is only waived for borrowers in a forbearance or deferral, which are almost always triggered by borrowers' endogenous choices. In IDR plans, however, the scheduled payment (P) for borrower i is a function of discretionary income (DI) and the IDR payment rate (r):

$$P_i = \begin{cases} 0 & \text{if } DI_i \leq 0 \\ rDI_i & \text{if } DI_i > 0, \end{cases} \tag{1}$$

where $DI_i = AGI_i - 1.5FPL(n)$, $FPL(n)$ is federal poverty line for family size n, and $r \in \{0.10, 0.15\}$.[22]

Due to administrative costs associated with collecting payments, the minimum monthly payment on any plan is $10. When a borrower's IDR payment – as calculated in equation (1) – falls between

[22] REPAYE, PAYE, and new IBR have a 10 percent payment rate, while old IBR has a 15 percent rate. ICR has a different discretionary income threshold (100% FPL) and a higher rate (20 percent) but over the period we study, few borrowers enroll in ICR. See Appendix B for additional details.

$5 and $10 per month, it is rounded up to $10. When their scheduled payment is less than $5 per month, it is set to $0. As a result of the latter provision, borrowers with income $399 above 150 percent FPL will also have $0 payments (i.e., 15 percent of $400 is $60 per year or $5 per month). Thus, we adjust the $0 discretionary income threshold by this amount. However, we do not know *ex ante* whether a borrower is eligible for a plan that sets payments to 15 percent versus 10 percent of discretionary income, and borrowers with income $200 above the revised threshold who have a 10 percent payment rate would also have their payments set to $0. Thus, we also exclude a "donut" of the small number of applicants with income $0 to $200 above the (updated) discretionary income threshold.

We estimate local linear regressions using a uniform kernel via ordinary least squares (OLS). Let Y_i be the outcome of interest for borrower i. Our estimating equation is:

$$Y_i = \alpha_t + \beta_0 DI_i + \beta_1 \mathbf{1}\left[DI_i \leq 0\right] + \beta_2 DI_i \mathbf{1}\left[DI_i \leq 0\right] + \epsilon_{it}, \tag{2}$$

where DI_i is the discretionary income of applicant i, defined above, $\mathbf{1}\left[DI_i \leq 0\right]$ is a binary variable indicating that the applicant has $0 (or lower) discretionary income, and α_t is a vector of application year fixed effects. For each of our main outcomes, we calculate the optimal CCT bandwidth and report estimates using the median CCT-optimal bandwidth of $4,350. We estimate heteroskedasticity-robust standard errors.

4.2 Testing the key RD identifying assumption

The key assumption required for the RD design to identify causal effects is for potential outcomes to be continuous through the treatment assignment threshold. While we cannot directly test for the continuity of unobservables at the $0 discretionary income threshold, we can do so for observed characteristics. Figure 2 shows the number of IDR applicants by distance to the $0 discretionary income threshold and year of initial application. Applicant density is continuous across the threshold for every cohort, indicating that borrowers applying for IDR cannot finely manipulate their incomes in order to reduce their monthly payment to $0 payment. This is not surprising, given that for most applicants, discretionary income is verified through prior-year tax returns.

As an additional test of the identifying assumption, we show that applicants' observable predetermined characteristics are also continuous across this threshold. Table 2 displays corresponding estimates of β_1 from placebo regressions of equation (2) on applicants' baseline characteristics. We find no evidence of discontinuities in most predetermined characteristics, including age, family income on first FAFSA, predicted race/ethnicity, educational attainment, household size, marital status, the probability of prior default, or use of auto debit. Two coefficients are significant at conventional levels, representing a 0.6 percentage point (0.9 percent) decrease in the probability of being female and a $658 (1.5 percent) increase in outstanding debt. To account for the role of multiple hypothesis testing, we test for discontinuities in an index of observable baseline characteristics based on predictions from a logistic regression of the probability of defaulting in the 2 years after initially applying for IDR (Appendix Figure A.4). The estimated change in the predicted probability of default — shown in column (16) — is statistically insignificant and economically small, with a 95 percent confidence interval excluding effects larger in magnitude than a 0.2 percentage point increase or a 0.1 percentage point decrease.

Finally, as additional placebo tests, we present estimates for borrower outcomes taking place over 12 months *prior* to their first IDR application. Under the assumption that the probability of having income on either side of the $0 discretionary income threshold is random within a small bandwidth, outcomes should be perfectly balanced (up to sampling error) when measured prior to a borrower's initial application. In the following section, we show that this is indeed the case.

4.3 First stage effects on monthly payments

Figure 3 shows that scheduled payments largely follow the formula in equation (1). Each marker represents the probability of a $0 scheduled monthly payment (Panel A) or average scheduled payment (multiplied by 12 to represent an annual amount) (Panel B) for applicants within a $250 bin, measured 9 months after they submitted their first IDR application.[23] Solid lines are a linear fit of the binned data, estimated separately on either side of the eligibility threshold and limited to the median CCT optimal bandwidth; dashed gray lines delineate 95 percent confidence intervals.

[23]Figure 1 indicates that, for some applicants, it takes several months for their IDR application to be approved. We focus on month 9 here because the share of applicants who are on an IDR plan peaks 7 to 10 months after initial application submission. Panels A and B of Appendix Figures A.5 and A.6 show that $0 payment probabilities and average scheduled payments follow similar patterns at months 6 and 12.

Borrowers with income just below 150% FPL see a large, discontinuous increase in the probability of a $0 scheduled payment compared to borrowers with income just above this threshold, approximately 70 percentage points in magnitude (Panel A).[24] There is also an approximately $60 drop in the average scheduled payment amount (Panel B).[25]

Table 3 provides a summary of estimated first stage effects on $0 payment probability and average scheduled payment amounts over the 12 months after initial application. Borrowers with an income below the threshold see an approximately $3 fall in scheduled monthly payments – a 5 percent reduction relative to payment burdens for ineligible borrowers – and a 64 percentage point increase in the probability of not being required to make any payment. We discuss estimated effects on scheduled payments after a borrower's first 12 months on IDR in the following section.

5 Main results

In this section, we first provide evidence on the reduced form effects of income eligibility for a $0 payment on repayment-related outcomes, including delinquency, default, and use of forbearance to pause payment obligations. We then turn to examine effects on the probability of reapplying for and remaining on an IDR plan and take-up of automatic payments through auto debit as a measure of "connectedness" with the federal student loan system. Next, we discuss estimated effects on outstanding debt and educational attainment and conclude with an examination of heterogeneity in repayment and IDR persistence outcomes for different groups of borrowers.

5.1 Effects on delinquency, default, and forbearance

One of the main goals of IDR is to provide insurance against unaffordable payments in times when a borrower's income is low. Thus, we first examine the extent to which eligibility for a $0 payment

[24] There are several reasons why the probability of having a $0 payment does not change from 0 to 1 at the threshold. First, applications might be denied by servicers or cancelled by applicants changing their mind about IDR participation. Second, there may be measurement error in the data we observe on household size. Third, borrowers who initially have a non-zero scheduled payment (i.e., have income above the $0 discretionary income threshold) and experience an unexpected shock to their income (e.g., job loss) can request a payment adjustment from their servicer. Finally, by requesting a discretionary forbearance, borrowers with a nonzero scheduled payment on IDR can temporarily bring their payments to $0.

[25] The kink in the relationship between distance from the threshold and payment amounts implies that for every $1,000 increase in income relative to the threshold, average scheduled payments increase by approximately $75. There is no kink in the probability of a $0 payment at the threshold.

affects the probability that a borrower is delinquent – defined as at least 30 days late with a payment – as an early sign of repayment difficulties. Panel A of Figure 4 plots the relationship between a the distance from the $0 discretionary income threshold and the probability of delinquency in the ninth month after a borrower submits their first IDR application. There is a clear discontinuity at the $0 discretionary income threshold, indicating an approximately 6 percentage point (60 percent) drop in delinquency risk.

Looking ahead to 18 months after initial application submission, we find a reversal of this pattern (Figure 4, Panel B). Borrowers with income on their initial application just below the $0 discretionary income threshold are 2 percentage points (14 percent) more likely to be delinquent with their student loan payments than borrowers who had income just above the threshold, suggesting that the insurance benefits of a $0 payment may be short lived.

We summarize the dynamics of first stage effects on the probability of delinquency by plotting point estimates of β_1 from equation (2), where outcomes are measured on a monthly basis. Panel C of Figure 4 displays these estimates and corresponding 95 percent confidence intervals over the 12 months before a borrower's first IDR application (i.e., placebo estimates) and the 42 following months. Differences in delinquency risk for borrowers above and below the $0 discretionary income threshold in the months before they submit their first application are small and largely insignificant. Beginning one month after they submit their first IDR application, borrowers with income just below the threshold see a significant reduction in delinquency risk, peaking at month 4, and persisting until month 14. Starting in month 16, treatment effects on borrowers who were initially eligible for a $0 payment follow a starkly different pattern, with these borrowers seeing a significant increase in delinquency rates that last for the following 6 months. Estimated treatment effects remain elevated but small in magnitude for the remainder of the panel.[26]

Student loan default occurs after 270 days of nonpayment. Thus, treatment effects on default rates should occur at an approximately 8-month lag. Consistent with this timing, Panel A of Figure 5 shows an approximately 2 percentage point (50 percent) drop in the probability of default 18 months after initial application submission. As shown in Panel B, the reduction in default risk

[26]The reduction and subsequent increase in delinquency rates for borrowers with income below 150% FPL are consistent with the descriptive findings of Conkling and Gibbs (2019), who show that IDR participants with a $0 payment experience increased financial distress five quarters after they first entered IDR.

peaks 21 months after a borrower first applies for IDR. In month 22, such borrowers are still less likely to default than their counterparts with initial application income above the threshold, but one month later, effects on monthly default risk fall to zero and remain small and largely insignificant until the end of the panel.[27]

Borrowers with a nonzero scheduled monthly payment have a second path for pausing payment obligations if their IDR payment is still unaffordable. Specifically, they can request that their loans be placed in forbearance. This method of pausing payments is more costly than qualifying for a $0 scheduled payment in IDR: Borrowers forgo the interest subsidies available in many IDR plans (see Appendix B), and any unpaid interest is capitalized into their outstanding principal when they exit forbearance.[28] Panel A of Figure 6 shows a clear discontinuity in the probability of forbearance 9 months after initial application submission.[29] Borrowers who were eligible for a $0 payment based on their initial application are less likely to use forbearance to pause payments in the short run, but 2 years after submitting their first application, they are significantly more likely to be in forbearance (Panel B) and this pattern persists up to month 36 (Panel C). Treatment effects on forbearance use are driven by discretionary forbearance spells, which are initiated at the request of the borrower, rather than administrative forbearances, which may be initiated by servicers or automatically in response to major disasters (results available upon request).

Table 4 shows reduced form estimates of β_1 from equation (2) for summary repayment outcome measures by years since initial application. The first three columns contain estimated effects on the probability of any delinquency in each 12-month period after initial application submission.

[27] Although Panel B of Figure 5 shows significant positive estimated effects on default beginning at month 36, Appendix Figure A.7 does not show a clear discontinuity in the probability of default at the $0 discretionary income threshold at that point in time.

[28] There two broad categories of forbearances: general/discretionary and mandatory. The reduction in forbearances for $0 payment-eligible borrowers are driven by discretionary forbearances, suggesting that even borrowers facing payments as small as $10 per month are willing to pay to further reduce their current obligations. Borrowers experiencing financial difficulties, medical issues, job loss, or other extenuating circumstances can request a discretionary forbearance from their servicer. Discretionary forbearance spells are limited to 12 months at a time and a cumulative limit of 3 years. Mandatory forbearance requests are linked to a specific set of circumstances, such as National Guard duty, medical residencies, and AmeriCorps, and must be granted by servicers if requested. A limited set of circumstances, such as living in an area affected by a federally declared major disaster, can trigger automatic placement in an administrative forbearance. See https://studentaid.gov/manage-loans/lower-payments/get-temporary-relief/forbearance (accessed 9/7/2023) for details.

[29] There is also a kink in the relationship between forbearance use and distance from the $0 payment eligibility threshold, mirroring the kink in scheduled payments (Figure 3). The kink in forbearance use is notable given the lack of a kink in delinquency or default risk during this same period (Figures 4 and 5) and is consistent with borrowers responding to a marginal increase in monthly payments by using forbearance, which enables them to avoid default.

The estimated effect of $0 payment eligibility on repayment outcomes during a borrower's first 12 months on IDR can be interpreted as the combined effect of relaxing a borrower's budget constraints through a reduction in scheduled monthly payments and the effect of removing the requirement to make any payment. Estimated treatment effects after the first 12 months will provide insight into changes in other behavior resulting from a $0 payment following a borrower's first year on IDR. Columns (4) and (5) of Table 4 display estimated effects of initial eligibility for a $0 payment on additional outcomes: the probability of ever having being delinquent, in default, or using forbearance since a borrower's initial IDR application. Comparing the estimates for the the 12-month and cumulative measures can provide insight into whether effects after a borrower's first 12 months on IDR represents a retiming of repayment difficulties that would have otherwise been experienced at an earlier point.

Mirroring the results shown in Figure 4, borrowers who qualify for a $0 payment based on their first IDR application see an 18 percentage point drop in cumulative delinquency risk in their first year (Table 4, Panel A). The estimated effect on cumulative delinquency risk falls to 3.5 percentage points by the end of year 2 – an 80 percent reduction – and to 1.3 percentage points by the end of year 3 – a 93 percent reduction. Thus, although initial eligibility for a $0 payment does reduce cumulative risk of delinquency significantly over the longer run, most of the decrease in borrowers' first year after applying for IDR comes from a shift in the timing, rather than incidence, of delinquency.

Panel B of Table 4 shows estimated effects on the probability of default in each 12-month period and since initial IDR application.[30] Consistent with Figure 5, after the initial 2.4 percentage point drop in default risk for borrowers eligible for a $0 payment over their first year on IDR, these borrowers are equally likely to default over the subsequent 12-month period and remain 0.5 percentage points (6 percent) less likely to have defaulted at any point since submitting their first IDR application. By year 3, estimated effects on default risk are positive and significant (albeit small in magnitude) and effects on ever defaulting are small and statistically insignificant. These results suggest that although borrowers eligible for a $0 payment on IDR initially receive protection from default, any

[30]Note that we lag the timing of measured effects on default to reflect the 9-month lag between the initial missed payment and default, such that year 1 covers the 9th through 18th month since repayment entry, year 2 covers the 19th through 30th, and year 3 covers month 31 through 42.

insurance value of not being required to make payments ultimately fades. Estimated effects on forbearance (Panel C) follow a similar pattern: Initial eligibility for a $0 payment shifts the timing of forbearances but has much smaller effects on long run use.

In summary, the short and longer run effects of initially qualifying for a $0 payment on repayment outcomes differ not only in magnitude but also in sign. Borrowers with income below the threshold on their first IDR application experience significant increases in repayment difficulties approximately 12 months later, the point in time at which borrowers would be required to submit a recertification application. Thus, in the next subsection, we turn our focus to examine effects on reappplications to and persistence in IDR.

5.2 Initial eligibility for a $0 payment reduces persistence in IDR

During the time period our study covers, borrowers were required to reapply for IDR every 12 months. This recertification process is essentially the same as the initial application process – borrowers either must fill out the online application or submit a paper application and provide their tax records or alternative documentation of income. Herbst (2023) finds that many borrowers who enter IDR after a period of financial distress are no longer in the program one year later, and the patterns in Figure 1 suggest that, among first-time applicants, there is a similar fall in IDR participation. For some borrowers, failure to recertify may be optimal (e.g., those who experience an increase in their income may face a lower payment under a non-IDR plan), while for others, it may be a consequence of administrative barriers, hassle costs, and/or inattention to the requirement to reapply.

Figure 7 displays estimates of initial eligibility for a $0 payment ($\beta_1$ in equation (2)) on the probability of being on an IDR plan, by months since a borrower first applied for IDR.[31] In the 13th month after initial application submission, there is a significant drop in the probability of being in an IDR plan (1.2 percentage points or 4 percent relative to the average IDR participation rate for borrowers with initial incomes just above the $0 payment threshold). Treatment effects on IDR participation continue to fall for the next 5 months, reaching 2.5 percentage points (6 percent) in month 17. The gap in IDR participation decreases in magnitude but remains significant at the 5

[31] Appendix Figure A.8 plots the average IDR participation rate by income over three intervals: 7-12 months after initial application (Panel A), 13-18 months (Panel B), and 19-24 months (Panel C).

percent level for the remainder of the panel.

The drop in IDR participation is driven by failure to recertify. Figure 8 plots the probability that a borrower submits any IDR reapplication (Panel A) and a reapplication that was successful (Panel B) in the 7th through 12th month after initially applying and in the following 6 months (Panels C and D, respectively). Those eligible for a $0 payment based on their initial application income are significantly less likely to reapply in either period.

Reduced form effects on summary measures of IDR reapplication and persistence are shown in Table 5. Treatment effects on IDR participation are similar in magnitude to the reduction in the probability of (re)applying for IDR. While the probability of submitting a successful application is lower overall, the discontinuity in this probability is similar in magnitude to the discontinuity in the probability of submitting any application.

Failure to recertify for IDR has important implications for borrowers' monthly payments and outstanding debt. During the period we study, when a borrower fails to recertify for IDR, unpaid interest is capitalized into their principal balance. Additionally, if they do not actively switch to an alternative plan, their scheduled payments will return to a mortgage-style amortization schedule (see Appendix B for details). Indeed, starting in the second year after submitting their first IDR application, borrowers whose initial application income was below the $0 discretionary income threshold experience a large, statistically significant increase in monthly scheduled payments (Figure 9). The discontinuous increase in payments persists until almost the end of the 42 month panel, suggesting that initial eligibility for a $0 payment leads to higher payments over the longer term.[32]

The rise in delinquencies and defaults subsequent to failure to remain on IDR for borrowers initially qualifying for a $0 payment indicate that the choice to exit IDR may not have been driven by such borrowers experiencing differential growth in earnings. For the approximately $17 increase in monthly payments in year 2 to come from borrowers who were marginal to recertification (i.e., those who recertify if their first-year payment was nonzero and do not recertify if their first-year payment was $0), these borrowers would need to see a $850 increase in monthly payments. Al-

[32]These patterns are apparent in Panels C and D of Appendix Figure A.6, which show average (annualized) scheduled payments by distance from the $0 discretionary income threshold at 18 and 24 months after initial application submission. These borrowers are also slightly more likely to have a $0 payment (Appendix Figures A.5 and A.9), likely due to the increased use of forbearance (Figure 6).

though we do not observe income for borrowers who do not recertify for IDR, for the increase in monthly payments on IDR to exceed $850, such borrowers would need to see their income grow by more than $65,000.[33]

Although the IDR recertification process is the same for borrowers eligible for a $0 payment and those who are not, borrowers who are required to make monthly payments will likely have more opportunities to interact with the student loan system, and, as a result, may be more attentive to the need to recertify. We examine enrollment in "auto debit" payments as a measure of the extent to which borrowers are interacting with their loan servicers and the student loan system after they first apply for IDR. Borrowers sign up for auto debit with their servicer, which allows their monthly payments to be automatically deducted from their bank account and results in a 0.25 percentage point reduction in their interest rate. Even borrowers with a $0 payment can enroll in auto debit and, in doing so, receive the interest rate reduction and see their balances grow by less during their time on IDR.[34]

One month before submitting their first IDR application, around 5 percent of borrowers with income just below the threshold and a similar share of borrowers with income just above the threshold were signed up for auto debit (Figure 10, Panel A). In stark contrast, 13 months later, borrowers eligible for a $0 payment were over 15 percentage points (60 percent) less likely to be enrolled in auto debit than those with income just above the threshold (Panel B). Notably, in the month after initial application submission, this gap is quite small and continues to grow over the entire year (Panel C), suggesting that requiring borrowers to make payments increases the likelihood that they will continue to engage with their servicer during their first year in an IDR plan. While the gap in auto debit enrollment narrows after the first 12 months, it remains at 6 percentage points by the end of our panel, 3.5 years after initial application.

