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FRAMING EFFECTS, EARNINGS EXPECTATIONS, AND THE DESIGN OF STUDENT LOAN REPAYMENT SCHEMES

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ABSTRACT

Income-driven student loan repayment (IDR) plans provide protection against unaffordable loan payments and default by linking loan payments to borrowers' earnings. Despite the advantages IDR would offer to many borrowers, take-up remains low. We investigate how take-up is affected by the framing of IDR through a survey of University of Maryland undergraduates. When the insurance aspects of IDR are emphasized, students are significantly more likely to participate, while participation is significantly lower when costs are emphasized. IDR framing interacts with expected labor market outcomes. Emphasizing the insurance aspects of IDR has larger effects on students who anticipate a higher probability of not being employed and/or low earnings at graduation. In contrast, when costs are emphasized, IDR take-up is uncorrelated with students' expected labor market outcomes. Simulation results suggest that a simple change in the framing of IDR could generate substantial reductions in loan defaults with little cost to long-run federal revenue.

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1 Introduction

At the end of 2017, outstanding U.S. student loan debt exceeded $1.38 trillion (Federal Reserve Bank of New York 2018). Concerns over growing debt, delinquency, and defaults have stimulated proposals for expanding loan repayment options that link loan payments to borrowers' earnings.[1] Broadly defined, such "income-driven repayment" (IDR) schemes provide insurance against unaffordable loan payments due to unanticipated earnings shocks. Despite considerable outreach efforts on the part of the Department of Education and the increasing generosity of available options, borrowers' take-up of IDR remains low.

In this paper, we use data from a survey of University of Maryland (UMD) undergraduates to explore the factors that influence students' selection into IDR, focusing on the role of the framing of IDR and expected labor market outcomes. Framing significantly affects students' choices. Students randomly assigned to treatment arms that emphasize the insurance aspects of IDR are significantly more likely to choose IDR over the standard repayment plan in a hypothetical scenario and report a significantly higher willingness to pay (as percentage of their income) for IDR. We find the opposite effect for students randomly assigned to treatment arms with framing more similar to that of existing IDR plans, which emphasize the potential for a longer repayment period and higher total interest payments over the life of the loan.

Furthermore, our findings suggest that the current framing of available IDR options may discourage borrowers who would most value the insurance aspect of IDR from participating in these plans. On average, students who anticipate a higher probability of not working or having low earnings at graduation are significantly more likely to prefer IDR. In treatment arms that emphasize the costs of IDR, however, this relationship does not hold, and students' expected labor market outcomes are uncorrelated with their reported preferences for IDR. Simulated effects of IDR framing on aggregate payments and defaults suggest that a simple change in the framing of IDR could generate substantial reductions in loan defaults with little cost to long-run federal revenue.

Our survey of University of Maryland (UMD) undergraduates presented participants with hypothetical scenarios in which they were told to assume that they had borrowed a specified amount for college and needed to choose a loan repayment plan. In each case, the loan repayment options included the standard "mortgage-style" loan repayment plan and a variant of IDR. Using information on expected future labor market outcomes together with students' stated preferences over the plans they were offered, we test how the framing of IDR affects students' choices, the extent to which expected labor market outcomes are correlated with plan choice, and whether labor market expectations interact with IDR framing to minimize or reinforce selection into IDR.

[1] E.g., Dynarski and Kreisman (2013), Asher, Cheng and Thompson (2014), and Boatman, Evans and Soliz (2014).

IDR framing has large and significant effects on students' choices, both in absolute terms and relative to the effects of other plan parameters. Compared to students presented with an IDR plan that was neutrally framed, those randomly assigned to the framing that emphasized IDR costs were 50 percent less likely to choose IDR, while those randomly assigned to the insurance frame were over 60 percent more likely to choose IDR. In comparison, a $10,000 increase in hypothetical student loan debt generated an approximately 2 to 3 percentage point increase in the probability of choosing IDR over the standard plan.[2]

We also provide evidence that students' expectations about their future labor market outcomes at graduation are correlated with their preferences for IDR. Conditional on expected outcomes at graduation, however, students do not appear to take into account their expected growth in earnings or expected likelihood of low or no earnings at later points in life. Even at graduation, only the expected probability of having low or no earnings influences repayment plan choice. Labor market expectations significantly interact with IDR framing. The expected probability of a poor labor market outcome only influences the choices of students randomly assigned to the neutral or insurance frames. As IDR payments will be less than payments under the standard plan only when annual earnings are very low, risk averse students with a higher probability of experiencing this bad outcome should place higher value on the insurance provided by IDR. Our results suggest that an emphasis on the costs of IDR reduces selection into the plan for students who would place the highest value on the insurance it offers.

We simulate how altering the framing of IDR would affect aggregate payments, defaults, and selection into IDR at the national level by reweighting our sample of UMD survey respondents to match the characteristics of bachelor's (BA) degree-seeking borrowers nationwide, then drawing a sequence of earnings and nonemployment probabilities from a parameterized experience-earnings profile generated based on the students' elicited labor market expectations.[3] For payment rates that fall within the range of the parameters of currently available IDR options, relative to the current emphasis on IDR costs, the lifetime risk of loan default falls substantially when IDR is framed as insurance. The reduction in defaults is obtained at minimal cost to the government over the long-run. For IDR payment rates that are similar to those offered by current IDR plans (e.g., 10-15 percent of disposable income), the present discounted value of total payments after 20 years is virtually the same across the three alternative frames.

Finally, we simulate the degree of adverse selection into IDR by calculating the difference between the average present value of the IDR payments the government would have received from students who chose the standard plan had they instead chosen IDR and the average present value of the payments made by students

[2]Students were randomly assigned to hypothetical loan balances of either $30,000 or $60,000 and estimated effects of loan size come from a linear interpolation of the effect of shifting debt between these two values.

[3]This exercise involves a number of assumptions, most importantly, that students' expected labor market outcomes are, on average, an accurate measure of their realized labor market outcomes. We discuss these assumptions and the steps of the simulation exercise in more detail in Section 6.

who did choose IDR. Standard economic theory suggests that, all else the same, income-driven repayment schemes will be most attractive to borrowers who expect to have low or variable earnings. Theoretical work by Findeisen and Sachs (2016) suggests that, in the presence of information asymmetries, repayment plans that include IDR at low levels of earnings and constant payments (in dollar amounts) above a certain income level are socially optimal.[4] We contribute to this literature by providing empirical evidence on the importance of labor market expectations in borrowers' decisions to take up IDR.Our results indicate that small decisions around the framing of IDR can have large effects on the types of borrowers who select into IDR, but that differences in selection into IDR by frame are small when payment rates are similar to those of existing IDR plans. This is the case even though take-up is much higher under the insurance frame. While selection into IDR under the insurance frame is highly correlated with the expected risk of low earnings at graduation, it is relatively uncorrelated with expected labor market outcomes over the longer-run.

Income driven repayment (in the form of a "graduate tax") was first proposed by Friedman (1955) as a solution to a key failure in the market for higher education. Potential borrowers cannot use their human capital as collateral in exchange for loans in the private market, undermining private lenders' willingness to provide funds to prospective students. As a result, individuals who would benefit from higher education will have lower attainment than in a setting with complete credit markets. Similar to the sorting that can occur in other insurance markets, if borrowers have private information about the path of their future earnings, those who expect to have low lifetime earnings may adversely select into IDR (Sheets and Crawford 2014), potentially undermining the financial viability of voluntary IDR schemes.

In the United States, the vast majority of student loan aid is provided by the federal government. Although the first federal IDR plan was introduced in 1994, the default (and most popular) repayment plan is a "mortgage style" repayment schedule with fixed payments over a 10 year period. In contrast, numerous countries have implemented IDR plans that are universal or cover a substantial share of borrowers (Chapman 2006; Lochner and Monge-Naranjo 2015).[5] Existing government-run IDR plans both in the U.S. and abroad only require payments until the borrower has repaid the original principal plus accrued interest (with the remaining balance discharged after a specified number of years). In contrast to such "fixed amount" IDR plans, "fixed length" IDR plans (often referred to as "income-share agreements" or "human capital contracts") require payments for a set period of time, regardless of the total amount paid. Though

[4]Lochner and Monge-Naranjo (2015) show that in the presence of limited repayment enforcement, moral hazard, and costly verification of borrowers' labor market outcomes, efficient student loan programs link payments to earnings but the amount of insurance provided will depend on the extent to which lenders can verify income and enforce contracts.

[5]These countries include Sweden (IDR introduced in 1989), Australia (1989), New Zealand (1992), Chile (1994), South Africa (1996), UK (1997), Hungary (2001), and South Korea (2010). As examples, IDR is mandatory in Australia and the United Kingdom. In the Australian plan, students repay 4 to 8 percent of their income in excess of approximately A$55,000 until the loan is repaid with interest. In the United Kingdom, students repay 9 percent of their income in excess of approximately £17,500 until the loan is repaid with interest or the balance is forgiven after 25-35 years.

no broadly-available fixed-length IDR plans have been implemented to date, they have been explored by several state legislatures (Harnisch 2014). A small number of individual colleges and private lenders also have started to experiment with offering such policies in addition to or in place of traditional student loans, but there is little empirical evidence on how the design of fixed-length IDR programs affects participation. We fill this gap by providing evidence that take-up of fixed length IDR - while lower than fixed amount IDR - is also affected by framing.

Furthermore, our results contribute to the growing evidence that individuals' economic choices, including decisions about borrowing and repayment, may depend on how they are framed.[6] Marx and Turner (2017) and Marx and Turner (2018) show that nonbinding student loan "offers" affect take-up. Holding constant loan eligibility, students who receive a $0 loan recommendation borrow less and have lower educational attainment than those who receive a nonzero offer. Caetano, Palacios and Patrinos (2011) measure Latin American students' preferences over alternative means for financing higher education and provide evidence that students are willing to pay a premium to avoid a contract labeled as a loan (but similar in all other ways to the alternative contract).[7] Field (2009) provides evidence on the differences in employment decisions made by law school graduates who, at entry, received equivalent financial aid offers framed alternately as loans that would be forgiven if the student worked in public interest law versus tuition assistance that would have to be repaid if the student did not end up in public interest law.

The remainder of this paper proceeds as follows: In Section 2, we describe existing IDR options available to student borrowers in the U.S. We describe our survey of UMD undergraduates and resulting analysis sample in Section 3, while Section 4 details our methodology. In Section 5, we present estimates of the correlations between IDR preferences and expected labor markets and explore the impact of IDR framing on preferences. Section 6 reports on simulations that make use of students' plan preferences and earnings expectations to assess whether and to what extent making an IDR option available affects the present discounted value of loan payments and default rates. Section 7 concludes.

2 Income Driven Repayment in the United States

U.S. college students with federal loan debt have access to five IDR options that limit borrowers' payments to a certain fraction of earnings (e.g., 15 percent) and allow for debt forgiveness after a certain period of time

[6] Agents' financial decisions around investment, savings, retirement plan contributions, and credit card payments also are affected by factors such as the default option presented to them (Madrian and Shea 2001; Choi et al. 2006; Chetty et al. 2014; Bernheim, Fradkin and Popov 2015) and other information that anchors the available options (Keys and Wang 2016). Other educational investment decisions have been shown to be distorted by requirements to complete a complex application (e.g., Dynarski and Scott-Clayton 2006; Bettinger et al. 2012) and self control issues (Cadena and Keys 2013).

[7] Evans, Boatman and Soliz (2016) replicate this exercise and find similar effects of labeling among U.S. high school and college students.

(e.g., 20 years).[8] Under these plans, borrowers with temporarily low income pay less in the current period, while accruing additional interest and extending the length of repayment, while those with permanently low incomes pay less each period and ultimately will have much or all of their debt forgiven.[9] Borrowers who do not actively select a repayment plan are automatically enrolled in the standard "mortgage style" plan, under which they make fixed monthly payments for ten years.

