Parental Support, Savings and Student Loan Repayment*

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Abstract

Using unique survey and administrative data from the Canada Student Loans Program, we document that parental support and personal savings substantially lower student loan repayment problems. We develop a theoretical model for studying student borrowing and repayment in the presence of risky labor market outcomes, moral hazard, and costly earnings verification. This framework demonstrates that non-monetary costs of applying for income-based repayment assistance are critical to understanding why resources other than earnings lead to greater repayment. We further show that eliminating these non-monetary costs may be inefficient and lead to undesirable redistribution. Empirically, we demonstrate that expanding Canada's income-based Repayment Assistance Plan to automatically cover all borrowers would likely reduce program revenue by nearly one-half over early years of repayment. Finally, we show how student loan programs can be more efficiently designed to address heterogeneity in parental transfers in the presence of non-monetary earnings verification costs and moral hazard.

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1 Introduction

Recent increases in student borrowing, coupled with growing labor market risk (Moffitt and Gottschalk, 2012; Lochner and Shin, 2014; Cunha and Heckman, 2016), have highlighted the policy relevance of a key aspect of government student loan programs: their ability to provide insurance to borrowers against adverse labor market outcomes by reducing repayment amounts when income is low (Friedman and Kuznets, 1954; Nerlove, 1975; Chatterjee and Ionescu, 2012; Lochner and Monge-Naranjo, 2016). In Canada and the U.S., formal repayment assistance for borrowers with low post-school earnings includes deferment and forbearance, as well as explicit income-contingent repayment amounts (e.g. *Pay-as-You-Earn, PAYE,* in the U.S. or the *Repayment Assistance Plan, RAP,* in Canada).[1]

In recent years, plans incorporating repayment assistance have become substantially more prominent. While very few Canadian and American students were enrolled in income-based repayment plans a decade ago, by 2014, roughly one-in-four borrowers who recently entered repayment had enrolled in these types of plans (Government Accountability Office, 2015; Employment and Social Development Canada, 2016). The benefits of income-contingent repayment have also served as the impetus for many recent policy proposals, with considerable interest in fully income-based programs (like those of Australia and, recently, the United Kingdom) that automatically reduce payments when earnings are low (Nelson, 2013).

While offering important benefits to many students, these formal insurance mechanisms, as well as the informal insurance provided by the options of default and delinquency, can also be quite costly. For example, the U.S. Department of Education expects to collect only 75-80% of any outstanding amounts when borrowers enter either income-driven repayment plans or default (Department of Education, 2017). Since Canadian and American government student loan programs are meant to be self-financing, any shortfalls arising from borrowers who make reduced payments (or default) are typically offset by 'profits' from those who are repaying in full. In practice, student loans include an interest premium to cover the risk that many borrowers will not fully repay.

Given the costs associated with repayment assistance and default, it is important to understand whether the insurance provided by current student loan programs is well-designed. Several recent studies consider potential improvements to current student loan repayment plans (Nelson, 2013) or the optimal design of student loans under uncertainty and various market frictions (Chatterjee and Ionescu, 2012; Gary-Bobo and Trannoy, 2015; Lochner and Monge-Naranjo, 2016); yet, the empirical relevance of different frictions is largely unknown. Importantly, none of these studies consider the role of one potentially crucial aspect of current programs – that a borrower's (and spouse's) earnings is the only financial resource taken into account when considering the ability to repay. Neither the possibility of changing this aspect, nor the implications that this

[1] We use the terms income-driven, income-based and income-contingent repayments interchangeably.

aspect might have for other policy changes, has entered recent policy discussions. Yet, access to other resources like parental transfers (including in-kind assistance such as the opportunity to live at home) and personal savings also provides valuable insurance against adverse labor market outcomes (Kaplan, 2012; Edwards, 2015; McGarry, 2016). Little is known about how these additional resources impact student loan repayment or their implications for the design of student loan programs. These issues are the focus of this paper.

To study the interaction of parental support and student loan repayment, we begin by developing a simple model of student borrowing, (unobserved) post-school effort, and repayment under the existing system of student loans. After borrowing for school, students must decide between repaying their loan in full or, if eligible, applying for reduced income-based payments. Crucially, payment reductions depend on post-school earnings but not parental transfers. A novel feature of our model is that borrowers may decide not to apply for income-based payments due to non-monetary verification/application costs. As emphasized in Government Accountability Office (2015), these costs not only reflect potential stigma effects but also the burdens of regularly reporting earnings and any changes in family structure.

The model implies that the presence of these costs will induce some eligible borrowers to forego repayment assistance if they have sufficient parental support, generating a negative relationship between parental transfers and repayment assistance take-up. By contrast, monetary verification costs and problems associated with moral hazard predict no relationship or even a positive relationship between parental support and application for repayment assistance. Thus, the model is not only a useful framework for understanding the relationship between parental support and student loan repayment, but it also provides testable predictions that shed light on underlying market frictions central to the design of efficient student loan programs (i.e. verification costs and moral hazard).

Our model highlights the importance of knowing whether there exists a strong connection between student loan repayment and parental transfers (or other available financial resources other than the borrower's own earnings).[2] Perhaps surprisingly, there is little or no current empirical evidence about this relationship, likely due to a lack of data on these resources. While some data sets (e.g. Baccalaureate and Beyond, Beginning Postsecondary Students) contain limited information about parental income when borrowers attended college (usually from financial aid applications), this information may not serve as an effective proxy for post-school access to parental transfers (or other resources like personal savings). Parental transfers capture not only differences in parents' ability to help their children, which would tend to be reflected in parental income, but also differences in parents' willingness to help, which need not be.[3]

[2]While we do not explicitly model access to other resources like personal savings in our theoretical analysis, they would play a similar role to parental transfers.

[3]Park (2016) documents considerable heterogeneity in parental support for higher education conditional on parental income.

We address this data limitation by combining administrative data on student loan amounts and repayment outcomes from the Canada Student Loans Program (CSLP) with data from a new survey that we helped design to measure a broad array of available resources, including personal savings and unique information about potential parental support.[4] These data reveal a strong relationship between student loan repayment and all types of financial resources available to borrowers. While repayment problems are primarily concentrated among borrowers with low post-school earnings, we find that many low-earning borrowers still manage to make their standard loan payments by taking advantage of access to parental assistance and personal savings.[5] For example, only 4% of low-earning borrowers with access to (at least) a modest amount of parental assistance and savings experience a situation where they fail to make their standard payments (i.e. receive repayment assistance or experience delinquency/default), while 60% of low-earning borrowers with access to little parental support and negligible savings fail to make their standard payments. Taking into account other factors that could be correlated with parental support and savings does not change this basic result. Thus, our findings demonstrate that (Canadian) student borrowers with the resources to pay their loans almost always do and that resources other than own earnings play a critical insurance role for many borrowers who experience adverse labor market outcomes. Further highlighting the importance of our new resource measures, we find that the value of parental income for predicting repayment is quite modest.

Since nearly half of CSLP borrowers who are eligible for repayment assistance (due to low earnings) do not apply for reduced payments, it is not surprising that student loan administrators have raised concerns about a lack of student awareness of repayment options.[6] However, it is difficult to reconcile a general lack of borrower awareness with the significantly lower repayment assistance take-up rates among eligible borrowers with greater parental support and savings. When viewed through the lens of our model, these results suggest an alternative explanation: that non-monetary verification costs discourage application for repayment assistance among eligible borrowers with access to financial resources beyond their own earnings.[7]

Motivated by concerns about low take-up rates for repayment assistance among eligible borrowers, the CSLP has introduced several initiatives to reduce application/verification costs (e.g. introduction of online enrolment). Reducing these costs is also a central feature of U.S. proposals

[4]The CSLP services all provinces and territories in Canada except Quebec. In 2011-12, the CSLP provided loans to 447,000 full-time students (Employment and Social Development Canada, 2016).

[5]Several previous American and Canadian studies document higher rates of non-payment among low-earners (Dynarski, 1994; Flint, 1997; Lochner and Monge-Naranjo, 2015; Schwartz and Finnie, 2002). See Gross et al. (2009) for a recent survey.

[6]Similar concerns have also been raised in the U.S., where the Treasury Department estimated that only 20% of all Direct Loan borrowers eligible for income-based repayment plans in 2012 were actually enrolled (Government Accountability Office, 2015).

[7]Of course, most borrowers may be initially uninformed about their repayment options, choosing to become informed about repayment assistance only when necessary. Our results are consistent with this possibility, where acquiring the information is simply part of the cost of applying – a cost borrowers with greater parental support are less willing to pay.

aimed at facilitating enrolment in income-based repayment plans (Government Accountability Office, 2016). Our theoretical framework raises important concerns about these efforts, since they could result in sizeable repayment reductions by borrowers with low post-school earnings but sufficient parental support (or savings), who often choose to repay their loans in full despite their eligibility for reduced payments. To the extent that interest rates would need to be raised to cover the losses associated with these payment reductions, reducing application/verification costs would generate an ex ante transfer from students with little parental support to those with greater support. Eliminating verification costs may not only have undesirable redistribution effects, but we demonstrate that it could also be economically inefficient given the current structure of student loan programs. With the focus of current repayment assistance on the borrower's earnings alone, the existence of modest verification costs may be an efficient way to target that assistance to borrowers who need it most.

To study the empirical relevance of these concerns, we simulate the effects of moving from the current CSLP environment, in which income-based payments are offered as an option to low-earning borrowers under RAP, to a policy which automatically enrolls all borrowers in RAP. On one hand, this policy change could raise revenues by encouraging currently delinquent/defaulting borrowers with low earnings to make reduced income-based payments. However, these gains are likely to be quite small, since most borrowers in delinquency/default have low earnings, and would, therefore, be expected to make low (or zero) RAP payments. On the other hand, the policy change would generate revenue losses from low-earning borrowers who currently make the standard payment even though they are eligible for reduced payments. Our finding that many low-earning borrowers have access to other resources and make standard payments suggests that these revenue losses would be substantial. Considering the balance of these two effects, our calculations suggest that making RAP enrollment automatic would lead to sizeable revenue losses for CSLP, at least in the short-run.

Given the drawbacks of simply reducing non-monetary verification costs under the current system, it is natural to consider more general changes that better account for the important role of parental transfers. Specifically, we consider the design of a (constrained) efficient student loan program that aims to provide liquidity for school and insurance against post-school earnings risk, subject to concerns about moral hazard and non-monetary costs of income verification. We show that efficient student loan contracts would have similar features to current government student loan programs in Canada and the U.S., in that borrowers with high earnings would make a standard fixed payment, while those with low earnings would have their earnings verified and receive reduced income-based payments. The primary distinction is that, under efficient contracts, implicit interest rates for the standard payment, income-based payment amounts, and the eligibility threshold (for reduced payment) would all be borrower-specific, depending on the amount borrowed, (reported) parental support, and earnings potential. Unlike current loan contracts, ef-

ficient contracts would compensate borrowers for non-monetary verification costs associated with applying for reduced income-based payments. With efficient loan contracts designed to maximize the amount of insurance that can be provided given market frictions, it would be optimal to reduce verification costs as much as possible. When these contracts are structured to be actuarially fair (i.e. zero expected returns) for each borrower, there would be no ex ante redistribution across borrowers with different parental support or earnings potential. In some cases, efficiency and actuarial fairness at the borrower level can eliminate incentives for students applying for loans to misrepresent the level of parental support they expect to receive after school. This would not be the case if an attempt were made to simply tie repayment amounts to borrower-reported parental transfers under current programs.

2 Student Loan Contracts with Parental Transfers, Costly Income Verification and Moral Hazard

In this section, we develop a model of student borrowing and repayment when post-school earnings depend on (unobserved) effort and are uncertain. We consider current government student loan programs, which offer borrowers the option of repaying their loans in full or, if eligible, applying for reduced income-based payments.[8] Crucially, payment reductions are independent of parental transfers, and eligible borrowers may decide not to apply for income-based payments due to non-monetary verification/application costs. We use the model to examine how parental transfers impact student loan repayment, as well as other choices. Insights from this analysis motivate a new test for the presence of non-monetary verification costs.

2.1 Environment

We assume that individuals live for two periods. During college (period 1), they make tuition payments costing $T \geq 0$, consume c_1, and borrow d – all coming from their initial resources $w \geq 0$, which includes any early parental support. After college (period 2), they consume c_2 out of their earnings y and post-school transfers from parents $\tau \geq 0$ less loan repayments D. While we refer to τ as parental transfers, it may also reflect other financial resources available to borrowers but not considered by student loan programs in setting income-based payments.[9]

Post-school earnings $y \geq \underline{y} \equiv \min\{y\}$ are uncertain and depend on costly (unobserved) effort $e \geq 0$, which may reflect such activities as studying during college or post-school job search. We assume a well-behaved conditional density function $\Phi(y|e)$ and $\phi(y|e) \equiv \partial\Phi(y|e)/\partial y \in (0, \infty)$ for all $(e, y) \in [0, \infty) \times [\underline{y}, \infty)$. We also assume that earnings under higher effort first-order stochastically dominate (FOSD) earnings under low effort, so $\frac{\partial\Phi(y|e)}{\partial e} < 0$ for all (e, y).

[8] For simplicity, we abstract from the option of default; however, we introduce this possibility in Section 2.2.6.

[9] To simplify the exposition, most of our analysis assumes that post-school parental transfers are exogenous and anticipated in period 1. We consider the role of endogenous transfers from altruistic parents in Subsection 2.2.7.