[33] Table 5 shows that approximately 2 percent of borrowers are marginal with respect to recertification and $\frac{17}{.02} = 850$. An increase in monthly payments of $850 would lead to a $10,200 increase in annual payments. For borrowers with a 15 (10) percent payment rate, income would need to increase by $\frac{10,200}{.15} = \$68{,}000$ ($\frac{10,200}{.1} = \$102{,}000$) to result in an $850 increase in monthly payments on IDR.

[34] Although most IDR plans have at least partial subsidies for accrued interest not covered by the borrower's scheduled monthly payment in the first three years on IDR, the only borrowers who would not experience any interest accumulation during this period are those on REPAYE with only subsidized loans. See Appendix B for additional details.

5.3 Effects on outstanding debt and attainment

Herbst (2023) shows that borrowers who switch into an IDR plan also experienced decreases in their outstanding debt. In our setting, borrowers initially eligible for a $0 payment do not have significantly higher amounts of outstanding debt after their first 12 months on IDR (Appendix Figure A.10), despite having lower scheduled monthly payments over this same time period. Further, despite significant increases in payment obligations after their first year on IDR, estimated effects on outstanding debt remain small and insignificant over 24 months. By the end of our panel, we find some evidence of statistically significant — albeit modest in magnitude — reductions in total outstanding debt, but estimates are relatively imprecise. Overall, we do not find strong evidence that eligibility for a $0 payment has beneficial or adverse effects on borrowers' loan balances or amortization.

Payment obligations could affect whether borrowers reenroll in higher education through several channels. First, borrowers who have defaulted on their federal student loans are ineligible for any form of federal student aid. By preventing default, a $0 payment could help borrowers maintain access to resources needed to finish a program or pursue an advanced degree. Second, borrowers intending to pay for additional postsecondary education out of pocket may be better able to finance reenrollment via savings with lower student loan payments, even if they are not at risk of default. Finally, borrowers who enrolled on a half-time basis or higher are eligible for an in-school deferment (i.e., pause) on their loan payments. Eligibility for a $0 payment could reduce incentives to return to college by offering an alternative way to pause payment obligations. Estimated effects on reenrollment in any postsecondary institution are most consistent with the last mechanism. As shown in Panel A of Appendix Figure A.11, borrowers initially eligible for a $0 payment are significantly less likely to reenroll in months 6 through 16, although effects are small in magnitude (approximately 0.5 percentage points). In the longer run, estimated effects on enrollment are largely negative but insignificant. We find no evidence of significant effects on degree receipt (Panel B).

5.4 Heterogeneity

We test for heterogeneity in treatment effects with the goal of understanding the distributional consequences of the short run insurance benefits and longer run costs of initial eligibility for a $0 IDR payment. We focus on three dimensions of heterogeneity: predicted race/ethnicity, educational attainment, and whether a borrower has previously defaulted on a loan. We focus on delinquency and default, since these are the most consequential outcomes for borrowers' credit scores.

We first test for heterogeneity in treatment effects by race and ethnicity. Conditional on educational attainment, Black borrowers take on more student loan debt (Scott-Clayton, 2018), and Black and Hispanic borrowers face a higher risk of default (Haughwout et al., 2019), both factors that may lead to larger benefits from a lower or $0 IDR payment. Panel A of Figure 11 shows estimates of β_1 from equation (2), in which observations are weighted by the predicted probability of belonging to the indicated racial/ethnic group. The left two panels plot estimated effects on the probability of delinquency or default after initial application submission through the end of our panel, measured in 6-month intervals. In the short run, borrowers with a high predicted probability of being Black see the largest reductions in delinquency and default risk, but over the longer run, effects are fairly similar across racial groups. The right two panels show effects on the probability of ever being delinquent or ever defaulting since first applying for IDR. The pattern of results suggests that Black borrowers see the largest benefits over the longer run, although estimates are sufficiently imprecise by the end of the panel that they are not statistically distinguishable from estimates for borrowers predicted to be Hispanic or White.

Next, we turn to examine heterogeneity by educational attainment. Although borrowers who do not complete their undergraduate degrees tend to take on less student loan debt, they also default at a higher rate (Hillman, 2014; Mezza and Sommer, 2016). Panel B of Figure 11 displays estimated effects on default and delinquency for three mutually exclusive subgroups defined by educational attainment at the time of initial IDR application: first-year undergraduates (i.e., likely drop-outs), other undergraduates (a group that will include a mix of completers and drop-outs), and graduate borrowers. The initial benefits from a $0 payment are larger for borrowers with lower attainment. In their first year after applying, undergraduate drop outs experience substantially larger reductions in delinquency and default than borrowers from other groups when they are

eligible for a $0 payment. Likewise, other undergraduate borrowers receive larger benefits than graduate borrowers. Longer-term effects on the probability of ever becoming delinquent or defaulting following initial IDR application remain significantly larger in magnitude for drop outs, but differences in effects between other undergraduates and graduate borrowers are no longer statistically distinguishable.

In the final set of analyses, we test for heterogeneity by whether a borrower has ever defaulted on a student loan in the past. Past default is a strong predictor of future repayment difficulties. For instance, Consumer Financial Protection Bureau (2017) reports that over 40 percent of borrowers who enter and leave default will ultimately default again in the next 3 years. Panel C of Figure 11 shows that prior defaulters see significantly larger short run benefits from initial eligibility for a $0 payment in terms of reductions in defaults and delinquency risk. Longer run effects on the probability of ever defaulting remain significantly larger in magnitude for prior defaulters over the remainder of the panel.

In summary, borrowers who may be more likely to struggle to keep up with their student loan payments and those who have struggled in the past experience larger benefits when they are eligible for a $0 payment on IDR.

6 Mechanisms

Thus far, we have remained agnostic as to the channels through which eligibility for a $0 payment affects borrowers outcomes. At the 150% FPL threshold, borrowers potentially are exposed to two different treatments: a reduction in monthly payments (and corresponding relaxation of their budget constraint) and a relaxation of the requirement to remit any payment to their loan servicer. Why should these considered different treatments? In the short run, even a borrower who could afford a monthly payment of $10 could forget to make the payment in a given month, especially if they are not enrolled in auto debit. For such a borrower, removing the requirement to make any payment would reduce their risk of delinquency and default by eliminating the cost of their inattention. Further, removing the requirement to make monthly payments for an entire year may reduce borrowers' "stock" of attention (e.g., Stango and Zinman, 2014), increasing the risk that

a borrower becomes disconnected from the federal loan system and subsequently fails to reapply for IDR. In both cases, the additional dimension of treatment that operates through a $0 payment comes from borrowers' inattention.

We cannot separately identify these effects using the discontinuity alone through an instrumental variables strategy. This is because the existence of the additional treatment dimension represents a violation of the exclusion restriction, i.e., having income below the $0 discretionary income threshold potentially affects outcomes through multiple mechanisms. However, the IDR formula also produces a discontinuous change in the *slope* of the relationship between discretionary income and scheduled payments. With additional assumptions, this kink can be used as an additional source of identifying variation in a regression kink (RK) design. In this section, we outline these assumptions and show how estimates using the kink and discontinuity can be combined to separately identify these treatment dimensions.

We first test whether estimates of the effect of a marginal increase in monthly payments is the same when using the discontinuity versus the kink for identification. To use the kink in the IDR payment schedule for identification, additional assumptions are required beyond those discussed in Section 4. Analogous to the RD design, using a discontinuity in first derivatives requires the assumption of continuity in the first and second derivatives of potential outcomes across the $0 discretionary income threshold. Figure 2 provides support for this assumption, as there is no evidence of a kink in the density of first-time applicants. Although the change in the slope of the composite index of baseline characteristics – shown in Appendix Figure A.4 – is marginally significant, it is small in magnitude, representing a 0.001 decrease in the predicted probability of default per $1,000 increase in AGI above the threshold.[35]

We estimate instrumental variables (IV) models in which average scheduled payments over the 12 months following a borrower's initial application is the endogenous regressor and either $\mathbf{1}\left[DI_i \leq 0\right]$ (the discontinuity) or $DI_i\mathbf{1}\left[DI_i \leq 0\right]$ (the kink) serves as the excluded instrument. Equation (2)

[35] Appendix Table A.1 contains point estimates of the change in the slope of baseline observable characteristics and the index.

is the reduced form equation. The first stage estimating equation is:

$$P_i = \delta_t + \gamma_0 DI_i + \gamma_1 \mathbf{1}\left[DI_i \leq 0\right] + \gamma_2 DI_i \mathbf{1}\left[DI_i \leq 0\right] + \varepsilon_{it}, \tag{3}$$

where P_i is borrower i's monthly payment in their first year on IDR and DI_i is their discretionary income. The hypothesis we test is:

$$\mathrm{H}_0 : \frac{\beta_1}{\gamma_1} = \frac{\beta_2}{\gamma_2}. \tag{4}$$

Appendix Table A.2 shows contains these estimates along with p-values from the test of the hypothesis in equation (4).[36] In the first year after initial application submission, we reject the hypothesis of equal IV-RD and IV-RK treatment effects with $p < 0.01$ for delinquency, default, and reapplication for IDR, and with $p < 0.05$ for forbearances. Treatment effects on repayment outcomes all indicate that reductions in payments also reduce the risk of delinquency, default, and forbearance, but the magnitude of IV-RD estimates are substantially larger. For instance, using the discontinuity for identification suggests that a \$10 reduction in monthly payments leads to a 8.5 percentage point reduction in the risk of default, while the estimate obtained from IV models that use the kink for identification suggest a much smaller reduction of 0.2 percentage points per \$10 decrease in monthly payments.

Two and three years after initial application, we continue to reject the hypothesis of statistically indistinguishable effects of (initial) monthly payments for most outcomes at conventional significance levels. For 7 out of the 8 outcomes we examine, p-values remain below 0.1. In the case of effects on forbearances, reapplications, and IDR persistence, the IV-RD and IV-RK estimates also have different signs, with RD estimates indicating that lower first-year payments lead to significant increases in forbearances and significant decreases in IDR persistence over the longer run, and RK estimates indicating the opposite. These patterns suggest that eligibility for a \$0 payment affects outcomes through more than just a reduction in monthly payment amounts. Card et al. (2015) show that in the presence of a discontinuity and a kink, additional restrictions on treatment effect heterogeneity are required for the regression kink (RK) estimator to identify a causal effect. Thus, the results in Appendix Table A.2 are consistent with heterogeneous treatment effects of

[36] Reduced form estimates of the kink in outcomes – β_2 in equation (2) – are shown in Appendix Table A.3.

monthly payments. In the following subsection, we outline additional assumptions about the functional form of this heterogeneity that allow us to separately identify the effect of waiving payment requirements from a marginal reduction in monthly payments.

6.1 Identification of multiple treatment parameters

To separately identify the effects of variation in the intensive and extensive payment margins, we impose two additional assumptions. The first is that the treatment effect of a marginal increase in monthly payments is locally constant.[37] If facing a \$0 payment obligation only affects a borrower's outcomes through the reduction in their payment *amount*, then we should not reject the hypothesis in equation (4), but for most outcomes, we do reject this hypothesis. The second assumption is that of additive separability of the intensive and extensive margin effects of payment amounts (i.e., we rule out treatment effect interactions between the impact of *whether* payments need to be made versus impacts from the *amount* of scheduled payments).

Let τ_P represent the effect of a marginal increase in payment burden on a given outcome and τ_0 be the extensive margin effect. During the first 12 months on IDR, τ_0 can be thought of as the effect of relaxing the requirement to make payments, above and beyond the effect of the payment burden on a borrower's budget constraint, e.g., through reducing the cost of inattention. After a borrower's first year on IDR, τ_0 can be interpreted as the remaining impact on the probability that a borrower attends to the requirement to reapply for IDR (i.e., a "disconnection" effect). Under the assumptions of additive separability and locally constant treatment effects, outcome Y for borrower i with discretionary income DI_i and monthly payment P_i can be written as:

$$Y_i = \mathbf{1}\left[P_i = 0\right]\tau_0 + P_i\tau_P + f(DI_i) + \epsilon_i, \tag{5}$$

where $P_i = g(DI_i)$ as defined in equation (1).[38]

[37] An example of a violation of this assumption is the case in which a marginal increase in monthly payments from \$10 to \$11 has a different effect than a marginal increase in monthly payments from \$1 to \$2.

[38] For the case of imperfect compliance, payments are not a fully deterministic function of discretionary income, so that $P_i = g(DI_i, v_i)$, where v_i is an unobserved factor that may be correlated with borrower outcomes but is continuous and continuously differentiable at the \$0 payment threshold.

Given equation (5), the reduced form RD estimator can be written as:

$$\begin{aligned} &\lim_{di\uparrow 0} E\left[Y|DI=di\right] - \lim_{di\downarrow 0} E\left[Y|DI=di\right] \\ &= \tau_0 \left(\lim_{di\uparrow 0} \Pr(P=0|DI=di) - \lim_{di\downarrow 0} \Pr(P=0|DI=di) \right) \\ &+\tau_P \left(\lim_{di\uparrow 0} E\left[P|DI=di\right] - \lim_{di\downarrow 0} E\left[P|DI=di\right] \right). \end{aligned} \tag{6}$$

With perfect compliance to the IDR payment formula in Section 4, the expression in the first set of parentheses in equation (6) will resolve to 1, and the expression in the bottom set of parentheses will resolve to \$10 (the minimum monthly IDR payment). In the absence of perfect compliance, the empirical counterpart of the second term will be γ_1 in equation (3). Similarly, the empirical counterpart to the first term will be π_1 in the additional first-stage equation:

$$\mathbf{1}\left[P_{it}=0\right] = \lambda_t + \pi_0 DI_{it} + \pi_1 \mathbf{1}\left[DI_{it}\leq 0\right] + \pi_2 DI_{it}\mathbf{1}\left[DI_{it}\leq 0\right] + \nu_{it}. \tag{7}$$

Replacing population parameters in equation (6) with their empirical counterparts yields an expression for the RD estimand that is a function of the two treatment dimensions and first stage estimates of the discontinuities in payments and the probability of a \$0 payment: $\pi_1\tau_0 + \gamma_1\tau_P$. If $\tau_0 \neq 0$ and $\pi_1 \neq 0$, IV-RD estimates of the effect of a marginal increase in payments will equal $\frac{\pi_1}{\gamma_1}\tau_0 + \tau_P$ and will not recover the causal effect of a marginal increase in scheduled payments (τ_P).

The RK estimator can be written as:

$$\begin{aligned} &\lim_{di\uparrow 0} \left[\frac{\partial Y|DI=di}{\partial DI}\right] - \lim_{di\downarrow 0} \left[\frac{\partial Y|DI=di}{\partial DI}\right] \\ &= \tau_P \left(\lim_{di\uparrow 0} \left[\frac{\partial P|DI=di}{\partial DI}\right] - \lim_{di\downarrow 0} \left[\frac{\partial P|DI=di}{\partial DI}\right] \right). \end{aligned} \tag{8}$$

The empirical counterpart to the term inside the parentheses in equation (8) is the change in the slope of the relationship between scheduled payments and distance to the \$0 discretionary income threshold, or γ_2 in equation (3). This implies that the IV-RK estimator will represent a causal effect of a marginal increase in scheduled payments.

Note that equations (6) and (8) are interpretable as the reduced form change in the level and the reduced form change in the slope of the outcome at the \$0 discretionary income threshold, or β_1 and β_2 in equation (2). These expressions can be combined to produce expressions for τ_0 and τ_P that are only functions of estimatable parameters:

$$\tau_P = \frac{\beta_2}{\gamma_2} \tag{9}$$

$$\tau_0 = \frac{\beta_1}{\pi_1} - \left(\frac{\beta_2}{\gamma_2}\right)\left(\frac{\gamma_1}{\pi_1}\right). \tag{10}$$

The first term in equation (10) – $\frac{\beta_1}{\pi_1}$ – is equivalent to the IV-RD estimand when $\mathbf{1}[P_i = 0]$ is the endogenous regressor. The second term – $\frac{\beta_2}{\gamma_2}$ – is equivalent to the IV-RK estimand when P is the endogenous regressor. The third term – $\frac{\gamma_1}{\pi_1}$ – is the ratio of the first stage discontinuity in payment amounts to the first stage discontinuity in the probability of a \$0 payment.[39] Intuitively, if a \$0 payment affects a borrower through both a reduction in payment burden and through modifying the cost of inattention, then the RD estimate of the \$0 payment treatment effect will represent the combined influence of these parameters. The assumption of locally constant treatment effects and additive separability means that we can partial out the payment portion of the effect using the IV-RK estimate (i.e., since these assumptions imply there is no kink in the effect of waiving payment requirements) scaled by the relative magnitude of the first stages.

6.2 Estimation and results

To generate estimates of τ_0, we jointly estimate the two first stage equations (3) and (7) with the reduced form equation (2) and replace the quantities in equation (10) with estimates of each coefficient. Standard errors are calculated using the delta method.

Table 6 contains these estimates. The results in Panel A indicate that in a borrower's initial year on IDR, eliminating the requirement to make payments reduces delinquency risk by 26 percentage points. In comparison to the estimates of τ_P, this is approximately the same effect as a \$330 reduction in monthly payments. Waiving payment requirements leads to smaller but still significant

[39] Note that if $\pi_2 = 0$ (i.e., there is no kink in the probability of a \$0 scheduled payment at the threshold), then the expressions in equations (9) and (10) will be equivalent to what would be obtained from 2SLS with two endogenous regressors and two instruments.

reductions in default risk (approximately 3 percentage points) and forbearance use (approximately 7 percentage points). If the benefits of removing the payment requirement accrue through reducing the cost of inattention to monthly payment requirements, these results suggest that the cost of such inattention is quite high.

The estimates of τ_P in Table 6 suggest that a marginal decrease in monthly payments increases the likelihood that a borrower reapplies for IDR by 0.6 percentage points per $10 reduction in monthly payments. In contrast, estimates of τ_0 shown in Table 6 suggest that waiving the requirement to make payments has the opposite effect and results in a 1.7 percentage point reduction in the probability of reapplying in year 1 and a 3.4 percentage point reduction in year 2. The resulting effect on IDR participation is a 3 to 3.5 percentage point reduction in both the second and third years after initial application. The consequence is a significant increase in delinquency (4 and 2 percentage points in years 2 and 3, respectively) and forbearance (2 and 1 percentage points). Increases in default are only present in year 3 (0.8 percentage points). These effects are also consistent with a sizable cost of inattention, in this case, to the requirement to reapply for IDR.

