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 nonemployment and/or low earnings at graduation. In contrast, when IDR costs are emphasized, 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 only small decreases in long-run federal revenue.

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1 Introduction

At the end of 2018, outstanding U.S. student loan debt exceeded $1.46 trillion (Federal Reserve Bank of New York 2019). Over 95 percent of outstanding student loan debt is held or guaranteed by the federal government. Concerns over growing debt, delinquency, and defaults have stimulated proposals for expanding loan repayment options that link loan payments to borrowers' earnings (e.g., Dynarski and Kreisman 2013; Asher, Cheng and Thompson 2014; Boatman, Evans and Soliz 2014). 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 relatively 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 roles played by the framing of IDR and students' anticipated 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 a 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 emphasizes the potential for a longer repayment period and higher total interest payments over the life of the loan. These findings are at odds with standard economic theory, insofar as the different framings provide the same information about repayment plans, differing only in the emphasis placed on their potential costs and potential benefits (Tversky and Kahneman 1981).

Our findings suggest that the current framing of available IDR options may discourage some of the borrowers who would benefit most from the insurance that IDR provides 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 the perceived risk of a bad labor market outcome is uncorrelated with students' reported preferences for IDR. Results from a simulation designed to assess the aggregate effects of IDR framing for bachelor's degree-seeking borrowers suggest that a simple change in how IDR is framed could generate substantial reductions in loan defaults with little loss in 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. The study population is a group for whom student debt should be highly salient. In each case, the loan repayment options included the standard mortgage-style loan repayment plan

and one of two IDR variants. 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.

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 51 to 59 percent less likely to choose IDR, depending on the variant they were offered, while those randomly assigned to the insurance frame were 66 to 91 percent more likely to choose IDR. In comparison, an increase in hypothetical student loan debt from $30,000 to $60,000 resulted in a 22 to 40 percent increase in the probability of choosing IDR over the standard plan.

We also show that students' expectations about their risk of having low or no earnings at graduation significantly interacts with IDR framing, but only for students randomly assigned to the neutral or insurance frames. As IDR payments will be less than payments under the standard plan only when earnings are 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 take-up of the plan for the students who should place the highest value on the insurance it offers.

The existing literature on IDR as a loan repayment alternative has focused mainly on currently available federal plans, under which a borrow makes payments until she has repaid the original principal plus accrued interest (or the balance is discharged after a specified number of years). An alternative to such "fixed-amount" IDR plans, "fixed-length" IDR plans, sometimes referred to as income-share agreements or human capital contracts, require borrowers to pay a fixed percentage of their disposable income for a set number of years. There has been growing interest in fixed-length plans in recent years, but limited empirical evidence on how the design of such plans affects participation (Mumford 2018). We begin to fill this gap by providing evidence that, similar to the findings for fixed-amount IDR plans such as those currently offered by the federal government, take-up of fixed-length IDR also is affected by framing.

Our results align with other evidence that students' economic choices, including decisions about borrowing and repayment, may depend on how they are framed. Marx and Turner (2018, 2019) show that nonbinding student loan "offers" affect borrowing. Holding constant loan eligibility, students who receive a zero dollar loan recommendation borrow less and have lower educational attainment than those who receive a nonzero offer. Caetano, Palacios and Patrinos (2011) and Evans, Boatman and Soliz (forthcoming) measure the preferences of Latin American students and U.S. high school and college students, respectively, 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). Field (2009) provides evidence that law school graduates choose different careers based on whether they received otherwise equivalent financial aid offers at entry that were framed as loans that would be forgiven if the student worked in public interest law or as tuition assistance that would have to be repaid if the student did not end up in public interest law.

Outside of the educational context, our findings relate most directly to the literature on how framing affects insurance purchase decisions. Johnson et al. (1993) show that consumers prefer an insurance policy that offers a rebate if no claims are filed to an essentially equivalent policy with a lower premium that applies deductibles. Lifetime annuities provide insurance against running out of money in retirement. Brown et al. (2008, 2013) show that survey respondents are more likely to prefer lifetime annuities under a consumption frame (highlighting consequences for consumption over the lifetime) than under an investment frame (highlighting risks and returns). In a separate experiment, Beshears et al. 2014 find that framing annuities as an investment significantly reduced the share of retirement plan assets respondents said they would use for that purpose. Brown, Kapteyn and Mitchell (2016) report effects of framing on survey respondents' planned age of Social Security claiming, with a years-to-break-even framing reducing the planned claiming age and a framing that emphasized the gains from delaying benefit receipt of benefits (and anchoring those gains to an older age) raising it. Schmitz and Ziebarth (2017) show that German consumers' willingness to switch health insurance plans increased significantly when prices were reported in Euros relative to a reference price rather than in percentage point payroll tax differences. For student borrowers, IDR offers insurance against potentially serious adverse consequences associated with poor earnings outcomes. Similar to other insurance take-up decisions, the framing of IDR significantly affects take-up.

Building on our results regarding IDR take-up, we simulate how altering the framing of IDR would affect aggregate payments, defaults, and selection into IDR at the national level. We do so 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 nonemployment and earnings probabilities from a parameterized age-earnings profile generated based on the students' elicited labor market expectations.[1] For IDR payment rates that fall within the range of the parameters of currently available repayment plans, shifting from the current emphasis on IDR costs to framing IDR as insurance substantially reduces the lifetime risk of loan default by increasing IDR take-up. In our simulations, the decrease in defaults is obtained at minimal cost to the government over the long run; moving from the cost to the insurance frame reduces the present discounted value of total payments per borrower received after 20 years by 1 percent or less while decreasing

[1]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.

projected defaults by at least 20 percent.

Finally, we simulate the degree of adverse selection into IDR, comparing 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 who did choose IDR. Standard economic theory predicts that, all else equal, income-driven repayment schemes will be most attractive to borrowers who expect to have low or variable earnings. 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 (Di and Edmiston 2017). Although borrowers' perceived risk of a poor labor market outcome at graduation is significantly correlated with IDR take-up under the insurance frame, in aggregate, our simulations suggest that differences in selection into IDR based on expected lifetime income across frames are small.

The remainder of this paper proceeds as follows: In Section 2, we describe existing IDR options available to U.S. student borrowers. We describe our survey of UMD undergraduates and resulting analysis sample in Section 3, and Section 4 details our methodology. In Section 5, we present estimates of the correlations between IDR preferences and expected labor market outcomes 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 how IDR framing available affects take-up, selection into IDR, defaults, and the present discounted value of loan payments. Section 7 concludes.

2 Income Driven Student Loan Repayment

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. A number of countries have implemented IDR plans that are universal or cover a substantial share of borrowers (Chapman 2006; Lochner and Monge-Naranjo 2016). These include Sweden (IDR introduced in 1989), Australia (1989), New Zealand (1992), Chile (1994), South Africa (1996), UK (1997), Hungary (2001), and South Korea (2010).[2] In the United States, IDR was first introduced 25 years ago, but even today, only a minority of student borrowers

[2]As examples, IDR is mandatory for student borrowers in Australia and the United Kingdom. In the Australian plan, borrowers 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, borrowers 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.

select an IDR plan.

2.1 IDR in the United States

In the United States, the vast majority of student loans are provided by the federal government. Borrowers who do not actively select a repayment plan are automatically enrolled in a mortgage-style "standard" repayment plan, under which they make fixed monthly payments for ten years. A borrower must affirmatively select one of the four available IDR plans to participate. Under each of these IDR options, borrowers' payments are limited to a set fraction of income earned above a threshold. After a borrower participating in IDR has made payments for a certain period of time, any remaining debt is forgiven.[3] Borrowers in IDR who have temporarily low income will 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.

The structure of the IDR plan presented to students who participated in our survey is similar to the existing Revised Pay As You Earn (REPAYE) plan that is the most widely used by recent borrowers who opt for IDR.[4] In REPAYE, payments are set to 10 percent of a borrower's discretionary income (defined as income above 150 percent of the federal poverty line) and any remaining debt is forgiven after 20 years of payments. Payments are not capped and borrowers at all income levels are eligible for REPAYE.