Despite considerable efforts by the U.S. Department of Education (hereafter, ED) to make student borrowers aware of IDR options – including targeted emails to borrowers and a partnership with TurboTax to automatically notify qualified borrowers who use the software that they are IDR-eligible – only a minority of borrowers have chosen IDR. As of the fourth quarter of 2017, just 28 percent of the 23 million borrowers with federal Direct Loans who had entered repayment were enrolled in one of the five available IDR options (U.S. Department of Education 2017).[10]

Low take-up is not due to a lack of eligibility. Until the introduction of the Revised Pay-As-You-Earn plan (REPAYE) at the end of 2015, IDR enrollment was limited to students with current incomes such that their IDR payment would be less than their payment under the standard plan, but once enrolled, borrowers could continue in IDR even if their incomes subsequently rose. Department of the Treasury estimates show that, as of 2012, 51 percent of borrowers in repayment would have been eligible for IDR based on their current incomes (U.S. Government Accountability Office 2015). Perhaps more relevant, since anyone who enrolls in IDR can remain there even if their income later rises, Hershbein et al. (2014) estimate that as of 2012, given median student loan debt of $26,500, 99 percent of borrowers would have qualified for IDR in their first year of repayment. As of the last quarter of 2016, 16 percent of borrowers in repayment had defaulted on their debt (U.S. Department of Education 2016), an outcome that is less likely under IDR, as required loan payments are set to zero when earnings are sufficiently low.[11]

[8] See U.S. Government Accountability Office (2016) for an overview of repayment plans that are currently available to federal student loan borrowers in the United States. The five IDR options have payments ranging from 10 to 20 percent of borrowers' discretionary income and offer debt forgiveness after 20 to 25 years of repayment. All but one of the available IDR plans caps payments at the amount that the borrower would have paid had they entered into the standard repayment plan or some lesser amount. Borrowers employed by nonprofit or public sector employers are eligible for the Public Service Loan Forgiveness (PSLF) program, in which federal loan balances are forgiven after 10 years of payments, whether under an IDR plan or a combination of years under an IDR and the standard plan.

[9] The Promoting Real Opportunity, Success, and Prosperity through Education Reform (PROSPER) Act, which was recently introduced as a bill to reauthorize of the Higher Education Act, would eliminate forgiveness of principal for borrowers in IDR plans while capping interest payments at the amount accrued over 10 years under the standard plan.

[10] See http://www.ed.gov/news/press-releases/us-department-education-announces-additional-efforts-inform-student-borrowers-repayment-options and http://www.ed.gov/news/press-releases/us-departments-education-and-treasury-announce-collaboration-intuit-inc-raise-awareness-about-income-driven-repayment-options-students-loans for more information on the ED outreach efforts.

[11] While it is possible to default on a student loan while participating in an IDR plan, U.S. Government Accountability Office (2016) reports that less than 1 percent of borrowers enrolled in an IDR plan between 2010 and 2014 defaulted on their loans, while 14 percent of borrowers enrolled in the standard 10-year repayment plan entered into default over this period.

2.1 Current IDR framing emphasizes costs and minimizes benefits

There are several reasons why borrowers who could benefit from IDR might not choose this option. First, borrowers who do not actively choose a repayment plan are defaulted into the 10-year standard plan. The choice of default has been shown to have a large effect on decisions made in other contexts, such as decisions about contributions to retirement savings plans (e.g., Madrian and Shea 2001; Choi et al. 2006; Chetty et al. 2014; Bernheim, Fradkin and Popov 2015). Second, borrowers may be deterred by hassle costs associated with IDR take-up. Borrowers must re-certify their income each year to continue to be eligible for IDR and some loan servicers have been found to be unresponsive to borrowers seeking to take up IDR (Dynarski 2014).[12] Third, borrowers may not be well-informed about IDR options. Based on informal feedback from borrowers, ED has reported that many borrowers lack awareness of IDR options or how they operate (U.S. Government Accountability Office 2015).[13] A related factor is a lack of knowledge about the cost of defaulting on federal loans, which would lead to an undervaluing of IDR.[14]

To address this information gap, in recent years, ED has conducted a number of outreach efforts and developed online tools to help borrowers understand the differences between standard and alternate repayment plans. A borrower who enters information on debt, earnings and family structure using ED's "Repayment Estimator" is provided with a comparison of the length of repayment, monthly payments, projected loan forgiveness, and total interest paid across the various plans.[15] Importantly, this tool assumes steady growth in earnings of 5 percent per year, and thus it emphasizes the increased interest payments and repayment length under IDR, rather than illustrating the extent of any protection against permanently low income or negative income shocks under the other plans.

Figure 1 displays the comparison of available repayment plans generated for a hypothetical unmarried individual with a $30,000 unsubsidized loan at a 5 percent interest rate and a starting salary of $30,000 per year. The output includes the size of the borrower's first and last monthly payment, total amount paid (principal plus interest) over the lifetime of the loan, the projected amount of loan forgiveness, and the length of repayment. Even though payments under IDR plans are spread out over a longer period, the tool simply adds up all of the nominal payments across the life of the loan, effectively assuming a discount rate of zero and making the IDR options appear more costly.

Given that borrowers must actively select into IDR, the limited knowledge of available options, and the

[12] Experimental evidence on the importance of hassle costs in a related context is provided by Bettinger et al. (2012), who show that the complexity of the federal application for student aid reduces college enrollment among low-income students eligible for student aid.

[13] Evans and Boatman (2016) find that less than half of a sample of low-income high school seniors who were prompted to think about college costs reported being aware of IDR.

[14] Only half of bachelor's degree recipients surveyed by the Federal Reserve Bank of New York could correctly describe the consequences of student loan default (Zafar et al. 2014).

[15] Available at: https://studentloans.gov/myDirectLoan/mobile/repayment/repaymentEstimator.action.

emphasis on (undiscounted) total payments and length of repayment in ED's loan comparison tool, it is perhaps not surprising that existing IDR plans are underutilized. Qualitative evidence from focus groups is consistent with the hypothesis that the desire to avoid accruing additional interest or extending the length of repayment leads some borrowers who could benefit from reduced payments not to take up IDR (Delisle and Holt 2015; Fishman and Love 2015). Our research builds on this idea and tests the effects of framing on students' views of IDR.

2.2 Income-share agreements as "fixed length" IDR

Our study also explores students' views of an alternate type of IDR scheme that are generally known as an "income-share agreements." Income-share agreements represent a version of IDR in which the length of repayment (rather than the amount of principal to be repaid with interest) is fixed.[16] In general, a student would enter into an income-share agreement with a college, a state, or the federal government. In exchange for postsecondary funding (either as cash to pay for college costs or in-kind access to public institutions), the student would contract to pay a fixed percentage of her income over a set number of years.

To date, the only U.S. income-share agreement that has been studied is a program for Yale graduates in the 1970s, which was characterized by a high degree of adverse selection and ultimately was ended with remaining debt forgiven. Recently, state-wide income share agreements have been considered in more than 20 state legislatures (Harnisch 2014).[17] In fall 2016, Purdue University introduced the new "Back a Boiler" income-share agreement as an alternative to private student loans for rising sophomores, juniors or seniors who had exhausted their federal loan eligibility.[18] Finally, a number of private companies currently offer income-share agreements, primarily to students in highly remunerative professional programs.

3 Data and Sample

Our data come from an online survey of UMD undergraduate students linked to student-level administrative data records. In this section, we describe the core content of the survey and the experiments embedded in it, the data collection process, and our measures of IDR preferences, labor market expectations, and other relevant student characteristics.

[16] For discussions of recent income-share agreement proposals in the U.S., see Asher, Cheng and Thompson (2014) and Boatman, Evans and Soliz (2014).

[17] Under the typical plan, students would attend public colleges at no cost in exchange for a pledge to pay a set percentage of income for specified number of years.

[18] See http://purdue.edu/backaboiler/ for details.

3.1 Survey questionnaire

The survey's core content included questions regarding students' expectations about future earnings and their preferences over hypothetical loan repayment options. In addition, the survey included questions designed to assess students' risk aversion and financial literacy and collected information on major, graduate school plans, experiences with debt, gender, and age.

To learn about preferences over different loan repayment options, each survey respondent was presented with two simple scenarios in which some amount of borrowing was assumed and a choice was offered between a standard loan repayment plan versus an income-based repayment plan. Under the standard plan, the student would pay a fixed amount every month for 10 years, with the monthly payment based on the amount borrowed and an interest rate of 5 percent. We distinguish between IDR plans that resemble the options currently available to the typical undergraduate borrower and hypothetical income-share agreements by labeling the former "fixed amount" IDR and the latter "fixed length" IDR. Half of the sample was randomly assigned to a "fixed amount" IDR plan, with monthly payments set as a percentage of income in excess of $1,000 per month and continuing until the loan balance is paid in full. Under this IDR plan, in any month in which the income-based payment falls below the amount of interest accrued over the month, the unpaid interest is added to the loan balance. Any unpaid balance remaining after 20 years is forgiven. The remainder of participants were given the choice between the standard 10-year plan and a "fixed length" IDR plan, under which monthly payments also are set as a fixed percentage of income in excess of $1,000 per month but payments continue for 20 years regardless of how much the student has paid in total. Figures 2 and 3 show how the standard plan and the alternative plan were presented in the survey for the fixed amount and fixed length repayment plans, respectively.

To measure the sensitivity of students' choices to the share of income paid under IDR, this percentage was varied across the two scenarios each student saw. It was set to either 15 or 20 percent in the "fixed amount" scenarios and to 6 or 10 percent in the "fixed length" scenarios.[19] Further, each student was asked to indicate the percentage payment that would make her indifferent between the standard plan and the specific alternative plan.

Three additional features of the scenarios were randomly assigned: (1) the framing of IDR as compared to the standard loan repayment plan; (2) the amount the student had borrowed ($30,000 or $60,000); and (3) the order in which the student saw the two income payment percentages associated with the IDR plan. The size of the monthly payment under the standard plan was determined by the amount borrowed ($318

[19]The fixed amount IDR payment percentages were chosen to mirror payments under existing IDR plans. The fixed length IDR low payment percentage was set such that, if all U.S. college graduates were to be enrolled in the plan, principal plus interest would be fully repaid for the group as a whole after 20 years.

for the $30,000 debt treatment arm and $636 for the $60,000 debt treatment arm), as was the total amount of interest paid over the life of the loan under the standard plan ($8,184 and $16,367 for the $30,000 and $60,000 treatment arms, respectively). We tested three separate framings of the IDR option: a "neutral" frame that simply described the two plans; a "cost" frame emphasizing that, under IDR, a borrower could make higher total payments and, in the case of fixed length IDR, spend longer in repayment over the life of the loan; and an "insurance" frame emphasizing the protection against payments that are unaffordable during periods of low earnings that IDR provides to borrowers. The exact wordings associated with each of the three framings are shown in Figure 4. A total of 24 separate treatments were randomly assigned (2 types of alternative repayment plan, 3 plan framings, 2 amounts borrowed, and 2 orderings for the percent of income paid under the alternative plan); Appendix A describes these treatment arms.

The survey elicited students' expectations regarding their earnings at three different points in the future and their degree of certainty about those anticipated earnings. This was done by asking students how much they expected to earn in the first full calendar year after graduation, at age 30 and at age 40, as well their expected likelihood of having no earnings, earnings of $35,000 or less, earnings between $35,001 and $75,000, or earnings of more than $75,000 at each of those points in time.

Finally, the survey included questions designed to measure risk aversion and financial literacy. We measured risk aversion by student's self reported willingness to take risk on a scale from 0 to 10.[20] The financial literacy questions included in the survey were adapted from Lusardi and Tufano (2009). Students' answers to these questions allow us to gauge how likely it is that respondents fully understood the implications of the choices they were asked to make between the standard and the alternative repayment plan. The full questionnaire with the fixed length IDR scenarios, neutral framing, a $30,000 loan and the lower income percent for the IDR plan presented first is included in Appendix B.

