Education Financing and Student Lending

Gene Amromin[1] and Janice Eberly[2,3]

[1]Federal Reserve Bank of Chicago, Chicago, Illinois 60604; email: gamromin@frbchi.org

[2]Kellogg School of Management, Northwestern University, Evanston, Illinois 60208; email: eberly@kellogg.northwestern.edu

[3]National Bureau of Economic Research, Cambridge, Massachusetts 02138

Annu. Rev. Financ. Econ. 2016. 8:289–315

First published online as a Review in Advance on September 7, 2016

The *Annual Review of Financial Economics* is online at financial.annualreviews.org

This article's doi: 10.1146/annurev-financial-121415-033040

JEL codes: I21, I24, J24

Keywords

student loans, education finance

Abstract

As the cost of education rises and student debt reaches new highs, more research has focused on financing the acquisition of human capital. Most research has had a positive focus, examining the effect of debt on student choices and outcomes. However, because education financing involves many public policy choices, normative questions have become more prominent. We discuss the trade-offs involved in these choices and propose simple models to help shape these questions. We first develop an overlapping generations framework of student debt to examine the macroeconomic impact of shifting from a parent-funded to a student debt–based financing system. We then consider a framework that includes the supply-side response to different funding regimes; that is, how do enrollment and tuition decisions of schools respond to changes in education financing?

We show that shifting from parent-based funding to a student loan program can lower aggregate savings, although welfare still improves if education has a higher return than physical capital investment. A public student loan program also tends to promote enrollment at the cost of higher tuition at for-profit schools and deteriorating loan performance, paid for by taxpayers. Alternative contract designs, with school participation in the lending program, tend to ameliorate these issues.

1. INTRODUCTION

Although financing for physical capital has been broadly studied, human capital is arguably even more important. Human capital accounts for a larger share of production, and its acquisition is the target of extensive public policy because it is associated with economic growth and mobility. Financing for capital investment has been the subject of a large body of empirical and theoretical work. Financing for human capital investment, however, is less well researched and understood, reflecting the unique and sometimes formidable information challenges associated with human capital. Moreover, financing of human capital acquisition has undergone dramatic changes in the last few decades. These changes have been studied empirically to some extent, although their effects are still playing out on students as they study, graduate (or not), enter the workforce, and carry on their lives.

In this review, we aim to raise both empirical and conceptual questions around financing the acquisition of human capital. We refer to the literature, but this review is not intended to be exhaustive. Instead, we focus on emerging questions and the need for a structure to address them. In particular, we focus on the macroeconomic and equilibrium consequences of changes in the mode of financing education. There has been substantial work, although it is still unresolved and in progress, on the implications of student debt for borrower outcomes, such as household formation and career choice, and on the growing incidence of loan defaults. Some policymakers have gone further, arguing that the US model of education financing, with extensive reliance on student borrowing, has economy-wide consequences. Such a claim requires a broad framework that accounts for investment in human capital in equilibrium.

We approach these questions with conceptual frameworks to focus on (*a*) the intergenerational aspects of education financing and (*b*) the effects of financing on the supply of education.

First, we show how switching from a largely parent-financed education model to a largely student-financed model can fundamentally change the structure of savings in the economy—although investing in education may be welfare-enhancing, financing with student borrowing can reduce aggregate savings and the formation of physical capital in the economy. Second, we expand on the frictions in the intergenerational model to include the supply of education. Most models with supply include profit-maximizing lenders with a passive provision of education. We reverse these roles, specifying the parameters of the government student loan program as the supplier of credit and including a maximizing provider of education. This supplier sector can include both a selective nonprofit sector and a nonselective for-profit sector. In this setting, government provision of guaranteed loans (whether direct or through loan guarantees) affects the provision of education, especially by the for-profit sector. Whereas other work has emphasized the effect of grants and loans on tuition (the Bennett hypothesis), we show that guaranteed loans create incentives to increase both price (tuition) and quantity (enrollment). This result is consistent with the recent expansion of proprietary (private, for-profit) schools in the provision of education, as well as the deterioration of credit quality of student borrowers.