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 have chosen IDR. As of the first quarter of 2019, just 29 percent of the 25 million borrowers with federal Direct Loans who had entered repayment were enrolled in one of the four available IDR options (U.S. Department of Education 2019).[5]

[3]See https://studentaid.ed.gov/sa/repay-loans/understand/plans/income-driven for an overview of repayment plans. The four IDR options available to recent borrowers set payments ranging from 10 to 20 percent of borrowers' discretionary income and offer debt forgiveness after 20 to 25 years of payments. Two IDR plans are only available to borrowers with income below a set threshold and cap borrowers' payments at the amount a borrower would have paid had she entered into the standard repayment plan. Borrowers in all 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 example, borrowers in REPAYE who don't recertify will be placed in an alternative repayment plan in which their required monthly payment is set equal to the amount necessary to repay the loan in full by the earlier of (a) 10 years from the date the borrower began repayment under the alternative repayment plan, or (b) the ending date of the 20- or 25-year IDR repayment period. 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.

[4]Between 2016 and 2019, 92 percent of the increase in the number of borrowers participating in IDR came from the increase in participation in REPAYE (U.S. Department of Education 2019).

[5]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. Accessed October 11, 2016.

While it is possible to default on a student loan while participating in IDR, U.S. Government Accountability Office (2015) reports that less than 1 percent of borrowers enrolled in an IDR plan between 2010 and 2014 defaulted on their loans within three years of entering repayment, compared to 14 percent of borrowers in the standard 10-year repayment plan. Two recent studies suggest that, on average, struggling borrowers benefit when they are encouraged into taking-up IDR. Mueller and Yannelis (2019) report on the findings from a randomized field experiment conducted by Navient, a major student loan servicer. Borrowers who were induced to participate in IDR experienced substantial reductions in their monthly loan payments and were significantly less likely to become delinquent on their loans. Hebst (2019) finds similar benefits for borrowers who take up IDR, though he also finds that such borrowers end up paying more towards their loans over the longer run.

2.2 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 automatically placed in the 10-year standard plan. The choice of "default" - the option that is automatically selected in the absence of an active choice - has been shown to have a large effect on decisions made in other contexts, such as participation in and contributions to retirement savings plans (e.g., Madrian and Shea 2001; Carroll et al. 2009; Chetty et al. 2014; Bernheim, Fradkin and Popov 2015). In the context of student loan repayment, Cox, Kreisman and Dynarski (2018) provide evidence from a series of lab experiments that changing the default repayment plan significantly increases IDR take-up. 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).[6] 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). Survey data confirm a general lack of awareness of IDR options for prospective and current students: less than half of a group of low-income high school seniors surveyed early in 2016 who were prompted to think about college costs reported being aware of IDR (Evans and Boatman forthcoming) and data from the 2015-2016 National Postsecondary Student Aid Study show that only 32 percent of U.S. undergraduate students were aware of IDR repayment plans (Anderson, Conzelmann and Lacy 2018). A related factor is a lack of knowledge about the cost of defaulting on federal loans (e.g., Zafar et al. 2014), which would lead to an undervaluing of IDR.

[6] Dynarski and Scott-Clayton (2006) note the importance of hassle costs in a related context, observing that the complexity of federal student aid makes it difficult for families to determine the benefits to which they are entitled and potentially deterring students from low-income households from attending college.

ED provides an online tool to help borrowers choose between loan repayment plans. A borrower who enters information on debt, earnings and family structure into 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.[7] 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 provided under the other plans.

Figure 1 displays the comparison of available repayment plans generated by the ED Repayment Estimator 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 range of monthly payments the borrower is projected to face, total amount paid (principal and interest) over the lifetime of the loan, 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.[8] Projected loan forgiveness under the tool's assumption that earnings will grow at a steady rate of 5 percent is displayed only if the borrower clicks on the "+" for the relevant repayment plan (Appendix Figure D.1).

Given that borrowers must actively select into IDR, the limited knowledge of available options, and the 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 used by only a minority of student borrowers. 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.

2.3 Income-share agreements as "fixed-length" IDR

Our study also explores students' views of an alternate type of IDR scheme more commonly known as an income share agreement or human capital contract. Income-share agreements are a version of IDR in which the length of repayment (rather than the amount of principal to be repaid with interest) is fixed.

[7] Available at: https://studentloans.gov/myDirectLoan/repaymentEstimator.action. Accessed July 6, 2019.

[8] Students are prompted to complete electronic exit counseling when they enter repayment. Screenshots containing information provided through this process are available in Appendix E. All of the appendices mentioned in the text are available in the online supplement to the paper. While a large amount of information is provided to borrowers at this point, near the end of the process borrowers are presented with an interactive tool that is very similar to ED's Repayment Estimator. In addition to entering their income, debt, and family size, the borrower can specify other monthly expenses (e.g., rent, utilities). The comparison of repayment plans that is provided includes the total amount paid and length of repayment using the same assumptions as the Repayment Calculator.

Income-share agreements could be established by the federal government, a state, or an individual college. 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.

The first income-share agreement offered to undergraduate students in the United States was a program for Yale graduates established in the 1970s. The Yale program was characterized by a high degree of adverse selection and ultimately was ended with all remaining debt forgiven. More recently, more than 20 state legislatures have considered the establishment of state-wide income share agreements (Harnisch 2014). Under the typical proposal considered by these legislatures, students would attend public colleges at no cost in exchange for a pledge to pay a set percentage of income for a specified number of years. In fall 2016, Purdue University introduced "Back a Boiler" income-share agreements as an alternative to private student loans for rising sophomores, juniors or seniors who had exhausted their federal loan eligibility (Mumford 2018). The terms of the Purdue plan depend on a student's class standing, major, and funding amount.[9] Following the introduction of the Back a Boiler program, a number of other institutions have introduced their own income-share agreement programs. These include Clarkson University (NY), Colorado Mountain College, Lackawanna College (PA), Messiah College (PA), Norwich University (VT), and the University of Utah. Finally, a number of private companies (e.g., Lumni and Edly) and education providers not participating in federal student aid programs (e.g., Flatiron School/Access Labs and General Assembly) 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.

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

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

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-driven 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 or nothing when income is $1,000 per month or lower. Under this IDR plan, in any month in which the income-driven payment falls below the amount of interest accrued over the month, the unpaid interest is added to the loan balance. Payments continue until the loan principal and interest are paid in full and 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 with payments continuing for 20 years regardless of how much the student has paid in total. Figure 2 shows how the standard plan and the alternative plan were presented in the survey for scenarios involving the fixed-amount plan; Figure 3 does the same for the scenarios involving the fixed-length plan.

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.[10] Further, each student was asked to indicate the percentage payment that would make her indifferent between the standard plan and the specific IDR 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 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 could (or, in the case of fixed-length IDR, would) spend longer in repayment over the life of the loan; and an "insurance" frame emphasizing the protection against payments that are unaffordable

[10]The fixed-amount IDR payment percentages were chosen to be in the range of 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.

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. The cost and insurance framing were designed to emphasize specific features of the two options but did not provide any additional information relative to the neutral framing. 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.

In the treatments just described, study participants were asked to respond to hypothetical scenarios regarding the repayment of student debt. Our analysis assumes that participants were sufficiently able to imagine themselves in the situations described that they could give us meaningful responses. While we expect that this should be true for most of today's college students, it should be especially true for study participants who had taken out student loans themselves, as was the case for nearly nearly half of our respondents. Sensitivity analyses described later in the paper include results for a sample restricted to those who had taken out student loans while at UMD; estimated effects of framing and other IDR parameters for this group of students are very similar to our baseline results.