Preferences for consumption each period are given by the strictly increasing and strictly concave function $u(c)$, while effort has a utility cost $v(e)$ that is strictly increasing and strictly convex. Individuals discount the future at rate $\beta > 0$.

With uncertainty in post-school earnings, borrowers maximize expected lifetime utility, evaluating consumption and effort allocations according to:

$$U = u\left(c_1\right) + \beta \left[\int_{\underline{y}}^{\infty} u\left(c_2(y)\right) \phi(y|e) dy - v(e) \right], \tag{1}$$

where consumption is given by $c_1 = w - T + d$ during school and $c_2 = y + \tau - D$ after school.

2.2 A Basic Government Student Loan Program

Consider a government student loan program that requires payments with a fixed gross interest rate of $R > 1$ when earnings are high, but offers reduced earnings-contingent payments $\xi(y) \geq 0$ for those who verify that their earnings are below the eligibility threshold θ. These payments $\xi(y)$ may reflect actual collections by the government lender as well as any financial costs of earnings verification imposed on borrowers. Consistent with many government loan programs (including the CSLP), we assume that these payments are non-decreasing in earnings with $0 \leq \xi'(y) < 1$ for all y.[10] For expositional purposes, we assume that repayments are zero at the lowest earnings level: $\xi(\underline{y}) = 0$.[11] Altogether, loan repayments are given by

$$D(d, y) = \begin{cases} \xi(y) & \text{if } y < \theta \text{ is verified} \\ Rd & \text{otherwise.} \end{cases} \tag{2}$$

Importantly, borrowers with $y < \theta$ who wish to have their earnings verified in order to reduce their payment must also incur a non-monetary verification cost of $\psi \geq 0$, which is directly subtracted from expected utility, U, as defined in equation (1). A key distinction between monetary verification costs, incorporated in $\xi(y)$, and non-monetary verification costs, ψ, is that the former directly lower the marginal utility of consumption while the latter do not. We pay particular attention to non-monetary verification costs below, since they have important implications for the role of parental transfers in repayment decisions.

[10] Eligibility for reduced payments is also typically limited to borrowers whose income-based payment amount does not exceed the debt-based standard payment amount. With non-negative monetary costs of verification/enrolment, this constraint would never bind and has no affect on behavior.

[11] This is typically the case for actual income-contingent payments; however, it need not be true when $\xi(\cdot)$ includes monetary verification costs. This assumption ensures that borrowers with very low earnings would always prefer the income-contingent payment to the standard payment in the absence of any verification costs. Otherwise, there may be some borrowers with very low loan amounts such that $Rd < \xi(\underline{y})$, in which case they would always choose the standard repayment. We effectively ignore this case, implicitly assuming that financial verification costs are small relative to loan amounts.

We assume throughout that initial wealth w is sufficiently low that students wish to borrow, so $d > 0$. Government student loans may be restricted by an upper loan limit:

$$d \leq d_{max}. \tag{3}$$

2.2.1 Repayment Decisions

Borrowers must make a standard repayment Rd if earnings are sufficiently high (i.e. $y \geq \theta$), in which case post-school consumption is given by

$$c_2^S(y, d; \tau) \equiv y + \tau - Rd.$$

For $y < \theta$, borrowers may prefer to have their earnings verified to qualify for the income-contingent payment, yielding post-school consumption

$$c_2^I(y; \tau) \equiv y + \tau - \xi(y).$$

It is optimal to incur the verification costs for reduced income-based payments if and only if the gains exceed the costs:

$$G(y, d; \tau) \equiv u(y + \tau - \xi(y)) - u(y + \tau - Rd) > \psi. \tag{4}$$

Those with low enough earnings are eligible for the income-contingent payment, but they may prefer making the standard payment if the income-based payment or the verification costs are sufficiently high. With $\psi > 0$, borrowers would never choose the income-contingent payment unless it entailed a payment reduction (i.e. $\xi(y) < Rd$), which would need to be large enough to offset the verification costs.

The gains from applying for income-based payments, $G(y, d; \tau)$, are strictly increasing in debt d, because the income-based payment does not depend on debt while the standard payment does. Furthermore, if the gains are non-negative, then (by concavity of $u(\cdot)$) they are decreasing in both earnings and parental transfers.[12] The assumptions that $\xi(\underline{y}) = 0$ and $d > 0$ imply that $G(\underline{y}, d; \tau) > 0$, so the gains from applying for income-contingent repayments are positive and decreasing in earnings at the very low end. As earnings rise, the gains may turn negative if $\xi(y)$ becomes sufficiently high.

Conditional on debt and realized earnings, effort does not affect repayment behavior. For $\psi > 0$, there are three potential repayment cases to consider for borrowers eligible for income-contingent payments:

Case 1: If $G(\underline{y}, d; \tau) \leq \psi$, then the gains from income-contingent repayment do not exceed the verification costs even when earnings are at their lowest. Borrowers with sufficiently low debt

[12] See Appendix E.1 for these derivatives and other technical details.

or high parental transfers (for whom this condition applies) would always make the standard loan payment regardless of their own earnings.

Case 2: If $G(\theta, d; \tau) \geq \psi$, then the gains of income-contingent repayment are at least as high as the verification costs even when earnings are at the eligibility threshold. Borrowers with sufficiently high levels of debt (for whom this condition holds) would choose to have their earnings verified in order to pay the lower income-based amount, for any level of earnings that makes them eligible for reduced payments. Borrowers with very little parental support are also likely to behave in this way; however, it is possible that $G(\theta, d; 0) < \psi$ if debt is low enough or the eligibility threshold is high enough.

Case 3: If $G(\theta, d; \tau) < \psi < G(\underline{y}, d; \tau)$, then there will be a threshold level of earnings $\hat{y}(d; \tau, \psi) \in (\underline{y}, \theta)$, above which borrowers will repay the standard amount and below which they will have their earnings verified in order to pay the lower income-based amount. This threshold solves

$$u\left[\hat{y}(d; \tau, \psi) + \tau - \xi\left(\hat{y}(d; \tau, \psi)\right)\right] - u\left[\hat{y}(d; \tau, \psi) + \tau - Rd\right] = \psi. \tag{5}$$

Using the implicit function theorem, one can show that $\hat{y}$ is decreasing in τ but increasing in d. This case is relevant for borrowers with moderate levels of debt and parental transfers. The probability of applying for a reduced income-based payment given student debt d, transfers τ, and effort e is $\Phi(\hat{y}(d; \tau, \psi)|e)$, which is decreasing in parental transfers but increasing in debt.

Summarizing these results, borrowers will choose to have their income verified to receive a reduced income-based payment if and only if

$$y < \tilde{y}(d; \tau, \theta) \equiv \max\{\underline{y}, \min\{\hat{y}(d; \tau), \theta\}\}, \tag{6}$$

where conditioning on ψ is implicit. This verification threshold does not depend on effort and depends on debt and parental transfers only in intermediate ranges between $\underline{y}$ and θ.[13] The probability of applying for a reduced income-based payment conditional on $(d, e; \tau, \theta)$ is $\Phi(\tilde{y}(d; \tau, \theta)|e)$.

2.2.2 Borrowing and Effort Choices

Students choose borrowing d and effort e to maximize expected utility U (equation 1) less non-monetary costs ψ in the case of verification subject to the borrowing constraint (equation 3) and repayment decision rule given by equation (6). As shown in Appendix E.1, the first order condition (FOC) for student debt d can be written as

$$u'(c_1) = R\beta(1 - \Phi(\tilde{y}|e))E[u'(c_2)|y \geq \tilde{y}, e] + \lambda, \tag{7}$$

where $\lambda \geq 0$ is the Lagrange multiplier on (3). If borrowing is unconstrained, then $\lambda = 0$ and $u'(c_1) \leq R\beta E[u'(c_2)|e]$, so the expected marginal utility of consumption *increases* after school

[13] Here, $\hat{y}(d; \tau)$ reflects the solution to equation (5) for any value of y. Notice that $\tilde{y} = \underline{y}$ if and only if $G(\underline{y}, d; \tau) \leq \psi$, and $\tilde{y} = \theta$ if and only if $G(\theta, d; \tau) \geq \psi$. As discussed below, $\hat{y}$ does not depend on τ when $\psi = 0$.

when $R\beta = 1$. That is, the potential for partial loan forgiveness associated with income-contingent repayments generates a tendency for "over-borrowing".[14]

Optimal effort must satisfy the following interior FOC:

$$v'(e) = \frac{\partial E\left[u(c_2(y))|e\right]}{\partial e} - \psi \frac{\partial \Phi(\tilde{y}|e)}{\partial e}, \tag{8}$$

equating the direct marginal utility costs of effort with the marginal gains from higher post-school earnings/consumption and reductions in expected verification costs.

2.2.3 Effects of Parental Transfers on Behavior

In this section, we use our model to study the effects of parental transfers τ on borrower behavior.[15]

We begin by discussing the effects of parental transfers on effort. Because income-based payments implicitly 'tax' earnings while standard payments do not, the effects of transfers on effort will depend, in part, on how the verification threshold adjusts. As discussed above, if non-monetary verification costs are sufficiently high ($\psi > G(\underline{y}, d; \tau)$) or sufficiently low ($\psi < G(\theta, d; \tau)$), the verification threshold is set at $\underline{y}$ or θ, respectively, and is unaffected by (marginal) changes in parental transfers or student debt. In these cases, parental transfers only impact effort through an income effect. With high verification costs, borrowers always repay in full, so consumption is monotonically increasing in earnings and effort. As a result, the income effect of effort is unambiguously negative: parental transfers reduce the marginal value of income, which reduces incentives to exert effort. When verification costs are low, consumption discontinuously drops when earnings rise above the eligibility threshold (as borrowers switch from income-based to standard payments). As a result, an increase in effort could lead to a reduction in consumption for a range of earnings realizations. As long as effort still lowers the expected marginal utility of post-school consumption, the income effect will continue to be negative, and parental transfers will reduce effort.[16] Letting d^*, e^*, and c_2^* reflect optimal borrowing, effort, and post-school consumption, we summarize these results in the following lemma. (Proofs for all results can be found in Appendix E.)

Lemma 1 *If (i)* $\psi > G(\underline{y}, d^*; \tau)$ *or (ii)* $\psi < G(\theta, d^*; \tau)$ *and* $\partial E[u'(c_2^*)|e^*]/\partial e < 0$*, then* $\frac{\partial \tilde{y}}{\partial d} = \frac{\partial \tilde{y}}{\partial \tau} = 0$ *and* $\frac{de^*}{d\tau} < 0$.

[14] When preferences are neutral with respect intertemporal consumption allocations in terms of time discounting (i.e. $R\beta = 1$) and prudence (i.e. $u'''(\cdot) = 0$), expected consumption *falls* after school in the absence of borrowing constraints. Stringent limits on borrowing (or sufficient patience or prudence) can more than offset this force, yielding increasing average consumption profiles.

[15] Note that unanticipated transfers would have no effect on borrowing or effort choices. They would only affect repayment behavior through direct effects of transfers on the verification threshold (i.e. $\partial \tilde{y}/\partial \tau$).

[16] Appendix E.1 shows that if the Monotone Likelihood Ratio Property (MLRP) is satisfied for $\Phi(y|e)$ and the eligibility threshold θ is not too near the point where effort goes from reducing to increasing the likelihood of earnings (i.e. where $\partial \phi(y|e)/\partial e = 0$), then the expected marginal utility of post-school consumption is declining in effort.

When verification costs are moderate ($G(\theta, d^*; \tau) < \psi < G(\underline{y}, d^*; \tau)$), borrowers will lower their verification threshold in response to an increase in parental transfers. Because this reduces the likelihood that borrowers apply for income-based payments, which implicitly 'tax' earnings, it encourages effort. If this effect dominates the opposing income effect, effort will be increasing in parental transfers.

Next, consider the effects of parental transfers on borrowing. On one hand, the availability of additional post-school resources encourages borrowing, as students wish to shift some of those resources to the schooling period. On the other hand, reductions in the verification threshold (and potentially effort) discourage borrowing. Unfortunately, it is not easy to determine which force will dominate, so the total effects of transfers on borrowing are generally ambiguous.

Finally, consider the effects of parental transfers on the probability of making a reduced income-based payment:

$$\frac{d\Phi(\tilde{y}(d,\tau)|e)}{d\tau} = \underbrace{\frac{\partial \Phi(\tilde{y}|e)}{\partial e}\frac{de}{d\tau}}_{\text{effort effect}} + \underbrace{\phi(\tilde{y}|e)\left[\frac{\partial \tilde{y}}{\partial d}\frac{\partial d}{\partial \tau} + \frac{\partial \tilde{y}}{\partial \tau}\right]}_{\text{threshold effect}}. \tag{9}$$

The first term reflects the fact that, by influencing effort, parental transfers will change the likelihood that a borrower's earnings are below a particular verification threshold $\tilde{y}$, while the second term reflects the fact that parental transfers will lead to an adjustment in the verification threshold itself.

When $\psi > G(\underline{y}, d^*; \tau)$, borrowers always repay in full, so both the 'effort' and 'threshold' effects are zero and marginal changes in parental transfers do not affect repayment behavior. There are also no 'threshold' effects when $\psi < G(\theta, d^*; \tau)$. However, the 'effort' effect is positive (assuming effort reduces the expected marginal utility of post-school consumption), since effort is strictly decreasing in transfers (Lemma 1) and $\Phi(y|e)$ is strictly decreasing in e (due to FOSD). In this case, the probability of making a reduced loan payment is strictly increasing in parental transfers. These results are summarized in the following proposition.