These frameworks allow an analysis of contracts for education financing. In credit models, information problems are typically addressed by requiring collateral to avoid moral hazard problems and underwriting loans to minimize selection problems. These solutions are not effective for student loans, however, because they finance human, rather than physical, capital. Human capital cannot generally be used as collateral. Moreover, underwriting loans selects students for financing on the basis of some measure of credit quality. There is often little information available for underwriting students, especially undergraduates (who are the largest group of borrowers). Moreover, even if such information were reliably available, selecting students on the basis of credit quality would likely be at odds with the access and opportunity goals of the public policy behind federal

education financing. These challenges raise questions about how contract design for education financing can help policy achieve its goals in the most effective way.

2. HISTORICAL AND CONCEPTUAL BACKGROUND; LITERATURE REVIEW OF DEMAND-SIDE PROGRAMS

2.1. The Role of Public Policy

Globally, the provision of education is one of the basic priorities of the government, and there is substantial research on the public benefits, and the rationale for public support, of education. There is a wide range of mechanisms through which this support is provided to higher education. The United States has historically backed higher education through two main public channels. First, there is an extensive system of public institutions—colleges and universities—largely financed at the state and/or local level. These institutions range from the highest-quality research universities to local community colleges, and their enrollments are large: The median student in the United States attends a public institution of higher learning. [According to the National Center for Education Statistics, enrollment in public colleges and universities accounted for 72% of the 20.6 million students in the fall of 2012 (NCES 2013, table 303.10).] In parallel, there is a large, private-sector system of higher education, also populated by world-class research universities as well as small, local institutions. Most of the private-sector providers are nonprofit institutions, although there has been rapid growth in the set of for-profit (or proprietary) providers. Although they are private, these schools also benefit from public financial aid for students in the form of grants and loans.

These grants and loans represent the second key form of public support for higher education in the United States. The federal grant programs, the largest of which is Pell grants, are generally need-based and targeted at the most financially disadvantaged students. The broader source of support has historically come in the form of loans. The two main strands of government-sponsored loan programs are commonly referred to as unsubsidized loans, available to all students enrolled in eligible schools, and subsidized loans, which have lower costs and are available to students on the basis of financial need. Both programs are subsidized in an economic sense by offering lower interest rates compared to private loans (CBO 2010, Lucas & Moore 2010, Avery & Turner 2012, CFPB 2012) and nonprice concessions. These concessions take the form of payment deferrals, forbearance, preferential terms for those in public-interest occupations, deferred principal accruals, and other risk mitigation features when borrowers in repayment experience financial distress. Government loan programs generally require no underwriting, and loan terms and borrowing limits do not vary with borrower characteristics or field of study.

Unlike private education loans, federal loan programs offer fixed interest rates. Although federal and federally guaranteed loans were initially offered at variable interest rates, the programs switched to fixed-rate lending in 2002, with interest rates set by statute. The advent of fixed rates transferred interest rate risk to the government. In the present form of the statute, rates are fixed for the life of the loan, although the statute specifies that the rate for newly originated loans resets each year at a fixed premium to US Treasury interest rates. Moreover, student loans have always had a prepayment option and, even with variable rates, students were able to consolidate their loans into a single fixed-rate loan, creating additional prepayment risk borne by taxpayers.

Government support for the loan program has had two incarnations: the Guaranteed Loan program (eliminated in 2010) and the Direct Lending program. In the Guaranteed Loan program, private lenders originated, funded, and serviced student loans, and the federal government provided a loan guarantee. Under Direct Lending, the government originates loans through schools, with direct federal funding. In both cases, the government bears the credit risk of the loans and

most of the responsibility for collection. Lucas & Moore (2010) and the Congressional Budget Office (CBO 2010) estimate that the guarantee program was more costly to the government, and hence there were efficiency gains from moving to Direct Lending. However, they also find that the cost of both programs is underestimated by federal budgeting rules, which do not fully account for the risks associated with the program. This underestimation of risks and costs has become quantitatively more important, as the programs have grown both in size (more borrowing per student and more students participating) and in number (adding borrowing for graduate and professional studies through graduate student PLUS loans, for example). These measurement issues imply that conventional budget estimates are not appropriate economic benchmarks for the true cost of the student loan programs (in fact, they often show the programs as making money for the federal government). This clouds the policy debate, rather than providing accurate estimates of the fiscal commitment to education.