3.2 Data collection

The population of interest for our survey was undergraduates enrolled at the University of Maryland aged 18 to 29 years who were U.S. citizens or permanent residents.[21] We were provided with access to administrative data containing considerable information about students' demographic characteristics, academic performance, and financial circumstances. In order to ensure the comparability of students assigned to different treatment arms, we first stratified the sample by whether the student had declared a major and whether SAT or ACT scores were available for the student. Then, within each of these explicit strata,

[20] A second question intended to measure risk aversion, which asked students how much they would be willing to pay for a lottery ticket that offered a 50 percent chance of winning $500 and a 50 percent chance of winning $1000, did not yield usable responses.

[21] Students who are neither citizens or permanent residents are not eligible for federal student aid (including loans).

we employed the serpentine ordering process described by Chromy (1979) to implicitly stratify the sample by class standing (new transfer, freshman, sophomore, junior or senior), gender, and those with science, technology, engineering, math (i.e., STEM), economics, or business majors versus those with other majors versus undeclared, and percentile within the SAT/ACT math test score distribution (when available). As we discuss in the following subsection, students in our analysis sample assigned to each of the 24 different treatment groups were similar along all of these dimensions.

The survey was administered for us by UMD's Office of Institutional Research, Planning, and Assessment (IRPA) to all undergraduate students at the email address they provided for communications from the university. Past research has found that offering the chance to win a prize in a lottery has a positive effect on the response rates to web surveys of college students (e.g., Heerwegh 2006; Laguilles, Williams and Saunders 2011). Students asked to participate in our survey were given the chance to enter a lottery to win one of three iPad Air 2 tablets. The invitation to participate in the survey was sent on February 17, 2016 at 8pm EST; three reminder emails were sent on February 23, February 29, and March 8, 2016 (all at 8pm EST). The text of the invitation and reminder emails is reproduced in Appendix C.

3.3 Sample selection and student characteristics

A total of 25,435 Maryland undergraduates were invited to participate and 5,500 (22 percent) started the survey. We focus our analyses on students who provided usable answers to "core" survey questions on expected earnings and preferences over loan repayment plans and who were expected to be under the age of 30 at graduation. This yielded a sample size of 4,399 students (17 percent of those invited to take the survey).[22]

Table 1 displays the relationship between selected predetermined student characteristics – the core variables used for stratified random assignment – and the assignment of treatment parameters in our analysis sample.[23] Only one of the 45 coefficients representing the correlation between treatment parameters and the variables used for stratification is statistically significant and in no case does the test for joint significance of the treatment parameters yield a test statistic significant at conventional levels. Estimates for other characteristics are contained in Appendix Table D.1. Of the 21 characteristics examined, the test for the joint significance of the treatment parameters yields a test statistic that is marginally significant at conventional levels in only one case (Maryland residency, with $p = 0.092$). We interpret these findings as strongly

[22] 927 individuals opened the survey but failed to answer all of the "core" survey questions. An additional 38 respondents gave clearly nonsensical responses (e.g., earnings at graduation of $123, earnings at age 30 of $456, and 100 percent probability of unemployment at every age). Students who were expected to be 30 or older at graduation (N = 136) were excluded from our main sample because only two of the three questions on expected labor market outcomes are applicable. Our results are robust to including respondents in these latter two categories.

[23] Appendix Tables D.2 and D.3 display characteristics of students within each of the 24 treatment arms.

supportive of our assumption of random assignment of treatment parameters in our analysis sample.[24]

3.4 Construction of key variables

We measure students' "willingness to pay" for IDR with the reported payment as a percentage of income that would make the respondent indifferent between the standard plan and the version of IDR presented to the student. We classify students as irrational if they report a willingness to pay of 0 percent, 100 percent, or an amount inconsistent with answers to the two prior hypothetical loan repayment scenario questions (e.g., the student reports preferring the standard plan when IDR payments equal 15 percent of discretionary income but lists their willingness to pay for IDR as 20 percent of discretionary income). We exclude irrational students when examining effects of plan parameters on students' willingness to pay for IDR.

Respondents are classified as financially literate if they answer either of the two financial literacy questions correctly. Skipped questions are considered to have been answered incorrectly. "More risk averse" respondents are those who chose a value of 4 or less on a scale of 0 to 10, where 0 is "not willing to take risks" and 10 is "very willing to take risks."[25] UMD borrowers are those who received loans during their time attending UMD, regardless of the outstanding balance.

3.5 Evaluating the validity of respondents' labor market expectations

To assess whether students' expectations of future labor market outcomes are reasonable, we compare average expected earnings among those in our sample in broad major categories to average realized earnings in the American Community Survey's nationally representative sample within the same broad major categories. Appendix Figure D.1 displays this relationship, assuming that students in our sample expect to graduate at age 23. In general, students in the analysis sample expect to have higher earnings than averaged realized earnings nationwide for individuals with the same major. UMD is more selective than the average higher education institution, but survey respondents also may be overly optimistic about their earnings prospects. The federal College Scorecard reports the average earnings of former Maryland students who received federal aid, 10 years after entry, to be \$60,500.[26] Assuming that most UMD students graduate in four years, this

[24] As shown in Appendix Table D.4, students in the analysis sample have different characteristics than other UMD students. These differences do not affect the internal validity of our results, as our key parameters of interest are randomly assigned. Appendix Table D.5 shows that several characteristics are predictive of the likelihood that a student who has opened the survey meets the criteria for inclusion in our analysis sample. Among students who opened the survey, younger students, STEM/econ/business majors, upperclassmen who are not new transfers, Maryland residents, and first generation students are significantly more likely to belong to the analysis sample, while female students and black students are significantly less likely to belong (Panel A). Importantly, none of the treatment parameters are significantly related to the probability that a student is included in the analysis sample and we can reject the hypothesis of joint significance across the 5 treatment parameters with $p = 0.624$ (Panel C).

[25] Analyses using this measure of risk aversion are robust to varying this threshold (e.g., value of 5 or less on scale or value of 3 or less on scale).

[26] See https://collegescorecard.ed.gov/school/?163286-University-of-Maryland-College-Park.

should be when students are approximately 30 years old. In our sample, federal aid recipients expected to earn approximately $85,000 at age 30.[27]

We also estimate auxiliary regressions of respondents' labor market expectations on population moments and respondents' observable characteristics (Appendix Table D.6). To construct the population moments, we use data from the American Community Survey (ACS) to generate analogues to the labor market outcome measures for which we elicit expectations in the survey within broad major categories. Respondents' expected earnings at graduation are highly correlated with major-specific population earnings at age 23, with a $0.85 increase in expected earnings for each $1 increase in population earnings. The relationship between respondents' expectations and population average earnings at age 30 is quite weak, while average earnings for 23 year olds and average earnings for 40 year olds within the same earnings category remain significantly correlated with respondents' expected earnings at age 30. Age 40 population earnings are significantly correlated with expected earnings at age 40, with a $0.40 increase in expected earnings for every $1 increase in population earnings. We find a strong correlation between the expected likelihood of having $0 earnings and the expected probability of having positive but low earnings (less than $35,000) with the corresponding population moments at all ages except in the case of the expected probability of low earnings at age 40 (Appendix Tables D.7 and D.8). Taken together, these estimates suggest that students' beliefs have a strong basis in realized labor market outcomes for graduates with similar fields of study.

4 Empirical Framework

Our main specification is an ordinary least squares (OLS) regression of the form:

$$Y = a + \boldsymbol{\beta}^{\boldsymbol{T}}\mathbf{Treat}^{\mathbf{T}} + \boldsymbol{\gamma}\mathbf{X} + \epsilon \tag{1}$$

where Y is the outcome of interest (the probability of choosing the income-driven repayment plan over the standard plan or percentage of income required for indifference), $\mathbf{Treat}^{\mathbf{T}}$ is a vector of treatment indicators (e.g., loan size, IDR payment as a percentage of income, framing), $\mathbf{X}$ is a vector of the predetermined observable student characteristics used for stratification, and ϵ represents the error term. We estimate all models separately for fixed length versus fixed amount IDR plans, as the expected stream of payments is not directly comparable between these plans, even for students with the same labor market expectations.

[27] Betts (1996) finds that students' beliefs about average earnings in the national population within their own major are biased downwards but that students with less time left before graduation have more accurate expectations. Wiswall and Zafar (2015) find that New York University students overestimate average earnings within broad major categories and update beliefs about their own expected earnings towards national averages when provided with accurate information on mean earnings for their major nationwide.

Additional specifications allow for interactions between students' expected labor market outcomes and treatment parameters:

$$Y = a + \boldsymbol{\beta}^{\boldsymbol{T}}\mathbf{Treat}^{\mathbf{T}} + \boldsymbol{\delta}^{\boldsymbol{T}}\mathbf{f}(\mathbf{earnings}, \mathbf{Treat}^{\mathbf{T}}) + \boldsymbol{\gamma}\mathbf{X} + \epsilon \tag{2}$$

In equation (2), $\mathbf{f}(\mathbf{earnings}, \mathbf{Treat}^{\mathbf{T}})$captures general interactions between treatment parameters and expected future labor market outcomes (e.g., earnings at graduation, the probability of zero earnings at graduation or annual earnings growth). We focus primarily on interactions between randomly assigned IDR framing and labor market expectations to test whether the impact of framing on preferences for income-driven repayment varies with expected earnings and/or the expected risk of low or no earnings.

5 Results

To preview our results, we present graphical evidence of students' willingness to pay for IDR based on the framing of the IDR plan and their expected probability of low or no earnings at graduation. Figures 5 and 6 display cumulative distribution functions (CDFs) of the IDR payment as a percentage of income that would make a respondent indifferent between IDR and the standard plan. We plot CDFs separately by loan size ($30,000 versus $60,000) and type of IDR plan (fixed amount versus fixed length).

Figure 5 shows large differences in students' willingness to pay for IDR between frames. The distribution of willingness to pay for IDR among students assigned to the insurance frame stochastically dominates the distribution for students assigned to alternative frames for both types of IDR and loan amounts. To give an example, the 50th percentile of willingness to pay for fixed amount IDR under the insurance frame is twice as large as the 50th percentile of willingness to pay under the cost frame (17 percent versus 8 percent for small loans and 18 percent versus 9 percent for large loans).

A comparison of Panel A (fixed amount IDR) and Panel B (fixed length IDR) shows that willingness to pay for fixed amount IDR is greater than willingness to pay for fixed length IDR at almost every point in the distribution. This is what we would expect if students are interpreting the descriptions of the two plans and their implications correctly, given that fixed length IDR requires payments for 20 years regardless of the amount already paid, whereas payments under fixed amount IDR stop when the loan principal and interest have been repaid. Loan size appears to have a very modest effect on willingness to pay for IDR.

We find smaller differences in willingness to pay by the expected probability of having low earnings at graduation (Figure 6). Nonetheless, the distribution for students with the highest expected probability of a poor labor market outcome at graduation stochastically dominates the CDF for students with the lowest

expected probability of having low earnings for each size of loan and type of IDR plan. As was the case for our examination of willingness to pay by IDR framing, we find evidence that, conditional on loan size and the expected probability of low or no earnings, students presented with fixed amount IDR viewed that choice as more favorable than students presented with fixed length IDR.

5.1 IDR framing has large effects on preferences

We first examine the main effects of framing, loan size, and IDR payment rate on students' preferences for IDR over the standard plan. Table 2 displays estimates from linear probability models of the effect of plan parameters on the probability a student reports preferring or strongly preferring IDR over the standard plan. In addition to the plan parameters, these models also include controls for the variables used for stratification (major, gender, class standing, missing SAT scores, and SAT scores) and whether the higher-cost IDR option was presented first. Framing generates sizable effects on students' preferences. Relative to the neutral frame, under the cost framing that emphasizes the increased payment length and interest payments associated with IDR, the probability of choosing fixed amount IDR decreases by 14 percentage points (51 percent) and the probability of choosing fixed length IDR falls by 12 percentage points (59 percent). When the insurance aspects of IDR are emphasized, students are 19 percentage points (66 percent) more likely to choose fixed amount IDR and 18 percentage points (91 percent) more likely to prefer fixed length IDR.