The survey elicited students' expectations regarding their earnings at three different points in the future and the likelihood of realizing various earnings outcomes. 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 less than $35,000, earnings between $35,001 and $75,000, or earnings exceeding $75,000 at each of those points in time. Figure 5 shows the wording of the questions regarding expected labor market outcomes at age 30.[11]

Finally, the survey included questions designed to measure risk aversion and financial literacy. Following Dohmen et al. (2011), we measured risk aversion by student's self reported willingness to take risk on a scale from 0 to 10.[12] 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. Appendix B contains the full questionnaire for the fixed-length IDR scenarios, neutral framing, a $30,000 loan, and the lower income percent for the IDR plan presented first.

[11] The intent of the question about expected earnings was to elicit students' expected earnings conditional on being employed. In cognitive interviews conducted prior to the survey's fielding in which this question was discussed, that was how subjects appeared to interpret the question. Because there was some ambiguity about what we were asking, however, we have replicated all analyses that make use of the responses to the question about expected earnings under the assumption that the answers reflect students' unconditional expectations and find similar results.

[12] Dohmen et al. (2011) examine the association between risk preferences elicited through different methods and how well they predicted individual behavior through a large study of the German population. The "willingness to take risks" question that we use was predictive of actual behavior in a experiment with real monetary stakes. Our survey also included a second question intended to measure risk aversion that 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. This question did not yield usable responses.

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.[13] 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, 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 test score distribution (when available).[14] Students were then randomly assigned to one of the 24 different treatment groups listed in Appendix A. Random assignment occurred before students were invited to complete the survey.

UMD's Office of Institutional Research, Planning, and Assessment (IRPA) administered the survey 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 are included in Appendix C.

3.3 Sample selection and student characteristics

A total of 25,435 Maryland undergraduates were invited to participate in the survey and 5,500 (22 percent) started it. 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).[15]

[13] Students who are neither citizens nor permanent residents are not eligible for federal student aid (including loans).

[14] SAT percentile ranks were calculated using the College Board's conversion table for the assumed entering class a student belonged (e.g., 2015-16 for freshmen). ACT scores were converted to SAT scores. Students with missing SAT scores were primarily transfer students.

[15] There were 927 individuals who 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) also were excluded from our main sample because only two of the three questions on expected labor market outcomes are applicable for

Table 1 reports on the relationship between predetermined student characteristics – the variables used for stratifying random assignment as well as selected other characteristics – and the assignment of treatment parameters in our analysis sample.[16] These estimates are the coefficients from descriptive regressions relating the given predetermined student characteristics to the treatment parameters. Across the 21 characteristics examined, there is only one (Maryland residency) for which the test for the joint significance of the treatment parameters yields a test statistic that is even marginally significant at conventional levels ($p = 0.092$). We interpret these findings as strongly supportive of our assumption of random assignment of treatment parameters in our analysis sample.[17]

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 "inconsistent" if the willingness to pay that they report is 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) or if their answers to the two scenarios are inconsistent (e.g., the student reports preferring IDR at the higher payment rate but preferring the standard plan at the lower payment rate). When examining the effects of plan parameters on students' willingness to pay for IDR, we exclude students who gave inconsistent answers as well as those who did not answer the willingness-to-pay question.[18]

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."[19] UMD borrowers are those who received loans during their time attending UMD, regardless of the outstanding balance.

them. Our results are robust to including respondents in these latter two categories.

[16] Appendix Tables D.1 and D.2 display characteristics of students within each of the 24 treatment arms.

[17] As shown in Appendix Table D.3, students in the analysis sample have somewhat different characteristics than other UMD students. These differences do not affect the internal validity of our results, as assignment to treatment was random. Appendix Table D.4 shows that several characteristics are predictive of the likelihood that a student who has opened the survey ends up in our analysis sample. 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 $p = 0.689$.

[18] We drop a total of 1,359 respondents, most because of inconsistencies between their stated willingness to pay for IDR and the answers to the hypothetical loan repayment scenarios. Appendix Table D.5 shows that respondents who gave inconsistent answers or did not answer the willingness to pay question have similar characteristics compared to respondents who gave consistent answers. Importantly, the probability of being classified as inconsistent or being dropped from the sample because of missing information on willingness to pay is uncorrelated with treatment parameters (Appendix Table D.6).

[19] 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).

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.2 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.[20] The federal College Scorecard reports the average earnings of former Maryland students who received federal aid, 10 years after entry, to be $62,900.[21] Assuming that most UMD students enter college immediately following high school graduation, this should be when the former students are between 28 and 29 years old. In our sample, federal aid recipients expected to earn approximately $85,000 at age 30.

We also estimate auxiliary regressions of respondents' labor market expectations on population moments and respondents' observable characteristics (Appendix Table D.7). 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 $0.99 increase in expected earnings for each $1 increase in population earnings. There is only a weak relationship between respondents' expectations regarding their age 30 earnings and population average earnings at the same age; population average earnings at age 23 and age 40 are more predictive of what students expect their earnings to be at age 30. Age 40 population earnings are significantly correlated with expected earnings at age 40, with a $0.44 increase in expected earnings for every $1 increase in population earnings. We find a strong correlation between the expected likelihood of having zero 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.8 and D.9). Taken together, these estimates suggest that students' beliefs have a strong basis in realized labor market outcomes for graduates with similar fields of study.

[20] 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. In contrast, Betts (1996) shows 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.

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

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-amount versus fixed-length IDR plans, as the expected stream of payments is not directly comparable between these plans, even for students with the same labor market expectations. In all specifications, we calculate robust standard errors that are clustered at the student level.

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 6 and 7 display empirical 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 6 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 both loan amounts. To give

an example, for both large loans and small loans, 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.

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 7). Nonetheless, the distribution for students with the highest expected probability of a poor labor market outcome at graduation stochastically dominates the distribution 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, an indicator for missing SAT scores, and the SAT percentile) 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 14.1 percentage points (51 percent) and the probability of choosing fixed-length IDR falls by 11.6 percentage points (59 percent). When the insurance aspects of IDR are emphasized, students are 18.5 percentage points (66 percent) more likely to choose fixed-amount IDR and 17.9 percentage points (91 percent) more likely to prefer fixed-length IDR.[22]

Estimated effects of the amount of student loan debt and "price" of IDR (i.e., IDR payment as a per-

[22]The magnitude of these effects is comparable to estimated framing effects on insurance take-up in other settings. In the baseline analysis of Brown et al. (2008), for example, the share of people preferring a lifetime annuity to a savings account of comparable actuarial value rose from 21 percent under the investment frame to 72 percent under the consumption frame.

centage 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, being assigned $60,000 in loans versus $30,000 in loans results in a 6.1 percentage point increase in the probability of choosing fixed-amount IDR (2.0 percentage points per $10,000 increase in loan size) and a 7.8 percentage point increase in the probability of choosing fixed-length IDR (2.6 percentage points per $10,000 increase in loan size). 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 one 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 reduction 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. The 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) excludes students who provided inconsistent answers to the questions on their preferences for loan repayment plans or did not report their willingness to pay for IDR.

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 (conditional) earnings at graduation, age 30, or age 40. Finally, the column (9) model reweights our data to be representative of bachelor's degree seeking borrowers nationwide.[23]

[23]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

Results are consistent across specifications.

Table 4 reports estimates of the effect of framing on the willingness to pay for IDR (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 respondent and because we have excluded students who provided a rate that was inconsistent with answers in the earlier hypothetical loan repayment scenarios or did not answer the survey question about the percentage of income that would make them indifferent between IDR and the standard plan. The estimates imply that the cost framing reduces willingness to pay for fixed-amount IDR by 3.96 percentage points (30 percent relative to the mean reported by students assigned to the neutral framing) and fixed-length IDR by 2.08 percentage points (25 percent). The insurance framing raises willingness to pay for IDR by 4.92 percentage points (31 percent) in the case of fixed-amount IDR and 3.35 percentage points (48 percent) in the case of fixed-length IDR. Appendix Table D.10 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 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 presents descriptive regressions of UMD survey respondents' preferences for IDR on their labor market expectations. Neither the expected level of earnings at graduation nor expected earnings at later points in life 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

an expected family contribution of zero dollars), 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. 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). Weights were restricted to values between 1 and 8,000.

are not significantly correlated with IDR preferences.[24]

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 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 collected, 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, as just discussed (Table 5), expectations about these later outcomes are uncorrelated with students' preferences for IDR once outcomes at graduation are taken into account.