Proposition 2 *If $\psi > G(\underline{y}, d^*; \tau)$, then the probability of making a reduced loan payment is zero and unaffected by a marginal change in parental transfers. If $\psi < G(\theta, d^*; \tau)$ and $\partial E[u'(c_2^*)|e^*]/\partial e < 0$, then the probability of making a reduced loan payment is strictly increasing in parental transfers.*

With moderate non-monetary verification costs satisfying $G(\theta, d^*; \tau) < \psi < G(\underline{y}, d^*; \tau)$, parental transfers may raise or lower the likelihood of making reduced payments, since borrowers will adjust the verification threshold and the 'effort' effect is ambiguous. If additional parental transfers lead to large increases in the verification threshold, then effort may increase and the probability of making a reduced income-based payment may fall.

2.2.4 A Test for the Presence of Non-Monetary Verification Costs

The previous subsection shows that non-monetary verification costs affect the relationship between parental transfers and student loan repayment. Based on this, we now develop a test for the presence of non-monetary verification costs.

When $\psi = 0$, the repayment decision (for those eligible for reduced payments) depends only on a comparison of $\xi(y)$ and Rd, so the verification threshold does not directly depend on parental transfers. This means that the probability of making reduced payments conditional on debt depends only on the effect of transfers on effort (and, therefore, the distribution of earnings). With population heterogeneity in initial wealth w and parental transfers τ, borrowers anticipating different transfer amounts may still borrow the same amount (due to differences in initial wealth).[17] The following proposition shows that among borrowers with the same debt, those receiving higher parental transfers will put forth less effort (due to the income effects discussed earlier) and will be more likely to make reduced loan payments.[18]

Proposition 3 *Suppose $\psi = 0$. If $\partial E[u'(c_2^*)|e^*]/\partial e < 0$ for all (e^*, c_2^*), then among borrowers with the same level of debt, those with higher levels of parental transfers exert less effort and have a greater probability of making reduced income-based payments.*

Appendix E.2 shows that when $\psi = 0$, the condition $\partial E[u'(c_2)|e^*]/\partial e < 0$ is satisfied for all borrowers with low levels of debt $d^* \leq R^{-1}\xi(\theta)$. It is also satisfied for borrowers with higher levels of debt under fairly general conditions.[19] Important for our purposes, it is always satisfied when there is no arbitrary eligibility limit on earnings alone. This is consistent with current U.S. and Canadian student loan programs, which generally allow borrowers for whom the income-based payment is lower than the standard debt-based payment to apply for reduced payments.

Proposition 3 implies an empirically testable prediction for the presence of non-monetary verification costs based on our cross-sectional data from Canada: basic logic dictates that if borrowers with higher levels of parental transfers (but the same debt) *do not* have a greater probability of making reduced income-based payments, then non-monetary verification costs ψ must not be zero.[20] This test is easy to implement, since it only depends on the cross-sectional relationship between parental transfers and repayment choices.

One potential concern is that our test would be uninformative if borrowers with higher transfers always had a greater probability of applying for reduced payments, even when $\psi > 0$. Fortunately, this is not the case. In the presence of non-monetary verification costs, the verification

[17] This implicitly assumes that all individuals have the same earnings potential, or ability. Alternatively, these results would apply conditional on ability. Unobserved differences in ability are discussed in Subsection 2.2.5.

[18] Note that this proposition considers a comparison across borrowers with different levels of parental transfers who chose to borrow the same amount, while Lemma 1 and Proposition 2 report standard comparative statics results holding initial wealth constant.

[19] See footnote 16 or Appendix E.

[20] The reverse need not be true: if borrowers with higher transfers have a greater probability of making reduced payments, ψ need not be zero.

threshold will be lower for those with higher parental transfers. This can easily offset any incentives of higher parental transfers to reduce effort, resulting in a negative relationship between parental transfers and income-based payments. Our empirical results in Section 4 suggest that this is, indeed, the case in our context and that non-monetary verification costs must be positive.

2.2.5 Heterogeneity in Ability

The distribution of earnings may differ across individuals due to factors other than effort. Thus far, we have abstracted from such differences, or implicitly assumed that these factors (e.g. ability) can be observed and conditioned upon. Fortunately, it is straightforward to generalize our 'test' for $\psi = 0$ to account for unobserved heterogeneity in ability by simply conditioning on post-school earnings as well as debt when examining the relationship between parental transfers and repayment behavior. To see why, notice that when $\psi = 0$, repayment choices should be independent of parental transfers conditional on both debt and post-school earnings, since the repayment decision depends only on a comparison of $\xi(y)$ and Rd (among the eligible). When $\psi > 0$, the probability that someone applies for reduced payments should be weakly decreasing in transfers (conditional on both debt and earnings), since the verification threshold is weakly decreasing in transfers.[21] This is what we observe in our data.

2.2.6 Incorporating Default

Suppose individuals also have the option to stop paying their loans altogether (i.e. default), which entails monetary costs $\xi_D(y) \geq 0$ and non-monetary costs $\psi_D \geq 0$, where we assume $0 \leq \xi_D'(y) < 1$. Monetary costs may reflect legal or collection fees, wage garnishments, etc., while non-monetary costs may reflect stigma or other costs associated with a poor credit record (e.g. difficulty renting an apartment or obtaining a credit card). In this case, borrowers choose between repaying in full, applying for a reduced income-based payment, and default.

When the non-monetary costs associated with both income-based payments and default are similar, the choice between them simplifies to the lesser of $\xi(y)$ and $\xi_D(y)$. There may be some earnings levels for which default is preferred and others for which the income-based payment is preferred.[22] As discussed further in Appendix E.3, the choice between making the standard (full) repayment vs. making a reduced payment (i.e. default or reduced income-based payment) is quite similar to the problem without default, replacing $\xi(y)$ with the preferred reduced payment,

[21] In the absence of measurement error, the probability of applying for a repayment reduction is one for earnings below $\tilde{y}$ and zero above, where $\tilde{y}$ is independent of τ when $\psi = 0$ and weakly decreasing in τ when $\psi > 0$. With classical measurement error in earnings (i.e. error independent of true earnings and debt), the probability of a repayment reduction conditional on debt and measured earnings will typically be between 0 and 1, but it will continue to be independent of τ when $\psi = 0$ and weakly decreasing in τ when $\psi > 0$.

[22] Instead, assuming $\xi(y) = \xi_D(y)$ and $\psi \neq \psi_D$, individuals would always prefer the option with the lesser non-monetary cost. This yields the same reduced payment decision (default or income-based payments) for all earnings outcomes.

$\min\{\xi(y), \xi_D(y)\}$. Under reasonable assumptions regarding the costs of default, effort continues to be declining in parental transfers when non-monetary costs are high or low. Furthermore, among borrowers with the same debt, those with greater parental transfers should be more likely to make a reduced payment (either default or income-based payments) in the absence of non-monetary costs of verification and default. Even with positive non-monetary costs of default (i.e. $\psi_D > \psi = 0$), reduced payments should be more common among those with greater parental transfers as long as non-monetary default costs are not too high and default is only preferred at the lowest earnings levels.[23] (Appendix Table A1 shows that delinquency and default are rare when annual earnings exceed $20,000.) Altogether, our evidence in Section 4 that the failure to make standard loan payments (due to default or income-based payments) is strongly declining in parental transfers suggests that non-monetary verification costs ψ are important.

2.2.7 Altruistic Parents and Endogenous Transfers

Parental transfers are likely to be endogenous to their children's earnings. Appendix E.4 shows that when parents are altruistic towards their children, all previous qualitative results with respect to parental transfers apply directly to parental income. Furthermore, parental transfers are declining in own earnings and increasing in both parental income and altruism. Because transfers are increasing in parental income for any given level of altruism, qualitative results with respect to exogenous parental transfers continue to apply even when the transfers are endogenous. Furthermore, when parental wealth and altruism vary across families, parental transfers and *access to parental support* (defined as the value of transfers when own earnings equal $\underline{y}$) reflect a combination of both the means and willingness of parents to provide support.

3 Data

In order to understand the relationship between the financial resources available to borrowers and their repayment decisions, we exploit both survey data and administrative data from the CSLP.

The CSLP's Client Satisfaction Survey (CSS) is an annual telephone survey of roughly 2,700 borrowers of all ages (in-study and in-repayment).[24] This survey is traditionally used to gauge borrowers' general satisfaction with the CSLP program. However, for the years 2011 and 2012, we were given the opportunity to add new questions to the survey in an effort to understand why some people experience repayment problems for their student loan obligations while others do

[23] Alternatively, if ψ_D is so high that nobody ever wants to default, then Propositions 2 and 3 apply directly.

[24] Survey response rates were 50% and 52%, respectively, in 2011 and 2012. The survey administrator conducted an analysis of non-response to see whether responders and non-responders differed in the following dimensions relevant to our analysis: loan amount, repayment status (current, in arrears, on Interest Relief), institution type (private vs. public), province, and age. Nearly all of these differences were statistically insignificant at the 5% level in both survey years; however, responders were 3-4 percentage points less likely to be in arrears in both surveys, suggesting that students having repayment problems are slightly under-represented.

not. Most importantly, this opportunity enabled us to collect unique information about financial resources – not only borrowers' post-school earnings, but also their access to parental support and savings – in addition to standard background characteristics (e.g., gender, indigenous status, province of residence, educational attainment) and a novel measure informative about the perceived consequences of not repaying student loans. We merge data from the CSS with administrative records from the CSLP, which provide information on borrowers' loan balances and repayment outcomes (i.e., loan status) throughout the entire time they were clients. Administrative records also contain information about dependency status and parental income levels (for dependent students) at the time of student aid application.

CSLP borrowers are not required to begin making payments on their loans until six months after leaving school. After this grace period, all CSLP loans are consolidated and repayment begins. While most borrowers enter loan repayment after a single period of schooling, some leave and return to school and may have multiple distinct repayment periods. We focus on repayment outcomes during the last repayment period observed in our data (as of two months after the CSS). Since repayment begins six months after borrowers leave school, our sample respondents have been out of school for at least eight consecutive months. To mitigate CSS sampling concerns associated with borrowers who have been out of school for many years, we limit our sample to borrowers who entered their most recent loan repayment period no more than two years prior to answering the CSS.[25] Thus, we analyze repayment behavior during the first two years after repayment begins. These borrowers are of particular interest, because most repayment problems surface relatively quickly. For example, 27% of recent CSLP borrowers entered RAP during their first two years of repayment, compared to only 1.5% first entering RAP over the next two years (Office of the Chief Actuary, 2014). Finally, we restrict our sample to borrowers under age 30 to ensure a more homogeneous group of respondents.

For comparability across analyses, we restrict our sample throughout the paper to the 689 borrowers who had administrative loan records, non-missing responses to our main financial resource variables of interest, and other 'baseline' variables likely to influence repayment. Sample weights are used for all calculations to account for stratified sampling by province, loan type, and repayment status (within the CSS sampling frame).

Based on our administrative records, CSLP borrowers in our sample owed nearly $14,000 on their student loans, on average, at the beginning of the repayment period. To study repayment, we create an indicator for whether an individual has a repayment problem related to her student

[25] Unfortunately, the CSS does not survey borrowers who had fully repaid their loans nor those who were already in default (those in delinquency were surveyed). As discussed in Appendix B, our sample of respondents in the first two years of repayment excludes less than 5% of the population who was already in default and about 10% who had already fully repaid their loans. These exclusions primarily reflect individuals who never made a payment or repaid immediately. Restricting the sample to respondents in the first year of repayment eliminates concerns about exclusion due to early default and reduces any sample selection due to early repayment in full. This restricted sample, while much smaller, yields very similar results to those presented in the paper (e.g., see Appendix Table B1).

debt at the time of the CSS.[26] This variable takes a value of one if the administrative data indicates that a borrower is delinquent or in default on her loan or if she is receiving income-based repayment assistance through RAP.[27] Overall, 26% of borrowers experienced a repayment problem based on this definition.

Our comprehensive measure of repayment problems is consistent with our conceptual framework, which emphasizes the choice between making the standard debt-based loan payment vs. a reduced income-based amount with additional non-monetary costs. Borrowers in delinquency or default (effectively an extended period of delinquency) are often subjected to wage garnishments, income tax offsets, and other financial penalties that are generally low but increasing in their earnings, much like income-based payments associated with RAP. Furthermore, delinquency/default may carry stigma or other non-monetary penalties (e.g. contact with collection agencies, difficulties in renting due to a poor credit rating) analogous to the non-monetary verification or application costs of repayment assistance. As discussed in Section 2.2.6, borrowers will compare their utility under standard payment against the better of repayment assistance and delinquency/default. Our comprehensive measure also avoids the difficulty of making subjective judgments about which repayment problems are most similar or deserve greater attention.[28] While this is our preferred measure of repayment problems, Appendix A repeats the paper's primary empirical analysis using an indicator that includes only delinquency and default (experienced by 10% of our sample). The general conclusions associated with this outcome are the same as those reported for our more comprehensive (and preferred) measure.

As discussed earlier, a borrower's own earnings is the only financial resource taken into account by CSLP when determining his/her ability to repay student debt. Figure 1 (panel A) shows the distribution of current earnings in all available categories recorded by the CSS. Nearly half of our sample of recent school-leavers earned less than $20,000 annually, and about 85% earned less than $40,000. These low earnings levels suggest that many borrowers would have difficulty repaying their student loans if this were the only source of funds available to them.

[26] The 2011 and 2012 CSS surveys took place in January and February of both years. We examine repayment status as of February 2011 and 2012.