7 Conclusion

The IDR program impacts an increasingly large share of student loan borrowers who hold the majority of outstanding student loan debt. Many IDR participants qualify for $0 payments. A key question is whether lower (or no) monthly loan payments on IDR helps improve borrower repayment outcomes. We show that $0 payments do protect borrowers by staving off delinquency and default in the short term. Nonetheless, the dynamics of treatment effects over time suggest that in the presence of annual reapplication requirements, many borrowers see only temporary protection from repayment difficulties. Borrowers who initially qualify for a $0 monthly payment are significantly less likely to submit an IDR recertification application and, as a result, see significant reductions in persistence on IDR. We provide evidence that the short-run benefits from $0 payments come from both a relaxation of borrowers' budget constraints and through reducing the cost of inattention to payment requirements, with the latter channel dominating. Our results are consistent with inattention (to reapplication requirements) driving the longer-run effects of $0 payments as well, possibly due to borrowers becoming disconnected from the loan repayment

system.

The timing and frequency of recertification requirements has been studied in the context of other U.S. means-tested benefit programs, such as the Supplemental Nutrition Assistance Program, cash welfare, and public health insurance (Ribar et al., 2008; Pei, 2017; Gray, 2019). In addition to examining the traditional trade-offs between type I and type II errors (Kleven and Kopczuk, 2011), recent papers also shed light on the role of behavioral factors such as misperceptions of estimated benefits or inattention (Homonoff and Somerville, 2021; Finkelstein and Notowidigdo, 2019). Our results suggest that policies that reduce the cost of inattention – either through longer recertification periods or policies that increase the salience of recertification requirements – may provide substantial benefits to borrowers. One such policy is the provisions for automatic recertification due to the 2019 FUTURE Act. Beginning in 2023, borrowers in IDR will be able to provide consent for their income to be provided on an annual basis such that they will automatically be recertified for IDR. Our results suggest this policy has the potential to increase the longer-run insurance benefits of IDR participation.

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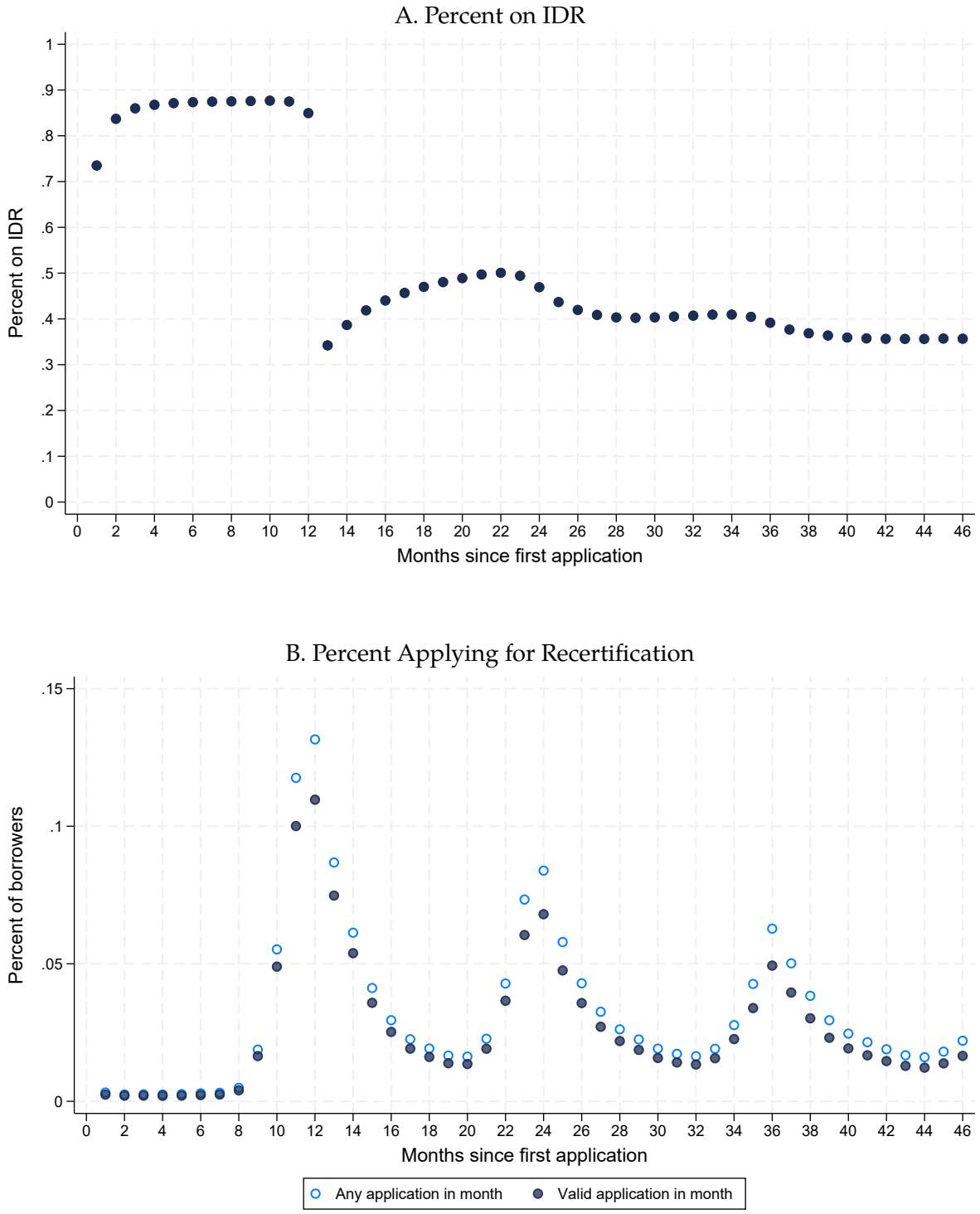
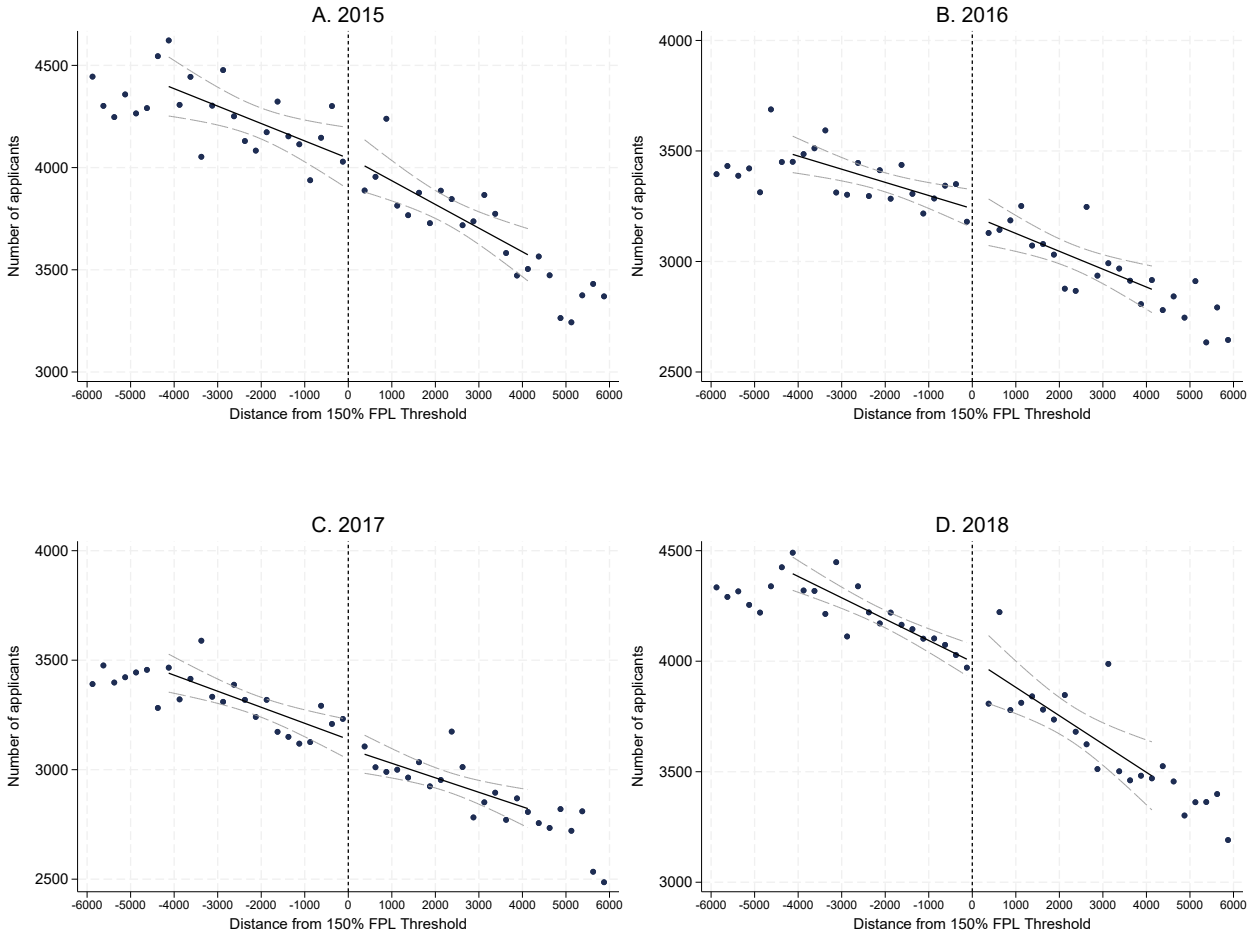
Figures and Tables

Figure 1: IDR Participation and Recertification by Months Since Initial Application



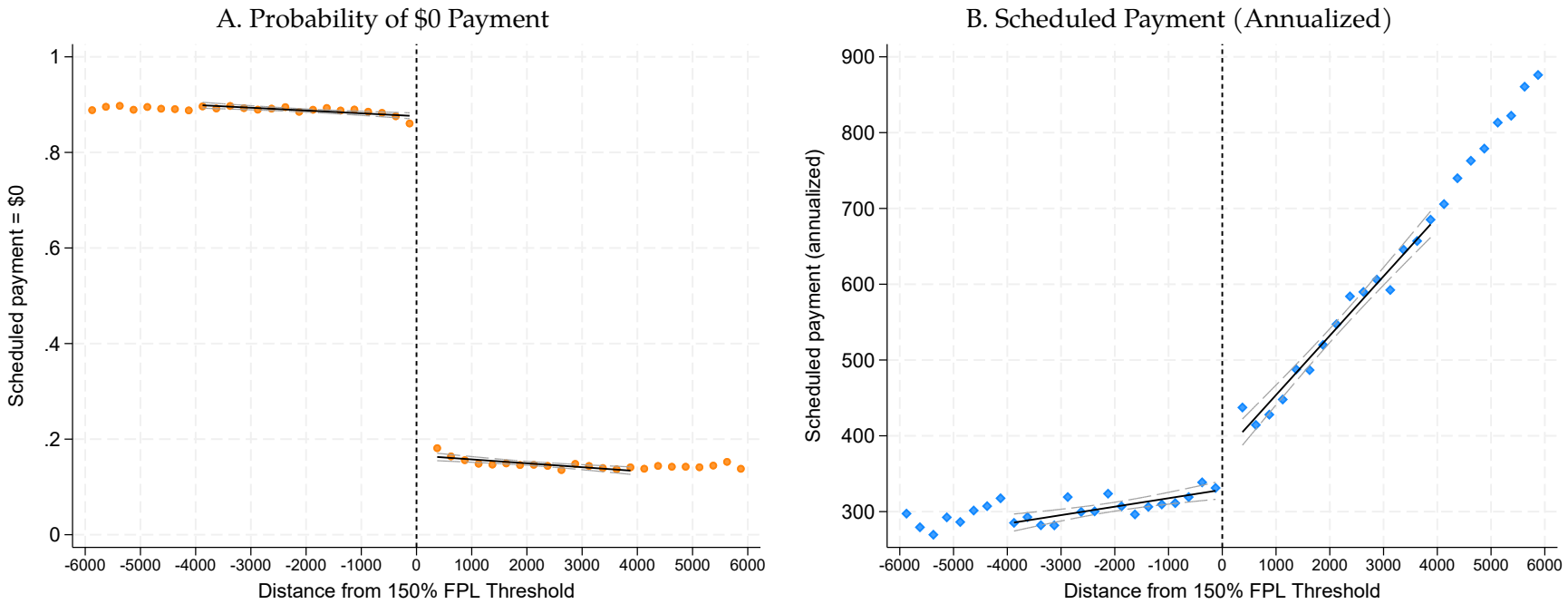
Notes: The sample includes first-time IDR applicants in 2015 through 2018. Recertification applications are defined as subsequent applications submitted by first-time applicants successfully enrolled in an IDR plan after their first application submission. Valid applications are IDR applications that are approved.

Figure 2: Number of IDR Applicants by Distance to $0 Discretionary Income Threshold



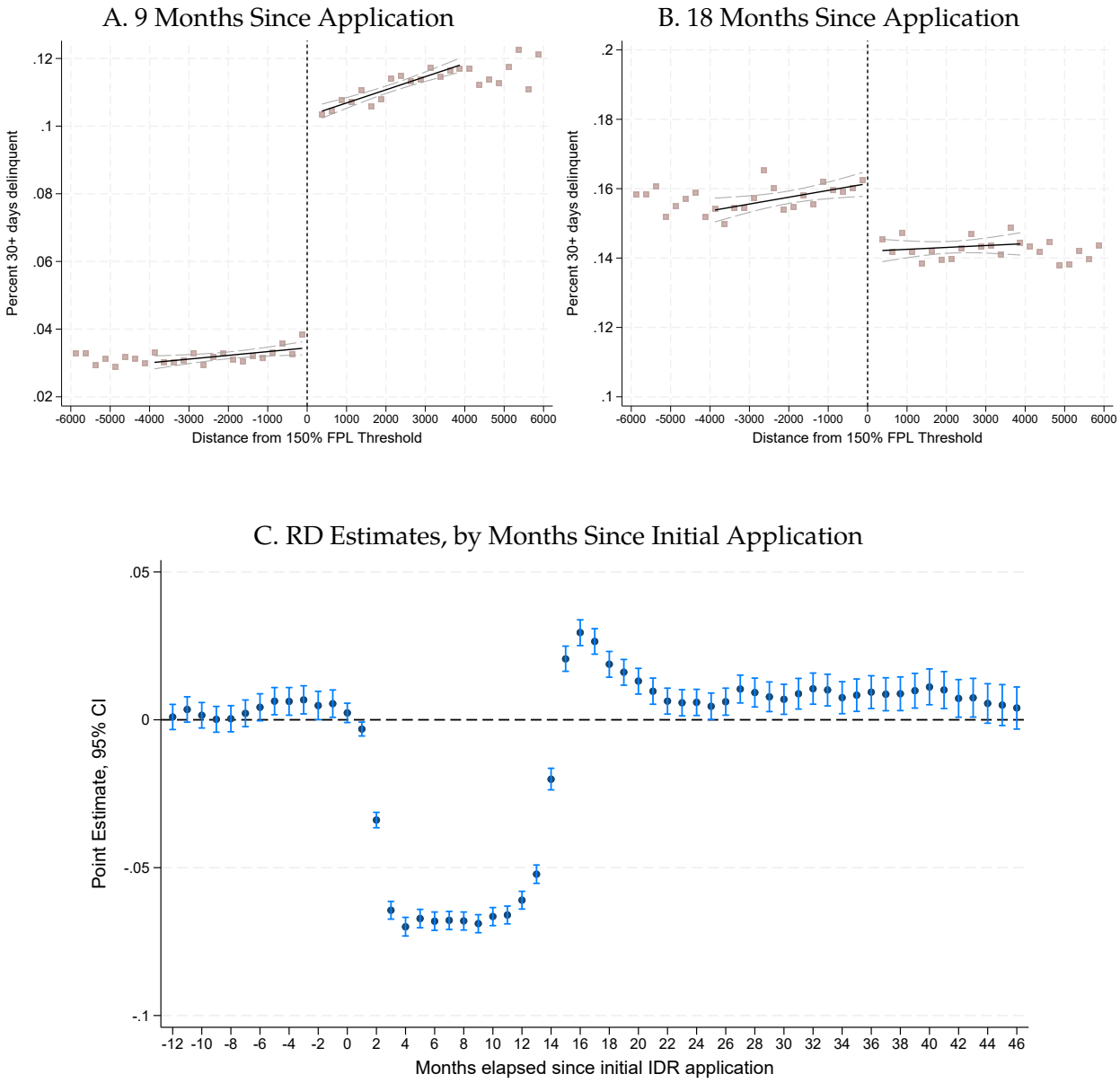
Notes: The sample includes first-time IDR applicants in 2015 through 2018 who had income within $6,000 of the $0 discretionary income threshold. Scatter plots of the number of first-time IDR applicants within a $250 income bin, by distance to the $0 discretionary income cutoff (150% FPL). Dark lines represent OLS estimates of the outcome by distance to the $0 discretionary income threshold, estimated separately on either side of the threshold for applicants within a $4,350 bandwidth around the cutoff. Dashed gray lines represent 95% confidence intervals for OLS estimates, based on heteroskedasticity robust standard errors.

Figure 3: Scheduled Payments by Distance to $0 Discretionary Income Threshold, 9 Months After Initial IDR Application



Notes: Sample includes first-time IDR applicants in 2015 through 2018 who had income within $6,000 of the $0 discretionary income threshold and a non-missing scheduled payment 9 months after initial application. Scatter plots of the probability of a $0 payment (Panel A) or average scheduled payment (Panel B) within a $250 income bin, by distance to the $0 discretionary income cutoff (150% FPL). Each bin contains between 13,000 and 18,000 IDR applicants, pooling across 2015-2018 application cohorts. A "donut" of applicants with income between $0 and $200 above the 150% FPL cutoff is excluded from the sample; see Section 4 for details. Annualized scheduled payment is measured by summing monthly scheduled payments for all loans held by the applicant and multiplying by 12. Dark lines represent OLS estimates of the outcome by distance to the $0 payment threshold, estimated separately on either side of the threshold for applicants within a $4,350 bandwidth around the cutoff (weighted by the underlying number of individuals in each bin). Dashed gray lines represent 95% confidence intervals for OLS estimates, based on heteroskedasticity robust standard errors. Payment amounts are adjusted for inflation using the CPI-U and reported in 2022 dollars.