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. 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.[25] To put these effects into context, consider what they imply about the decisions of a student

[24]These patterns are robust to a variety of specifications and sample restrictions that include using standardized measures of students' expected earnings profiles ($\mu = 0$, $\sigma = 1$); assuming that students responded to the earnings expectations questions with their expected level of earnings not conditional 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.11.

[25]In Appendix Table D.12, we 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.

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 roughly 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 8. The short-dashed gray line corresponds to the density of observations by expected probability of low earnings to illustrate the region that represents the support of the data. The figure confirms that the linearity assumption underlying the Table 6 regressions is reasonable as well as the conclusions drawn from those regressions.[26]

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 two financial literacy questions correctly); and having taken out a student loan while at UMD, respectively. As can be seen in column (1), STEM, business and economics students' preferences for IDR are significantly less sensitive to receiving the insurance framing versus the cost framing than are the preferences of students in other (or undecided) majors. STEM students' smaller response to the insurance framing could be driven

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.

[26] Using information on students' expected earnings at graduation, we can generate a measure of the difference in monthly payments between the standard plan and IDR. This difference will be positive when payments under the standard plan exceed those under IDR. Appendix Figure D.3 displays estimates from local linear regressions of the probability of preferring IDR over the standard plan on the expected difference in annual loan payments at graduation. Over the support of the data, the effect of an increase in the benefits of IDR over the standard plan in terms of the size of payments is relatively linear when the insurance aspect of IDR is emphasized. In contrast, the relatively flat slope of the solid dark line shows that, when the costs of IDR are emphasized, students do not take into account differences in payments between the two repayment plans.

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 compared to the cost frame on students who have borrowed while at UMD for those assigned to fixed-length IDR, but this is not the case for 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)). More 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.[27]

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 nationally 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.[28] 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, the effects we document are stronger among the demographic groups that are more prevalent in the overall population of college borrowers than in our sample, with the difference in effects of framing being most pronounced for female students.[29]

[27]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.

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

[29]UMD students are more likely to complete college than the average bachelor's degree-seeking student. Thus, in addition to the tests reported in Table 7, we also have explored whether framing effects vary by three additional characteristics that are predictive of leaving college without a degree: class standing, family income, and receiving low grades in college (Bowen, Chingos and McPherson 2009; Stinebrickner and Stinebricker 2012; Mabel and Britton 2018). As shown in Appendix Table D.13, none of these additional characteristics interacts significantly with framing.

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

This section describes how we estimate the effects of changing IDR payment rates and framing on IDR take-up, selection into IDR, aggregate loan 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. Additional technical details and simulated effects of varying the parameters of fixed-length IDR are contained in Appendix F.

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 and students' expected labor market outcomes at graduation, age 30, and age 40. We first generate frequency weights via raking to match characteristics of bachelor's degree-seeking borrowers nationwide. Second, for each sample member, we estimate parameters for a quadratic age-earnings profile, broadly following Wiswall and Zafar (2015), and interpolate the probability of nonemployment across the three reported expected probabilities. Third, we draw a sequence of earnings and nonemployment probabilities from each student's parameterized age-earnings profile and interpolated nonemployment profile, where the number of draws equals the raked frequency weight. Finally, we allow each hypothetical borrower's choice of repayment plan to be determined by the IDR rate that they reported would make them indifferent between the standard repayment plan and IDR. For the purposes of the simulation exercise, our initial sample excludes students who answered this survey question in a way that was inconsistent with their responses to earlier hypothetical loan repayment scenarios, as well as those who gave no answer. We exclude an additional 17 percent of the remaining students due to an inability to fit a parameterized age-earnings profile, resulting in a final sample of 2,539.[30]

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. While this assumption is untestable, within broad major categories, survey respondents' age-specific expected labor market outcomes are correlated with actual labor market outcomes of college graduates in the ACS (see Appendix Figure D.2, Appendix Tables D.7, D.8, and D.9).[31] Second, we assume that the framing of repayment plans has no effect on whether or how much a student borrows or on other educational investment

[30] 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.

[31] Wiswall and Zafar (2016) provide evidence that New York University students' expectations of their earnings and labor force participation at age 25 are quite similar to their realized outcomes, suggesting that, on average, college students can predict at least their short-term future labor market outcomes with reasonable accuracy.

decisions that might affect future earnings profiles. While the structure of loan repayment options theoretically could influence these decisions (Findeisen and Sachs 2016), most current and prospective students do not know about IDR options (U.S. Government Accountability Office 2015; Boatman and Evans 2017; Anderson, Conzelmann and Lacy 2018). In Australia, the establishment of universal IDR had no effect on college enrollment or degree receipt (Chapman and Nicholls 2013).[32] As further evidence, in a field experiment carried out among students at the University of Missouri, Darolia and Harper (2018) found that giving students targeted information about student loans and future payments had no effect on their subsequent borrowing or other education-related decisions.[33]

Third, we abstract from the effects of student loan debt on labor supply, marriage, and child-bearing, all of which could affect both the choice of repayment plan and repayment outcomes. Chapman and Leigh (2009) and Britton and Gruber (2019) test for labor supply distortions among Australian and UK borrowers, respectively, by examining bunching at income thresholds above which borrowers are required to make payments. In both cases, the authors find little evidence that borrowers near these thresholds manipulate their income to avoid making payments. To our knowledge, the effects of student repayment options on marriage and child-bearing have not been studied. Finally, we use the parameters of IDR plans presented to students within the survey's hypothetical scenarios, which differ from the features of some currently available IDR options. The most important difference is that borrowers are allowed to leave existing IDR plans, although any additional interest accrued while enrolled in IDR must be repaid.

Figure 9 displays the simulated IDR take-up rate by IDR frame and price. The shaded region represents the range of IDR payment rates for currently available plans. At every price, simulated take-up is substantially higher under the insurance frame. Differences in take-up are much smaller between the neutral and cost frames.[34]

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,

[32]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.

[33]In related research, Schmeiser, Stoddard and Urban (2017) study a natural experiment in which Montana State University students with relatively high levels of debt received a letter offering them one-on-one financial counseling, but similarly-indebted University of Montana students did not. The letter told students "If you continue to accept student loans at this rate, you will accrue a debt level that may become difficult to repay, which may place you at risk for defaulting on your loans" and offered them a one-hour session with a certified financial planner. Receipt of the letter had very small, statistically insignificant effects on borrowing in the following semester but led to improved academic performance. Although these results are interesting, the treatment analyzed goes far beyond just giving students information about their loan repayment options.

[34]The large decreases in predicted IDR take-up for payment rates at 5 percentage point intervals most likely result from the tendency in surveys for responses to be heaped at numbers divisible by 5 or 10 (Holbrook et al. 2014).

representing advantageous selection (from the government's perspective). For payment rates available to current borrowers, there is little selection into IDR based on cumulative payments for any frame (Figure 10), suggesting that adverse selection into IDR may not be a large concern for borrowers with average debt levels. While this finding may seem to be at odds with the fact that students who expect a higher likelihood of having low or no earnings being more likely to choose IDR when assigned to the insurance frame (e.g., Table 6), it can be explained if the risk of a poor labor market outcome at graduation is relatively uncorrelated with expected labor market outcomes at later points.

Next, we simulate how changes to the price and framing of IDR would affect lifetime 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. Given we find limited selection into IDR across payment rates or frames, differences in defaults will be due largely to differences in participation rates. 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 to the share defaulting when the costs of IDR are emphasized (Figure 11). Switching from the cost to a neutral frame has smaller effects on lifetime default rates.