Estimated effects of the amount of student loan debt and "price" of IDR (i.e., IDR payment as a percentage of income) go in the expected directions. All else equal, students with larger loans are more likely to prefer IDR, whereas students who face a higher IDR payment are less likely to prefer IDR. Based on the estimated coefficients on the loan size variable, which are identified based on the differences in preferences between those assigned $60,000 in loans versus those assigned $30,000 in loans, a $10,000 increase in outstanding debt results in a 2 percentage point increase in the probability of choosing fixed amount IDR and a 3 percentage point increase in the probability of choosing fixed length IDR. Similarly, the coefficients on the payment as a percent of income variables, which are identified based on the differences in preferences between the scenarios with the higher versus the lower of the two payment rates associated with the given IDR plan type, imply that a 1 percentage point increase in the IDR payment as a percent of disposable income results in a 1.1 percentage point reduction in the probability of preferring fixed amount IDR and a 1.4 percentage point decrease in the likelihood of choosing fixed length IDR. Relative to the effect of varying these objective plan parameters, IDR framing generates substantial changes in students' reported preferences for IDR. To put the estimated effects of framing into context, emphasizing the costs of IDR (relative to the neutral frame) is equivalent to an approximately 13 percentage point increase in the price of fixed amount

IDR and an approximately 8 percentage point increase in the price of fixed length IDR.

As shown in Table 3, the estimated effects of framing on preferences for IDR are robust to a variety of specifications and sample restrictions.The first column displays estimates from models that exclude all controls except treatment parameters, while column 2 contains estimates from models that include the standard set of controls for random assignment strata (which are included in all of the remaining specifications) and additional controls from administrative data. T he models in column 3 include controls for risk aversion (willingness to take risks on a scale from 0 to 10), financial literacy (number of questions answered correctly), self reported debt (student loans, auto loans, credit card balances, loans from family, and other unsecured debt), and indicators for having skipped the risk aversion and self reported debt questions. The sample for the models in column 4 is limited to students who provided "rational" answers to the questions on their preferences for loan repayment plans. The column 5 models exclude students with low financial literacy, while the column 6 models limit the sample to students who have borrowed during their time at UMD. The models in column 7 restrict the sample to those who spent at least 5 minutes completing the survey and the column 8 models drop observations for which expected earnings at any age were below the 1st percentile or above the 99th percentile of responses provided for expected (unconditional) earnings at graduation, age 30, or age 40. Results are consistent across specifications.

Table 4 reports estimates of the effect of framing on the willingness to pay for IDR (the payment for IDR is defined as the percentage of disposable income that would make a student indifferent between the specific version of IDR in the assigned treatment arm and the standard plan). Sample sizes in these models are smaller than in the specifications reported in Table 2, both because the Table 4 models include only one observation per person and because we have excluded students that did not answer the survey question about the percentage of income that would make them indifferent between IDR and the standard plan, provided a rate that conflicted with earlier answers, or stated that a payment of 0 percent or 100 percent would make them indifferent. The estimates imply that the cost framing reduces willingness to pay for IDR by 2 to 4 percent of income and that the insurance framing raises willingness to pay for IDR by 4 to 6 percent. Appendix Table D.9 provides results concerning the sensitivity of these effects to the controls included and sample restrictions applied. As was the case for the estimates of framing effects on preferences for IDR, the estimates are very consistent across specifications.

5.2 Correlations between labor market expectations and preferences for IDR

While those selecting into existing IDR plans appear to have low earnings at entry (U.S. Government Accountability Office 2015) and carry higher-than-average loan balances (Baum et al. 2016; U.S. Government

Accountability Office 2015), little is known about the evolution of these borrowers' earnings over the longer run. Table 5 explores the associations between UMD survey respondents' labor market expectations and their preferences for IDR. Neither the expected level of earnings at graduation nor expected earnings at later points in life, conditional in both cases on being employed, are significantly associated with the likelihood that the student prefers IDR. The expected likelihood of having zero earnings at graduation has a significant positive association with preferences for fixed amount IDR and the expected likelihood of having low earnings at graduation has a significant positive association with preferences for both fixed amount and fixed length IDR. In contrast, the expected probabilities of having zero or low earnings at age 30 or age 40 are not significantly correlated with IDR preferences.[28]

There are good reasons for the risk of an especially negative labor market outcome following graduation to be associated with stronger preferences for IDR. It is exactly during periods of zero or low earnings that IDR's advantages are realized and newly graduated borrowers who have had no opportunity to accumulate a precautionary savings would be especially vulnerable in the event of a negative earnings shock. Among new graduates with better labor market outcomes, provided earnings are above some threshold, having somewhat higher or somewhat lower earnings could well have little effect on preferences for IDR.

The lack of correlation between expected labor market outcomes at age 30 or age 40 and preferences for IDR is perhaps more surprising. One possible explanation is that students are myopic, applying a high discount rate to future financial outcomes. It also is possible that, in contrast to their expectations about the distribution of potential outcomes at graduation, which presumably are informed by observing the experiences of recent graduates, students may have less certainty in their assessments of the range of potential outcomes they will face 10 or 20 years in the future. This could lead them to disregard those assessments in making their decisions. Whatever the explanation, among the labor market expectation measures we have examined, only the expected probability of low or zero earnings at graduation is predictive of loan repayment plan preferences.

5.3 Heterogeneity in framing effects by labor market expectations

Next, we test whether students' expected labor market outcomes interact significantly with the framing of IDR. We focus on interactions between framing and students' expectations of the likelihood of having low or no earnings at graduation. We do not examine interactions with expected labor market outcomes beyond graduation because expectations about these later outcomes are uncorrelated with students' preferences for

[28]These patterns are robust to a variety of specifications and sample restrictions including: using standardized measures of students' expected earnings profiles ($\mu = 0$, $\sigma = 1$), not conditioning expected earnings on employment, dropping respondents who spent less than 5 minutes on the survey, and dropping respondents with outlier expected earnings (above the 99th percentile or below the 1st percentile). These results can be found in Appendix Table D.10.

IDR once outcomes at graduation are taken into account (Table 5).

Table 6 displays estimates from specifications in which IDR framing is fully interacted with students' expected probability of having earnings below $35,000 in the year of graduation.[29] We find evidence of significant interactions between the expected probability of a bad labor market outcome and the neutral and insurance frames, but not between the probability of a bad labor market outcome and the frame emphasizing IDR costs. To put these effects into context, consider what they imply about the decisions of a student with an expected probability of low or no earnings at graduation equal to 50 percent and the decisions of a student whose expected probability is 25 percent (holding all other characteristics constant). When the costs of IDR are emphasized, these students are equally likely to choose IDR over the standard plan, as the expected risk of a bad labor market outcome is uncorrelated with IDR take-up. Under the neutral frame, a student who expects a 50 percent risk of low or no earnings is roughly 3.5 percentage points more likely to choose IDR than the student who expects a 25 percent risk of low or no earnings, while under the insurance frame, the difference in their IDR take-up is 6 to 7 percentage points.

A natural question is whether the estimates displayed in Table 6 are robust to allowing for possible nonlinearities in the interaction effects between framing and the probability of a bad labor market outcome. To address this concern, we estimate local linear regressions of the probability of preferring IDR over the standard plan on the expected probability of having earnings less than $35,000 (either zero earnings or low positive earnings); these estimates are displayed in Figure 7. The short-dashed gray line corresponds to the density of observations by expected probability of low earnings to illustrate the region that represent the support of the data. The figure confirms that the linearity assumption underlying the Table6 regressions is reasonable as well as the conclusions drawn from those regressions.

5.4 Other correlates of heterogeneity in framing effects

In addition to varying with students' labor market expectations, the sensitivity of preferences to the framing of loan repayment plans also could vary with other student characteristics. The first three columns of Table 7 provide evidence on whether the groups of students we would expect to be more capable of assessing available repayment plans objectively are less affected by the framing of those options. We augment our baseline model - shown in equation (1) - by fully interacting the plan framing variables with an indicator for being in a STEM, economics or business major; financial literacy (i.e., having answered at least one of the

[29] In Appendix Table D.11, display results from two additional specifications. The first allows for separate interactions between framing and expected earnings at graduation, the probability of no earnings at graduation, and the probability of low earnings at graduation. The second allows for separate interactions between framing and separate terms for the probability of no earnings and the probability of low earnings at graduation. Framing does not significantly interact with expected earnings. Framing significantly interacts with both the probability of low earnings and the probability of no earnings in the fixed amount IDR treatment arm. For fixed length IDR, estimated interactions with framing and the expected probability of no earnings are positive but not statistically significant at conventional levels.

two financial literacy questions correctly); and having taken out a student loan while at UMD, respectively. STEM, business and economics students' preferences for IDR are significantly less sensitive to the insurance framing than the preferences of students in other (or undecided) majors. STEM students' smaller response to the insurance framing could be driven by their higher earnings expectations rather than their quantitative reasoning skills, but the finding is robust to controlling for students' labor market expectations, suggesting that students in these majors may simply be better able to assess the value of IDR and thus less sensitive to framing. The results in column (2) provide suggestive evidence that students with lower financial literacy may be more sensitive than other students to the framing of available loan repayment options, but we cannot reject equality of the framing-financial literacy interactions at conventional significance levels. Finally, the insurance frame has larger effects on students who have borrowed while at UMD for those assigned to fixed payment length IDR, but this is not the case for students presented with the option of fixed amount IDR. Overall, these findings provide only weak support for the idea that more capable or more knowledgeable students are less susceptible to framing effects.

We next explore whether students who are more risk averse are more susceptible to changing their views based on the risks that a framing emphasizes. Consistent with this idea, in both the fixed payment amount and fixed payment length models, more risk averse students exhibit greater sensitivity to framing (Table 7, column 4). Risk averse students are less likely to choose the IDR plan when given information that emphasizes the possibility that IDR will carry higher costs and more likely to choose IDR when given information that emphasizes the plan's insurance aspect.[30]

With the results presented in the final three columns of Table 7, we explore whether framing effects vary with student gender, status as an underrepresented minority, and status as a first-generation college student. Among undergraduate borrowers who were enrolled during the 2011-12 academic year, 60 percent were female, 42 percent were Black, Hispanic, or Native American, and 43 percent were first generation college students.[31] Thus, UMD students in our analysis sample (and as a whole) are less likely to be female and less likely to be in an underrepresented minority group than the typical college student and they are more likely to have college educated parents. If anything, it appears that the effects we document are stronger among the demographic groups that are under-represented in our sample, with the difference in effects of framing being most pronounced for female students.

[30]Students who report being less willing to take risks also expect to have lower earnings and a higher probability of low or no earnings at graduation, which makes it difficult to disentangle the heterogeneous effects of framing by student risk aversion from heterogeneity in effects by expected labor market outcomes.

[31]Authors' analysis of the 2012 National Postsecondary Student Aid Study using PowerStats (available at: https://nces.ed.gov/datalab/). First generation college students in the NPSAS are those whose parents do not have college degrees and have never attended college.

6 Simulated Effects of IDR Framing on Government Revenue and Borrower Defaults

This section describes how we estimate the effect of changes in IDR payment rates and framing on selection into IDR, aggregate payments, and defaults. We focus our discussion on the simulated effects of changing the parameters of fixed-amount IDR as similar repayment programs already exist. Appendix E discusses the simulated effects of varying the parameters of fixed length IDR.

To simulate the effect of varying the "price" of IDR, we use students' response to the survey question that asks what IDR payment, as a percentage of income, would make the student indifferent between the standard loan repayment plan and IDR. Thus, for the purposes of the simulation exercise, our sample is limited to students who answered this particular survey question. Of the students who answered this question, an additional 17 percent are excluded due to an inability to fit a parameterized age-earnings profile (discussed below).[32] The resulting sample includes 2,618 survey respondents.