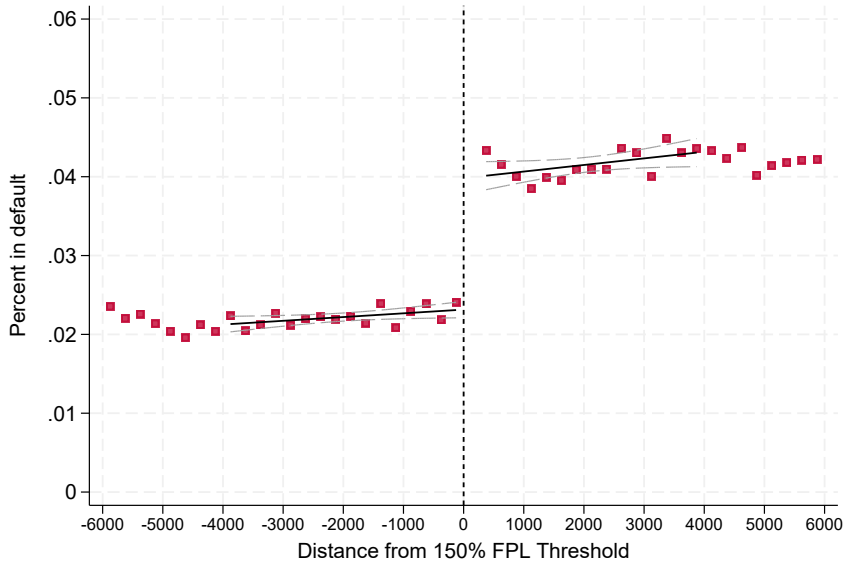
Figure 4: Reduced Form Impacts on Borrower Delinquency (30+ Days)



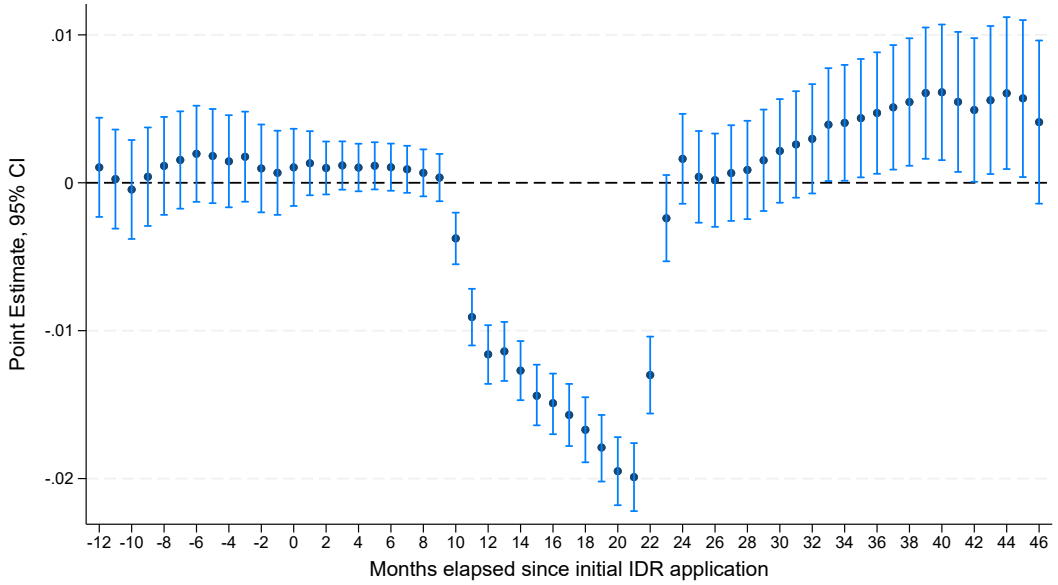
Notes: Sample includes first-time IDR applicants in 2015 through 2018 who had income within $6,000 of the $0 discretionary income threshold (Panels A and B) or within $4,350 of the threshold (Panel C). Panels A and B are scatter plots of the probability of being 30 or more days delinquent on a student loan payment in the specified time period within a $250 income bin, by distance to the $0 discretionary income threshold (150% FPL). Dark lines represent OLS estimates of the outcome by distance to the $0 discretionary income threshold, estimated separately on either side of the threshold for applicants within a $4,350 bandwidth around the cutoff (weighted by the underlying number of individuals in each bin). Dashed gray lines represent 95% confidence intervals for OLS estimates, based on heteroskedasticity robust standard errors. Panel C shows OLS estimates of β_1 from equation (2) and 95% confidence intervals based on heteroskedasticity robust standard errors; the outcome is the probability of being 30 or more days delinquent with a student loan payment in the indicated number of months before or after the borrower's first IDR application.

Figure 5: Reduced Form Impacts on Borrower Default

A. 18 Months After Initial Application

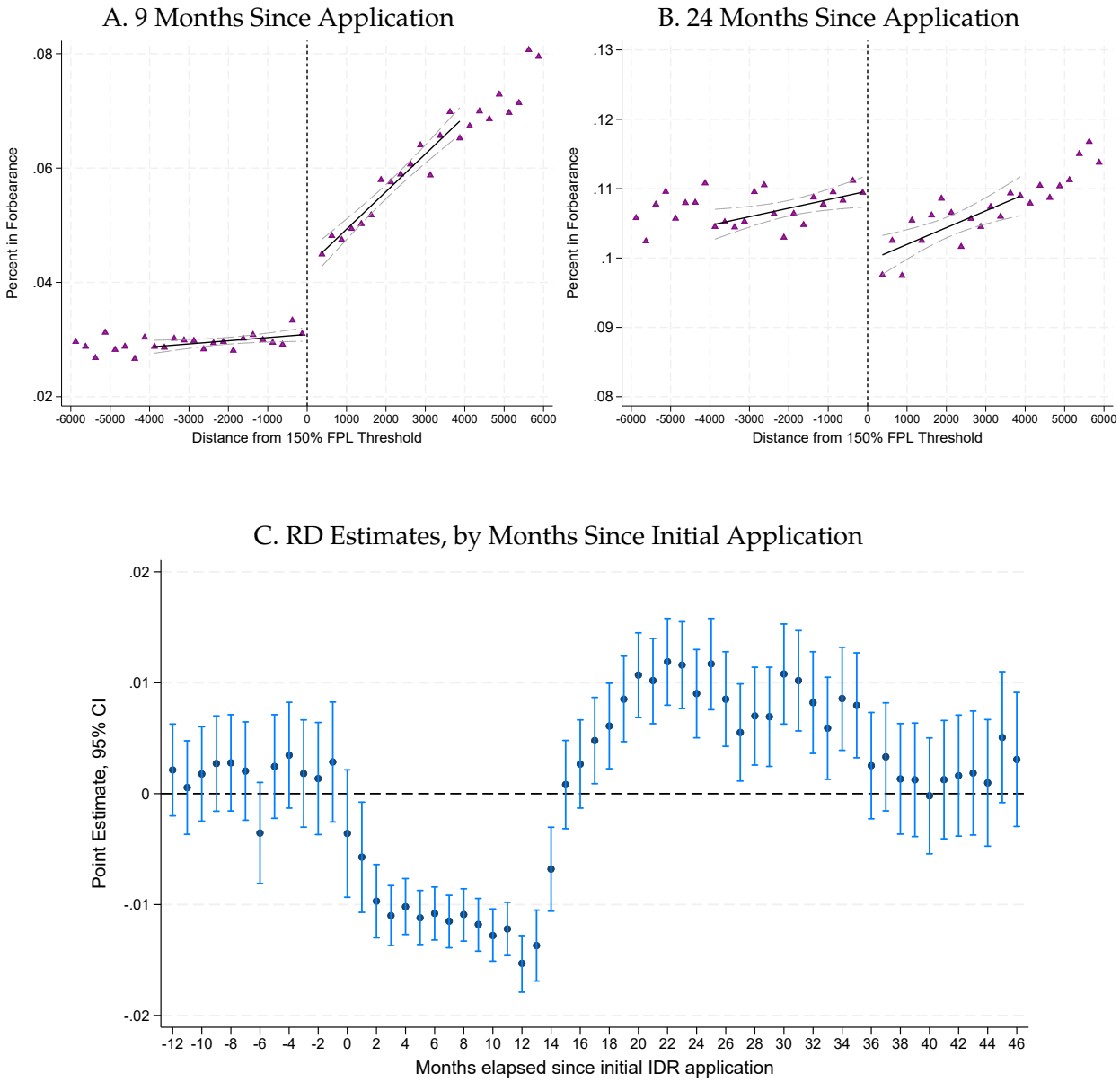


B. RD Estimates, by Months Since Initial Application



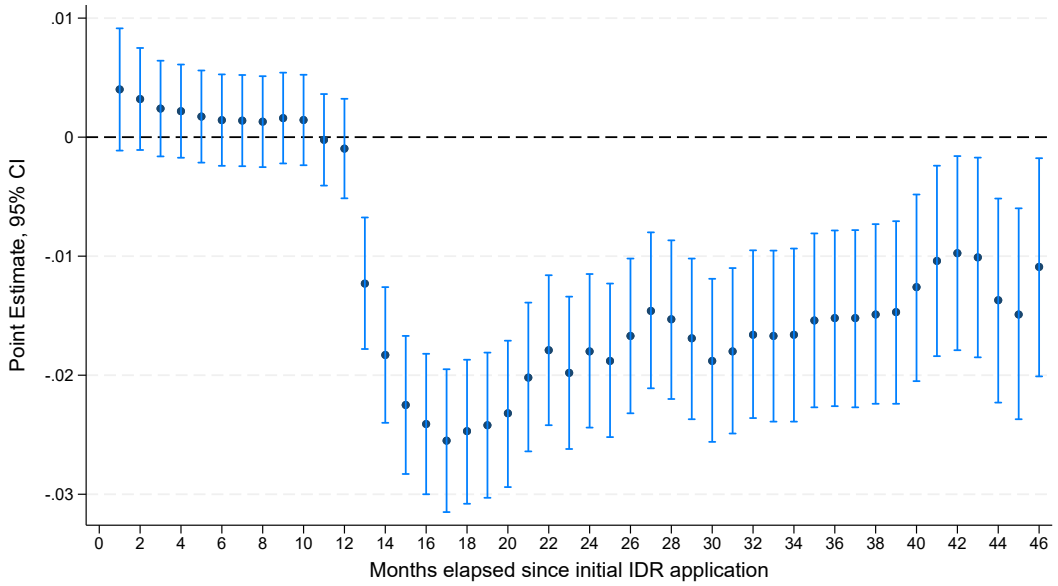
Notes: Sample includes first-time IDR applicants in 2015 through 2018 who had income within \$6,000 of the \$0 discretionary income threshold (Panel A) or within \$4,350 of the threshold (Panel B). Panel A is a scatter plot of the probability of being in default on a student loan 18 months after the borrower's first IDR application within a \$250 income bin, by distance to the \$0 discretionary income threshold (150% FPL). Dark lines represent OLS estimates of the outcome by distance to the \$0 discretionary income threshold, estimated separately on either side of the threshold for applicants within a \$4,350 bandwidth around the cutoff (weighted by the underlying number of individuals in each bin). Dashed gray lines represent 95% confidence intervals for OLS estimates, based on heteroskedasticity robust standard errors. Panel B shows OLS estimates of β_1 from equation (2) and 95% confidence intervals based on heteroskedasticity robust standard errors; the outcome is the probability of being in default on a student student loan in the indicated number of months before or after the borrower's first IDR application.

Figure 6: Reduced Form Impacts on Forbearance



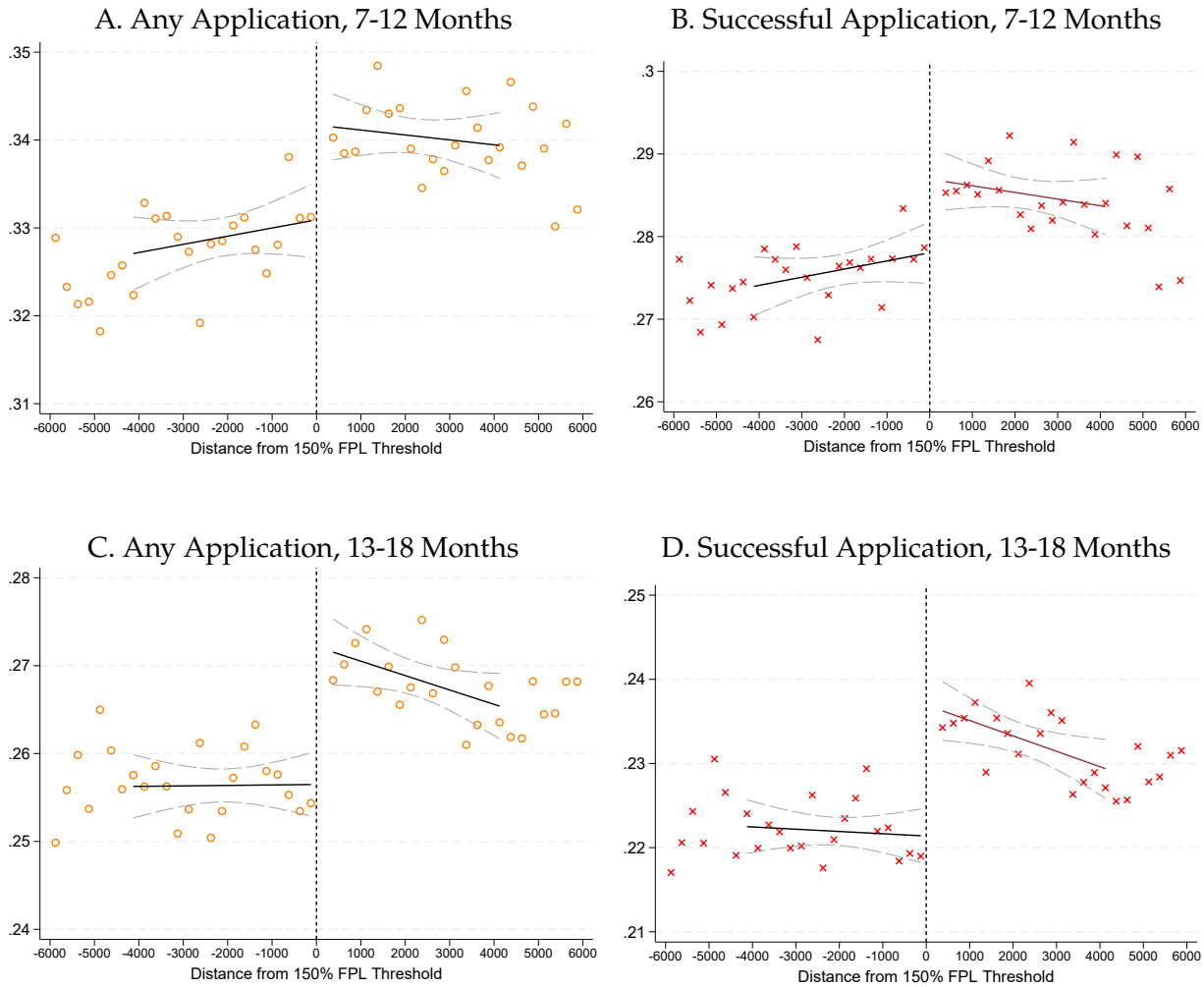
Notes: Sample includes first-time IDR applicants in 2015 through 2018 who had income within \$6,000 of the \$0 discretionary income threshold (Panels A and B) or within \$4,350 of the threshold (Panel C). Panels A and B are scatter plots of the probability of having a student loan in forbearance in the specified time period within a \$250 income bin, by distance to the \$0 discretionary income threshold (150% FPL). Dark lines represent OLS estimates of the outcome by distance to the \$0 discretionary income threshold, estimated separately on either side of the threshold for applicants within a \$4,350 bandwidth around the cutoff (weighted by the underlying number of individuals in each bin). Dashed gray lines represent 95% confidence intervals for OLS estimates, based on heteroskedasticity robust standard errors. Panel C shows OLS estimates of β_1 from equation (2) and 95% confidence intervals based on heteroskedasticity robust standard errors; the outcome is the probability of having a student loan in forbearance in the indicated number of months before or after the borrower's first IDR application.

Figure 7: RD Estimates of Effects on Persistence in IDR Program by Months Since Initial IDR Application



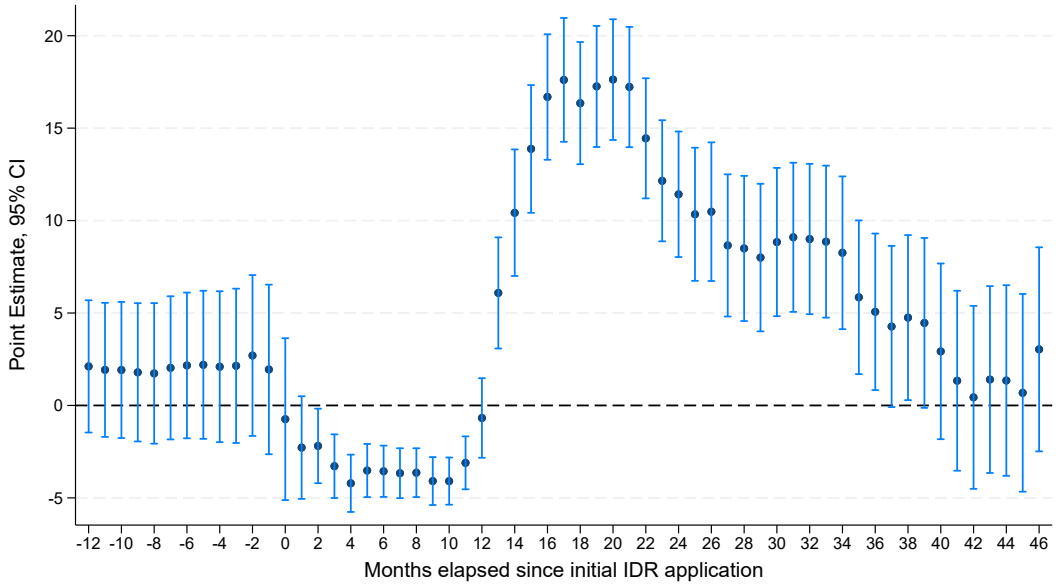
Notes: Sample includes first-time IDR applicants in 2015 through 2018 who had income within \$4,350 of the \$0 discretionary income threshold. OLS estimates of β_1 from equation (2) and 95% confidence intervals based on heteroskedasticity robust standard errors; the outcome is the probability of being in an IDR plan in the indicated number of months after the borrower's first IDR application.