[27] RAP reduces CSLP loan payments for eligible borrowers to 'affordable' amounts no greater than 20% of gross family income. We discuss RAP further in Section 5 and Appendix D. In a few cases, respondents received very similar repayment assistance delivered through earlier programs referred to as Interest Relief (IR) and Debt Reduction in Repayment (DRR). We observe a very small number of defaults in our sample, since the sampling frame (which generally excluded borrowers in default) was determined a couple months before the CSS was administered. Our repayment problem indicator also includes less common non-payment statuses like claim submitted, consumer proposal, and return-to-government.

[28] Although borrowers on formal repayment assistance are generally considered by the CSLP to be in good standing, these programs are also costly even when borrowers do not ultimately default, since interest payments are often covered by CSLP and loan amounts may be forgiven. In 2010-11, nearly 90% of RAP recipients made no monthly payments, so CSLP covered associated interest payments at an estimated cost of $83 million; another $36 million was budgeted to cover future unpaid principal amounts associated with the RAP program for CSLP loans disbursed in 2010-11 (Human Resources and Skills Development Canada, 2012). As noted in the introduction, evidence from the U.S. suggests that borrowers entering default vs. income-based payments are expected to repay a similar share of their remaining debt over the rest of their lives.

This paper is motivated by the possibility that other financial resources may also play a crucial role in repayment. Panels B and C of Figure 1 report the distributions for expected parental transfers and own savings, respectively, for all the categories used by the CSS. When asked how much parents or other family would be willing to give them if they needed money over the next six months, 30% reported that they could obtain at least $2,500.[29] Roughly half of the borrowers in our sample report at least $1,000 in savings. Combining these additional sources of support, we find that 63% of respondents have access to at least $2,500 in parental transfers or $1,000 in savings, while only 19% have access to both.

Since other data sources do not contain direct measures of student borrowers' parental support and savings, previous studies have sometimes considered the roles of dependency status and parental income at the time students applied for aid (Lochner and Monge-Naranjo, 2015). About 40% of our sample attended school as a dependent student. Among these students, average annual parental income was about $46,000 with 30% having income below $25,000.

Descriptive statistics for other variables used in our analysis, referred to as 'baseline determinants', are reported in Table 1. In terms of background characteristics, our sample contains more women than men, has an average age of twenty-four, and contains 8.3% indigenous persons. Roughly 40% of borrowers had earned at least a university degree (from four-year institutions), with only 14% of our sample having attended a private for-profit institution (typically a vocational/technical school). The CSS contains a unique survey question eliciting beliefs about the importance of repaying student loans. Specifically, the survey asks borrowers which type of loan (e.g. CSLP, credit cards, home mortgage) they would repay first if financial difficulties prevented them from paying them all. Table 1 shows that roughly 40% of all respondents report that they would stop paying their CSLP loans first.[30]

[29] Specifically, the CSS asks: "If you needed money during the next six months, how much would parents or other family be willing and able to give you?" We focus on whether the borrower reports that he/she could expect to receive $2,500 or more from parents/family – a modest sum but enough to cover up to a year of typical monthly loan payments. In Appendix C, we consider a broader measure of parental assistance that includes the ability of students to move back in with their parents. Based on this broader measure of parental assistance, approximately 85% of all borrowers can count on financial transfers of at least $2,500, can move back in with their parents, or already live with them. Results using this alternative measure are qualitatively consistent with those discussed in the paper.

[30] The CSS also asks respondents what they think would happen to their credit rating if they did not repay their CSLP loans. We created an indicator variable that takes a value of one if the borrower reports that not paying would make borrowing much more difficult or impossible. Using this indicator in place of the indicator describing whether resondents would stop paying their CSLP loan first yields very similar conclusions to those reported in the text.

4 Empirical Importance of Financial Resources for Student Loan Repayment

This section examines the empirical importance of financial resources for student loan repayment, emphasizing the roles of expected parental transfers and personal savings. The relationship between these financial resources and repayment (for individuals with the same level of debt) provides new evidence about the types of informal insurance individuals may have against poor labor market outcomes after leaving school. As detailed in Proposition 3, this relationship is also informative about the presence of non-monetary costs of applying for and enrolling in repayment assistance. We discuss the implications of these costs for student loan policy in Section 5.

4.1 Parental Transfers and Savings

Table 2 documents the probability that borrowers experience repayment problems for our three measures of available resources: post-school earnings, expected parental transfers, and personal savings. In all cases, repayment problems are lower for borrowers with greater available resources. For example, repayment problems for borrowers earning less than $20,000 (41.0%) are almost three times more likely than those earning $20,000-$40,000 (15.3%) and 17 times more likely than those earning more than $40,000 (2.4%). Borrowers who have expected parental transfers of less than $2,500 are three times as likely to experience a repayment problem as those who can expect at least $2,500 in help if they need it (32.2% vs. 10.5%). Finally, borrowers with little or no savings (less than $1,000) are five times as likely to experience a repayment problem as those with at least $1,000 in savings (43.7% vs. 8.7%).

Recognizing that these different types of resources may be correlated with each other, as well as other factors that determine loan repayment, we estimate a linear probability model in which repayment problems are allowed to depend on our resource measures as well as student debt, educational attainment, reported beliefs about the importance of repaying student loans, whether the borrower had attended a private post-secondary institution, province indicators, and demographic variables. These other 'baseline determinants' may affect repayment behavior conditional on debt and financial resources due to individual differences in expected costs associated with delinquency, default, or enrolling in repayment assistance.

Table 3 reports least squares estimates of the linear probability model for several different specifications.[31] In column 1, we exclude all forms of available resources to see how student debt and our 'baseline determinants' influence repayment. Column 2 also includes indicators for all available categories of the borrower's current earnings. Consistent with the model of Section 2 and previous research (Gross et al., 2009; Lochner and Monge-Naranjo, 2015), the probability of a repayment problem is significantly increasing in student debt. The estimated

[31] Average marginal effects from analogous Probit models are similar.

effect of graduating university with a 4 year degree (or more) is moderate when not accounting for earnings, but it becomes small and statistically insignificant once we condition on post-school earnings in column 2. This is not surprising, since one would expect that educational attainment largely affects repayment through earnings and accumulated debt. Repayment problems are more likely among borrowers who attended a private for-profit post-secondary institution even after conditioning on post-school earnings.[32] Other 'baseline determinants', including reported beliefs about the importance of student loan repayment, have only modest and statistically insignificant effects on repayment problems.

We are mainly interested in the role of financial resources. Column 2 of Table 3 shows that even after conditioning on student debt, schooling, and many other factors, we estimate strong effects of the borrower's own earnings on student loan repayment problems, with a sizeable jump occurring around $20,000. Borrowers with no earnings, borrowers with yearly earnings between $1 and $10,000, and borrowers with yearly earnings between $10,000 and $20,000 are 55 percentage points, 44 percentage points, and 37 percentage points, respectively, more likely to experience a repayment problem than borrowers earning more than $40,000 (the omitted category).[33]

Despite the importance of post-school earnings for student loan repayment, nearly 60% of borrowers with annual earnings below $20,000 still manage to make timely CSLP payments (see Table 2). Our theoretical analysis in Section 2.2 suggests that other resources not taken into account by the CSLP (in determining income-based payments) may explain why. The next few columns of Table 3 demonstrate that additional resources in the form of parental support and personal savings also play critical roles in enabling repayment.

Column 3 includes measures of access to parental support (at least $2,500) and personal savings (at least $1,000), in addition to the baseline determinants (without controlling for own post-school earnings). Both access to parental support and savings substantially reduce the likelihood of repayment problems. Highlighting the importance of these additional resources, the R-squared statistics at the bottom of the table reveal that accounting for savings and parental support explains a similar share of the variation in repayment problems as does accounting for the borrower's own earnings (i.e., compare columns 2 and 3). In column 4, we simultaneously control for post-school earnings, parental support, and savings. Access to parental support reduces the likelihood of a repayment problem by 14 percentage points, while access to savings reduces the likelihood by 25 percentage points. The estimates in column 5 suggest that the added benefit from having access to both parental support and savings (vs. just one of these) is modest. Relative to having access to neither savings nor parental support, having access to only parental support reduces the likelihood of a repayment problem by 25 percentage points, having access to only

[32] The estimated effects of private for-profit attendance are significant at the .05 level in column 1 and 0.10 level in column 2.

[33] Using very similar data from the CSLP's Defaulter Survey, we have also shown elsewhere that defaulters are significantly more likely to return to good standing if they experience increases in earnings relative to when they entered default (Lochner et al., 2013).

savings reduces the likelihood of a repayment problem by 31 percentage points, and having access to both reduces the likelihood of a repayment problem by 37 ($= 25.3 + 31.1 - 19.5$) percentage points.

Consistent with our theoretical framework, Figure 2 shows that parental support and savings are particularly important for borrowers with low post-school earnings. Only 4% of low-earning borrowers (i.e. borrowers earning less than $20,000) with access to both parental assistance and savings experience repayment problems. However, the rate of repayment problems is much higher, 26%, for low-earning borrowers with access to only one form of additional financial resources (i.e., parental assistance or savings, but not both), and nearly 60% of low-earning borrowers with access to neither parental support nor savings experience a repayment problem.

Among borrowers earning at least $20,000, Figure 2 shows that only 5% with access to both parental assistance and savings and 7% of those with access to only one of these additional resources experience repayment problems. Among these higher-earning borrowers with neither parental support nor savings, repayment problems are more common at 31%, but still much less common than among their low-earning counterparts. While these results suggest a role for parental assistance and savings in reducing repayment problems even among those with moderate to high earnings, that role is considerably muted relative to that observed for those with lower earnings. In particular, the added benefit from access to a second form of additional resources (i.e. both savings and parental support vs. just one) is negligible for higher earners.

In Table 4, we estimate the importance of parental assistance and savings for low-earning borrowers (less than $20,000/year) accounting for other possible determinants of repayment problems (as studied previously in Table 3). Consistent with Table 3 and Figure 2, we estimate that both parental transfers and savings substantially reduce the likelihood of repayment problems. Based on the estimates in column 2, relative to having access to neither parental support nor savings, having access to only parental support decreases the likelihood of a repayment problem by 22 percentage points, having access to only savings decreases the likelihood of a repayment problem by 41 percentage points, and having access to both decreases the likelihood of a repayment problem by 49 ($= 41.3 + 22.4 - 14.6$) percentage points.

Altogether, these results suggest that parental assistance and savings serve as critical sources of 'insurance' for borrowers in the event that they experience periods of low earnings or unemployment after leaving school. Borrowers with low earnings and no access to other resources (from savings or parents) are more likely than not to experience some form of repayment problem. However, low-earners with modest savings and parental support are very unlikely to experience repayment problems. In light of Proposition 3, these results suggest that non-monetary verification/application costs are an important factor in repayment decisions. We explore the policy implications of these costs in Section 5.

4.2 Parental Income and Repayment Problems

Sections 2 and 4.1, respectively, describe the conceptual and empirical importance of our novel measure of parental transfers. Given that parental income is often observed in administrative data, it is natural to examine whether it can serve as an effective proxy for parental transfers.

Table 5 reports estimates from regressions of repayment problems analogous to those of columns 4 and 5 of Table 3, replacing measures of expected parental transfers and savings with measures of parental income at the time students applied for aid. The omitted parental income category is the group of independent students for whom no parental income information is available. Thus, the estimated effects of income for dependent students are relative to all independent students. Column 1 of Table 5 reports estimates from the full sample and reveals that differences in repayment problems by parental income are modest. Compared to independent students, dependent students with annual parental income of at least $25,000 (at the time they applied for aid) are about 13 percentage points less likely to experience a repayment problem. The difference in repayment problems among dependent students from lower vs. higher parental income backgrounds is much smaller (about 4 percentage points). Comparing the R-squared for this specification (0.239) with that reported in column 2 of Table 3 (0.227) suggests that accounting for parental income explains relatively little of the variation in repayment across borrowers with similar backgrounds, debt, and earnings.[34] This contrasts sharply with the specifications in columns 4 and 5 of Table 3, which account for differences in expected parental transfers and savings and show substantially greater R-squared statistics (0.312 and 0.321, respectively).

Why is parental income so much less predictive of repayment problems than expected transfers and savings? In addition to the fact that parental incomes may change between the time students apply for aid and the first few years of loan repayment, post-school parental support need not be tightly linked to parental income. Parental transfers are not only based on parents' ability to help their children, which would tend to be reflected in parental income, but they also depend on parents' willingness to help, which would not necessarily be reflected in parental income. Indeed, column 2 of Table 5 shows that parental income is irrelevant for repayment among the subset of borrowers who do not expect any support from their parents, while Column 3 shows that parental income reduces repayment problems among those borrowers who report that they could receive at least some support from their parents if they needed it. Altogether, this evidence suggests that parental income (at least when students first apply for aid) is, at best, a weak proxy for actual post-school parental support.

[34] Controlling for additional parental income categories does not change this conclusion. For example, the R-squared statistic is unchanged (to the third decimal place) when adding another indicator for parental income of at least $50,000.

5 Implications for Canada's Repayment Assistance

Our empirical results showing the importance of parental support and savings for student loan repayment have direct implications for the design of government student loan programs. Most notably, they suggest that the non-monetary costs of earnings verification (or repayment assistance take-up more generally) are likely to be sizeable, buttressing concerns by some that the seemingly low enrolment in income-based repayment plans may be due to hassles involved in the application/verification process (Government Accountability Office, 2015). Concerns about these costs have led some to call for streamlining the application process or abolishing it altogether (as in Australia and the United Kingdom) through automatic enrolment in income-based repayment schemes (Dynarski and Kreisman, 2013).