Our approach requires several assumptions. Most importantly, we assume that students' expected labor market outcomes are, on average, an accurate measure of their *ex post* labor market outcomes. Within broad major categories, survey respondents' age-specific expected labor market outcomes and appear to be highly correlated with actual labor market outcomes of college graduates in the ACS (see Appendix Figure D.1, Appendix Tables D.6, D.7, and D.8). Furthermore, Wiswall and Zafar (2016) provide evidence that New York University students' expectations of their earnings and labor force participation at age 30 are quite similar to their realized outcomes, suggesting that, on average, college students can predict their future labor market outcomes with reasonable accuracy.

Second, we abstract from the effects of student loan debt on graduate school enrollment, marriage, and child-bearing, all of which could affect both the choice of repayment plan and repayment outcomes.[33] Finally, we use the parameters of IDR plans presented to students within the survey's hypothetical scenarios, which differ from the features of currently available IDR options in two important ways. Most (but not all) currently available IDR plans cap payments at the standard plan payment amount. In addition, borrowers are allowed to leave IDR, although any additional interest accrued while enrolled in IDR still must be repaid.[34]

[32]This group primarily includes students who reported expected annual earnings that were inconsistent with their expected probabilities of earning less than $35,000, between $35,000 and $75,000, and more than $75,000. For example, a student who reported their expected earnings at age 30 to be $100,000 and a 100 percent probability of earning less than $35,000 would be excluded.

[33]To our knowledge, the effects of student loan debt on marriage and child-bearing have not been studied, but Fos, Liberman and Yannelis (2017) show that increases in undergraduate debt reduce the probability of graduate school attendance. Whether enrollment in IDR would strengthen or attenuate this relationship is unclear.

[34]Borrowers participating in extant U.S. IDR plans must "recertify" their income and family size at least once a year. Failure to recertify will pause IDR participation and a borrower's future payments will depend on the version of IDR initially chosen. For borrowers in REPAYE, those who don't recertify will be removed from the REPAYE Plan and placed on an alternative repayment plan in which the required monthly payment is equal to the amount necessary to repay the loan in full by the earlier of (a) 10

6.1 Simulation procedure

We first generate frequency weights via raking to match characteristics of bachelor's degree-seeking borrowers in the nationally representative 2012 National Postsecondary Student Aid Study (NPSAS). Students in our sample are matched to NPSAS borrowers based on observable characteristics including indicators for eligibility for the maximum Pell Grant (i.e., students with an expected family contribution of $0), eligibility for a Pell Grant less than the maximum (versus ineligible), class standing (lower level versus upper level), missing SAT score, race (Asian, Black, Hispanic, White, or Other), first generation student, in-state student, 11 major categories (science and math, business and economics, computer and information sciences, education, engineering, general studies, social sciences excluding economics, humanities, applied health-related, other applied field, or undecided), gender, and age (less than 20 years old versus 20 and older). We also match based on outstanding debt assigned to survey respondents in the hypothetical loan repayment scenarios. Given that our hypothetical scenarios only provide us with two different loan amounts ($30,000 and $60,000), we use the midpoint between these amounts ($45,000) to generate a dichotomous indicator for large estimated loans at graduation.[35] Weights were restricted to values between 1 and 8,000. As shown in Appendix Table D.12, the reweighted analysis sample matches the NPSAS sample along all dimensions used to generate the weights. The reweighted sample of UMD students is also similar to the nationally representative sample in terms of parental income and SAT scores. However, the reweighed sample of UMD survey respondents is younger and has higher EFCs than bachelor's degree-seeking borrowers nationwide.

Following Wiswall and Zafar (2015), we estimate parameters for each sample member's potential experience-earnings profile, assuming that a borrower with potential experience a has earnings equal to $earn_a \sim N(\mu_a, \sigma_a)$, $\mu_a = \mu_0 + \mu_1 exp + \mu_2 exp^2$, and $\sigma_a = \sigma_0 + \sigma_1 exp$.[36] We estimate the parameter vector $\theta = \{\mu_0, \mu_1, \mu_2, \sigma_0, \sigma_1\}$ via simulated method of moments, weighting by the inverse variance of sample moments. Finally, we interpolate the expected probability of zero earnings for each student across the three reported expected probabilities (at graduation, age 30, and age 40).

Next, for each sample member, we draw a sequence of earnings and nonemployment probabilities from

years from the date the borrower began repayment under the alternative repayment plan, or (b) the ending date of the 20- or 25-year repayment period. The borrower can choose to leave the alternative repayment plan and repay under any other repayment plan for which they are eligible. For borrowers in other IDR plans (PAYE, IBR, ICR), those who don't recertify will remain on the same IDR plan, but monthly payments will no longer be based on the borrower's income. Instead, payments will be set equal to the amount the borrower would pay under the 10-year standard repayment plan had they chosen the standard plan when first entering repayment. Borrowers in REPAYE, PAYE, IBR who fail to recertify will have any unpaid interest capitalized (i.e., added to the principal balance). See https://studentaid.ed.gov/sa/repay-loans/understand/plans/income-driven for details.

[35] For NPSAS sample members, we predict outstanding debt at graduation by multiplying current debt by 4 for freshmen, 2 for sophomores, and $\frac{4}{3}$ for juniors. Approximately 16 percent of borrowers attending four-year institutions in 2012 are projected to have debt at or above $45,000 when entering repayment (versus approximately 50 percent of survey respondents in the unweighted sample).

[36] Age is measured at the beginning of the academic year. We assume that seniors' age at graduation is their current age plus one year, juniors are two years older at graduation, sophomores are three years older at graduation, and freshmen are four years older at graduation. We use new transfer students' self-reported class level and the above logic to generate an age at graduation for transfer students.

their parameterized experience-earnings profile and interpolated nonemployment profile, setting earnings to zero if the sample member is not employed at age a. The number of draws for a given sample member is determined by their raked frequency weight, so that the final data set has a distribution of characteristics that matches those of all bachelor's degree-seeking borrowers.

Once we have generated this sample of borrowers, we allow each borrower's choice of repayment plan to be determined by the price of IDR. For instance, if a student reports that a 6 percent payment rate would make them indifferent between IDR and the standard plan, we assume that for any rate below 6 percent, they would choose IDR and for any rate at or higher than 6 percent, they would choose the standard plan. Payments are calculated following the description of each plan in Section 3.1. At a given point in time after entering repayment, a student is assumed to default on their loan if their payment exceeds 50 percent of their income for two years in a row. Students who choose IDR never enter into default.

For each payment rate and IDR frame, we calculate the IDR take-up rate, average total payments over the 10 and 20 year periods following entry into repayment, and the share of borrowers who ever default on their loan in the 20 years after entering repayment (almost all defaults occur within the first 10 years of repayment). We provide a measure of the degree of adverse selection into IDR by calculating the difference between average total IDR payments that the government would have received had the students who chose the standard plan instead chosen IDR and the average total payments received by students who did choose IDR. We use a student loan interest rate of 5 percent (as stated in the hypothetical survey scenarios). We set the government's discount rate to 3 percent.[37]

Under a universal standard repayment plan, the present discounted value of payments over the first 10 years of repayment by borrowers with average debt of approximately $35,000 at graduation is $36,200 over the first 10 years of repayment; the present discounted value of payments over the first 20 years of repayment is $37,500. We project that approximately 34 percent of these borrowers would default on their loan at some point during the 20 years following entry into repayment if only the standard repayment plan was available (with the vast majority of defaults occurring in the first 9 years of repayment). While the projected share of students ever defaulting is much larger than the average three-year cohort default rates reported by the federal government in recent years, it is reasonably consistent with the five-year default rate of 28 percent for students in the 2008-09 repayment cohort reported by Looney and Yannelis (2015), especially since actual default rates include the substantial minority of borrowers who are enrolled in IDR and thus face little risk of default. It is also important to note that our measure represents the share of borrowers who we project to default on their loan at any point in the 20 years after leaving college, and is substantially larger than

[37]The Federal Credit Reform Act of 1990 requires that estimated net payments on federal loans be discounted at a rate equal to the interest rate for U.S. Treasury securities of the same maturity as the loan (between 1.5 and 3 percent for 10-20 year Treasury notes in recent years).

the share of borrowers that we predict will default in any given year.

6.2 Simulation results for fixed amount IDR

Figure 8 displays the simulated IDR take-up rate by IDR frame and price. At every price, simulated take-up is substantially higher under the insurance frame, although differences are smaller at lower, more generous IDR payment rates. There is little difference in take-up between the neutral and cost frames.[38]

As described above, we measure the degree of adverse selection into IDR using the difference between the present discounted value of payments students who chose the standard plan would have made under IDR and the present discounted value of payments made by students who chose IDR. If borrowers adversely select out of IDR based on their expected cost of participation, this difference should be positive. Conversely, if borrowers who select into IDR are those who would expect to pay more under this plan, this difference will be negative, representing advantageous selection (from the government's perspective). As shown in Figure 9, across all three frames, we find relatively little selection into IDR. At most, borrowers who opt-out of IDR in favor of the standard plan would have paid $4,000 more in present value terms under IDR than borrowers who chose IDR. At payment rates below 6 percent, both the cost and neutral frames generate adverse selection into IDR, while the insurance frame generates advantageous selection into IDR. At higher payment rates, there is essentially no selection into IDR, suggesting that at payment rates in the range of those available to actual borrowers (e.g., 10 to 15 percent of disposable income), adverse selection into IDR may not be a large concern for borrowers with average debt levels.[39] While this finding may seem to be at odds with the fact that students who expect to have low or no earnings are more likely to choose IDR when assigned to the insurance frame (e.g., Table 6), it is not necessarily inconsistent; in our sample, the expected risk of a poor labor market outcome at graduation is relatively uncorrelated with expected labor market outcomes at later points.

Next, we examine the simulated effect of IDR framing and payment rates on government revenue when borrowers are allowed to choose their repayment plan. Figure 10 displays the present discounted value (PDV) of payments received over the first 10 (Panel A) or 20 (Panel B) years of repayment. For students with average debt levels, any IDR payment rate above 5 percent generates essentially the same eventual revenue as universal participation in the standard plan (indicated by the horizontal dashed line).[40] However, when we examine aggregate payments over the 10 year time horizon used by the standard plan, the IDR rate must exceed 12 percent for revenue to be approximately equal to that received under a universal standard

[38] As shown in Appendix Figure D.2, this pattern does not hold for borrowers with above average debt. In this group, take-up under the neutral frame exceeds take-up under the cost frame at every rate.

[39] Patterns are fairly similar when we compare borrowers with below and above average debt (Appendix Figure D.3), although differences in selection between frames for borrowers with above average loans are larger in magnitude and less precise.

[40] For borrowers with above average debt, this pattern holds for any IDR rate above 12 percent (Appendix Figure D.5).

plan (Figure 10). For borrowers with $60,000 in debt, allowing students to select into IDR leads to revenue losses over the 10-year horizon for every IDR rate we examine, although losses are small when the IDR payment rate exceeds 18 percent (Appendix Figure D.4).

Finally, we simulate how changes to the price and framing of IDR would affect aggregate default rates. Under a given IDR payment rate and frame, the reduction in defaults will be driven by the IDR take-up rate and the degree of selection into IDR. Even with a payment rate of 22 percent - the highest we examine - when IDR is framed as providing insurance, the share of borrowers who default falls substantially relative the share defaulting when the costs of IDR are emphasized (Figure 11). The reduction in the share of borrowers ever defaulting due to moving them from the cost frame to the insurance frames is largest for IDR rates between 10 and 14 percent. Switching from the cost to a neutral frame has much smaller effects on lifetime default rates.[41] Taken together with the simulated effects on federal revenue (Figure 10), Figure 11 suggests that a simple change in the framing of IDR could generate substantial reductions in loan defaults with minimal loss of federal revenue. Outside of very low IDR payment rates, which would generate substantial amounts of debt forgiveness for many students, we project that the vast majority of students who borrow while attending a four-year institution will repay their debt within 20 years. While the revenue collected from students with loans of above-average size will be lower over the 10-year horizon used in the standard plan, in the case of borrowers with average levels of debt, revenue losses at 10 years following the start of repayment are relatively minor.