Figure 8: IDR Reapplication Rates by Income and Month Since Application



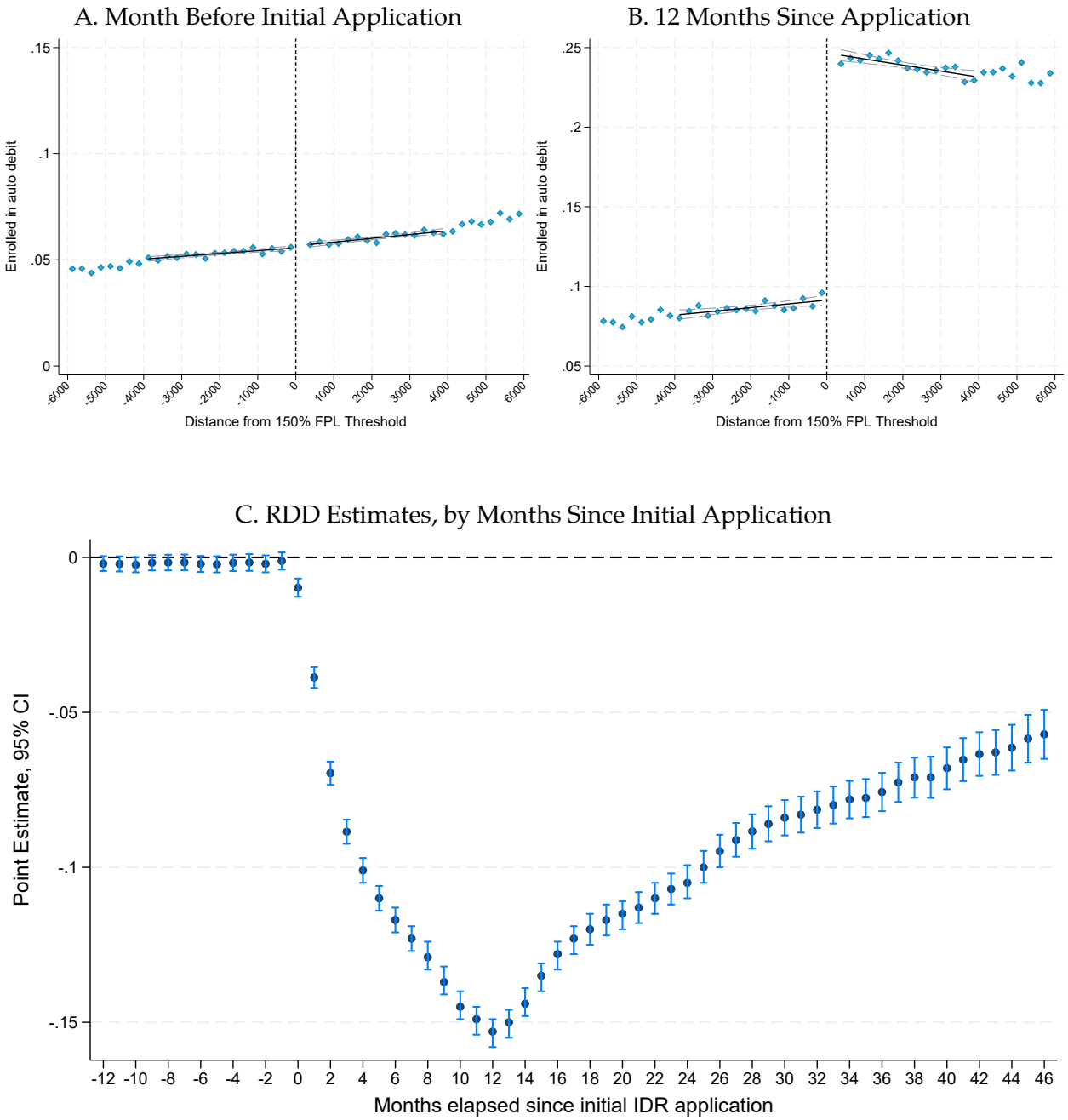
Notes: Sample includes first-time IDR applicants in 2015 through 2018 who had income within $6,000 of the $0 discretionary income threshold. Scatter plots of the probability of submitting an IDR application (Panels A and C) or the probability of submitting an IDR application that was approved (Panels B and D) in the specified time period within a $250 income bin, by distance to the $0 discretionary income threshold (150% FPL). Dark lines represent OLS estimates of the outcome by distance to the $0 discretionary income threshold, estimated separately on either side of the threshold for applicants within a $4,350 bandwidth around the cutoff (weighted by the underlying number of individuals in each bin). Dashed gray lines represent 95% confidence intervals for OLS estimates, based on heteroskedasticity robust standard errors.

Figure 9: RD Estimates of Effects on Scheduled Payments by Months Since Initial IDR Application



Notes: Sample includes first-time IDR applicants in 2015 through 2018 who had income within $4,350 of the $0 discretionary income threshold and a nonmissing scheduled payment in the specified time period, measured by months since the date of the first IDR application, with negative months corresponding to months prior to initial application. OLS estimates of β_1 from equation (2) and 95% confidence intervals based on heteroskedasticity robust standard errors. The outcome is scheduled monthly payments, adjusted for inflation using the CPI-U, and reported in 2022 dollars.

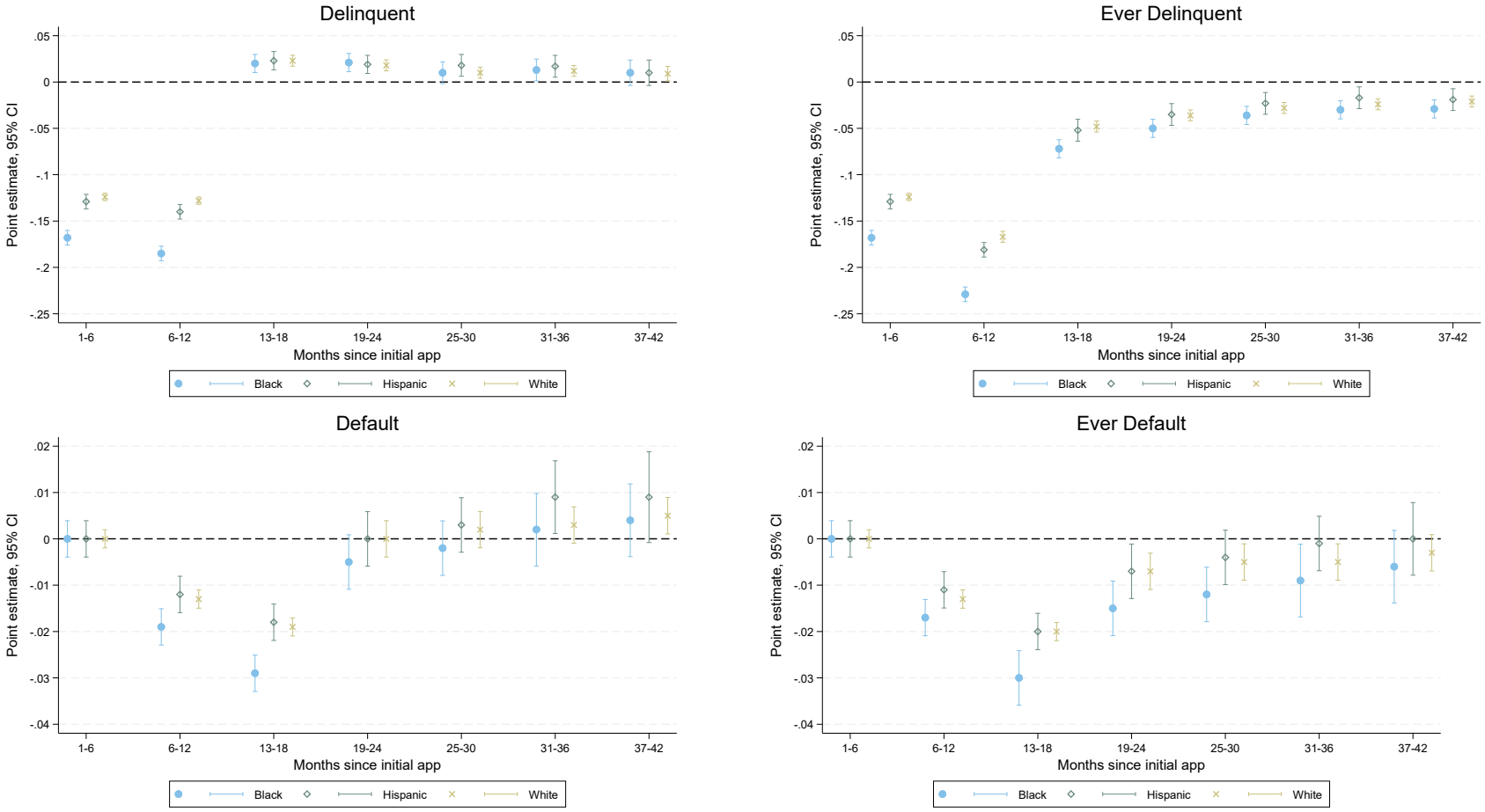
Figure 10: Reduced Form Effects on Use of Auto Debit



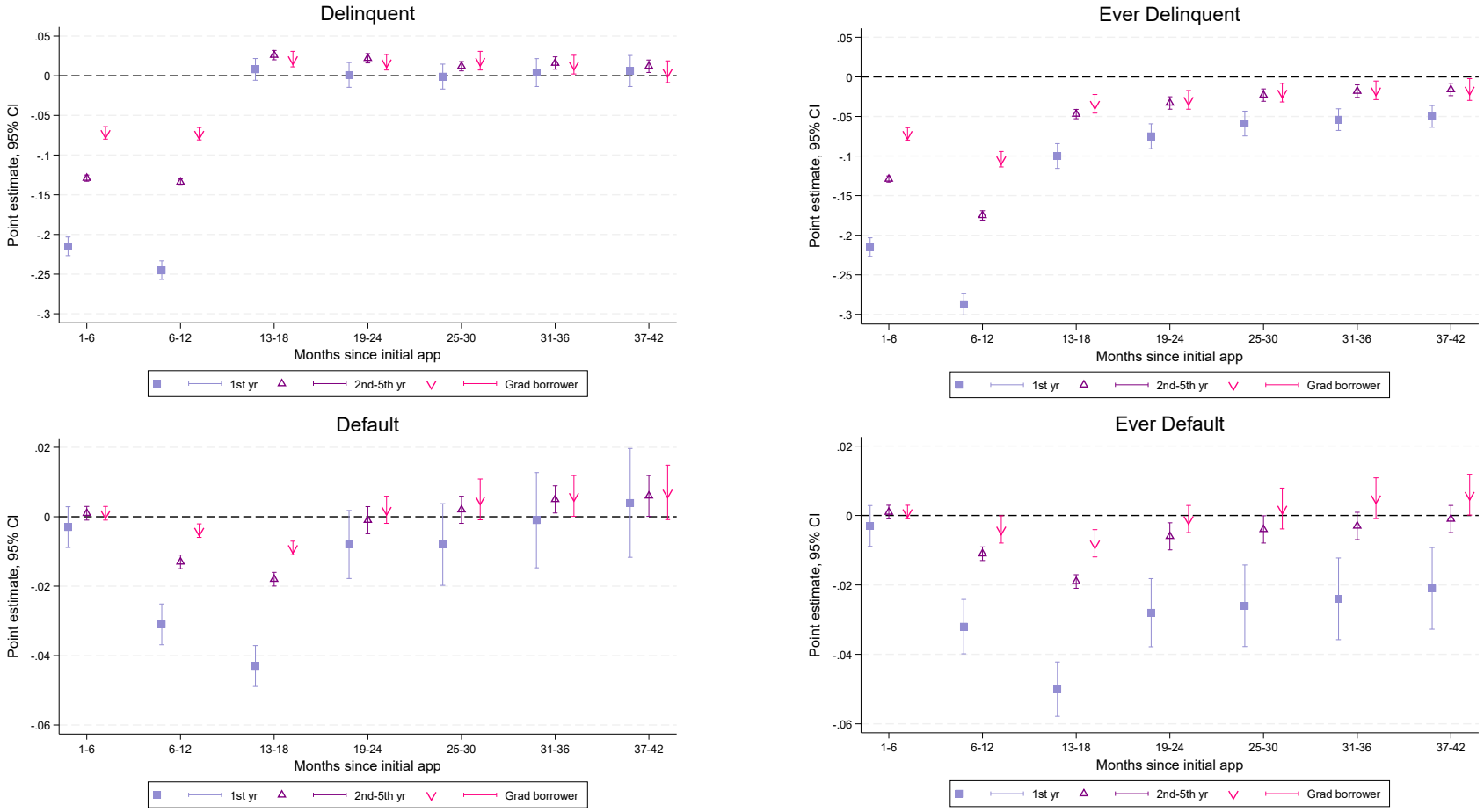
Notes: Sample includes first-time IDR applicants in 2015 through 2018 who had income within $6,000 of the $0 discretionary income threshold (Panels A and B) or within $4,350 of the threshold (Panel C). Panels A and B are scatter plots of the probability of using auto debit for student loan payments in the specified time period within a $250 income bin, by distance to the $0 discretionary income threshold (150% FPL). Dark lines represent OLS estimates of the outcome by distance to the $0 discretionary income threshold, estimated separately on either side of the threshold for applicants within a $4,350 bandwidth around the cutoff (weighted by the underlying number of individuals in each bin). Dashed gray lines represent 95% confidence intervals for OLS estimates, based on heteroskedasticity robust standard errors. Panel C shows OLS estimates of β_1 from equation (2) and 95% confidence intervals based on heteroskedasticity robust standard errors; the outcome is the probability of using auto debit for student loan payments in the indicated number of months before or after the borrower's first IDR application.

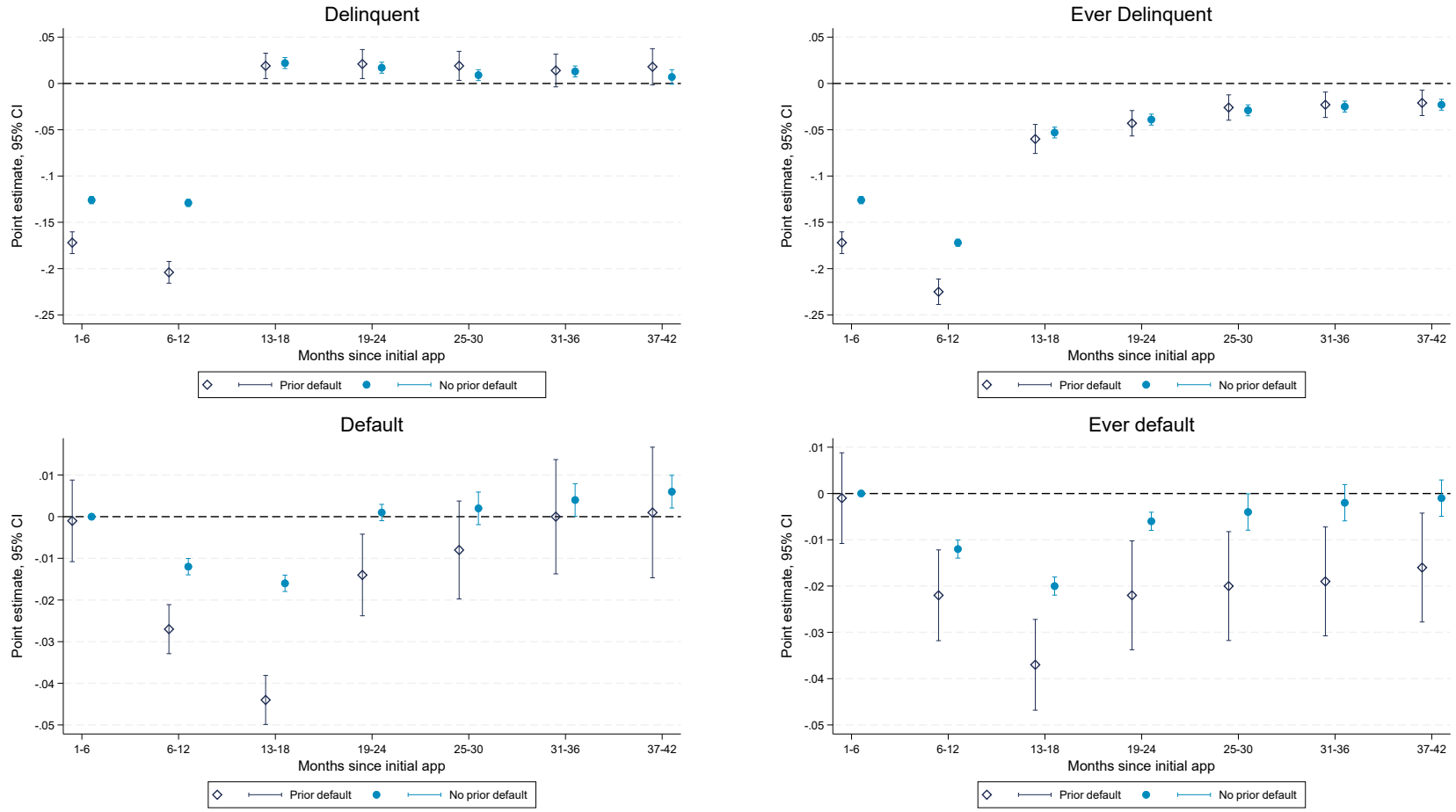
Figure 11: Heterogeneity in Effects on Delinquency and Default by Predicted Race/Ethnicity

A. Race/ethnicity (predicted probability)



B. Educational Attainment





Notes: Sample includes first-time IDR applicants in 2015 through 2018 who had income within $4,350 of the $0 discretionary income threshold. Each plot shows OLS estimates of β_1 from equation (2). In Panel A, observations are weighted using the predicted probability of belonging to the specified racial/ethnic group. Predicted racial probabilities are based on logit fitted values from a model of self-reported race on individual characteristics (first and last name, zip code, etc.) using the 2016 NPSAS survey and extrapolated to the borrower population. In Panels B and C, models are estimated separately for each subgroup. Outcomes are indicators for the probability of being 30+ days delinquent or in default on a student loan payment within the specified 6-month period (left panels) or since applying for IDR (right panels). 95% confidence intervals are based on heteroskedasticity robust standard errors.

Table 1: Characteristics of IDR Applicants

	All first-time IDR applicants	$4350 bandwidth
Outstanding balance	$52,118	$44,082
Scheduled monthly payment	$385	$349
IDR application information		
Income	$23,371	$27,717
Household Size	2.0	1.9
Married	9%	7%
Borrower Characteristics		
Graduate loans	23%	17%
Years since repayment entry >= 2	33%	32%
Prior default	18%	17%
First FAFSA Characteristics		
Dependent	54%	61%
Family AGI	$54,398	$55,292
Female	69%	69%
Observations	5,646,325	636,332

Notes: The Sample includes first-time IDR applicants in 2015 through 2018; limited to those who had income within $4,350 of the $0 discretionary income threshold in the second column. Outstanding student loan balances are measured at the month of initial IDR application. Scheduled monthly payments are measured 3 months before initial application and only reported for borrowers in repayment. All dollar amounts adjusted for inflation using the CPI-U and reported in 2022.

Table 2: Placebo Estimates - Applicant Characteristics at the 150% FPL $0 Payment Cutoff

	A. Borrower characteristics and attainment							
	(1) Age	(2) Gender = female	(3) Family income‡	Predicted probability race/ethnicity = (4) Black	(5) Hispanic	(6) White	Highest attainment§ (7) 1st yr	(8) Grad
$\mathbf{1}[DI \leq 0]$	0.010	-0.006	371	-0.0004	-0.002	0.003	0.0001	0.003
	(0.055)	(0.003)*	(399)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)
Dep var mean	31.2	0.687	$56,406	0.198	0.144	0.577	0.148	0.189
Observations	472,154	469,820	471,689	481,095	481,095	481,095	484,571	484,571
	B. Initial IDR application, debt, repayment							
	(9) HH size	(10) Married	Application income source (11) Taxes	(12) ADOI	(13) Outst. debt	(14) Any prior default	(15) Auto debit	(16) Index
$\mathbf{1}[DI \leq 0]$	0.007	0.0001	0.0005	-0.0005	658	0.002	-0.002	0.001
	(0.007)	(0.001)	(0.003)	(0.003)	(281)*	(0.002)	(0.001)	(0.001)
Dep var mean	1.90	0.064	0.728	0.272	$45,874	0.174	0.067	0.084
Observations	484,571	484,571	484,571	484,571	484,571	484,571	484,571	484,571

Notes: The sample includes first-time IDR applicants in 2015 through 2018 who had income within $4,350 of the $0 discretionary income threshold. Point estimates from regressions of the baseline characteristic indicated in the column heading on discretionary income (DI, defined as AGI minus 150% FPL), an indicator for AGI less than or equal to 150% FPL, and an interaction between these variables. Household size, marital status, and application income source based on initial IDR application. Highest and attainment years since entering repayment measured as of the month before initial application submission. Auto debit measured over the 6 months prior to initial application submission. Age, gender, and family income from first FAFSA. Index is the predicted probability of defaulting in the 2 years after initial application, based on all observable baseline characteristics. Robust standard errors in parentheses; ** $p < 0.01$, ** $p < 0.05$, + $p < 0.1$. § Highest attainment is highest level as borrower. ‡ From first FAFSA, adjusted for inflation (2022 dollars).