In this section, we begin by discussing the implications of reducing or eliminating non-monetary verification/application costs using the economic model developed in Section 2.2. We then use our administrative and CSS data on student borrowing, repayment, and earnings, as well as longitudinal data on student debt and earnings from Canada's Survey of Labour and Income Dynamics (SLID) to empirically study the implications of making enrolment in the CSLP's RAP automatic. We refer to this potential program as 'Universal RAP'.

5.1 Effects of Lowering Non-Monetary Verification Costs: Theory

Using our model of government student loan programs from Section 2.2, we can study the effects of reducing non-monetary verification costs ψ on repayments. Notice that

$$\frac{d\Phi(\tilde{y}(d;\tau,\theta,\psi)|e)}{d\psi} = \phi(\tilde{y}|e)\frac{\partial \tilde{y}}{\partial \psi} + \phi(\tilde{y}|e)\frac{\partial \tilde{y}}{\partial d}\frac{\partial d}{\partial \psi} + \frac{\Phi(\tilde{y}|e)}{\partial e}\frac{\partial e}{\partial \psi}. \tag{10}$$

Consider, first, the short-term impacts of lowering verification costs ψ on borrowers who have already entered the labor market. Their debt and effort choices have already been made. Only the first (direct) effect of ψ on the threshold $\tilde{y}$ in equation (10) applies to these borrowers, so $d\Phi/d\psi \leq 0$ since an increase in ψ reduces $\tilde{y}$ whenever $G(\theta, d; \tau) < \psi < G(\underline{y}, d; \tau)$.

In the long term, new borrowers will be affected by a reduction in ψ, adjusting their borrowing and effort choices. The following proposition shows that if the Monotone Likelihood Ratio Property (MLRP) holds and the probability of earning the threshold amount $\tilde{y}$ is increasing in effort (i.e. $\tilde{y}$ is not too low), then debt is decreasing and effort is increasing in verification costs.[35] Effort is also increasing in verification costs for eligible borrowers that always apply for reduced income-based payments.

Proposition 4 *For $d < d_{max}$, if the MLRP holds for $\Phi(y|e)$ and $\frac{\partial \phi(\tilde{y}|e)}{\partial e} \geq 0$, then $\frac{\partial d}{\partial \psi} < 0$. If (i) the MLRP holds for $\Phi(y|e)$ and $\frac{\partial \phi(\tilde{y}|e)}{\partial e} \geq 0$, or (ii) $\psi < G(\theta, d; \tau)$, then $\frac{\partial e}{\partial \psi} > 0$.*

[35] Intuitively, the MLRP implies that higher effort is more likely to have been exerted when observing higher earnings values. Formally, it requires $\frac{\partial}{\partial y}\left[\frac{\partial \phi(y|e)/\partial e}{\phi(y|e)}\right] > 0$.

Intuitively, an increase in verification costs encourages effort, since exerting higher effort reduces the likelihood that earnings are low and verification is needed (holding constant the verification threshold). Borrowers also reduce their verification threshold when $G(\theta, d; \tau) < \psi < G(\underline{y}, d; \tau)$. As long as increases in borrowing do not strongly encourage effort, the reduction in $\tilde{y}$ further encourages effort and discourages borrowing. The stated conditions ensure that this is the case.

Given the results of Proposition 4, it is straightforward to see from equation (10) how changes in verification costs affect the probability of a repayment reduction in the long-term when borrowing and effort respond. Among borrowers with $\psi < G(\theta, d; \tau)$, $\tilde{y} = \theta$ is fixed and increases in verification costs reduce the likelihood of a repayment reduction through an increase in effort: $\frac{d\Phi(\tilde{y}|e)}{d\psi} = \frac{\partial \Phi(\tilde{y}|e)}{\partial e} \frac{\partial e}{\partial \psi} < 0$. Among borrowers with $G(\theta, d; \tau) < \psi < G(\underline{y}, d; \tau)$, if the MLRP holds and $\phi(\tilde{y}|e)$ is increasing in effort, then an increase in verification costs will cause them to lower their verification threshold (directly due to the increase in ψ and indirectly due to reductions in borrowing). This, along with an increase in effort, reduces the likelihood that they apply for a payment reduction.

Except for borrowers with $G(\underline{y}, d; \tau) < \psi$ who always repay the standard amount, a decline in non-monetary verification costs will typically lead to an increase in the use of income-based payments. The long-term effects of such a change are likely to be greater than the short-term effects, since new borrowers will respond by increasing the amount they borrow and reducing their effort during school or in the labor market. Both of these effects further increase the use of income-based payments.

5.2 Distributional and Efficiency Effects of Eliminating Verification Costs

Next, we briefly discuss the distributional and efficiency implications of eliminating all verification costs within the context of our model, before quantitatively examining the short-term effects of making enrolment in Canada's RAP automatic.

Fully eliminating verification costs (from $\psi > 0$ to zero) would have different effects on the probability of making reduced payments depending on student debt and transfer levels. Consider the short-run effects (holding debt and effort fixed) for three distinct groups. First, repayment decisions for borrowers with high debt and few parental transfers (satisfying $G(\theta, d; \tau) \geq \psi$) would be unaffected by the elimination of verification costs, since they already apply for reduced payments whenever eligible. Second, borrowers with intermediate levels of debt and parental transfers (satisfying $G(\theta, d; \tau) < \psi < G(\underline{y}, d; \tau)$) would respond to the elimination of verification costs by increasing the rate at which they apply for reduced payments, with the largest increases occurring for those with high parental transfers. Third, borrowers with low debt and high parental transfers (satisfying $G(\underline{y}, d; \tau) \leq \psi$) initially choose not to apply for reduced payments regardless of their earnings. It would now become optimal for these borrowers to apply for reduced payments

for at least some earnings realizations. The probability of making reduced payments would increase more among those with high levels of debt but would not depend on parental transfers. Altogether, the probability of making reduced payments would increase the most for borrowers with high parental transfers and low levels of debt. Reductions in payment amounts would be small for those with low levels of debt, but they could be sizeable for borrowers with higher levels of debt and considerable parental support.

The implied reductions in repayment amounts present an important challenge for initiatives that reduce non-monetary verification costs within the existing student loan system.[36] Revenue losses could be made up by raising the interest rate; however, this would reduce the welfare of individuals who repay in full. Ex post, lowering verification costs would transfer resources from borrowers with high earnings realizations to those with lower realizations, especially to those with substantial parental support. Ex ante, it would produce an expected transfer from youth with little parental support to those with greater support. This ex ante redistribution is likely undesirable.

Aside from redistribution concerns, there are several efficiency considerations. On the one hand, lowering verification costs would directly benefit all borrowers who would sometimes choose lower income-based payments. This benefit must be weighed against the costs associated with higher interest rates (assuming the program must maintain its current budget).[37] With heterogeneity in earnings potential, borrowers with high expected earnings would face a higher expected repayment. For some borrowers, this additional cost may outweigh the benefits of reduced verification costs in low earnings states. Even with all borrowers ex ante identical, it is possible that a poorly structured loan program with easy eligibility criteria and modest income-based payments would result in very few borrowers repaying in full at very high interest rates. Even ignoring the potential for over-borrowing in such an environment, it is possible that imposing modest non-monetary verification costs would encourage enough borrowers to repay their loans in full, allowing for significant reductions in interest rates. Indeed, the following proposition shows that $\psi > 0$ can be efficient under a student loan program that offers pure forgiveness when earnings are low (i.e. $\xi(y) = 0$ for all $y < \theta$).

Proposition 5 *Assume ex ante identical agents, quadratic preferences, and no moral hazard. Under a break-even student loan program with pure forgiveness and a low eligibility threshold $\theta > \underline{y}$, it is efficient to impose strictly positive verification costs if optimal debt (when $\psi = 0$) exceeds $2\beta E[y - \underline{y}]$.*

[36] For simplicity, this discussion abstracts from the option of default. If verification costs were eliminated, some borrowers currently in default might make reduced income-based payments instead. As shown below, the potential revenue implications of this are likely to be quite small in practice, since most borrowers in default have low earnings and face very low (or zero) income-based payments.

[37] Alternatively, other changes in the structure of repayments (e.g. eligibility threshold or income-based repayment amounts) could be made to collect more revenue. We discuss this further below.

Appendix E.6 provides a proof of this result, as well as additional details on the tradeoffs relevant to the optimal choice of ψ in the general case.

The potential welfare value of $\psi > 0$ derives from two key shortcomings of the current system.[38] First, the failure to account for parental transfers means that it may be welfare-improving to exclude youth from rich families from income-based payments, since they gain little from the implied insurance. Imposing non-monetary verification costs is one way to do this.[39] Second, even if $\tau = 0$ for everyone, the structure of loan contracts could be inefficient with 'too many' borrowers eligible for and taking up the reduced income-based payments. Verification costs can be used to reduce the set of borrowers who choose to apply.[40]

Of course, imposing non-monetary verification costs (e.g. lengthy and complicated application forms, waiting periods) is a socially wasteful means to exclude some borrowers from payment reductions. Adjustments in repayment functions $\xi(y)$ and/or the eligibility threshold θ are likely to be more efficient; however, they cannot easily address the issue of targeting assistance primarily to borrowers without external support. In Section 6, we discuss the design of loan contracts that address the shortcomings of current student loan programs by efficiently setting loan limits, standard payments, payment reductions, and the eligibility/verification threshold based on all available information.

5.3 Effects of Moving to a 'Universal RAP' on Loan Repayments

We now consider the potential implications of moving to a 'Universal RAP' for CSLP revenues.[41] In particular, we examine how payments (based on earnings and debt levels) would change if all borrowers were automatically enrolled in RAP and made the expected payments under RAP (i.e., the lesser of the RAP amount based on their earnings and the standard payment).

Two groups of borrowers would be most directly affected by such a move. First, many low-earning borrowers may see their payments reduced. Under the current system, many of these borrowers make their standard payments even though they are eligible for much lower (or zero) payments under RAP. This may reflect high costs associated with RAP enrollment or a lack of

[38] This discussion assumes that lenders could eliminate verification costs for borrowers without incurring any new expenses. Of course, some costs are likely inherent to the verification process or might not be freely eliminated. In this respect, it is notable that government student loan programs in both Canada and the U.S. do not take advantage of information about borrower's earnings already collected by the government in other contexts (e.g. for purposes of taxation, social security, unemployment insurance). By contrast, loan collections in Australia are done in concert with the tax system.

[39] See Nichols and Zeckhauser (1982) for a related discussion of targeting transfers for redistribution purposes.

[40] See Diamond (1984) for a related point on the potential value of imposing non-pecuniary penalties (not captured by lenders) as an efficient way to improve loan contracts. Unlike the current setting, he considers the efficient design of contracts constrained by non-negative consumption for borrowers. The penalties allow lenders to punish borrowers beyond where there consumption goes to zero in some states, allowing for lower payments in other states.

[41] This would reduce enrolment costs associated with applying for and participating in RAP and would also alleviate concerns that some eligible borrowers are unaware of the option. This can be viewed as an extension of several recent CSLP initiatives meant to streamline application for and to facilitate use of RAP.

information about the program coupled with access to other resources like parental support or savings that make lower payments unnecessary. Second, some low-earning borrowers that are currently delinquent or in default may instead choose to make lower income-based payments. The main revenue implications of moving to a 'Universal RAP' program, therefore, depend on the balance of reduced payments from low-earning borrowers currently making standard payments against the potential increased revenue from encouraging current delinquents/defaulters to make some (potentially small) payments.

We use two data sources to explore the potential CSLP revenue effects of moving to a 'Universal RAP'. We begin by using our 2011 and 2012 CSS sample. These data are ideally suited for this task, because they allow us to determine current loan payments (using administrative records on loan amounts and repayment status) as well as counterfactual payments under 'Universal RAP' (using survey reports of earnings and administrative loan amounts). The main limitation of these data is that they only provide a snapshot of earnings during the first two years of repayment for our sample respondents; yet, earnings may be unusually low during these early years due to the transition from school to work. We, therefore, exploit data from Canada's SLID to study potential repayment and revenue effects of a 'Universal RAP' over the first five years of borrowers' post-school labor market experience. These longitudinal data contain information on the amount borrowed for school and annual post-school earnings; however, they do not contain information on actual payments. With these data, we compare potential payments under a 'Universal RAP' with standard debt-based payment amounts.

5.3.1 A Few Details on CSLP's Repayment Assistance Plan

Before simulating the effects of moving to automatic enrolment in Canada's RAP, we briefly describe key features of the program and student loan repayment in Canada more generally.[42]

Canadians borrowing from the CSLP can choose to apply for repayment assistance if they are currently in good standing on their loan and have sufficiently low earnings. Under Canada's RAP, eligible borrowers are expected to pay a fraction of their current earnings above a threshold – from zero to 20% based on their earnings – towards their student loan. As documented in Appendix D, these income-based payment amounts are greater than under the analogous American "Pay-as-you-Earn" (PAYE) income-contingent repayment scheme and in other countries with universal income-contingent loan programs like Australia and the United Kingdom.[43] Notably, the income-based amount is zero for single, childless borrowers with monthly earnings below $1,685 (annual earnings of roughly $20,000). In 2010-11, nearly 90% of the 165,000 RAP recipients

[42]In late 2016, RAP shifted the required repayment schedule, so that childless, single borrowers do not need to make any payments if their annual earnings fall below $25,000 (up from around $20,000). We discuss and study the program structure prior to that change, which we refer to as 'current' RAP since that structure covered the period we study.