7 Conclusion

We show that the framing of IDR options has large effects on the stated preferences of UMD undergraduate students presented with hypothetical loan repayment scenarios. When the potential for higher interest payments and longer repayment periods is emphasized, as is the case with existing tools intended to help borrowers choose among repayment plans, students are significantly less likely to choose IDR over the standard plan, even when their expected labor market outcomes suggest that they would stand to benefit from the protection against unaffordable loan payments. In contrast, when the insurance aspects of IDR are emphasized, students are significantly more likely to choose IDR. Moreover, the increased take-up of IDR is driven by those students who stand to benefit the most from this type of insurance - those who anticipate a high probability of unemployment or relatively low earnings and those who would pay more under the standard plan based on their expected earnings at graduation. We provide evidence of similar framing effects for borrowers' take-up of fixed length IDR options, a class of policies that have attracted

[41] For students with below average loans, default rates are essentially the same under the cost and neutral frames, while the lifetime default rate is lower under the neutral frame for borrowers with above average debt (Appendix Figure D.6).

increasing attention in recent years but have yet to be implemented on a large scale or studied empirically.

Simulation results provide supporting evidence that adverse selection into IDR based on earnings over the entire repayment period is limited, even when the insurance aspect of IDR is emphasized. Our findings imply that under the IDR options currently available to U.S. student borrowers, default rates of bachelor's degree-seeking borrowers could be lowered substantially with little long-term cost to the federal government by emphasizing the fact that IDR provides insurance against unaffordable loan payments.

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Figures and Tables

Figure 1: Output from the Department of Education Repayment Plan Comparison Tool

Repayment Plan	First Monthly Payment	Last Monthly Payment	Total Amount Paid	Projected Loan Forgiveness	Repayment Period
Standard	$318	$318	$38,184	$0	120 months
Graduated	$180	$540	$40,294	$0	120 months
Revised Pay As You Earn (REPAYE)	$102	$401	$51,982	$0	234 months
Pay As You Earn (PAYE)	$102	$318	$52,358	$252	240 months
Income-Based Repayment (IBR)	$152	$318	$44,377	$0	175 months
IBR for New Borrowers	$102	$318	$52,358	$252	240 months
Income-Contingent Repayment (ICR)	$203	$251	$44,542	$0	196 months

Notes: Output from the Department of Education's Repayment Estimator (available at: https://studentloans.gov/myDirectLoan/mobile/repayment/repaymentEstimator.action). Calculations are for a $30,000 unsubsidized loan with 5 percent interest for a single individual with an initial adjusted gross income equal to $30,000. The estimator assumes a zero discount rate, income growth of 5 percent per year, and no risk of unemployment.

Figure 2: Hypothetical Loan Repayment Scenarios: Fixed Payment Amount

Plan A	Plan B
• You will pay back the money you owe over the next 10 years.	• You will make monthly payments on your loan for up to the next 20 years. Your payments will stop once you have paid off your loan. Any money that you still owe after 20 years will be forgiven.
• You will make a fixed monthly payment of $636 per month, which will cover both the interest that you owe and your loan principal.	• You will not make payments in any month in which your income is less than $1,000 (in 2016 dollars). • In months when your income exceeds $1,000, your payments will equal 20% of the amount you earn above $1,000. • If you make no payment or if your payment isn't enough to cover the interest you owe, any unpaid interest will be added to your loan balance.

*Note*s: Loan repayment scenario from the student survey treatment with a fixed payment amount IDR plan, high loan amount, high IDR payment amount, and neutral framing. See Figure 3 for a sample fixed-length IDR scenario, Figure 4 for additional language used in the non-neutral framing scenarios, and Appendix A for a list of all treatment arms.

Figure 3: Hypothetical Loan Repayment Scenarios: Fixed Payment Length

Plan A	Plan B
• You will pay back the money you owe over the next 10 years.	• Your student loan debt will be replaced with a contract requiring you to make monthly payments over the next 20 years. Regardless of how much you end up paying, you will be required to make payments for the full 20-year period.
• You will make a fixed monthly payment of $636 per month, which will cover both the interest that you owe (calculated at 5% per year) and your loan principal.	• You will not make payments in any month in which your income is less than $1,000 (in 2016 dollars). • In months when your income exceeds $1,000, your payments will equal 10% of the amount you earn above $1,000.

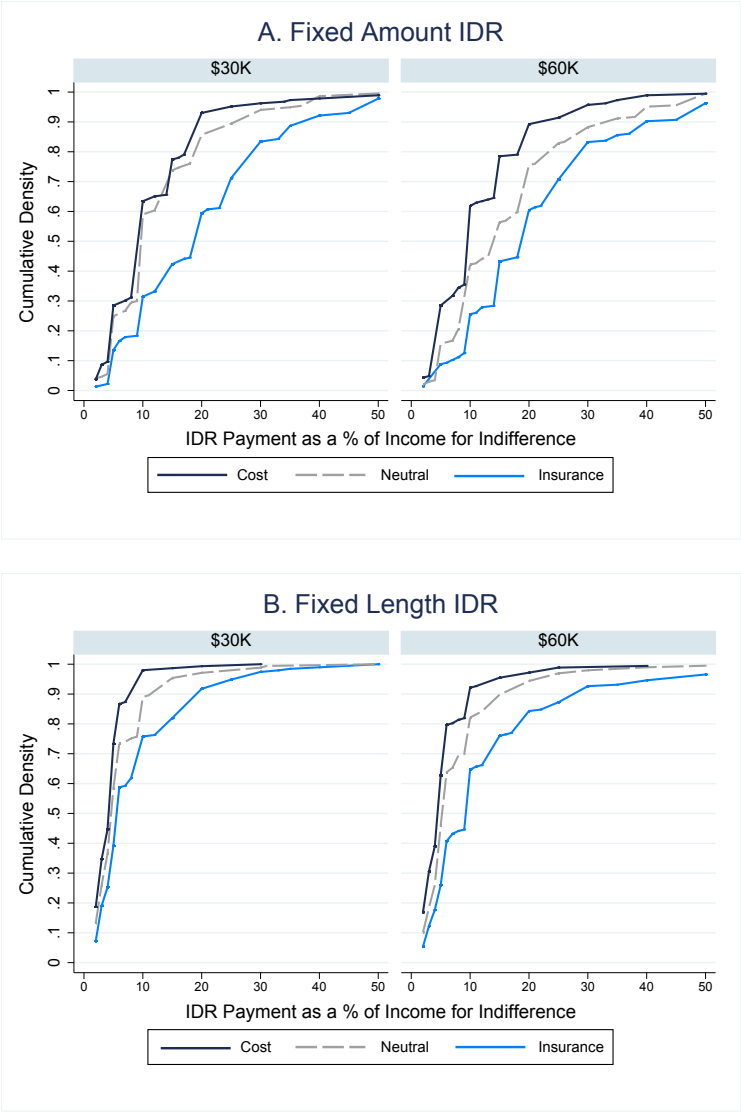
*Note*s: Loan repayment scenario from the student survey treatment with a fixed repayment length IDR plan, high loan amount, high IDR payment amount, and neutral framing. See Figure 2 for a sample fixed-length IDR scenario, Figure 4 for additional language used in the non-neutral framing scenarios, and Appendix A for a list of all treatment arms.

Figure 4: Alternate Repayment Plan Framing

Framing	Standard Plan	IDR Plan
Neutral	No additional language.	No additional language.
Emphasis on Costs	With this plan, you know exactly how much you will have to pay each month for the next 10 years. Over the life of the loan, in addition to repaying the amount you borrowed, you will pay a total of $8,184 (or $16,367) in interest.	With this plan, you could end up paying substantially more than you would pay under Plan A and you could be required to make payments for a longer period of time. [fixed amount IDR] or With this plan, you could end up paying substantially more over the 20-year duration of the contract than you would pay under Plan A and you will be required to make payments for a longer period of time. [fixed length IDR]
Emphasis on Insurance	With this plan, you will be required to make the monthly payment of $318 (or $636) for the next ten years even in months when your income is low. You could face the risk of defaulting on your loan if you cannot make the required monthly payment.	With this plan, you will be protected against having to make unaffordable payments when your income is low and you will be protected from the risk of default.

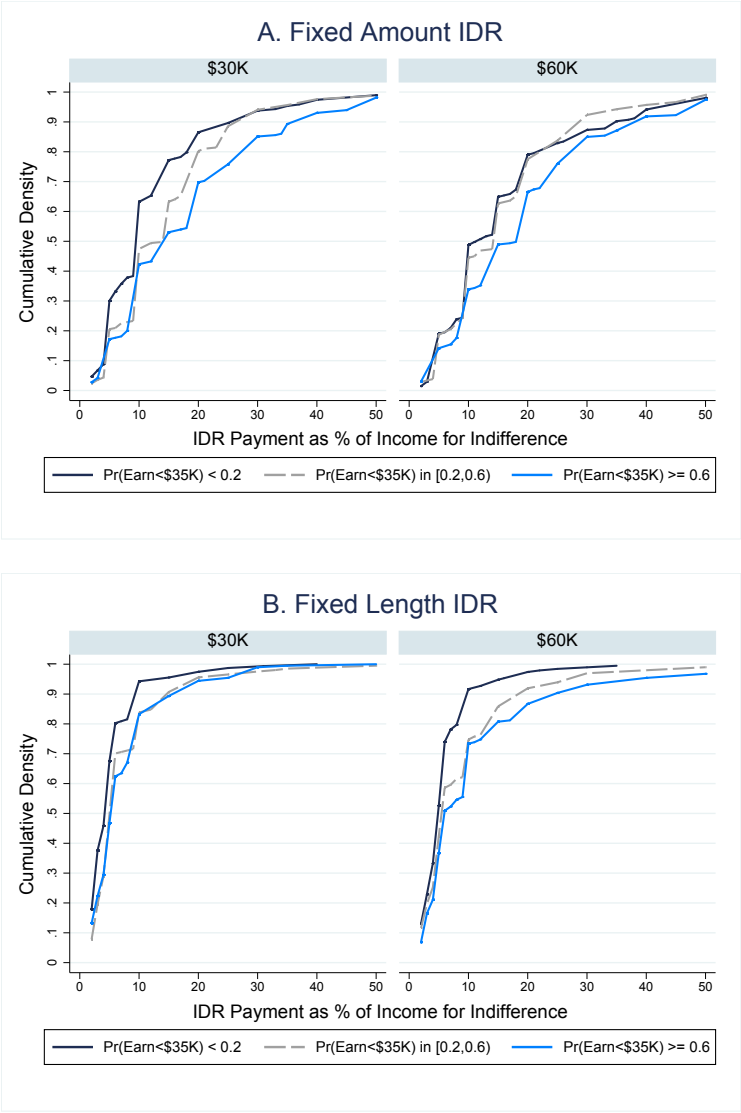
*Note*s: Additional language included in hypothetical loan repayment scenarios by framing treatment arm.