Table 3: Summary of First Stage Effects on Payments

	(1) Scheduled monthly payment	(2) Any scheduled $0 payment
$\mathbf{1}[DI \leq 0]$	-2.96	0.643
	(0.69)**	(0.002)**
Mean | DI > 0	$59.41	0.232
Observations	488,937	488,937

Notes: The sample includes first-time IDR applicants in 2015 through 2018 who had income within $4,350 of the $0 discretionary income threshold. Point estimates from regressions of scheduled monthly payments or the probability of having a $0 scheduled payment over the 12 months after initial application on discretionary income (defined as AGI – 150% FPL), an indicator for AGI less than or equal to 150% FPL, an interaction between these variables, and application year fixed effects. Robust standard errors in parentheses; ** $p < 0.01$, ** $p < 0.05$, + $p < 0.1$.

Table 4: Reduced Form Estimates, Effects on Risk of Delinquency, Default, and Forbearance

	(1)	(2)	(3)	(4)	(5)
	Any in 12 month period			Any since initial IDR app	
Years since initial IDR application =	*1*	*2*	*3*	*2*	*3*
A. Delinquency					
$\mathbf{1}[DI \leq 0]$	-0.180	0.028	0.015	-0.035	-0.013
	(0.0023)**	(0.0029)**	(0.0034)**	(0.0031)**	(0.0036)**
Mean | $DI > 0$	0.272	0.307	0.306	0.400	0.467
Observations	488,937	444,490	334,001	444,490	334,001
B. Default					
$\mathbf{1}[DI \leq 0]$	-0.024	0.0001	0.006	-0.005	0.004
	(0.0010)**	(0.002)	(0.0021)**	(0.0018)**	(0.002)
Mean | $DI > 0$	0.041	0.067	0.088	0.091	0.122
Observations	488,937	444,490	334,001	444,490	334,001
C. Forbearance					
$\mathbf{1}[DI \leq 0]$	-0.052	0.013	0.009	-0.015	-0.007
	(0.0021)**	(0.0027)**	(0.0031)**	(0.0029)**	(0.0036)*
Mean | $DI > 0$	0.183	0.257	0.244	0.353	0.452
Observations	488,937	444,490	334,001	444,490	334,001

Notes: The sample includes first-time IDR applicants in 2015 through 2018 who had income within $4,350 of the $0 discretionary income threshold. Point estimates from regressions of the probability of delinquency (30+ days late), default, or forbearance in the specified 12-month period (columns 1-3) or since initial application on discretionary income, an indicator for AGI less than or equal to 150% FPL, an interaction between these variables, and application year fixed effects. Defaults are lagged by 6 months (e.g., year 1 = 6-18 months after initial application). Robust standard errors in parentheses; ** $p < 0.01$, ** $p < 0.05$, + $p < 0.1$.

Table 5: Reduced Form Estimates, Effects on IDR Persistence

Years since initial IDR application =	*2*	*3*
A. In an IDR plan		
$\mathbf{1}[DI \leq 0]$	-0.021	-0.021
	(0.003)**	(0.004)**
Mean | $DI > 0$	0.561	0.556
Observations	451,183	338,848
B. Any (re)application to date		
$\mathbf{1}[DI \leq 0]$	-0.021	-0.019
	(0.003)**	(0.003)**
Mean | $DI > 0$	0.676	0.741
Observations	451,183	338,848
C. Successful (re)application to date		
$\mathbf{1}[DI \leq 0]$	-0.021	-0.021
	(0.003)**	(0.003)**
Mean | $DI > 0$	0.591	0.682
Observations	451,183	338,848

Notess: The sample includes first-time IDR applicants in 2015 through 2018 who had income within $4,350 of the $0 discretionary income threshold. Point estimates from regressions of the probability of being on an IDR plan, any IDR application submitted since the initial application, and any successful application submitted since the initial application, measured over the period indicated in column headings, an indicator for AGI less than or equal to 150% FPL, an interaction between these variables, and application year fixed effects. Robust standard errors in parentheses; ** $p < 0.01$, ** $p < 0.05$, + $p < 0.1$.

Table 6: Contemporaneous and Longer-Run Effects of Marginal Reductions in Monthly Payments and Waiving the Requirement to Make Payments

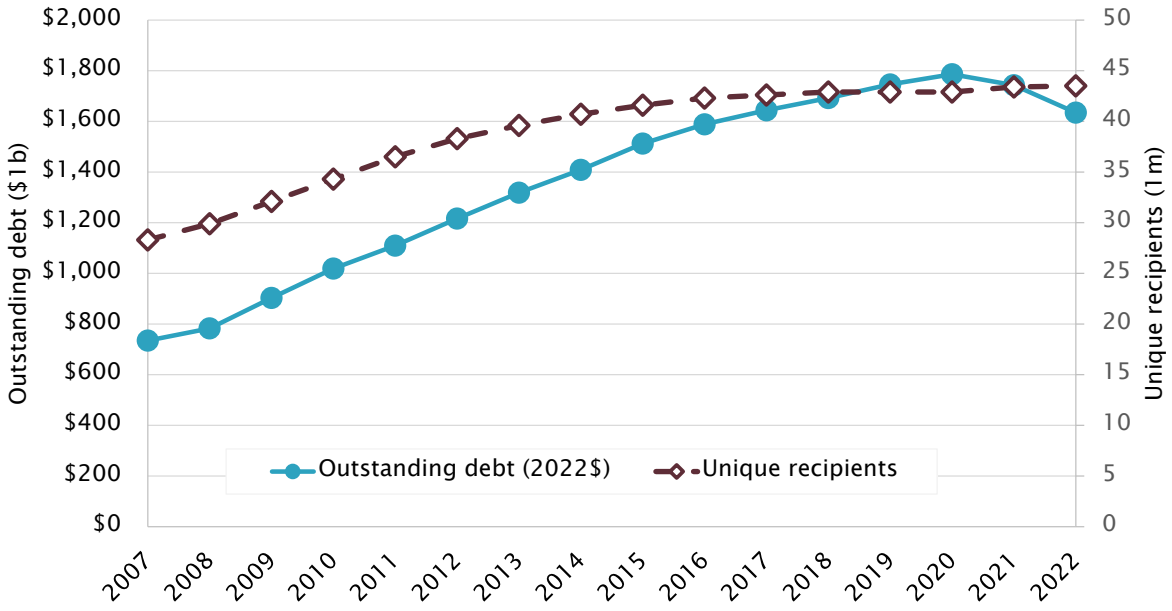
	(1) Delinquent	(2) Default	(3) Forbearance	(4) Any IDR app TD	(5) In IDR
A. Contemporaneous (year of app)					
τ_0	-0.264	-0.034	-0.066	-0.017	--
	(0.004)**	(0.002)**	(0.005)**	(0.004)**	--
τ_P	-0.008	-0.002	-0.025	0.002	--
	(0.002)**	(0.001)*	(0.002)**	(0.002)	--
B. One year later					
τ_0	0.04	0.0001	0.022	-0.034	-0.035
	(0.005)**	(0.002)	(0.004)**	(0.005)**	(0.005)**
τ_P	0.005	0.001	-0.009	0.006	0.007
	(0.002)*	(0.001)	(0.002)**	(0.002)**	(0.002)**
C. 2 years later					
τ_0	0.021	0.008	0.014	-0.030	-0.033
	(0.005)**	(0.003)*	(0.005)**	(0.005)**	(0.006)**
τ_P	0.004	0.002	-0.001	0.004	0.006
	(0.002)	(0.001)	(0.002)	(0.002)+	(0.003)*

Notess: Estimates of the effect of a marginal reduction in monthly payments, multiplied by -10 so that estimates reflect the effect of a \$10 decrease in payments (τ_p) and the effect of not having to make payments (τ_0) on repayment outcomes, IDR recertification, and persistence in IDR. See Section 6 for additional details.

Appendix

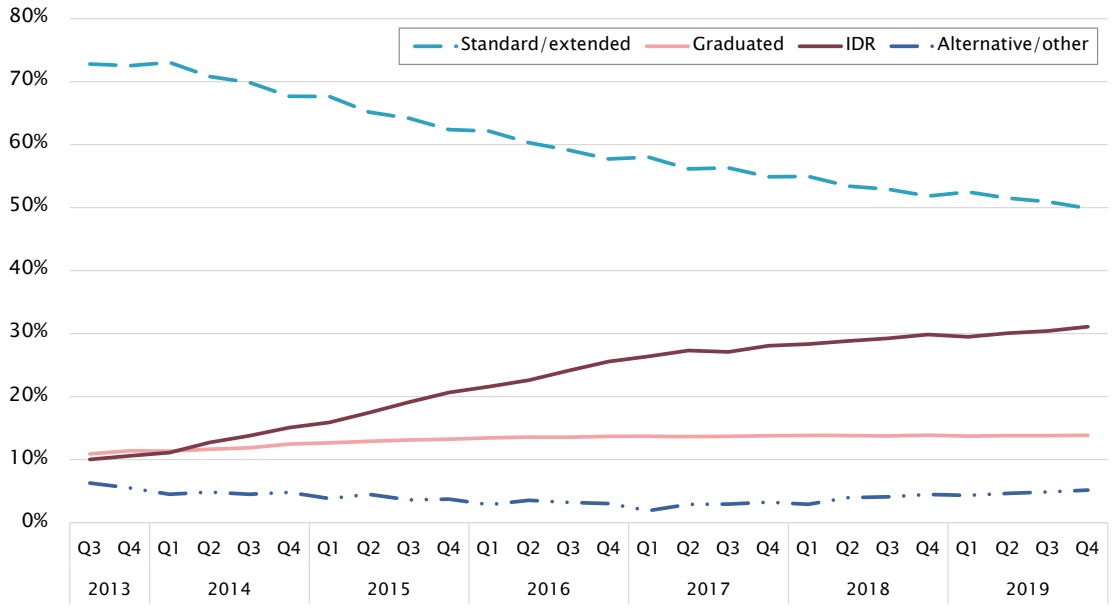
Appendix A Additional Figures and Tables

Figure A.1: Outstanding debt and unique borrowers by Federal Fiscal Year



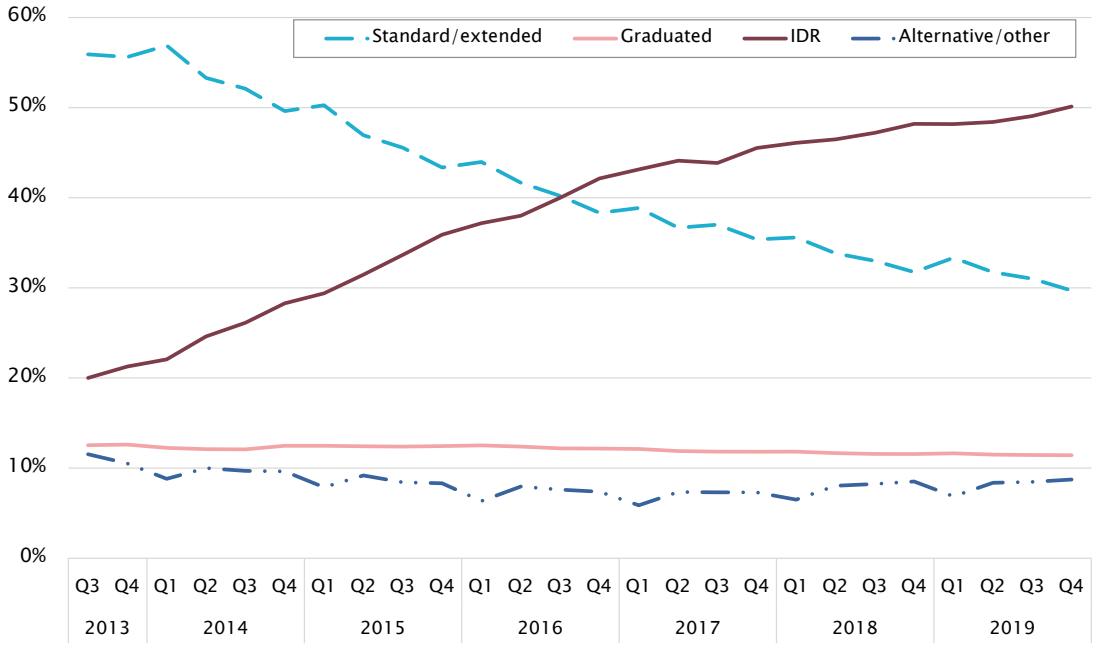
Source: Federal Student Aid Portfolio Summary (https://studentaid.gov/data-center/student/portfolio, accessed 7/15/2023).

Figure A.2: Percent of Direct Loan Borrowers by Repayment Plan



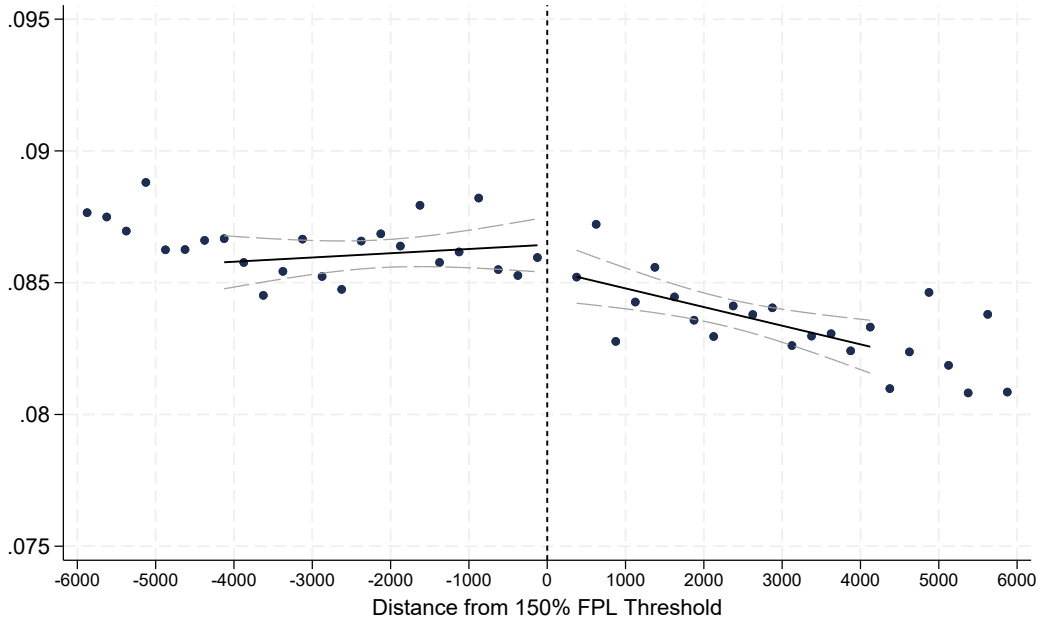
Source: Publicly available data on borrowers with Direct Loans in repayment, forbearance, or deferment, from FSA Data Center.

Figure A.3: Percent of Student Loan Debt by Repayment Plan



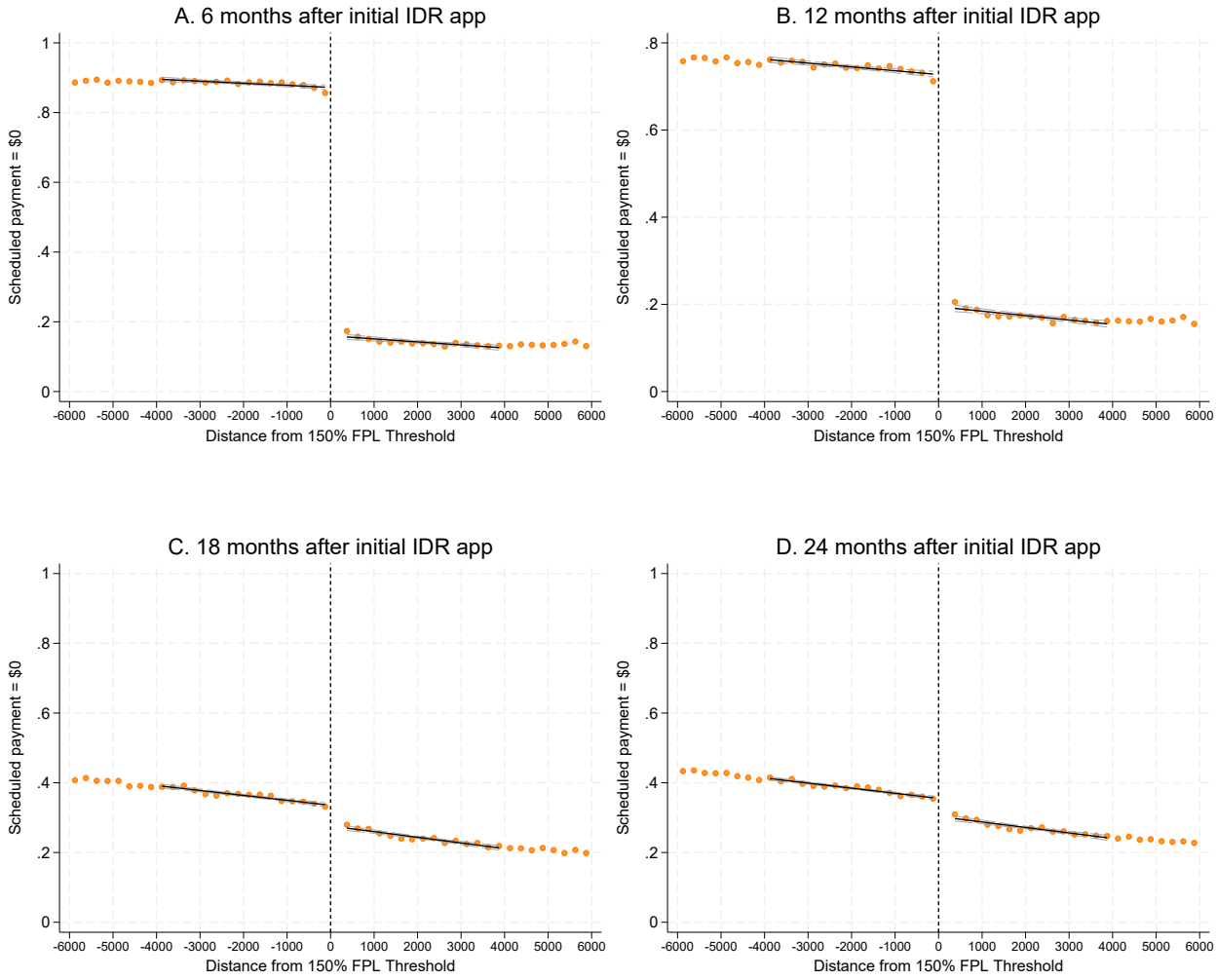
Source: Publicly available data on outstanding balances by repayment plan for Direct Loans in repayment, forbearance, or deferment from FSA Data Center.