Finally, we examine effects on government revenue. Figure 12 displays the present discounted value (PDV) of payments received over a 20 year repayment period. For payment rates in the range of those offered by current IDR plans, payments received under universal participation in the standard plan (indicated by the horizontal dashed line) and when borrowers are allowed to choose IDR are very similar. For instance, the total payments per borrower under universal IDR are projected to be approximately $38,700. At a 10 percent IDR rate, per borrower payments fall by approximately $400 with the cost framing and by approximately $530 with the insurance framing (Appendix Table F.2) Taken together with the simulated effects on defaults (Figure 11), Figure 12 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 result in substantial amounts of debt forgiveness, the vast majority of students who borrow while attending a four-year institution are projected to repay their debt within close to 10 years.

These general findings regarding the effects of framing and IDR payment rates on IDR take-up, selection, defaults, and revenue are robust to varying assumptions about the functional form of students' age-earnings profiles and about the circumstances under which students default on their loans (see Appendix Section F.2 for details and results). At a minimum, they establish that encouraging more of those who could benefit from IDR to take it up need not necessarily come at the expense of significant adverse long-run effects on the federal budget.

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 emphasis is placed on potential for higher interest payments and a longer repayment period under IDR, as is the case with the existing tool 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 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 nonemployment 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 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 IDR is framed as insurance. Our findings suggest 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 only small long-term costs to the federal government by emphasizing the fact that IDR provides insurance against unaffordable loan payments.

Our findings should be interpreted with the caveat that they are based on hypothetical scenarios rather than borrowers' actual choices. Even if the precise magnitudes of the framing effects we have estimated do not necessarily translate to the field, however, the accumulation of evidence about the importance of framing for many types of real-world decisions (e.g., Field 2009; Marx and Turner 2018, 2019; Schmitz and Ziebarth 2017) suggests that effects of the sort we have documented are plausible.[35] In addition to shedding light on the factors that affect how students perceive fixed-amount IDR plans of the sort currently available to them, we have provided evidence on how framing might affect students' responses to fixed-length IDR plans (income sharing agreement or human capital contracts), repayment options that are not generally available at this point but have attracted growing interest. Future research could explore framings that emphasize other benefits of IDR (e.g., the increased monthly purchasing power that an IDR plan would afford low-income individual relative to the standard repayment plan), scenarios that vary the length of repayment,

[35] As examples, Field (2009) reports that framing the aid offered to graduates of one law school who choose to go into public interest law as tuition assistance rather than as a loan raised the share accepting a public interest placement by 36 to 45 percent. Schmitz and Ziebarth (2017) find that requiring health insurance plans to report plan costs in Euros relative to a reference value rather than in payroll tax percentage points raised demand elasticities by a factor of four. Marx and Turner (2019) report that listing a nonzero loan amount rather than a zero loan amount on the aid offers given to students at a large community college raised the probability of a student taking a loan by 40 percent.

and scenarios that place a cap on the amount paid in fixed-length IDR. If nothing else, we would hope that our findings will provide an impetus for experimentation with alternative framings in a real-world setting.

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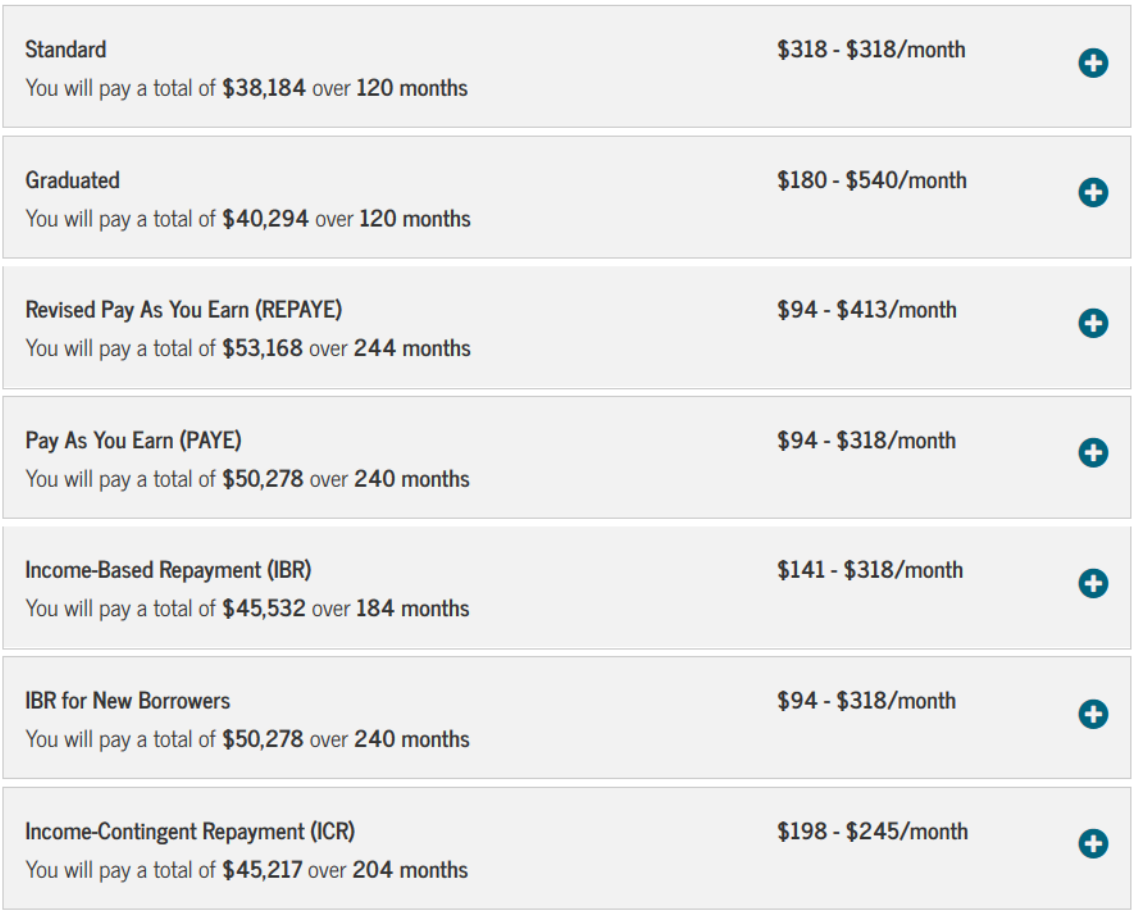
Figures and Tables

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



Notes: Output from the Department of Education's Repayment Estimator (generated July 6, 2019). The Repayment Estimator is 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 nonemployment. See Appendix Figure 1 for additional information provided when the "+" buttons are clicked.

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, Appendix A for a list of all treatment arms, and Appendix B for the full survey. The introduction to the fixed-amount scenarios stated: "You will graduate from the University of Maryland this May. You have borrowed [$30,000/$60,000] at an interest rate of 5% per year to pay for your education. You will not be required to begin making payments until December 2016."

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, Appendix A for a list of all treatment arms, and Appendix B for the full survey. The introduction to the fixed-length scenarios stated: "You will graduate from the University of Maryland this May. You have borrowed [$30,000/$60,000] to pay for your education. You will not be required to begin making payments until December 2016."

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: Survey Questions on Expected Labor Market Outcomes at Age 30

How much do you expect to earn in a year **when you are 30 years old**?

Please answer in thousands of today's dollars. Don't try to adjust for inflation between now and age 30.