Figure 5: Willingness to Pay for IDR by Framing and Loan Size



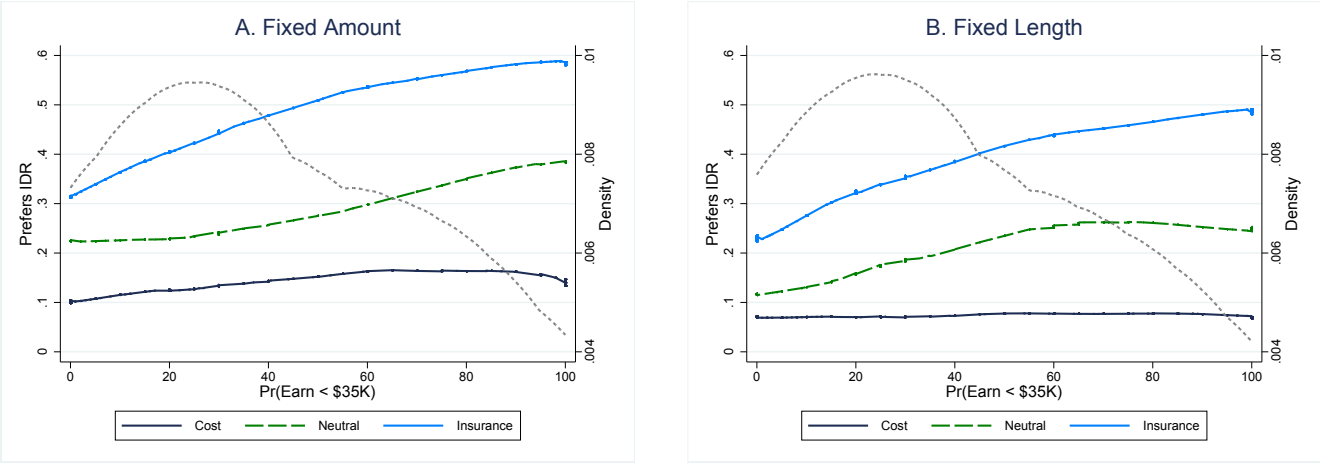
Notes: Each figure displays the CDF of students' reported percentage of income as payment that would make them indifferent between IDR and the standard loan repayment plan. Students who reported a willingness to pay equal to 0 percent, 100 percent, or an amount inconsistent with answers to the two hypothetical loan repayment scenario questions are excluded.

Figure 6: Willingness to Pay for IDR by Expected Probability of Low Earnings and Loan Size



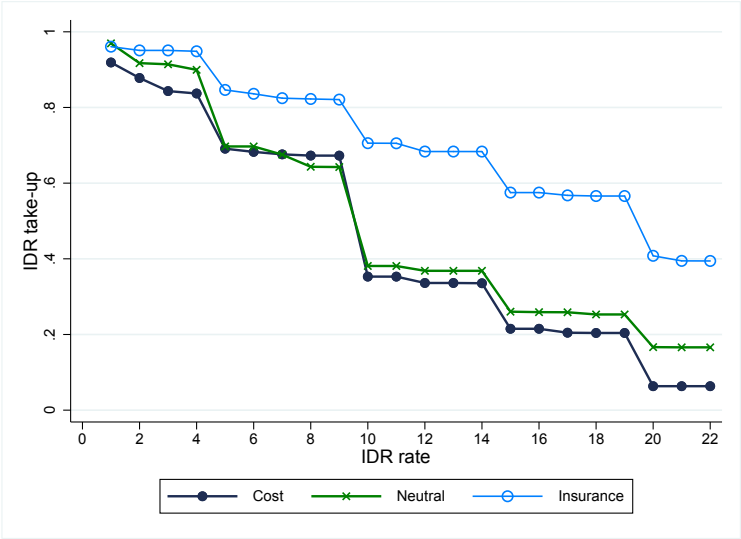
Notes: Each figure displays the CDF of students' reported percentage of income as payment that would make them indifferent between IDR and the standard loan repayment plan. Students who reported a willingness to pay equal to 0 percent, 100 percent, or an amount inconsistent with answers to the two hypothetical loan repayment scenario questions are excluded.

Figure 7: Share Choosing IDR by Framing and Expected Probability of Low Earnings at Graduation



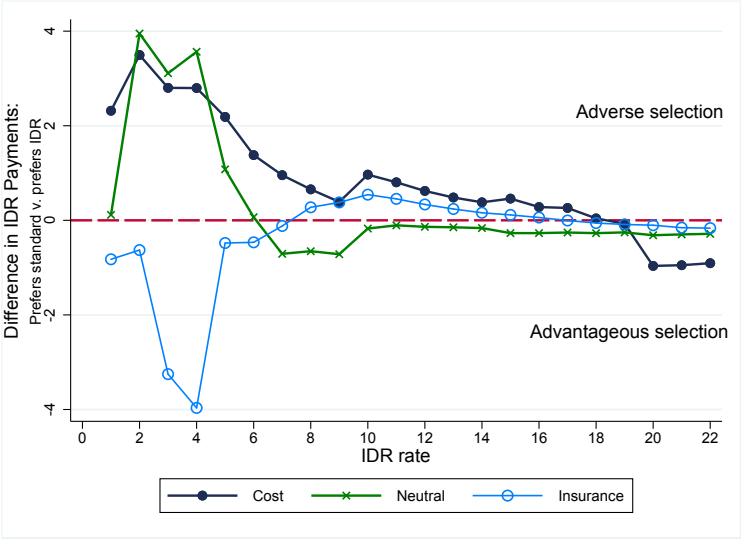
Notes: Each figure displays local linear regressions of the probability of preferring IDR on the probability of having low earnings (less than $35,000) at graduation, separately by framing. The short-dashed gray line represents the density of observations with respect to the probability of low earnings (corresponding to the right y-axis).

Figure 8: Fixed Amount IDR Take-up by Frame and Payment Rate



Notes: Simulated take-up of IDR by payment rate and framing (see Section 6 for details). Payment rate is the IDR payment as a percent of disposable income.

Figure 9: Selection into Fixed Amount IDR by Frame and Payment Rate

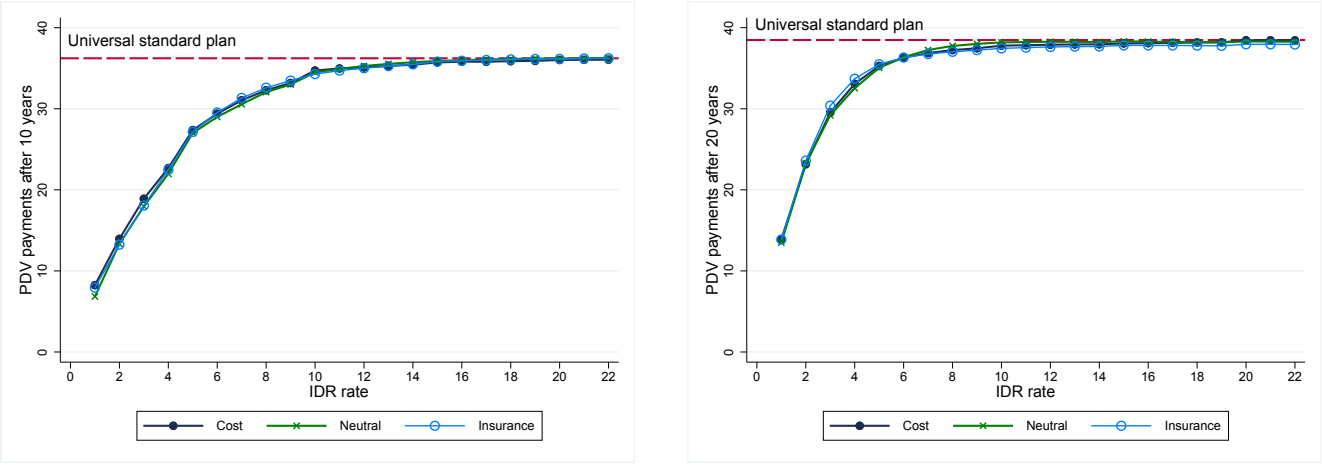


Notes: Simulated difference in average payments borrowers who chose the standard plan would have made had they chosen IDR and average payments made by borrowers who chose IDR, by payment rate and framing (see Section 6 for details). Payment rate is the IDR payment as a percent of disposable income.

Figure 10: Present Discounted Value of Payments by Frame and Fixed Amount IDR Payment Rate

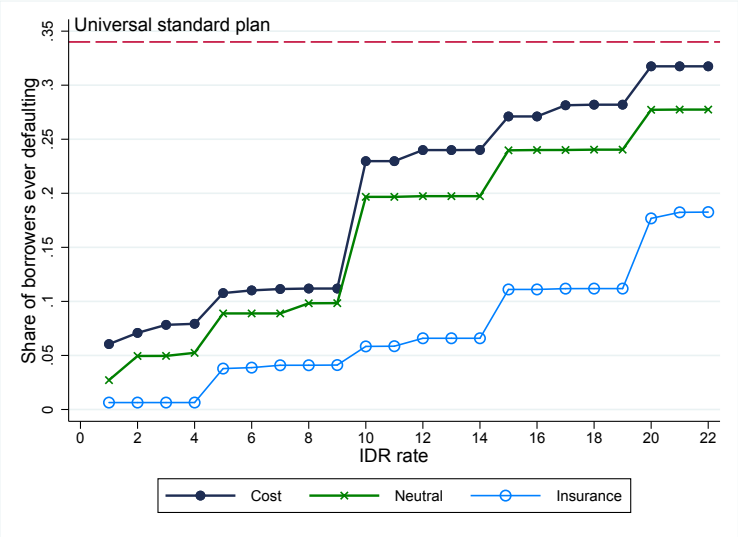
A. After 10 years

B. After 20 years



Notes: Simulated average present discounted value of loan payments after 10 and 20 years, by payment rate and framing, using a 3 percent discount rate (see Section 6 for details). Payment rate is the IDR payment as a percent of disposable income.

Figure 11: Share of borrowers defaulting within 20 years by Frame and Fixed Amount IDR Payment Rate



Notes: Simulated probability of defaulting within 20 years of entering repayment, by payment rate and framing (see Section 6 for details). A borrower defaults if her required loan payment exceeds 50 percent of her income for two consecutive years. Students choosing IDR are assumed never to default. Payment rate is the IDR payment as a percent of disposable income.

Table 1: Correlations between Selected Predetermined Characteristics and Treatment Parameters

Dependent variable:	(1) STEM major	(2) Other major	(3) Female	(4) SAT percentile	(5) Missing SAT	(6) Fresh.	(7) Soph.	(8) Junior	(9) Senior
Sample mean	0.559	0.337	0.497	82.5	0.133	0.193	0.163	0.244	0.318
Fixed payment length	0.022	-0.010	0.018	0.1	-0.013	-0.013	0.015	-0.016	0.006
	(0.015)	(0.014)	(0.015)	(0.6)	(0.010)	(0.012)	(0.011)	(0.013)	(0.014)
Framing (rel. to neutral)									
Cost	0.026	-0.004	0.036	0.7	-0.008	0.004	-0.001	-0.015	0.006
	(0.018)	(0.018)	(0.019)+	(0.7)	(0.013)	(0.015)	(0.014)	(0.016)	(0.017)
Insurance	-0.007	0.017	0.014	1.5	-0.012	-0.004	0.012	0.003	0.000
	(0.018)	(0.017)	(0.018)	(0.7)*	(0.012)	(0.014)	(0.014)	(0.016)	(0.017)
Low payment in 1st scenario	-0.020	0.001	0.017	-0.6	0.009	0.005	0.002	0.011	-0.016
	(0.015)	(0.014)	(0.015)	(0.6)	(0.010)	(0.012)	(0.011)	(0.013)	(0.014)
Loan amount = $60,000	0.003	-0.007	-0.002	0.8	-0.006	-0.003	0.012	-0.005	-0.001
	(0.015)	(0.014)	(0.015)	(0.6)	(0.010)	(0.012)	(0.011)	(0.013)	(0.014)
Test of joint sig. (p-val.)	0.182	0.788	0.232	0.162	0.627	0.886	0.509	0.549	0.910

*Note*s: Analysis sample (N = 4,399); column (4) specification limited to students with nonmissing math SAT scores (N = 3,813). Regression of specified characteristic on treatment parameters. Robust standard errors in parentheses; ** p<0.01, * p<0.05, + p<0.1. See Appendix Table D.1 for correlations between treatment parameters and additional predetermined variables.