Figure A.4: Index of Baseline Characteristics by Income Relative to 150% of Federal Poverty Line



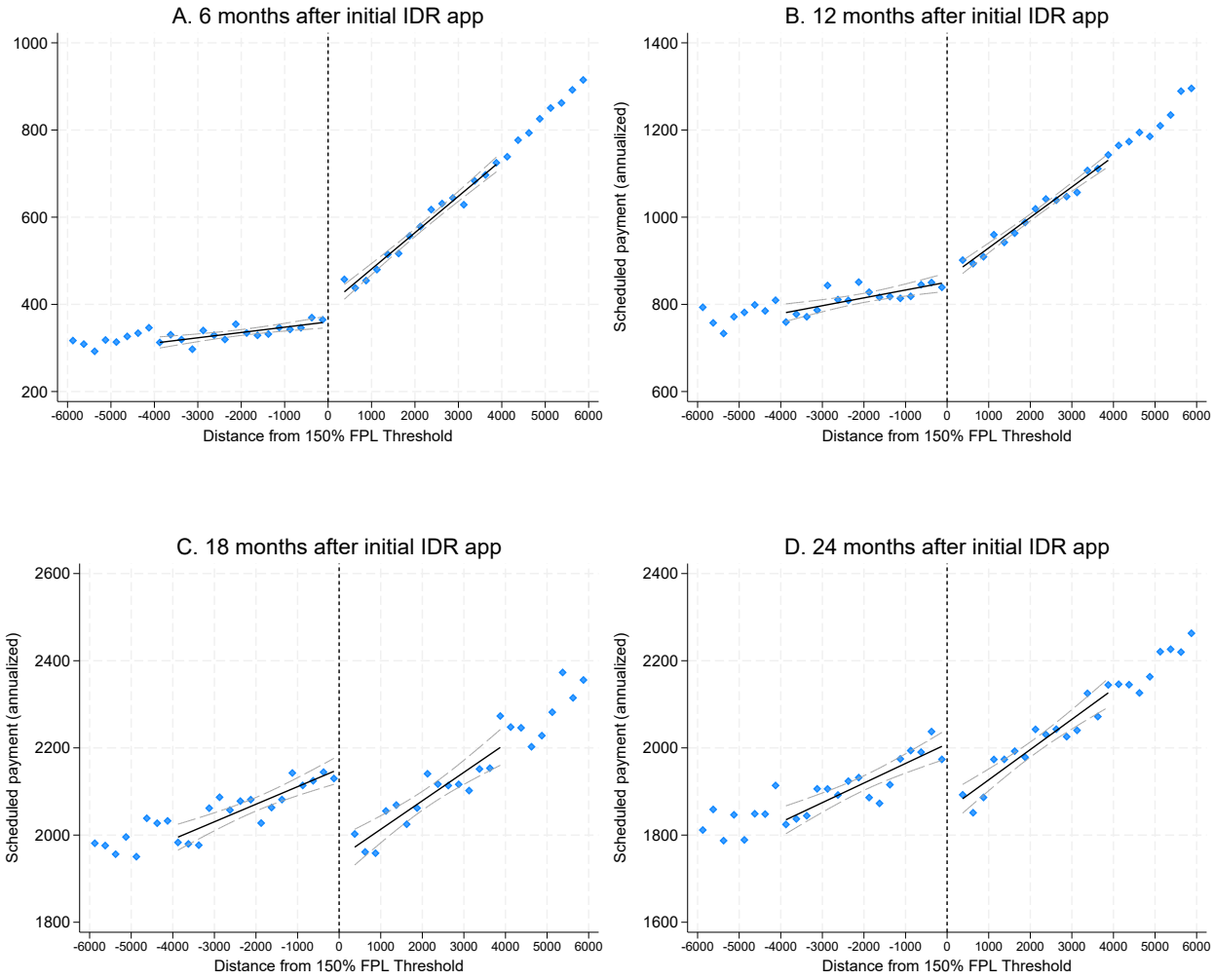
Notes: Sample includes first-time IDR applicants in 2015 through 2018 who had income within $6000 of the $0 discretionary income threshold and a non-missing scheduled payment 9 months after initial application. A "donut" of applicants with income between $0 and $200 above the 150% FPL cutoff is excluded from the sample, see Section 4 for details. Linear OLS estimates on either side of the threshold are estimated for applicants within a $4,350 bandwidth around the cutoff (weighted by the underlying number of individuals in each bin). 95% confidence intervals for OLS estimates are based on heteroskedasticity robust standard errors. The outcome is the predicted probability of defaulting in the 2 years after initial application, based on all observable baseline characteristics.

Figure A.5: Probability of Scheduled $0 Payment, by Distance to $0 Discretionary Income Threshold



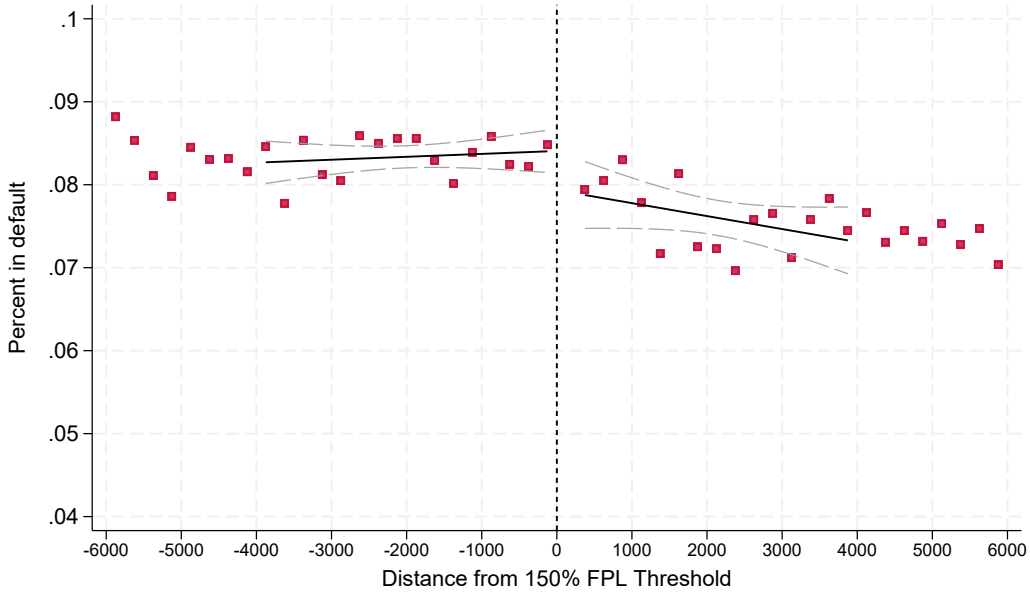
Notes: Sample includes first-time IDR applicants in 2015 through 2018 who had income within $6,000 of the $0 discretionary income threshold and a nonmissing scheduled payment in the specified time period, measured by months since the date of the first IDR application. Each bin contains between 13,000 and 18,000 IDR applicants, pooling across 2015-2018 application cohorts. Scatter plots of the probability of having a scheduled $0 payment within a $250 income bin, by distance to the $0 discretionary income threshold (150% FPL). Dark lines represent OLS estimates of the outcome by distance to the $0 discretionary income threshold, estimated separately on either side of the threshold for applicants within a $4,350 bandwidth around the cutoff (weighted by the underlying number of individuals in each bin). Dashed gray lines represent 95% confidence intervals for OLS estimates, based on heteroskedasticity robust standard errors.

Figure A.6: Average Scheduled Payment (Annualized), by Distance to $0 Discretionary Income Threshold



Notes: Sample includes first-time IDR applicants in 2015 through 2018 who had income within $6,000 of the $0 discretionary income threshold and a nonmissing scheduled payment in the specified time period, measured by months since the date of the first IDR application. Each bin contains between 13,000 and 18,000 IDR applicants, pooling across 2015-2018 application cohorts. Scatter plots of average scheduled monthly payments (multiplied by 12 to represent an annual amount) within a $250 income bin, by distance to the $0 discretionary income threshold (150% FPL). Dark lines represent OLS estimates of the outcome by distance to the $0 discretionary income threshold, estimated separately on either side of the threshold for applicants within a $4,350 bandwidth around the cutoff (weighted by the underlying number of individuals in each bin). Dashed gray lines represent 95% confidence intervals for OLS estimates, based on heteroskedasticity robust standard errors.

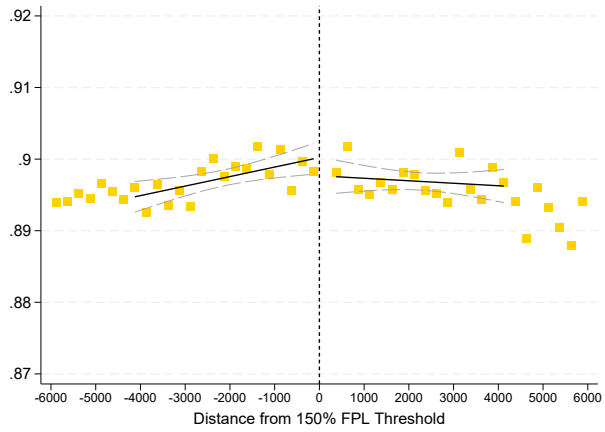
Figure A.7: Reduced Form Impacts on Borrower Default, 36 Months Since Application



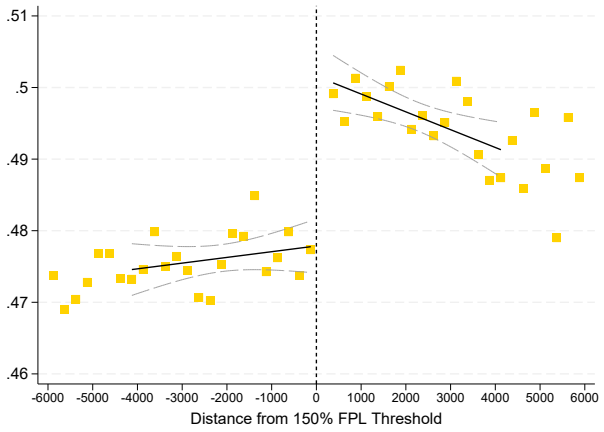
Notes: Means of default indicator 36 months after initial IDR application, by income bin. Linear OLS estimates on either side of the threshold are estimated for applicants within a $4,350 bandwidth around the cutoff (weighted by the underlying number of individuals in each bin); 95% confidence intervals for OLS estimates are based on heteroskedasticity robust standard errors.

Figure A.8: RD Scatters for Probability of IDR Participation, by Months Since Application

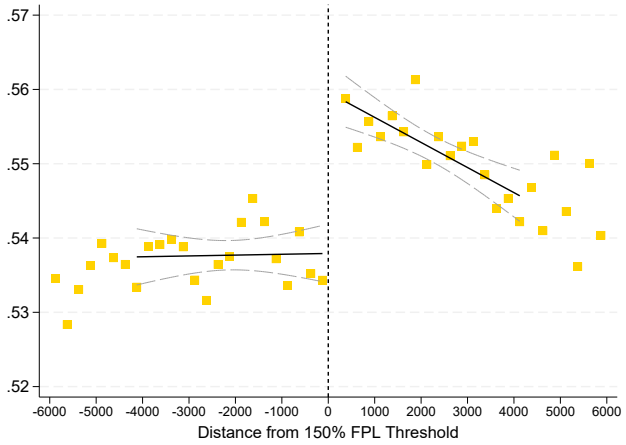
A. 7-12 months since initial application



B. 13-18 months since initial application

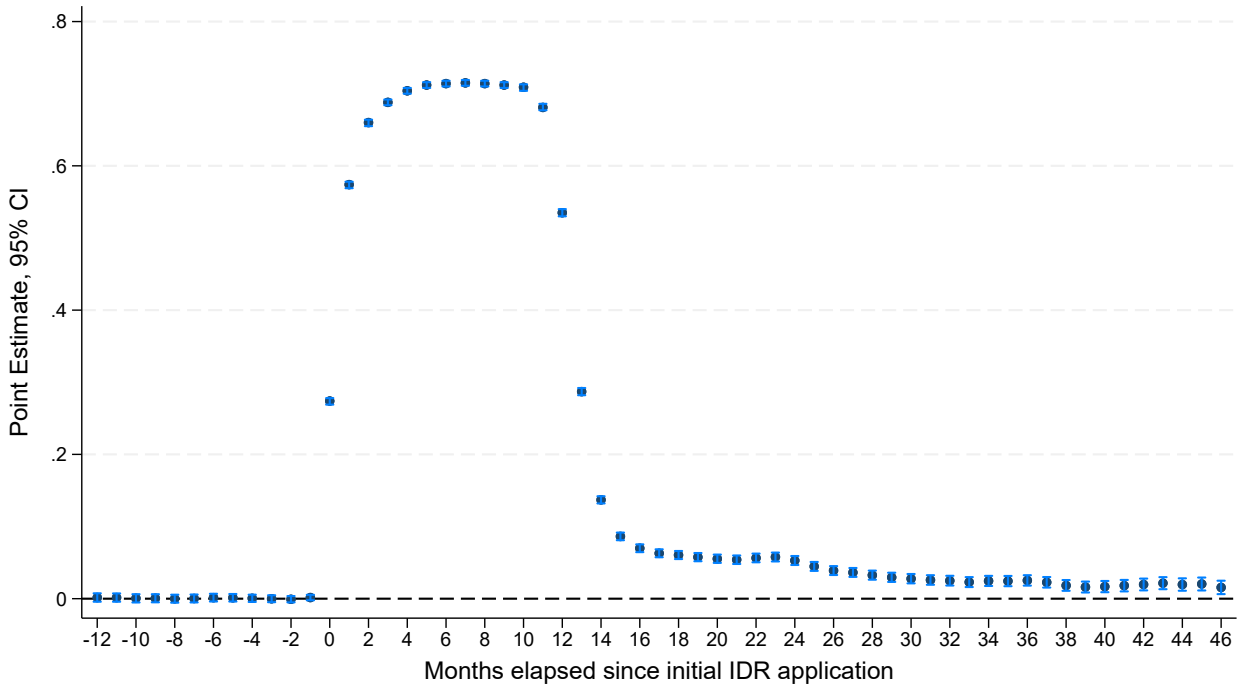


C. 19-24 months since initial application



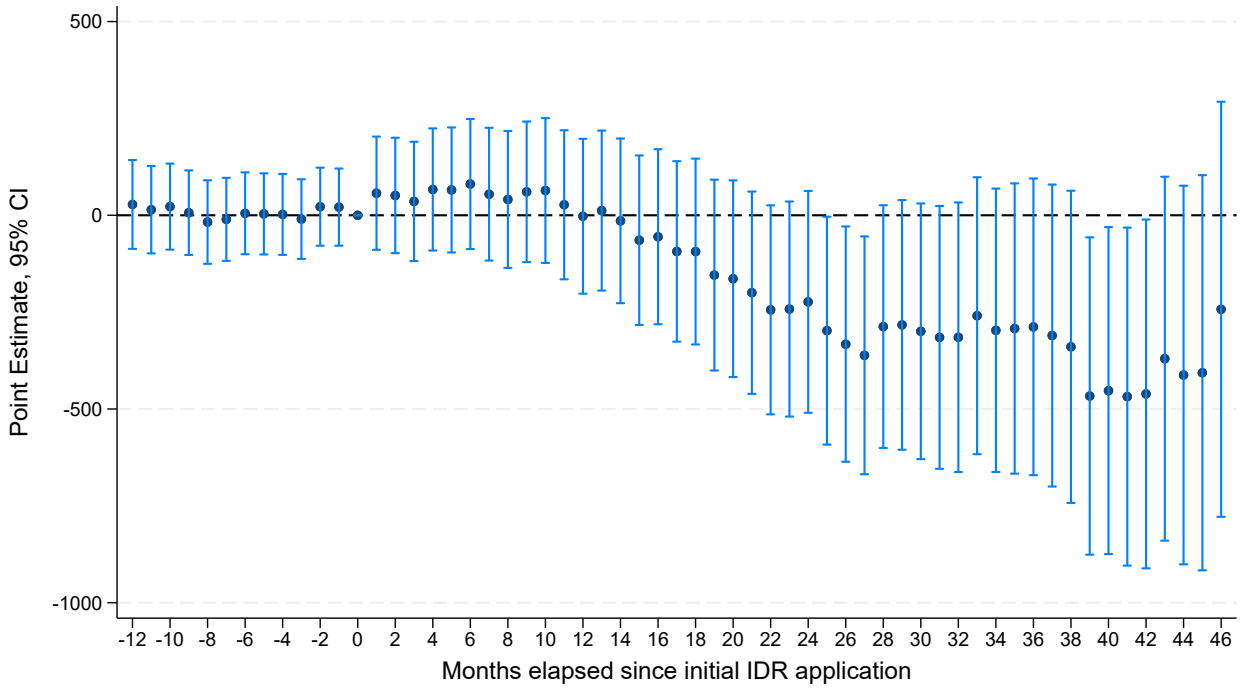
Notes: Binned scatter plots showing means of indicator for having an IDR repayment plan, by income bins of width $250 around the 150% FPL cutoff. IDR participation is measured monthly since the date of first IDR application. Each bin contains between 13,000 and 18,000 IDR applicants, pooling across 2015-2018 application cohorts. Linear OLS estimate on either side of the threshold estimated for applicants within a $4,350 income window around the cutoff; 95% confidence bands for OLS estimates are based on heteroskedasticity robust standard errors.

Figure A.9: RD Estimates on Probability of $0 Payment by Months Since Initial IDR Application



Notes: Sample includes first-time IDR applicants in 2015 through 2018 who had income within $4,350 of the $0 discretionary income threshold and a nonmissing scheduled payment in the specified time period, measured by months since the date of the first IDR application, with negative months corresponding to months prior to initial application. OLS estimates of β_1 from equation (2) and 95% confidence intervals based on heteroskedasticity robust standard errors. The outcome is an indicator for $0 scheduled payment.