[43]The American PAYE plan links payments to earnings for 20 years, forgiving any remaining debt.

faced a zero monthly payment (Office of the Chief Actuary, 2010). If the income-based payment amount exceeds the standard debt-based amount, RAP recipients are only responsible for the lower standard amount. During the early portion of the repayment period (Stage 1 of RAP), if the calculated RAP payment is less than the interest accumulating on their debt that period, the federal government pays the remaining interest amount, so the principal does not grow. After five years of reduced payments, borrowers move to Stage 2 of RAP, and the government effectively forgives the full difference between any reduced RAP payment and the expected standard repayment amount.[44] Participating borrowers are debt-free after fifteen years.

5.3.2 Using the CSS

We use the administrative loan records combined with earnings reported in the CSS to measure the revenue effects under a 'Universal RAP' relative to the current CSLP regime. We consider a best-case fiscal scenario for 'Universal RAP' by assuming that all borrowers would always make their calculated payments under this counterfactual regime. That is, payments under 'Universal RAP' are set equal to the lesser of the income-based RAP amount and their actual scheduled payment, regardless of the borrower's current repayment status.[45] In calculating payments under the current regime, we use borrowers' scheduled payment as given by administrative records if they are currently in good standing or on RAP and zero if they are currently delinquent or in default.

Figure 3 reports the distribution of monthly payments under these two regimes. Our calculations suggest that the fraction of borrowers paying zero would nearly double under a 'Universal RAP' regime, since many low-earning borrowers currently making their loan payments would not be expected to make any RAP payments. This highlights the role of additional resources (i.e., savings and parental support) in enabling repayment for many low-earning borrowers. Automatically placing all of these borrowers on RAP would significantly reduce their repayment obligations. Our calculations further suggest that average monthly payments (including payments of zero) over the first two years of repayment would decline by nearly half from $130 to $68 for recent school-leavers if RAP were made universal. If persistent, a decline in revenue of this magnitude would likely threaten the viability of CSLP.

5.3.3 Using SLID

It is possible to extend the timeframe of our 'Universal RAP' analysis to cover the first five years of borrower's post-school careers using SLID. Panel 5 of SLID contains longitudinal data on earnings, schooling, and the amount borrowed for post-secondary education covering the years

[44] See Appendix D for further details.

[45] To simplify the calculation of payments under RAP, we focus on single borrowers with no children (the majority of our sample), since the threshold earnings level above which RAP payments begin depends on household size. See Appendix D for further details.

2005-2010. For comparability with our previous analysis, we limit our sample to all individuals in SLID who attended some post-secondary schooling, reported borrowing for school, and left school by age 30. We date observations based on the year individuals are observed leaving school, and we calculate both debt-based payments and 'Universal RAP' payments based on their outstanding student loan amount when they left school and their earnings each year after leaving school. We, therefore, observe five post-school earnings measures for those leaving school in 2005, four measures for those leaving in 2006, and so on.

Table 6 reports measures of the earnings distribution by educational attainment and years since leaving post-secondary school for all borrowers in our sample. About 45% of borrowers with less than a four-year university degree earned less than $20,000 in their first year out of school compared to only 27% of four-year degree recipients. While earnings tend to increase over time, many students still earn less than $20,000 four to five years after leaving school – especially among those with less than a four-year degree. Table 7 calculates the ratio of expected RAP payments to debt-based payments each year after school based on the amount borrowed and post-school earnings.[46] Consistent with our results from the CSS, calculated RAP payments are substantially lower than debt-based payments, ranging from 56% of the debt-based amount in year 1 to 68% in year 5. Because earnings levels are higher in this SLID sample than in the CSS sample, the implied RAP payments are also a bit higher here.[47] Table 7 reveals that nearly 40% of all borrowers would be asked to pay nothing during their first year out of school under a 'Universal RAP'; nearly 30% would still not be expected to make any payments five years out of school.

These figures are not necessarily alarming if low-earnings states are highly transitory, since borrowers may only require reduced payment amounts for one or two years. In this case, they may take a few extra years to pay off their loan, but long-term losses (e.g. forgiven interest payments) may be fairly minor. However, the structure of RAP is such that borrowers receiving reduced payments for more than 60 months begin to see reductions in their debt burden equal to the difference between the RAP amount and what they would otherwise be expected to pay based on their debt level. Thus, it is important to know whether the RAP payment reductions observed over years 1-5 in Table 7 represent reductions for different borrowers each year or reductions for the same subset of borrowers year after year. Fortunately, the longitudinal nature of SLID allows us to explore this issue.

In Table 8, we show the discounted present value of RAP payments relative to debt-based

[46] The smaller sample sizes in Table 7 relative to Table 6 reflect the fact that some respondents did not report a student loan amount even though they report that they had taken out a student loan. Table 6 includes these individuals, while Table 7 does not.

[47] The higher earnings in SLID relative to the CSS are not surprising given that the Canadian labor market was in much worse shape in 2011-12 (CSS) than it was in 2006-08 (SLID) due to the Great Recession. Unemployment rates for 25-29 year olds ranged from 5.9-6.3% in 2006-08 but were as high as 8.0% in 2011. The measures may also differ somewhat, because the CSS asked respondents about their current (annualized) earnings at the time of the survey, while SLID asks about actual earnings over the previous year.

payments over the first three, four, and five years after leaving school.[48] The first row shows that borrowers would repay only 55-60% of the total debt-based amount under 'Universal RAP'. Roughly 40% of all borrowers would pay less than half the debt-based amount after five years, while only one-in-four would pay the full amount. While not shown in the table, 15% of all borrowers would make zero payments over the first four years under 'Universal RAP'.

Unlike with the CSS, we are unable to use SLID to determine actual payments under the current system where some borrowers are delinquent, default, or make reduced payments by signing up for RAP. However, these results indicate that our CSS results do not simply reflect very short-term problems associated with the transition from school to work. Many borrowers experience very low earnings for several years after leaving school.

5.3.4 General Discussion and Caveats

These calculations are only illustrative and come with a few important caveats. First, it is possible that some low-earning borrowers would continue to make higher payments than required by RAP even if their automatic payments were reduced. Second, many currently delinquent borrowers may continue to remain delinquent under a 'Universal RAP'; however, the implications of this are likely to be modest since expected RAP payments for many of these borrowers are very low or zero given their incomes. Third and most importantly, these calculations do not factor in any dynamic long-run effects (beyond the first five years after school) a move to 'Universal RAP' might entail. If the program keeps borrowers better connected with CSLP, it could ultimately result in higher lifetime payments among borrowers who temporarily experience poor labor market outcomes after leaving school. Even in this case, however, government interest payments for many RAP recipients who do not make payments for several years can add up. Of much greater concern are the payment reductions that would be granted to the many borrowers who reach Stage 2 of RAP due to persistently low earnings. Under the current system, nearly half of all borrowers who enter RAP shortly after leaving school remain on RAP more or less continuously for at least five years and enter Stage 2 in their sixth year (Office of the Chief Actuary, 2014). Our simulations suggest similar patterns might be expected for the larger set of borrowers that would participate in RAP if enrolment were made automatic. Unfortunately, a full accounting of the long-run effects of a 'Universal RAP' would require better longitudinal data than is currently available and is, therefore, beyond the scope of this paper. Nonetheless, our findings provide strong evidence that caution is warranted when considering policies that dramatically increase the take-up of income-based repayment.[49]

[48] In calculating present values, we use a discount rate of 2.1%, which is the government cost of borrowing for the CSLP (Office of the Chief Actuary, 2010). Results are nearly identical for an interest rate of 5.5%, which corresponds to the interest rate paid by the vast majority of borrowers who choose the floating rate.

[49] Our calculations also abstract from potential behavioral changes that might affect borrower earnings due to moral hazard or adverse selection; levels of borrowing might also adjust. (See Proposition 4.) These effects would likely increase the costs of moving to a 'Universal RAP' system.

It is important to note that these results do not imply that income-based repayment schemes are inherently bad or that they should be scaled back. Instead, they shine a light on important shortcomings in the design of current student loan programs. These problems can be ameliorated by re-thinking the overall structure of student loan contracts, an issue we turn to next.

6 A (Constrained) Efficient Student Loan Program

We now consider the design of student loan programs that efficiently set loan amounts and repayment functions to maximize student welfare subject to breaking even in expectation.

Consistent with our analysis and evidence above, we consider (constrained) efficient contracts in the presence of non-monetary income verification costs $\psi > 0$. We also incorporate unobserved effort (i.e. moral hazard), which is likely to be present. Our analysis focuses mainly on the case in which parental transfers τ are easily observed by the lender; however, we briefly discuss the case of hidden transfers in Subsection 6.2. The main points we wish to make apply in both cases; however, details of efficient contracts can certainly depend on the observability of transfers.

For expositional purposes, we assume that the lender's discount factor equals the student's discount factor β. In the absence of any market frictions, the optimal contract would provide full insurance, equating consumption across time and all post-school earnings realizations. This is not possible in the presence of non-monetary verification costs and moral hazard, which restrict the extent of consumption smoothing that can be achieved.[50]

6.1 Observed Parental Transfers

We begin by considering the case in which the government lender can observe parental transfers.

For any given borrower, the (constrained) efficient contract can be written such that the lender chooses the loan amount d, post-school repayment $D^v(y)$ contingent on y when earnings are verified, a fixed repayment $\bar{D}$ when earnings are not verified, and a threshold $\bar{y}$ below which earnings are verified to maximize expected utility:

$$u(w - T + d) + \beta \left[\int_{\underline{y}}^{\bar{y}} [u(y + \tau - D^v(y)) - \psi]\phi(y|e)dy + \int_{\bar{y}}^{\infty} u(y + \tau - \bar{D})\phi(y|e)dy - v(e) \right], \quad (11)$$

subject to the following break-even constraint for the lender:

$$d \leq \beta \left[\int_{\underline{y}}^{\bar{y}} D^v(y)\phi(y|e)dy + \int_{\bar{y}}^{\infty} \bar{D}\phi(y|e)dy \right]. \quad (12)$$

[50] See Lochner and Monge-Naranjo (2016) for efficient student loan contracts in the presence of moral hazard, limited commitment, and monetary costs of income verification. They do not consider non-monetary verification costs or unobservable transfers.

Unlike with current student loan programs, lenders earn zero expected profits on every borrower, and there is no ex ante redistribution across borrower types.

For simplicity, we consider two effort levels with $e_L < e_H$. When high effort is optimal, it must be induced. The contract is, therefore, constrained by the following incentive compatibility constraint:

$$\int_{\underline{y}}^{\bar{y}} [u(y+\tau-D^v(y))-\psi][\phi(y|e_H)-\phi(y|e_L)]dy+\int_{\bar{y}}^{\infty} u(y+\tau-\bar{D})[\phi(y|e_H)-\phi(y|e_L)]dy \geq v(e_H)-v(e_L). \tag{13}$$

Finally, borrowers must be indifferent between verifying their earnings to receive a reduced payment and paying the fixed amount $\bar{D}$ at the threshold $\bar{y}$, so

$$u(y+\tau-D^v(y))-\psi = u(\bar{y}+\tau-\bar{D}). \tag{14}$$

This implicitly defines $\bar{D}$ as a function of $\bar{y}$. Substituting in for $\bar{D}$ into the contracting problem, lenders choose d, $D^v(y)$ for all $y < \bar{y}$, and $\bar{y}$ to maximize equation (11) subject to equations (12) and (13) for $e = e_H$ when high effort is optimal. We focus on this case, briefly commenting on allocations when low effort may be efficient.

Let $\mu \geq 0$ reflect the (discounted by β) Lagrange multiplier on the incentive compatibility constraint (13), and define the likelihood ratio $\ell(y) \equiv \phi_L(y)/\phi_H(y)$. The first order conditions for d and $D^v(z)$ imply that

$$u'(c_1) = u'(c_2^v(y))[1+\mu(1-\ell(y))], \ \forall y < \bar{y}.$$

Assuming that the likelihood ratio $\ell(y)$ is decreasing in y (i.e. monotone likelihood ratio property), post-school consumption is strictly increasing in earnings whenever they are verified. Of course, consumption is also increasing (one-for-one) in earnings at higher levels when a fixed repayment is made (i.e. $y \geq \bar{y}$). Thus, moral hazard restricts the amount of insurance that can be provided for low earnings realizations, while verification costs prohibit any insurance across higher earnings levels.[51] Finally, notice that equation (14) implies that consumption must jump discontinuously at the verification threshold due to the verification costs. Borrowers must be offered higher consumption to compensate for the utility costs of verification, which means that loan payments must drop when borrowers apply for reduced payments (i.e. $D^v(\bar{y}) < \bar{D}$). See Appendix E.7 for the condition determining the optimal verification threshold $\bar{y}$ and other details.

While not emphasized thus far, it is noteworthy that optimal loan contracts $(d, \bar{y}, D^v(y), \bar{D})$ depend on initial wealth and parental transfers (w, τ), as well as any other individual factors like ability that might affect earnings functions or preferences. Clearly, an increase in total wealth due

[51] In the absence of moral hazard (or if low effort is optimal), $\mu = 0$ and there would be perfect consumption smoothing across the schooling period and all verified post-school earnings outcomes.

to increases in w or τ would lead to greater consumption c_1 and $c_2^v(y)$ for low earnings realizations. An increase in parental transfers would, therefore, imply a larger loan d and higher verification payment $D^v(y)$; however, it is more difficult to say how it would affect the fixed payment $\bar{D}$ and verification threshold $\bar{y}$.