Table 2: The Effect of IDR Framing on Student Preferences

	(1) Fixed payment amount	(2) Fixed payment length
Mean | neutral framing	*0.279*	*0.197*
Framing (rel. to neutral)		
Cost	-0.141	-0.116
	(0.019)**	(0.015)**
Insurance	0.185	0.179
	(0.022)**	(0.020)**
Test of eq. (p-val)	*<0.001*	*<0.001*
Loan size ($10k)	0.020	0.026
	(0.006)**	(0.005)**
Payment as % of income	-0.011	-0.014
	(0.002)**	(0.002)**
Observations	4,440	4,358

*Note*s: Dependent variable: prefers or strongly prefers IDR plan. Survey respondents were assigned a loan size of either $30,000 or $60,000; payment as a percent of income was assigned to be either 15% or 20% for fixed amount IDR and either 6% or 10% for fixed length IDR. All regressions also include controls for major (STEM/business/economics versus other), gender, class standing (freshman, sophomore, junior, senior, or new transfer), an indicator for missing SAT scores, SAT math percentile, and whether the high cost IDR option was presented first. See Figure 4 for description of framing treatments. Robust standard errors, clustered at the student level in parentheses; ** p<0.01, * p<0.05, + p<0.1.

Table 3: Robustness of IDR Framing Effects

	(1) No controls	(2) Adtl. admin conts	(3) RA, debt, FL	(4) Drop irrational	(5) Drop low FL	(6) UMD borrowers	(7) At least 5 minutes	(8) Drop outliers
A. Fixed amount								
Framing								
Cost	-0.139	-0.140	-0.139	-0.147	-0.117	-0.136	-0.152	-0.136
	(0.019)**	(0.019)**	(0.019)**	(0.024)**	(0.026)**	(0.028)**	(0.021)**	(0.020)**
Insurance	0.186	0.185	0.186	0.215	0.175	0.176	0.188	0.191
	(0.022)**	(0.022)**	(0.022)**	(0.029)**	(0.030)**	(0.031)**	(0.024)**	(0.023)**
Test of eq. (p-val.)	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
Loan size ($10K)	0.020	0.020	0.020	0.024	0.015	0.018	0.019	0.021
	(0.006)**	(0.006)**	(0.006)**	(0.007)**	(0.008)+	(0.008)*	(0.006)**	(0.006)**
Payment as % of income	-0.011	-0.011	-0.011	-0.020	-0.013	-0.011	-0.012	-0.010
	(0.002)**	(0.002)**	(0.002)**	(0.002)**	(0.002)**	(0.002)**	(0.002)**	(0.002)**
Observations	4,440	4,440	4,440	2,566	2,422	2,188	3,844	4,064
B. Fixed length								
Framing								
Cost	-0.118	-0.114	-0.117	-0.123	-0.107	-0.144	-0.115	-0.111
	(0.015)**	(0.015)**	(0.015)**	(0.020)**	(0.020)**	(0.023)**	(0.016)**	(0.016)**
Insurance	0.181	0.177	0.180	0.168	0.153	0.179	0.185	0.188
	(0.020)**	(0.020)**	(0.020)**	(0.027)**	(0.027)**	(0.029)**	(0.022)**	(0.021)**
Test of eq. (p-val.)	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
Loan size ($10K)	0.026	0.026	0.026	0.032	0.024	0.048	0.028	0.029
	(0.005)**	(0.005)**	(0.005)**	(0.007)**	(0.006)**	(0.007)**	(0.005)**	(0.005)**
Payment as % of income	-0.014	-0.014	-0.014	-0.028	-0.016	-0.013	-0.016	-0.013
	(0.002)**	(0.002)**	(0.002)**	(0.002)**	(0.002)**	(0.003)**	(0.002)**	(0.002)**
Observations	4,358	4,358	4,358	2,496	2,400	2,178	3,762	3,986

*Note*s: Dependent variable: prefers or strongly prefers IDR plan. All regressions except column 1 include controls for major, gender, class standing, missing SAT scores, SAT math percentile, and whether the high cost IDR option was presented first. Column 2 specification controls for race (white, underrepresented minority, other), first generation student, any borrowing at UMD, in-state student, missing GPA, 2015-16 FAFSA completion, and continuous measures of age, total loans received at UMD, total grants received at UMD, 2015-16 EFC (zero if no FAFSA filed), and GPA (0 for freshmen and new transfers). Column 3 specification controls for number of correct financial literacy questions, willingness to take risks (1-10), any UMD student loans, total UMD student loans, any credit card debt, any auto loans, any loans from family members, any other unsecured debt, any other secured debt, and indicators for skipping risk aversion and debt questions. Column 4 specification drops respondents with inconsistent responses to the hypothetical loan scenario questions and/or stated percentage of income that would make them indifferent between the standard plan and IDR. Column 5 specification drops respondents who answered both financial literacy questions incorrectly. Column 6 specification limits the sample to respondents who have taken out student loans while at UMD. Column 7 specification limits the sample to respondents who spent at least 5 minutes completing the survey. Column 8 specification drops respondents who reported expected earnings above the 99th percentile or below the 1st percentile at graduation, age 30, or age 40. Robust standard errors, clustered at the student level in parentheses; ** p<0.01, * p<0.05, + p<0.1.

Table 4: The Effect of Framing on Willingness to Pay for IDR

	(1) Fixed payment amount	(2) Fixed payment length
Mean | neutral framing	*15.66*	*7.15*
Framing (rel. to neutral)		
Cost	-3.77	-2.07
	(0.76)**	(0.43)**
Insurance	5.82	4.08
	(0.88)**	(0.66)**
Test of eq. (p-val)	*<0.001*	*<0.001*
Loan size ($10k)	0.76	0.69
	(0.23)**	(0.16)**
Number of students	1,283	1,248

*Note*s: Dependent variable: payment as a percentage of income that would make student indifferent between standard plan and IDR. Students reporting willingness to pay that conflicts with earlier answers or a payment equal to 0 or 100 percent are excluded. Survey respondents were assigned a loan size of either $30,000 or $60,000. All specifications also include controls for major, gender, class standing, missing SAT scores, SAT math percentile, and whether the high cost IDR option was presented first. Robust standard errors in parentheses; ** $p<0.01$, * $p<0.05$, + $p<0.1$.

Table 5: Correlations between Expected Labor Market Outcomes and Preferences for IDR

	(1) Fixed amount	(2) Fixed length
Expected earnings | employment ($10k)		
At graduation	0.002	0.002
	(0.003)	(0.003)
Age 30	-0.002	-0.000
	(0.002)	(0.002)
Age 40	0.001	-0.001
	(0.002)	(0.001)
Probability of $0 earnings		
At graduation	0.170	0.039
	(0.043)**	(0.035)
Age 30	0.075	0.038
	(0.174)	(0.143)
Age 40	-0.003	-0.058
	(0.162)	(0.125)
Probability of earnings in ($0, $35k]		
At graduation	0.111	0.134
	(0.038)**	(0.037)**
Age 30	0.132	0.144
	(0.098)	(0.096)
Age 40	-0.017	0.027
	(0.124)	(0.127)
Framing (rel. to neutral)		
Cost	-0.138	-0.116
	(0.019)**	(0.015)**
Insurance	0.187	0.180
	(0.022)**	(0.020)**
Loan size ($10k)	0.020	0.025
	(0.006)**	(0.005)**
Payment as % of income	-0.011	-0.014
	(0.002)**	(0.002)**
Observations	4,440	4,358

*Note*s: Dependent variable: prefers or strongly prefers IDR plan. All regressions also include controls for major, gender, class standing, missing SAT scores, SAT math percentile, and whether the high cost IDR option was presented first.. Robust standard errors, clustered at the student level in parentheses; ** p<0.01, * p<0.05, + p<0.1.

Table 6: Effects of Framing by Expected Probability of Low or No Earnings at Graduation

	(1) Fixed payment amount	(2) Fixed payment length
Framing (rel. to neutral)		
Cost	-0.098	-0.054
	(0.028)**	(0.021)*
Insurance	0.137	0.138
	(0.033)**	(0.029)**
Pr(earnings < $35k)		
× Cost framing	0.047	-0.019
	(0.036)	(0.026)
× Neutral framing	0.144	0.135
	(0.046)**	(0.039)**
× Insurance framing	0.261	0.232
	(0.046)**	(0.046)**
Test of equality (p-value)	*0.001*	*<0.001*
Observations	4,440	4,358

*Note*s: Dependent variable: prefers or strongly prefers IDR plan. All regressions also include controls for major, gender, class standing, missing SAT scores, SAT math percentile, and whether the high cost IDR option was presented first.. Robust standard errors, clustered at the student level in parentheses; ** p<0.01, * p<0.05, + p<0.1.

Table 7: Heterogeneity in the Effects of Framing

Interaction term:	(1) Major = STEM	(2) Low financial lit.	(3) Has UMD loan	(4) More risk averse	(5) Female	(6) URM	(7) First gen. student
A. Fixed payment amount							
Cost framing	-0.147	-0.121	-0.143	-0.076	-0.096	-0.141	-0.131
	(0.028)**	(0.026)**	(0.026)**	(0.032)*	(0.026)**	(0.021)**	(0.021)**
Insurance framing	0.250	0.173	0.194	0.171	0.152	0.162	0.178
	(0.032)**	(0.030)**	(0.031)**	(0.035)**	(0.030)**	(0.025)**	(0.025)**
Interaction term							
× Interest framing	0.016	-0.048	0.024	-0.063	-0.022	-0.004	-0.030
	(0.026)	(0.023)*	(0.023)	(0.026)*	(0.024)	(0.029)	(0.027)
× Neutral framing	0.006	-0.003	0.019	0.032	0.067	-0.005	0.012
	(0.032)	(0.030)	(0.030)	(0.031)	(0.030)*	(0.036)	(0.036)
× Insurance framing	-0.114	0.022	0.001	0.075	0.132	0.097	0.041
	(0.034)**	(0.032)	(0.032)	(0.034)*	(0.032)**	(0.039)*	(0.038)
Test of eq. (p-value)	*0.003*	*0.169*	*0.841*	*0.003*	*<0.001*	*0.069*	*0.260*
Observations	4,440	4,440	4,440	4,058	4,440	4,440	4,440
B. Fixed payment length							
Cost framing	-0.163	-0.107	-0.085	-0.093	-0.101	-0.104	-0.112
	(0.025)**	(0.020)**	(0.020)**	(0.025)**	(0.021)**	(0.017)**	(0.017)**
Insurance framing	0.175	0.156	0.179	0.148	0.135	0.179	0.170
	(0.032)**	(0.027)**	(0.028)**	(0.032)**	(0.027)**	(0.023)**	(0.023)**
Interaction term							
× Interest framing	-0.013	-0.015	0.017	-0.029	-0.012	0.003	0.014
	(0.020)	(0.018)	(0.017)	(0.019)	(0.017)	(0.023)	(0.023)
× Neutral framing	-0.093	0.004	0.078	-0.004	0.015	0.054	0.026
	(0.029)**	(0.027)	(0.025)**	(0.026)	(0.026)	(0.033)+	(0.032)
× Insurance framing	-0.087	0.058	0.076	0.075	0.104	0.053	0.064
	(0.033)**	(0.032)+	(0.031)*	(0.033)*	(0.032)**	(0.038)	(0.038)+
Test of eq. (p-value)	*0.015*	*0.125*	*0.064*	*0.023*	*0.005*	*0.288*	*0.506*
Observations	4,358	4,358	4,358	3,958	4,358	4,358	4,358

*Note*s: Dependent variable: prefers or strongly prefers IDR (relative to standard plan). All regressions also include controls for major, gender, class standing, missing SAT scores, SAT math percentile, and whether the high cost IDR option was presented first.. More risk averse are students who chose value of 4 or less on a scale of 0 to 10 where 0 is "not willing to take risks" and 10 is "very willing to take risks." Students who did not answer risk aversion question are excluded from column 4 specification. Financially literate are students who answered at least one of the two financial literacy survey questions correctly (skipped questions are considered incorrect answers). Robust standard errors, clustered at the student level in parentheses; ** p<0.01, * p<0.05, + p<0.1.