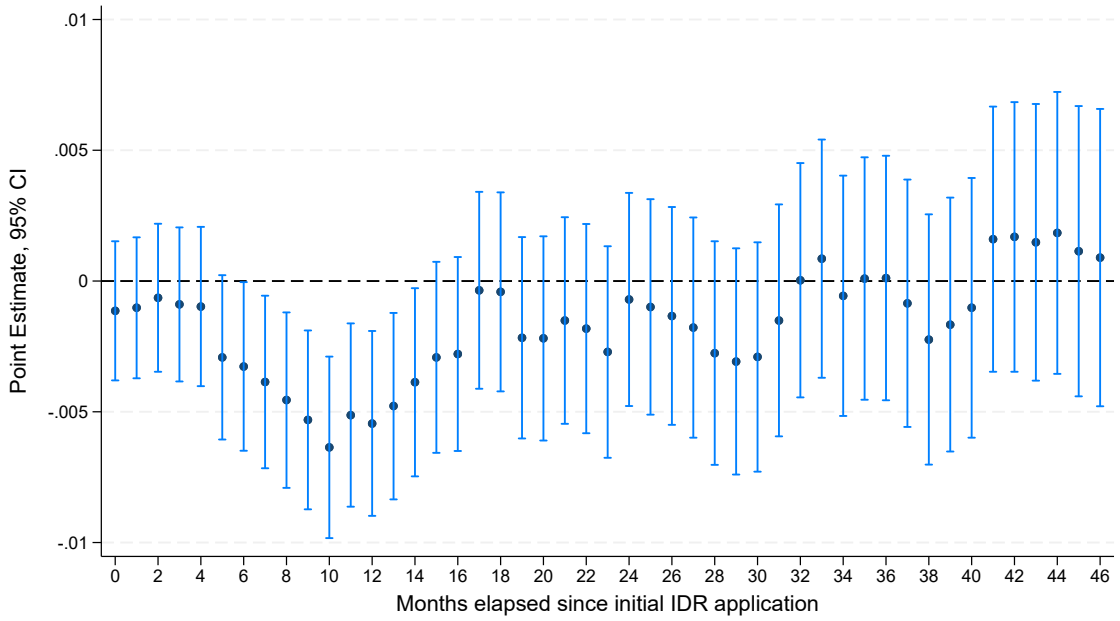
Figure A.10: Impacts on Outstanding Balances



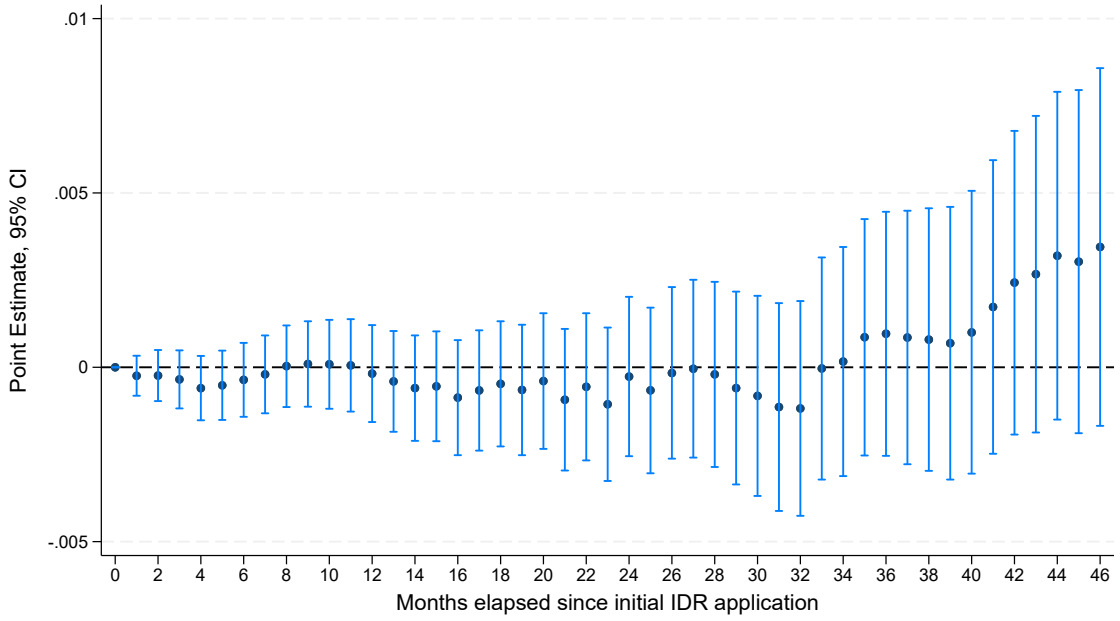
Notes: Plot shows OLS estimates of the RDD coefficient β_1 from equation (2) in the main text, using total outstanding balance as the outcome. Estimates based on pooled sample of first-time IDR applicants from 2015-2018, controlling for application year fixed effects. Outcomes are measured monthly since the date of first IDR application, with negative months corresponding to months prior to initial application; 95% confidence bands are based on heteroskedasticity robust standard errors.

Figure A.11: Impacts on Educational Attainment

A. Enrolled in month, RDD estimates



B. Any degree receipt since initial IDR application, RDD estimates



Notes: Plot shows OLS estimates of the RDD coefficient β_1 from equation (2) in the main text. Estimates based on pooled sample of first-time IDR applicants from 2015-2018, controlling for application year fixed effects. Outcomes are measured monthly since the date of first IDR application, with negative months corresponding to months prior to initial application. In Panel A, the outcome is an indicator being enrolled in a post-secondary education program, according to NSLDS enrollment reporting records from colleges. Panel B uses an indicator of graduation from any postsecondary program; 95% confidence bands are based on heteroskedasticity robust standard errors.

Table A.1: Placebo RK Estimates - Applicant Characteristics at the 150% FPL $0 Payment Cutoff

	A. Borrower characteristics and attainment							
	(1) Age	(2) Gender = female	(3) Family income‡	Predicted probability race/ethnicity = (4) Black	(5) Hispanic	(6) White	Highest attainment§ (7) 1st yr	(8) Grad
$\mathbf{1}[DI \leq 0] * DI$	0.005	0.0001	-325	0.0005	0.001	-0.002	0.001	-0.001
	(0.022)	(0.001)	(163)*	(0.001)	(0.001)*	(0.001)*	(0.001)+	(0.001)
Dep var mean	31.2	0.687	$56,406	0.198	0.144	0.577	0.148	0.189
Observations	472,154	469,820	471,689	481,095	481,095	481,095	484,571	484,571
	B. Initial IDR application, debt, repayment							
	(9) HH size	(10) Married	Application income source (11) Taxes	(12) ADOI	(13) Outst. debt	(14) Any prior default	(15) Auto debit	(16) Index
$\mathbf{1}[DI \leq 0] * DI$	0.003	-0.0003	-0.001	0.001	-60	0.003	0.0001	0.001
	(0.003)	(0.001)	(0.001)	(0.001)	(111)	(0.001)**	(0.001)	(0.0003)**
Dep var mean	1.90	0.064	0.728	0.272	$45,874	0.174	0.067	0.084
Observations	484,571	484,571	484,571	484,571	484,571	484,571	484,571	484,571

Notes: Point estimates from regressions of the baseline characteristic indicated in the column heading on discretionary income (DI, defined as AGI minus 150% FPL), an indicator for AGI less than or equal to 150% FPL, and an interaction between these variables. Household size, marital status, and application income source based on initial IDR application. Highest and attainment years since entering repayment measured as of the month before initial application submission. Auto debit measured over the 6 months prior to initial application submission. Age, gender, and family income from first FAFSA. Index is the predicted probability of defaulting in the 2 years after initial application, based on all observable baseline characteristics; $4,350 bandwidth. Robust standard errors in parentheses; ** $p < 0.01$, * $p < 0.05$, + $p < 0.1$. § Highest attainment is highest level as borrower. ‡ From first FAFSA, adjusted for inflation (2022 dollars).

Table A.2: IV-RD and IV-RK Estimates of the Contemporaneous and Longer-Run Effects of a $10 Decrease in First-Year Monthly Payments

	(1) Delinquent	(2) Default	(3) Forbearance	(4) Any IDR app TD	(5) In IDR
A. Contemporaneous (year of app)					
IV-RD	-0.641	-0.085	-0.183	-0.038	--
	(0.224)**	(0.030)**	(0.064)**	(0.017)*	--
IV-RK	-0.008	-0.002	-0.025	0.002	--
	(0.002)**	(0.001)*	(0.002)**	(0.002)	--
Test of eq (*p* -val)	0.005	0.005	0.013	0.021	--
Observations	488,937	488,937	488,937	488,937	--
B. In the 2nd year after initial application submission					
IV-RD	0.099	0.0003	0.047	-0.076	-0.077
	(0.037)**	(0.006)	(0.020)*	(0.029)**	(0.030)**
IV-RK	0.005	0.001	-0.009	0.006	0.007
	(0.002)*	(0.0011)	(0.002)**	(0.002)**	(0.002)**
Test of eq (*p* -val)	0.011	0.893	0.005	0.005	0.005
Observations	444,490	444,490	444,490	444,490	444,490
C. In the 3rd year after initial application submission					
IV-RD	0.054	0.020	0.033	-0.069	-0.075
	(0.023)*	(0.010)+	(0.016)*	(0.027)*	(0.029)*
IV-RK	0.004	0.002	-0.001	0.004	0.006
	(0.002)	(0.001)	(0.002)	(0.002)+	(0.003)*
Test of eq (*p* -val)	0.028	0.078	0.039	0.007	0.007
Observations	334,001	334,001	334,001	334,001	334,001

Notess: Point estimates from instrumental variables regressions of the outcome indicated in the column heading over the period indicated in the panel heading on year 1 average scheduled payments (multiplied by -10 so that estimates reflect the effect of a $10 decrease in payments), application year fixed effects, and an indicator for AGI less than or equal to 150% FPL (IV-RK) or the interaction between this indicator and the continuous measure of distance from the threshold (IV-RD). Limited to borrowers with initial application AGI within $4,350 of the 150% FPL threshold. Robust standard errors in parentheses; ** $p < 0.01$, ** $p < 0.05$, + $p < 0.1$.

Table A.3: Reduced Form RK Estimates, Effects on Repayment Outcomes, IDR Recertification, and IDR Persistence

	(1) Delinquent	(2) Default	(3) Forbearance	(4) Any IDR app TD	(5) In IDR
A. Contemporaneous (year of app)					
$\mathbf{1}[DI \leq 0] * DI$	-0.004	-0.024	-0.052	0.001	--
	(0.001)**	(0.001)**	(0.002)**	(0.001)	--
Observations	488,937	488,937	488,937	496,391	--
B. In the 2nd year after initial application submission					
$\mathbf{1}[DI \leq 0] * DI$	0.003	0.0001	0.013	0.003	0.004
	(0.001)*	(0.002)	(0.003)**	(0.001)*	(0.001)**
Observations	444,490	444,490	444,490	451,183	451,183
C. In the 3rd year after initial application submission					
$\mathbf{1}[DI \leq 0] * DI$	0.002	0.006	0.009	0.002	0.003
	(0.001)	(0.002)**	(0.003)**	(0.001)	(0.001)*
Observations	334,001	334,001	334,001	338,848	338,848

Notes: Point estimates from regressions of the outcome indicated in the column heading on discretionary income, an indicator for AGI less than or equal to 150% FPL, an interaction between these variables, and application year fixed effects. Defaults are lagged by 6 months (e.g., year 1 = 6-18 months after initial application). Limited to borrowers with initial application AGI within $4,350 of the 150% FPL threshold. Robust standard errors in parentheses; ** $p < 0.01$, * $p < 0.05$, + $p < 0.1$.

Appendix B Additional Information on IDR

The first IDR plan — Income Contingent Repayment or ICR — was established in 1994. It was followed by four additional plans: "old" Income Based Repayment (IBR), established in 2007; "new" IBR, established in 2010; Pay As You Earn (PAYE), established in 2012; and Revised Pay As You Earn (REPAYE), established in 2015. Eligibility for each IDR plan depends on the types of federal loans a borrower holds, when they first borrowed and/or when they last had student loan debt, and (for PAYE and IBR), their income relative to debt. See the top panel of Table B.1 for details.

As shown in the bottom panel of Table B.1, payment rates range from 10% in REPAYE, PAYE, and new IBR, to 15% in old IBR, and 20% in ICR. Outside of ICR, which defines discretionary income relative to 100% FPL, all plans in effect before 2023 used the 150% FPL threshold. There is no cap on REPAYE payments, but the other plans cap payments at the amount a borrower would pay on the 10-year standard plan (PAYE and IBR) or on a fixed-payment 12-year plan with adjustments for income (ICR). All plans outside of ICR provide subsidies for unpaid interest for at least the first 3 years of repayment; REPAYE is the most generous, providing a 50% subsidy on unpaid interest for the entirety of repayment. Remaining debt is forgiven after 20 to 25 years of payments.

Before 2023, borrowers were required to recertify their income on an annual basis to remain in IDR. This process was similar to the process of submitting an initial application: Borrowers had to either provide information to their servicer on their prior year income and family size via an income tax return (either electronically or via paper tax transcript) or provide "alternative documentation of income." The latter method is most commonly used when a borrower's current income is not reflected in their prior year tax return, such as following job loss or a large drop in earnings.

When a borrower fails to recertify but does not actively choose another repayment plan, their scheduled payments will depend on the specific IDR plan they were previously participating in. Monthly payments for borrowers previously in REPAYE equal the amount required to repay the loan by the earlier of 10 years from the date the borrower began repayment under the alternative repayment plan or the ending date of the 20- or 25-year IDR repayment period. Payments for borrowers enrolled in the other IDR plans who fail to recertify equal the amount paid under a 10-year standard repayment plan based on the loan amount owed when the borrower initially entered IDR. Failing to recertify or actively switching to a different repayment plan results in the borrower's unpaid interest being capitalized into their principal balance. Additionally, when a borrower in PAYE or IBR no longer qualifies for a "partial financial hardship," their unpaid interest is capitalized.[1]

Appendix Figure B.1 shows the composition of borrowers on IDR by plan. The increase in IDR par-

[1] A borrower qualifies for partial financial hardship based on their discretionary income and debt, specifically, when the annual amount due on eligible loans, as calculated under a 10-year Standard Repayment Plan, is lower than the amount that would be paid in PAYE or IBR.

ticipation between 2013 and 2016 shown in Appendix Figure A.2 appears to come from borrowers entering IBR and, to a lesser extent, PAYE, while the growth between 2016 and the end of 2019 is driven by entry into REPAYE.

In 2023, REPAYE was supplanted by SAVE (Saving on a Valuable Education), which increased the discretionary income threshold to 225% FPL and eliminated 100% of unpaid interest immediately. In 2024, additional changes were scheduled be implemented, including a reduction of the payment rate for undergraduate loans from 10% to 5% and a reduction in the number of payments required for forgiveness for borrowers with small balances. However, due to legal challenges, as of September 2024, these changes have yet to be implemented. Finally, beginning in 2024, borrowers can now consent to have their federal income tax automatically retrieved for recertification for up to 5 years.

Table B.1: Features of Available IDR Plans

	Revised Pay As You Earn (REPAYE)	Pay As You Earn (PAYE)	New Income Based Repayment (IBR)	Old IBR	Income Contingent Repayment (ICR)
Eligibility criteria					
Types of loans	Direct Stafford and Grad PLUS*	Direct Stafford and Grad PLUS*	Direct Stafford and Grad PLUS**	Direct and FFEL Stafford and Grad PLUS**	Direct Stafford, Grad PLUS, and Parent PLUS***
Income restrictions	None	PFH	PFH	PFH	None
Additional criteria	None	Borrowers who received their first federal student loan after 10/1/2007 and received a Direct Loan after 10/1/2011.	Borrowers who had no outstanding Direct or FFEL Loan balance as of 7/1/2014 and who received a Direct Loan on or after 7/1/2014.	Borrowers who had a Direct or FFEL loan balance on July 1, 2014.	None
Other parameters					
Discretionary income threshold	150% FPL	150% FPL	150% FPL	150% FPL	100% FPL
Payment rate	10%	10%	10%	15%	20%
Payment cap	None	10-year Standard	10-year Standard	10-year Standard	Amount based on fixed payment 12-year plan, adjusted for income
Interest subsidies	Subsidized loans: 100% of unpaid interest for 3 years, 50% thereafter. Unsubsidized loans: 50% of unpaid interest.	Subsidized loans: 100% of unpaid interest for 3 years. No benefit for unsubsidized loans.	Subsidized loans: 100% of unpaid interest for 3 years. No benefit for unsubsidized loans.	Subsidized loans: 100% of unpaid interest for 3 years. No benefit for unsubsidized loans.	None
Forgiveness	240 payments (UG), 360 payments (grad)	240 payments	240 payments	360 payments	360 payments

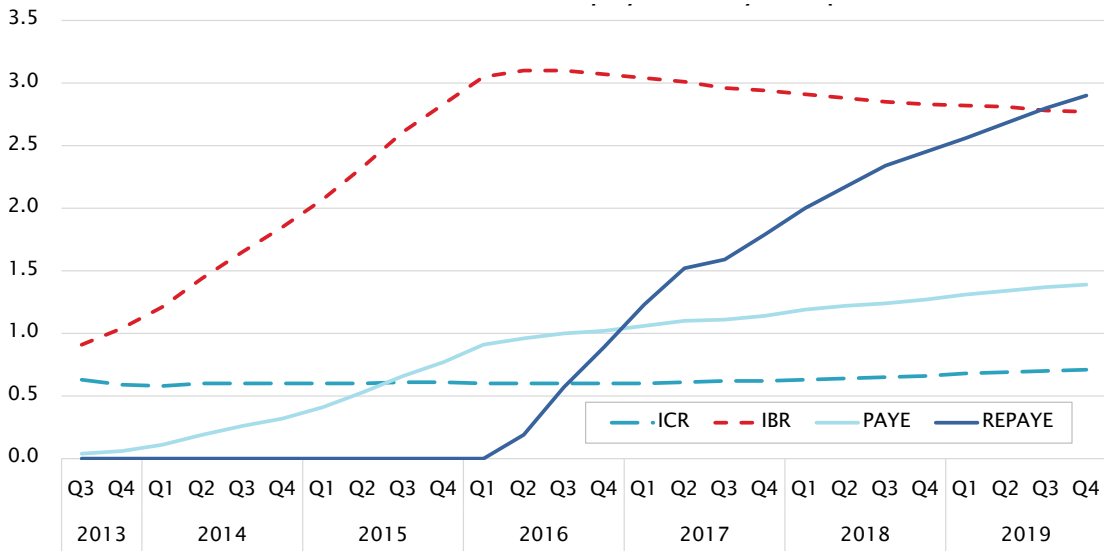
Notes: PFH = partial financial hardship, when the annual amount due on eligible loans, as calculated under a 10-year Standard Repayment Plan, your payment on the specified IDR plan.

* Including Direct Consolidation loans, comprised of Stafford (DL or FFEL), and/or Grad PLUS (DL or FFEL)

** Including Direct/FFEL Consolidation loans, comprised of Stafford and/or Grad PLUS

*** Including Direct Consolidation loans, comprised of Stafford (DL) and/or PLUS (DL)

Figure B.1: Number of Direct Loan Borrowers (1m) in IDR by Plan



Source: Publicly available data on the number of borrowers with Direct Loans (DL) in repayment in one of the listed IDR plans, from FSA Data Center.

Appendix C Data Appendix

We leverage administrative files from Federal Student Aid's Enterprise Data Warehouse (EDWA), a federal student aid (FSA) database housing 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, IDR plan applications, and the enrollment verification reports that colleges submit to NSLDS as part of the requirements for Title-IV aid eligibility. EDWA was first launched in 2014. The quality of the data is highest for this year and onward. Because older records were retroactively populated by FSA, they are more likely to be incomplete and can be less reliable. For example, digitized IDR application records are only available starting in 2014.

We first construct a data set of borrowers applying for IDR between 2015 and 2018. In order to identify applicants who have been in IDR before application data was stored in EDWA, we link the sample of IDR applicants to loan servicing data and exclude borrowers who are listed as being in an IDR repayment plan at any point prior to their first observed IDR application.

Theoretically, a borrower may have multiple loans in different statuses or even repayment plans. We aggregate this loan-level servicing data to the borrower level, measuring total outstanding debt and creating indicators of whether a borrower has a loan in each type of status or repayment plan.

In principle, repayment plan, scheduled payments, and loan status data are updated in every monthly draw from servicing data. In practice, however, servicers vary in the amount of time it takes them to update their loan status reports, generating measurement error on the effective timing of repayment plan changes in our data. When examining patterns of repayment plan and scheduled payment by servicer, we discovered a several month lag between IDR application and changes in scheduled payments for many borrowers, which could have either been caused by delays in processing time or reporting delays. We exclude borrowers from this servicer from our main analysis sample. Borrowers essentially are randomly assigned to servicers, thus it is not surprising that the exclusion of these borrowers has no affect any of the estimated effects on outcomes measured after month 6 or before month 0, but this does reduce the size of the analysis sample.

Borrowers who initially enroll in new IBR and PAYE and who fail to recertify still are listed in EDWA as having the same status as borrowers in these plans who do recertify but have sufficiently high income that their IDR payment would exceed their payment on the standard 10-year plan (i.e., in IBR/PAYE with no partial financial hardship). To distinguish between borrowers who fail to recertify and those who recertify but have high income, we use subsequent IDR application data and classify a borrower as remaining on IDR if they submitted a successful reapplication in the prior 12 months. We classify borrowers who did not reapply in the last 12 months or reapplied but were not approved for an IDR plan.