Comparing Current and Efficient Student Loan Contracts

While efficiently designed student loan contracts share a similar structure with current student loan contracts, they are much more flexible. Under efficient contracts, the fixed repayment for high earnings realizations $\bar{D}$ is analogous to the 'standard payment' Rd under current loan programs; however, the implicit interest rate $\bar{D}/d$ depends on the actual loan amount as well as initial resources, parental transfers and earnings functions. The efficient contract specifies income-based repayments $D^v(y)$ when earnings are verified. These payments are analogous to $\xi(y)$ under standard loan programs; however, $D^v(y)$ is set efficiently at the individual-level and varies with the loan amount, available resources (w, τ), and earnings functions. Furthermore, there is a discontinuous drop in efficiently determined repayments when earnings are verified (i.e. $D^v(\bar{y}) < \bar{D}$) to compensate borrowers for the non-monetary costs of verification. This feature is absent in current North American loan programs. Finally, the earnings threshold $\bar{y}$ under efficient loan contracts is analogous to an eligibility threshold θ; however, setting the eligibility threshold optimally (based on the verification cost, loan amount, available resources, and earnings functions) eliminates the potential discrepancy between eligibility and the desire to apply.

Altogether, efficient loan contracts provide as much consumption smoothing (across time and states) as possible, given inherent market frictions (moral hazard and verification costs). This directly implies that government lenders using efficient contracts would prefer to eliminate all non-monetary verification costs.[52] Indeed, if verification costs could be freely eliminated, efficient contracts would become fully contingent on earnings and parental transfers, so the only distortion limiting consumption insurance would be due to moral hazard.

Another important feature of the efficient student loan contracts discussed here is that they break-even (in expectation) on an individual basis depending on their available resources (w, τ) as well as any (observable) individual-specific characteristics related to preferences or earnings distributions (e.g. ability, college majors). Current student loan programs do not take these factors into account, leading to ex ante redistribution across borrowers. This can have important implications if parental transfers are not easily observed, as we discuss next.

[52] Assuming verification costs can be freely eliminated, the marginal welfare cost of ψ is $\Phi(\bar{y}|e) \geq 0$, where $\bar{y}$ and e are the optimal threshold and effort levels in the efficient loan contract above.

6.2 Unobservable Parental Transfers

Current government student loan programs effectively ignore parental transfers. If these transfers were easily observed by the government, it would be straightforward to take them into account when computing total earnings measures used in determining income-based payments. Unfortunately, this no longer works if parental transfers are unobservable by the government. In this case, borrowers would have no incentive to report transfers that led to higher payments.

If post-school transfers are known by borrowers at the time they make their borrowing decisions, it may be possible to design efficient loan contracts that induce borrowers to truthfully report those transfers. Indeed, in the absence of moral hazard (i.e. effort is observable), the efficient contracts derived in Section 6.1 would induce students to truthfully reveal their parental support, since those contracts: (i) maximize student welfare conditional on parental transfers and (ii) break-even in expectation for all borrowers.[53] Together, these features imply that students could not improve their welfare by, for example, under-reporting the amount of transfers their parents will provide after school. While such a mis-representation might lead to lower post-school payments, it would also reduce the loan amount offered to the student.

When moral hazard is a concern and parental transfers are unobserved by the lender, borrowers faced with the contracts derived in Section 6.1 (under the assumption of observable transfers) may prefer to mis-represent both their effort and parental transfers. Additional constraints must be placed on the contracting problem to prevent this from happening. We show in Appendix E.7 that if high effort can still be induced (with unobservable transfers), then efficient contracts will be identical to those of Section 6.1 – in this case, the unobservability of transfers does not affect the loan contract. However, it is possible that the unobservability of transfers leads to a break-down of effort-inducing contracts. In this case, loan contracts under unobservable transfers would be written to provide full consumption smoothing across verified post-school earnings realizations and borrowers would exert low effort, whereas contracts under observable transfers would provide only partial consumption smoothing across verified earnings realizations while inducing high effort. Despite contracts offering better consumption smoothing under unobservable transfers, welfare would be lower due to the reduction in effort and, as a consequence, expected earnings and consumption.

When parental transfers are imperfectly known at the time borrowing decisions are made, the efficient contract could simply be written as a function of (reported) expected parental transfers and a modified measure of borrower earnings inclusive of any realized deviation in parental transfers from their expectation.[54] If lenders could verify both earnings and transfer amounts

[53] This basic point would also apply with endogenous parental transfers in that parents would always choose to reveal their earnings and altruism.

[54] Let $E(\tau)$ reflect expected parental transfers and $Y = y + \tau - E(\tau)$ reflect the borrower's earnings plus any deviation from expected transfers. We can then write contracts in terms of $E(\tau)$ and conditional density for Y, $\Phi_Y(Y|e)$, instead of τ and $\Phi(y|e)$.

(imposing costs ψ on borrowers), the problem would be qualitatively the same as above.[55]

7 Conclusions

We show that many borrowers continue to make student loan payments even when they qualify for repayment assistance based on their (low) earnings. Exploiting unique new survey data on a broad set of resources available to student borrowers, we show that access to parental support and personal savings are critical to making standard payments in this situation. As we demonstrate with our economic model of current student loan programs, these findings indicate that non-monetary costs of applying for repayment assistance are non-negligible and provide an incentive for low-earning borrowers with access to other resources to continue making standard payments even when they are eligible for lower income-based payments.

The roles of parental resources and savings have been largely ignored in policy discussions related to student loans. Our analysis suggests that these resources have important implications for proposals under current discussion to expand the use of income-contingent repayment plans. In particular, we show that expanding the income-based RAP in Canada to automatically cover all borrowers would reduce revenues by roughly half during the first few years of repayment. This is because a more universal income-based repayment scheme would significantly reduce repayment levels for many low-earning borrowers (with parental support and/or personal savings) who currently make their standard payments. While it is possible that these early revenue losses would be made up later, the strong persistence in earnings and structure of RAP suggests that this is unlikely to be the case. At the same time, little revenue would be raised from inducing borrowers currently in delinquency/default to make income-based payments, because the vast majority of these borrowers have very low earnings, and, as a result, would be expected to make very low (or zero) payments under RAP.

The revenue losses associated with making RAP enrolment automatic would likely require notable increases in student loan interest rates (or other major program changes) to keep CSLP viable. Given the current structure of repayment assistance, we show theoretically that such changes could be inefficient and would tend to reduce the ex ante welfare of borrowers most in need of help. Counter-intuitively, the non-monetary costs associated with income verification may serve a useful purpose (under the current system) by targeting assistance to those most in need, while collecting full repayment amounts from borrowers with access to parental support and savings. As such, recent proposals aimed at facilitating enrolment in current repayment assistance plans may not be welfare-improving.

Instead, our analysis suggests that efforts should be made to better design student loan pro-

[55] This raises interesting possibilities where the costs imposed on borrowers when verifying their earnings may differ from those associated with verifying parental transfers. In this case, there may be regions where a subset of total income (earnings or transfers) is verified with contracts contingent only on the verified component.

grams, explicitly taking into account any inherent verification costs and the importance of parental support and personal savings for many borrowers. We show that an efficiently designed student loan program would look broadly similar to those currently in place in Canada and the U.S., with fixed payments above some earnings threshold and income-based payments below. However, repayments would be structured to compensate borrowers for any verification costs incurred and would be better tailored to each borrower's situation. Specifically, interest rates determining 'standard payments', income-based payment amounts, and the threshold determining eligibility for reduced income-based payments would depend on the amount borrowed, reported parental transfers, and the distribution of potential post-school earnings. With an efficiently designed system, there would be no benefit from imposing verification costs beyond that which are inherent to the process itself. A well-designed program would also induce borrowers to accurately reveal expected parental support at the time loans are taken out, with loan limits and the structure of repayments contingent on that support.

Finally, it is worth noting that our results are not only useful for evaluating changes in student loan policy, but they may also be helpful in explaining well-documented but not-well-understood differences in student loan repayment behavior across individuals. In particular, our results may help in understanding the alarmingly high default rates among African Americans (relative to whites), even when conditioning on student debt and post-school earnings (e.g. see Lochner and Monge-Naranjo, 2015). Previous studies document low levels of wealth conditional on earnings for blacks relative to whites (Oliver and Shapiro, 1997; Barsky et al., 2002), suggesting that black parents may be less equipped to provide financial support to their children after college. As such, African American students may have less access to the type of post-school parental insurance we find to be critical for student loan repayment in Canada.

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Figure 1: Distributions of Current Borrower's Earnings, Expected Parental Transfers, and Savings

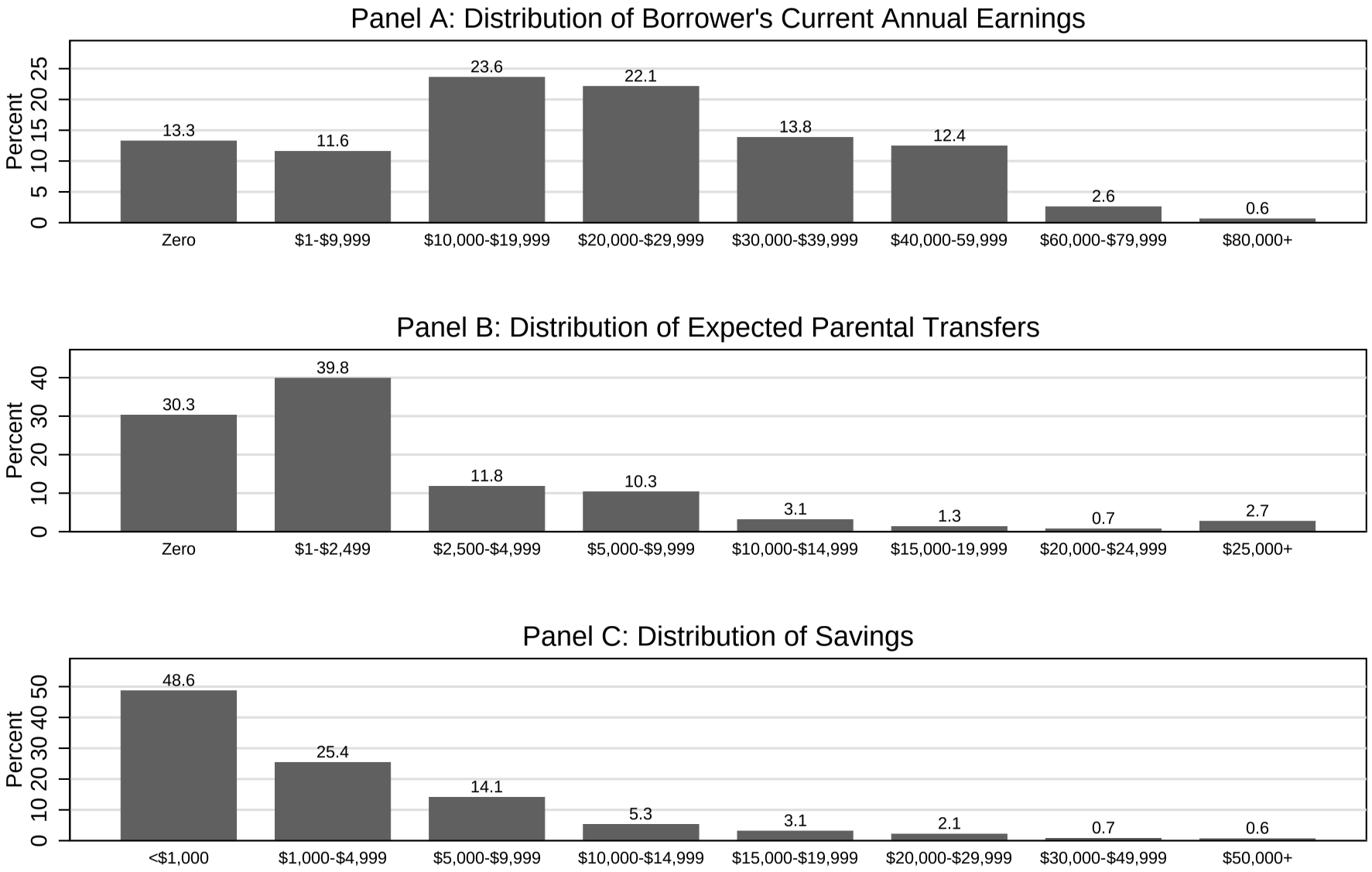
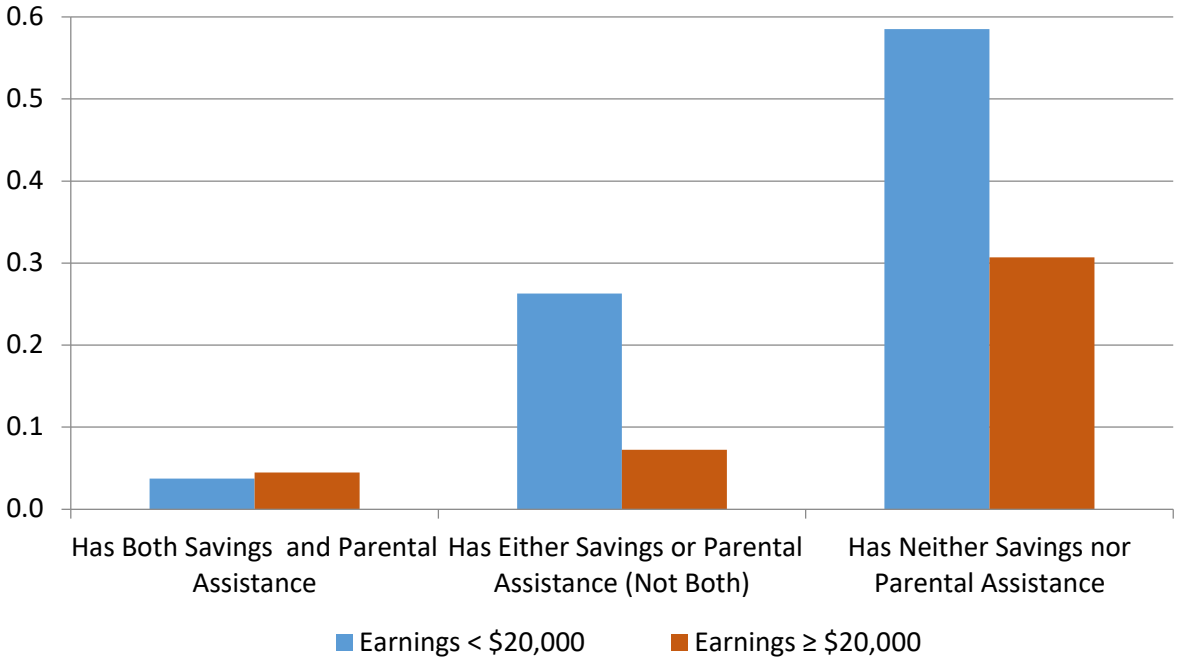


Figure 2: Probability of Repayment Problems at CSS by Earnings and Additional Financial Resources



Notes: `Savings' implies savings of at least $1,000. `Parental Assistance' implies expected parental transfers of at least $2,500. Sampling weights are used.