$,000 per year

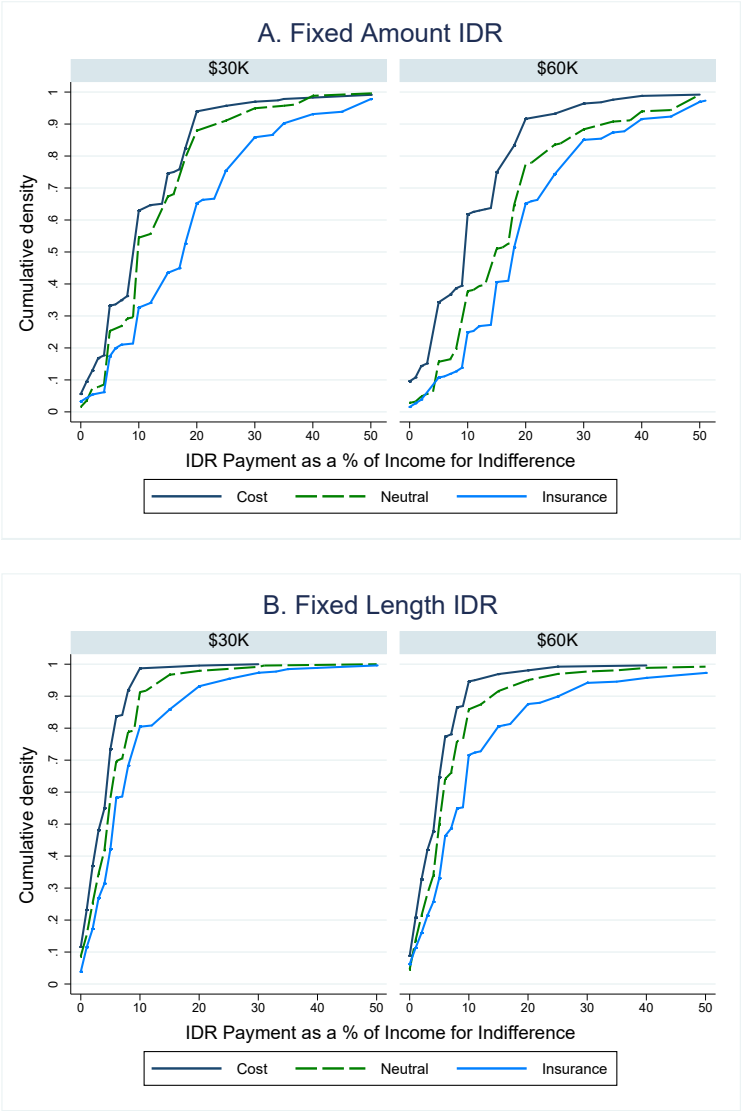
What do you think the chances are that you will be unemployed or not working for pay, earn up to $35,000, earn $35,001 to $75,000 or earn more than $75,000 **when you are 30 years old**?

Please answer in terms of today's dollars. The percentages you give should add up to 100 percent.

Percent chance you will be unemployed or not working for pay	0 %
Percent chance your annual earnings will be $35,000 or less	0 %
Percent chance your annual earnings will be $35,001 to $75,000	0 %
Percent chance your annual earnings will be more than $75,000	0 %
Total	0 %

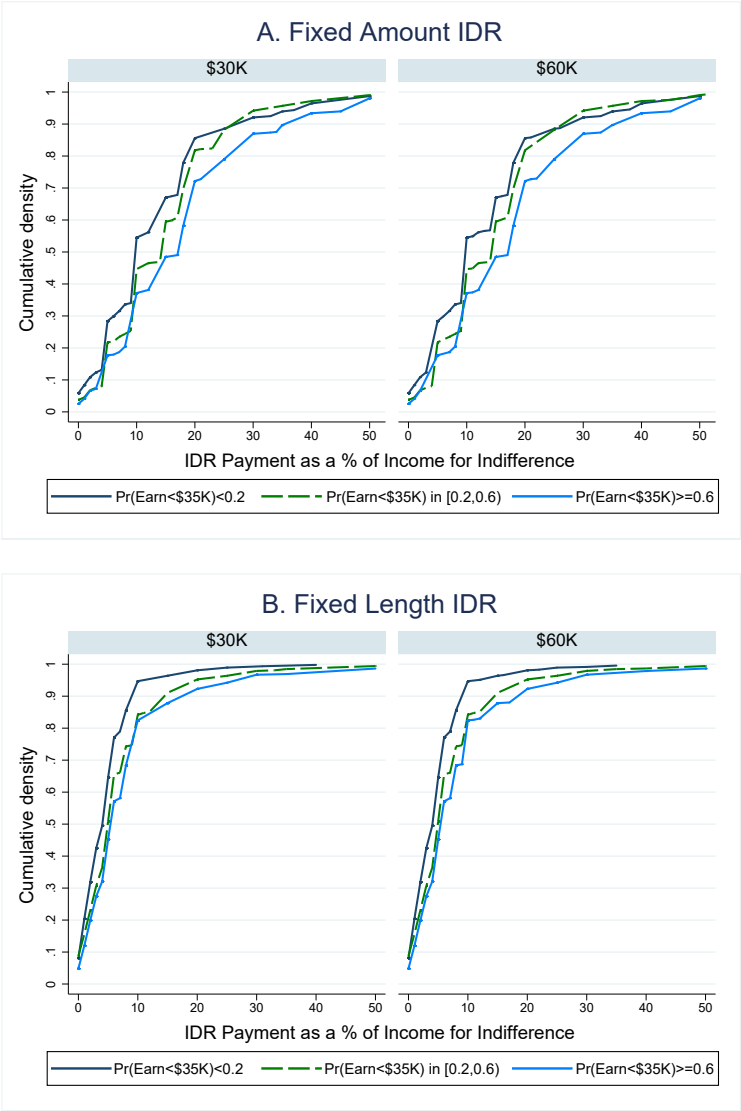
*Note*s: Students were also asked to report their expected earnings at graduation ("What do you expect to earn in the first full calendar year after you graduate from college?") and at age 40 ("How much do you expect to earn in a year when you are 40 years old?"). See Appendix B for the full survey instrument.

Figure 6: Willingness to Pay for IDR by Framing and Loan Size



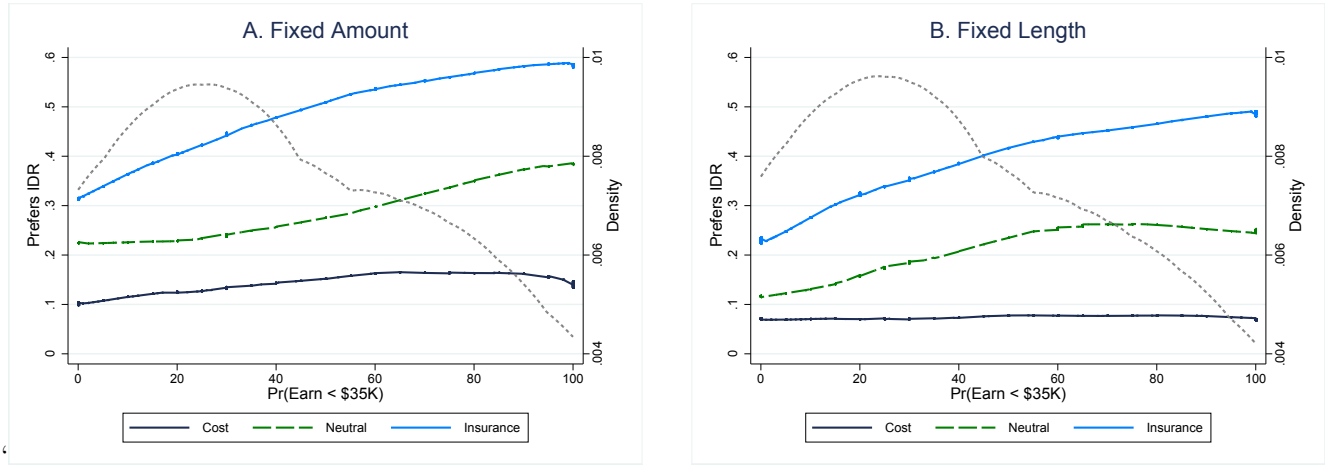
Notes: Each figure displays the empirical CDF of students' reported percentage of income as payment that would make them indifferent between IDR and the standard loan repayment plan. Students who reported a willingness to pay inconsistent with answers to the two hypothetical loan repayment scenario questions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

Figure 7: Willingness to Pay for IDR by Expected Probability of Low Earnings and Loan Size