Table 1: Descriptive Statistics for Baseline Determinants of Repayment

Variables	Mean	Std. Error
vocational/technical school graduate or more	0.793	0.028
4-year university graduate or post-graduate degree	0.416	0.033
would stop paying CSLP loan first if unable to repay all loans	0.418	0.033
male	0.421	0.033
age	23.720	0.193
indigenous	0.083	0.018
private for-profit post-secondary institution (CSS loan type)	0.139	0.014

Notes: Based on main sample of 689 individuals with non-missing responses to baseline determinants, current earnings, expected parental support and savings. Sample weights used in calculating all statistics.

Table 2: Repayment Problems at CSS by Earnings, Expected Parental Transfers, and Savings

	Mean	Std. Error
A. by current earnings		
earnings < $20,000	0.410	0.043
$20,000 ≤ earnings < $40,000	0.153	0.033
earnings ≥ $40,000	0.024	0.016
B. by expected parental support		
expected parental transfer < $2,500	0.322	0.032
expected parental transfer ≥ $2,500	0.105	0.032
C. by savings		
savings < $1,000	0.437	0.042
savings ≥ $1,000	0.087	0.018

Notes: Based on main sample of 689 individuals with non-missing responses to baseline variables, current earnings, expected parental support and savings. Sample weights used in calculating all statistics.

Table 3: Estimates for Probability of a Repayment Problem

Variables	(1)	(2)	(3)	(4)	(5)
constant	0.145	-0.514	0.450	-0.116	-0.118
	(0.239)	(0.237)	(0.233)	(0.244)	(0.244)
CSLP loan amount outstanding at consolidation (in $10,000)	0.143	0.127	0.108	0.097	0.097
	(0.051)	(0.045)	(0.045)	(0.043)	(0.043)
CSLP loan amount (in $10,000) squared	-0.013	-0.010	-0.010	-0.008	-0.008
	(0.010)	(0.008)	(0.009)	(0.008)	(0.008)
vocational/technical school graduate or more	-0.010	-0.004	0.008	0.015	0.019
	(0.075)	(0.072)	(0.069)	(0.067)	(0.066)
4-year university graduate or post-graduate degree	-0.128	-0.051	-0.036	-0.002	-0.003
	(0.063)	(0.064)	(0.059)	(0.059)	(0.058)
would stop paying CSLP loan first if unable to repay all loans	0.063	0.067	0.059	0.062	0.061
	(0.052)	(0.049)	(0.046)	(0.044)	(0.043)
male	-0.027	0.015	0.037	0.054	0.059
	(0.050)	(0.049)	(0.047)	(0.047)	(0.047)
age	-0.004	0.014	-0.006	0.008	0.010
	(0.011)	(0.010)	(0.010)	(0.010)	(0.010)
indigenous	0.061	0.066	-0.008	0.002	-0.010
	(0.105)	(0.104)	(0.088)	(0.095)	(0.093)
private for profit post-secondary institution (CSS loan type)	0.116	0.092	0.064	0.055	0.051
	(0.056)	(0.054)	(0.056)	(0.054)	(0.054)
current earnings: none		0.549		0.449	0.440
		(0.092)		(0.085)	(0.086)
current earnings: $1 to less than $10,000/year		0.438		0.324	0.290
		(0.086)		(0.082)	(0.086)
current earnings: $10,000/year to less than $20,000/year		0.365		0.259	0.241
		(0.067)		(0.062)	(0.062)
current earnings: $20,000/year to less than $30,000/year		0.143		0.095	0.093
		(0.051)		(0.054)	(0.052)
current earnings: $30,000/year to less than $40,000/year		0.090		0.097	0.085
		(0.058)		(0.058)	(0.056)
expected parental transfer ≥ $2,500			-0.144	-0.139	-0.253
			(0.044)	(0.043)	(0.082)
savings ≥ $1,000			-0.323	-0.251	-0.311
			(0.050)	(0.048)	(0.061)
has both savings ≥ $1,000 and parental transfer ≥ $2,500					0.195
					(0.094)
R-squared	0.088	0.227	0.233	0.312	0.321

Notes: Linear probability model estimated using OLS. Specifications also include indicators for CSS cohort and province. Based on main sample of 689 individuals with non-missing responses to baseline variables, current earnings, expected parental support and savings. Sampling weights are used. Robust standard errors in parentheses.

Table 4: Estimates for Probability of a Repayment Problem: Low-Earnings Borrowers

Variables	(1)	(2)
constant	0.469	0.449
	(0.427)	(0.426)
CSLP loan amount outstanding at consolidation (in $10,000)	0.241	0.247
	(0.078)	(0.077)
CSLP loan amount (in $10,000) squared	-0.022	-0.023
	(0.013)	(0.012)
vocational/technical school graduate or more	-0.020	-0.022
	(0.092)	(0.092)
4-year university graduate or post-graduate degree	0.155	0.166
	(0.093)	(0.092)
would stop paying CSLP loan first if unable to repay all loans	0.070	0.072
	(0.073)	(0.071)
male	-0.008	-0.008
	(0.077)	(0.076)
age	-0.003	-0.001
	(0.019)	(0.019)
indigenous	0.029	0.021
	(0.141)	(0.142)
private for profit post-secondary institution (CSS loan type)	0.083	0.082
	(0.077)	(0.077)
current earnings < $10,000/year	0.143	0.140
	(0.072)	(0.071)
expected parental transfer ≥ $2,500	-0.150	-0.224
	(0.082)	(0.129)
savings ≥ $1,000	-0.376	-0.413
	(0.072)	(0.082)
has both savings ≥ $1,000 and parental transfer ≥ $2,500		0.146
		(0.155)
Observations	356	356
R-squared	0.374	0.377

Notes: Linear probability models estimated using OLS. Specifications also include indicators for CSS cohort and province. Sample includes respondents with earnings less than $20,000 per year and is restricted to those with non-missing responses to baseline variables, current earnings, expected parental support and savings. Sampling weights are used. Robust standard errors in parentheses. Columns 1 and 2 correspond to Columns 4 and 5, respectively, of Table 3.

Table 5: Estimated Effects of Parental Income on Repayment Problems

Variables	Full Sample	Subsample with Expected Parental Transfers = 0	Subsample with Expected Parental Transfers ≥ 0
constant	-0.544	-1.469	-0.192
	(0.232)	(0.414)	(0.264)
CSLP loan amount outstanding at consolidation (in $10,000)	0.157	0.231	0.122
	(0.046)	(0.082)	(0.057)
CSLP loan amount (in $10,000) squared	-0.013	-0.028	-0.006
	(0.008)	(0.014)	(0.010)
vocational/technical school graduate or more	0.010	-0.084	-0.001
	(0.072)	(0.109)	(0.093)
4-year university graduate or post-graduate degree	-0.046	-0.174	0.014
	(0.064)	(0.123)	(0.076)
would stop paying CSLP loan first if unable to repay all loans	0.068	0.162	0.054
	(0.048)	(0.086)	(0.059)
male	0.031	0.025	0.051
	(0.048)	(0.085)	(0.062)
age	0.015	0.049	0.001
	(0.010)	(0.016)	(0.013)
indigenous	0.044	-0.173	0.208
	(0.098)	(0.146)	(0.130)
private for profit post-secondary institution (CSS loan type)	0.080	0.070	0.074
	(0.054)	(0.111)	(0.062)
current earnings: none	0.553	0.670	0.528
	(0.089)	(0.182)	(0.105)
current earnings: $1 to less than $10,000/year	0.432	0.622	0.402
	(0.086)	(0.160)	(0.107)
current earnings: $10,000/year to less than $20,000/year	0.366	0.589	0.326
	(0.067)	(0.143)	(0.079)
current earnings: $20,000/year to less than $30,000/year	0.145	0.214	0.138
	(0.051)	(0.108)	(0.063)
current earnings: $30,000/year to less than $40,000/year	0.100	0.189	0.053
	(0.058)	(0.125)	(0.065)
dependent student with parental income < $25,000	-0.089	-0.028	-0.083
	(0.077)	(0.121)	(0.094)
dependent student with parental income ≥ $25,000	-0.133	0.002	-0.142
	(0.064)	(0.134)	(0.079)
R-squared	0.239	0.373	0.233
Sample Size	689	207	482

Notes: Linear probability models for repayment problems estimated using OLS**.** Specifications also include indicators for CSS cohort and province. Based on main sample of individuals with non-missing responses to baseline variables, current earnings, expected parental support and savings. Sampling weights are used. Robust standard errors in parentheses.

Table 6: Earnings by Post-Secondary Education and Years Since Leaving School (SLID)

	Years since leaving post-secondary school:				
	1	**2**	**3**	**4**	**5**
A. Less than 4-year university degree					
Average earnings	24,709	27,170	26,274	31,024	29,077
Fraction earning < $10,000/year	0.214	0.208	0.182	0.150	0.174
Fraction earning < $20,000/year	0.441	0.397	0.385	0.329	0.294
Fraction earning < $30,000/year	0.683	0.611	0.540	0.537	0.486
Fraction earning < $40,000/year	0.825	0.809	0.830	0.683	0.674
Fraction earning < $50,000/year	0.906	0.884	0.916	0.825	0.928
Number of observations	314	238	145	94	38
B. Received 4-year university degree					
Average earnings	38,128	44,245	42,292	47,341	48,301
Fraction earning < $10,000/year	0.159	0.016	0.104	0.051	0.028
Fraction earning < $20,000/year	0.265	0.160	0.222	0.163	0.223
Fraction earning < $30,000/year	0.387	0.296	0.371	0.377	0.247
Fraction earning < $40,000/year	0.564	0.462	0.459	0.474	0.403
Fraction earning < $50,000/year	0.734	0.661	0.596	0.580	0.698
Number of observations	182	127	86	56	26

Notes: Sample includes individuals reporting some post-secondary borrowing, earnings, and educational attainment from SLID Panel 5 (covering 2005-10). All estimates use sample weights.

Table 7: Calculated Rap Payment Amounts vs. Debt-Based Amounts by Post-Secondary Education and Years Since Leaving School (SLID)

	Years since leaving post-secondary school:				
	1	**2**	**3**	**4**	**5**
A. Less than 4-year university degree					
Ratio of RAP to debt-based payment	0.495	0.526	0.525	0.609	0.696
Fraction paying zero	0.439	0.419	0.381	0.359	0.280
Number of observations	244	192	121	82	32
B. Received 4-year university degree					
Ratio of RAP to debt-based payment	0.661	0.721	0.720	0.705	0.660
Fraction paying zero	0.296	0.197	0.156	0.196	0.275
Number of observations	143	103	69	47	23
C. All borrowers					
Ratio of RAP to debt-based payment	0.558	0.592	0.588	0.646	0.680
Fraction paying zero	0.385	0.344	0.309	0.296	0.278
Number of observations	387	295	190	129	55

Notes: Sample includes individuals reporting some post-secondary borrowing, earnings, and educational attainment from SLID Panel 5 (covering 2005-10). All estimates use sample weights.

Table 8: Discounted Present Value of Calculated Rap Payments vs. Debt-Based Payments (SLID)

	Years since leaving post-seconary school:		
	Years 1-3	**Years 1-4**	**Years 1-5**
Ratio of DPV of RAP payments to debt-based payments	0.550	0.609	0.554
Percent with DPV of RAP payments...			
less than or equal to 50% of debt-based payments	51%	43%	42%
greater than 50% but less than 100% of debt-based payments	10%	22%	32%
equal to 100% of debt-based payments	39%	35%	26%
Number of Observations	190	129	55

Notes: Sample includes individuals reporting post-secondary borrowing amounts, earnings, and educational attainment from SLID Panel 5 (covering 2005-10). A discount rate of 2.1% is used to compute discounted present values over reported post-school years. All estimates use sample weights.