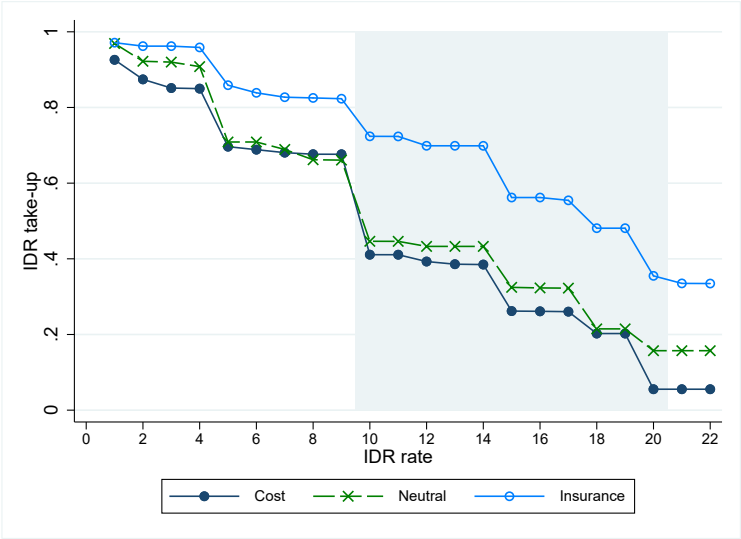
*Note*s: Each figure displays the CDF of students' reported percentage of income as payment that would make them indifferent between IDR and the standard loan repayment plan. Students who reported a willingness to pay inconsistent with answers to the two hypothetical loan repayment scenario questions are excluded.

Figure 8: Share Choosing IDR by Framing and Expected Probability of Low Earnings at Graduation



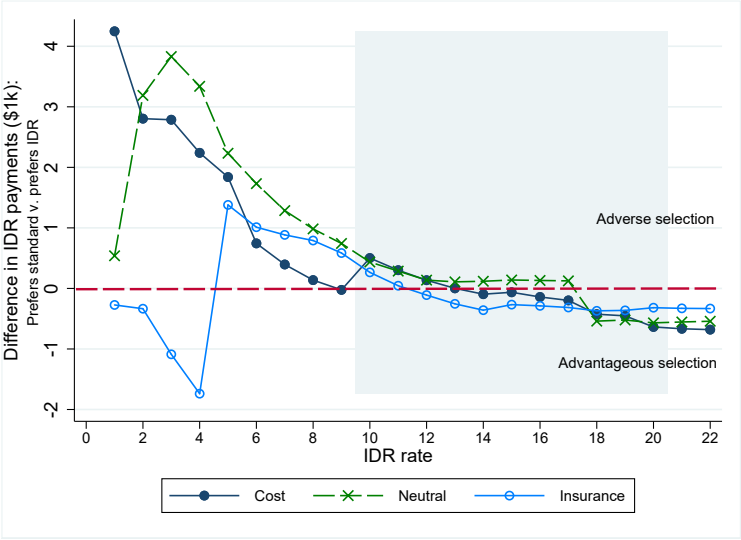
Notes: Each figure displays local linear regressions of the probability of preferring IDR on the probability of having low earnings (less than $35,000) at graduation, separately by framing. The short-dashed gray line represents the density of observations with respect to the probability of low earnings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

Figure 9: Fixed-Amount IDR Take-up by Frame and Payment Rate



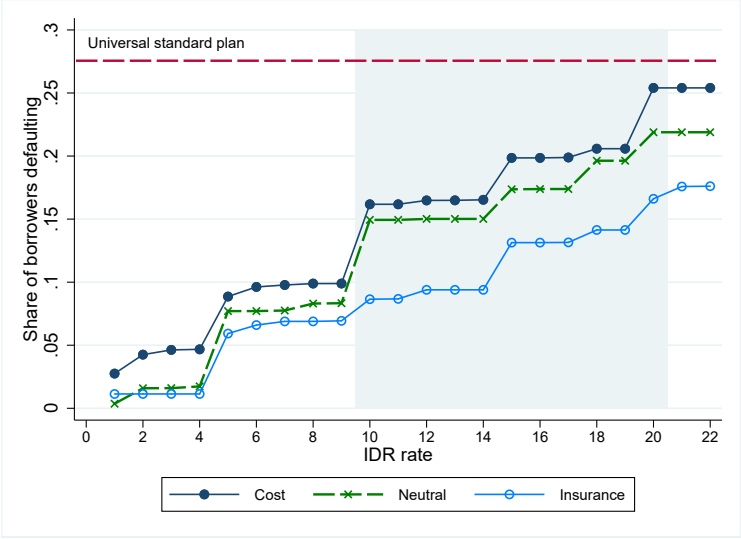
Notes: Simulated take-up of IDR by payment rate and framing (see Section 6 for details). Payment rate is the IDR payment as a percent of disposable income. The shaded area represents the range of IDR payment rates for currently available IDR plans.

Figure 10: Selection into Fixed-Amount IDR by Frame and Payment Rate



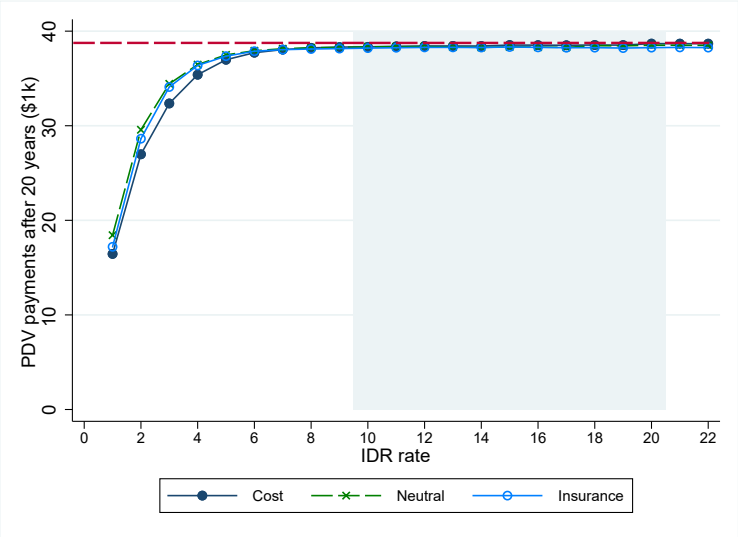
Notes: Simulated difference in average payments borrowers who chose the standard plan would have made had they chosen IDR and average payments made by borrowers who chose IDR, by payment rate and framing (see Section 6 for details). Payment rate is the IDR payment as a percent of disposable income. The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

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 is assumed to default 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. The shaded area represents the range of IDR payment rates for currently available IDR plans.

Figure 12: Present Discounted Value of Payments by Frame and Fixed-Amount IDR Payment Rate



Notes: Simulated average present discounted value of loan payments after 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. The shaded area represents the range of IDR payment rates for currently available IDR plans.

Table 1: Coefficients from Descriptive Regressions of Selected Predetermined Characteristics on 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	(10) Age	(11) First gen. student
Sample mean	0.559	0.337	0.497	82.5	0.133	0.193	0.163	0.244	0.318	20.11	0.240
Fixed payment length	0.022	-0.010	0.018	0.1	-0.013	-0.013	0.015	-0.016	0.006	0.01	0.006
	(0.015)	(0.014)	(0.015)	(0.6)	(0.010)	(0.012)	(0.011)	(0.013)	(0.014)	(0.06)	(0.013)
Framing (rel. to neutral)											
Cost	0.026	-0.004	0.036	0.7	-0.008	0.004	-0.001	-0.015	0.006	-0.01	-0.012
	(0.018)	(0.018)	(0.019)+	(0.7)	(0.013)	(0.015)	(0.014)	(0.016)	(0.017)	(0.07)	(0.016)
Insurance	-0.007	0.017	0.014	1.5	-0.012	-0.004	0.012	0.003	0.000	-0.04	-0.002
	(0.018)	(0.017)	(0.018)	(0.7)*	(0.012)	(0.014)	(0.014)	(0.016)	(0.017)	(0.07)	(0.016)
Low payment in 1st scenario	-0.020	0.001	0.017	-0.6	0.009	0.005	0.002	0.011	-0.016	0.03	0.024
	(0.015)	(0.014)	(0.015)	(0.6)	(0.010)	(0.012)	(0.011)	(0.013)	(0.014)	(0.06)	(0.013)+
Loan amount = $60,000	0.003	-0.007	-0.002	0.8	-0.006	-0.003	0.012	-0.005	-0.001	-0.04	-0.011
	(0.015)	(0.014)	(0.015)	(0.6)	(0.010)	(0.012)	(0.011)	(0.013)	(0.014)	(0.06)	(0.013)
Test of joint sig. (p-val.)	0.182	0.788	0.232	0.162	0.627	0.886	0.509	0.549	0.910	0.951	0.456

Dependent variable:	(12) Asian	(13) URM	(14) White	(15) GPA	(16) MD resident	(17) FAFSA submitted	(18) EFC ($1k)	(19) Any UMD loans	(20) Cum. grants ($1k)	(21) Cum. loans ($1k)
Sample mean	0.201	0.226	0.515	3.24	0.830	0.876	20.3	0.496	6.7	9.0
Fixed payment length	-0.016	0.009	0.005	-0.01	0.015	0.011	0.5	0.007	-0.1	-0.3
	(0.012)	(0.013)	(0.015)	(0.02)	(0.011)	(0.010)	(0.7)	(0.015)	(0.4)	(0.5)
Framing (rel. to neutral)										
Cost	0.022	-0.014	-0.011	0.04	-0.011	-0.025	0.5	-0.033	-0.2	-1.1
	(0.015)	(0.016)	(0.019)	(0.02)+	(0.014)	(0.012)*	(0.9)	(0.019)+	(0.5)	(0.6)+
Insurance	0.008	-0.004	-0.015	0.02	-0.034	-0.017	-0.4	-0.015	0.3	-0.9
	(0.015)	(0.015)	(0.018)	(0.02)	(0.014)*	(0.012)	(0.9)	(0.018)	(0.5)	(0.6)
Low payment in 1st scenario	-0.011	0.027	-0.018	0.0001	-0.010	-0.004	0.1	0.012	0.1	1.0
	(0.012)	(0.013)*	(0.015)	(0.02)	(0.011)	(0.010)	(0.7)	(0.015)	(0.4)	(0.5)*
Loan amount = $60,000	-0.008	-0.013	0.022	0.003	0.010	-0.006	0.3	0.003	-0.4	-0.2
	(0.012)	(0.013)	(0.015)	(0.02)	(0.011)	(0.010)	(0.7)	(0.015)	(0.4)	(0.5)
Test of joint sig. (p-val.)	0.382	0.218	0.516	0.701	0.092	0.269	0.865	0.555	0.775	0.144

*Note*s: Analysis sample (N = 4,399); column (4) specification limited to students with nonmissing math SAT scores (N = 3,813); column (15) specification limited to students with nonmissing GPA (N = 3,189); column (18) specification limited to students who submitted a FAFSA in 2015-16 (N = 3,855). URM = underrepresented minority (Black, Hispanic, or Native American student). Regression of specified characteristic on treatment parameters. Robust standard errors in parentheses; ** p<0.01, * p<0.05, + p<0.1.

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 = $60k	0.061	0.078
	(0.017)**	(0.015)**
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 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, FL, debt	(4) Drop inconsistent	(5) Drop low FL	(6) UMD borrowers	(7) At least 5 minutes	(8) Drop outliers	(9) Raked weights
A. Fixed amount									
Framing									
Cost	-0.139	-0.140	-0.139	-0.129	-0.117	-0.136	-0.152	-0.137	-0.175
	(0.019)**	(0.019)**	(0.019)**	(0.022)**	(0.026)**	(0.028)**	(0.021)**	(0.020)**	(0.032)**
Insurance	0.186	0.185	0.186	0.192	0.175	0.176	0.188	0.189	0.167
	(0.022)**	(0.022)**	(0.022)**	(0.026)**	(0.030)**	(0.031)**	(0.024)**	(0.023)**	(0.037)**
Test of eq. (p-val.)	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
Loan = $60k	0.060	0.060	0.060	0.059	0.044	0.055	0.058	0.062	0.076
	(0.017)**	(0.017)**	(0.017)**	(0.020)**	(0.023)+	(0.024)*	(0.018)**	(0.017)**	(0.029)**
Payment as % of income	-0.011	-0.011	-0.011	-0.010	-0.013	-0.011	-0.012	-0.010	-0.011
	(0.002)**	(0.002)**	(0.002)**	(0.002)**	(0.002)**	(0.002)**	(0.002)**	(0.002)**	(0.003)**
Observations	4,440	4,440	4,440	3,052	2,422	2,188	3,844	4,078	4,440
B. Fixed length									
Framing									
Cost	-0.118	-0.114	-0.117	-0.114	-0.107	-0.144	-0.115	-0.111	-0.119
	(0.015)**	(0.015)**	(0.015)**	(0.018)**	(0.020)**	(0.023)**	(0.016)**	(0.016)**	(0.028)**
Insurance	0.181	0.177	0.180	0.151	0.153	0.179	0.185	0.188	0.155
	(0.020)**	(0.020)**	(0.020)**	(0.023)**	(0.027)**	(0.029)**	(0.022)**	(0.021)**	(0.035)**
Test of eq. (p-val.)	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
Loan = $60k	0.077	0.078	0.078	0.086	0.072	0.144	0.085	0.087	0.091
	(0.015)**	(0.014)**	(0.014)**	(0.017)**	(0.019)**	(0.021)**	(0.016)**	(0.015)**	(0.025)**
Payment as % of income	-0.014	-0.014	-0.014	-0.015	-0.016	-0.013	-0.016	-0.013	-0.010
	(0.002)**	(0.002)**	(0.002)**	(0.002)**	(0.002)**	(0.003)**	(0.002)**	(0.002)**	(0.004)**
Observations	4,358	4,358	4,358	3,028	2,400	2,178	3,762	3,986	4,358

*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 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. Column 9 uses raked weights based on 2012 NPSAS. 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	*15.68*	*6.92*
Framing (rel. to neutral)		
Cost	-3.96	-2.08
	(0.71)**	(0.41)**
Insurance	4.92	3.35
	(0.80)**	(0.61)**
Test of eq. (p-val)	*<0.001*	*<0.001*
Loan = $60k	1.92	1.94
	(0.63)**	(0.43)**
Number of students	1,526	1,514

*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 100 percent of income are excluded. All specifications also include controls for major, gender, class standing, missing SAT scores, SAT 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: Coefficients from Descriptive Regressions of Preferences for IDR on Expected Labor Market Outcomes

	(1) Fixed amount	(2) Fixed length
Expected earnings ($10k)		
At graduation	-0.002	-0.0004
	(0.002)	(0.005)
Age 30	-0.0002	-0.0001
	(0.002)	(0.002)
Age 40	-0.0001	-0.0004
	(0.001)	(0.001)
Probability of $0 earnings		
At graduation	0.158	0.035
	(0.045)**	(0.043)
Age 30	0.102	0.051
	(0.175)	(0.142)
Age 40	-0.012	-0.064
	(0.164)	(0.126)
Probability of earnings in ($0, $35k]		
At graduation	0.090	0.121
	(0.037)*	(0.041)**
Age 30	0.140	0.149
	(0.098)	(0.095)
Age 40	-0.027	0.027
	(0.124)	(0.127)
Observations	4,440	4,358

Notes: Dependent variable: prefers or strongly prefers IDR plan. All regressions also include controls for treatment parameters (loan size, payment as a percentage of income, scenario order, and framing), major (STEM/business/economics versus other), gender, class standing (freshman, sophomore, junior, senior, or new transfer), missing SAT scores, and SAT percentile. These models assume that students responded to the question regarding their expected earnings with the expected level of earnings conditional on employment. Coefficients from additional specifications that assume respondents gave their expected level of unconditional earnings are displayed in Appendix Table D. 11. 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 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							
× Cost 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							
× Cost 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 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.