Beyond the direct budget effects of loan and grant programs, the existence and structure of these programs influence the decisions of schools, as well as those of student borrowers and their families. For example, the availability of federal funding has been argued to lead to higher college tuition levels. William Bennett, who served as the Secretary of Education in the Reagan Administration, argued that "if anything, increases in financial aid in recent years have enabled colleges and universities blithely to raise their tuitions, confident that federal loan subsidies would help cushion the increase" (Bennet 1987). Research into the Bennett hypothesis has shown mixed effects of financial aid on tuition, with the largest positive effects generally identified from responses of proprietary schools to grant programs [see Lucca, Nadauld & Shen (2015); for a study of proprietary schools' tuition, see Cellini & Goldin (2014)].

The loan programs are motivated by the desire to ensure student access and affordability of education. Although much of the research on the effect of credit constraints on college-going and college choice in the 1980s and 1990s finds little or no evidence of credit constraints (Heckman & Lochner 2000, Carneiro & Heckman 2002, Cameron & Taber 2004), studies based on more recent data paint a somewhat different picture. Belley & Lochner (2007) find strong effects of family income on college attendance. Brown, Scholz & Seshadri (2012) show that financial aid increases educational attainment primarily among children of middle-class families. These results suggest that student loans and other financial aid support college access, especially in more recent cohorts of students.

The increased use and size of student borrowing raises questions about how student outcomes and decisions other than college attendance might be affected by students' loans. There has been some discussion of a potential role for student debt in changing the consumption patterns of young people, as well as their decisions about household formation, homeownership, and entrepreneurship. Although broad trends show comovement between the rise in student debt and falling household formation and other changes (e.g., Brown & Caldwell 2013), it is difficult to isolate the effect of student debt from the effects of other contemporaneous factors, such as the financial crisis, recession, and poor labor market. Rothstein & Rouse (2011), for example, overcome these problems by using data from a university's implementation of a no-debt policy. They find that debt was associated with students' taking jobs in higher-salary occupations and fewer public-interest jobs, consistent with the idea that student debt imposes credit constraints on graduating borrowers. A recent study of homeownership patterns (Mezza et al. 2016) combines credit reports with data on college attendance from the National Student Clearinghouse (NSC). This combination allows the authors to differentiate between college graduates with and without student debt, as well as borrowers who did not attend college. The study finds a similar postrecession downward trend in homeownership for all groups, but with a large gap in ownership rates between college attendees and nonattendees. These results cast doubt on the hypothesis that college debt

is a meaningful deterrent for homeownership, emphasizing instead the importance of a sizable college earnings premium on homeownership rates.

Although a complete review of the support for higher education offered globally is beyond the scope of this review, we make a brief note here and refer the reader to the detailed discussion in OECD (2014). Many countries support public institutions of higher education through a national university system, and often also through state or provincial colleges. Many of these schools are nearly free of charge or have highly subsidized levels of tuition. Other countries—Australia and New Zealand are prominent examples—provide financial support to students through loan and income-based repayment programs that are far more extensive than those recently introduced in the United States. These programs explicitly link repayment to income and are administered through the tax system. Most repayment programs provide some contingencies, such as payment reduction or deferment, when borrowers experience financial distress. In practice, most countries in which governments provide students loans for higher education offer only a limited number of contingencies for repayment, which we discuss further below.

2.2. Incentive and Funding Issues in Student Lending

Supporting higher education through loan programs raises questions of both fiscal cost and incentives. Although, as discussed above, loans are cheaper to the government per dollar of upfront funding than grants because they are partially repaid, loan terms have a significant impact on their ultimate cost and on repayment incentives, especially given the asymmetric information between borrowers and the government. The previous section discussed shortcomings of budgetary rules in estimating the economic cost of providing student loans and risks borne by the government. The experience of the Great Recession and its aftermath demonstrates the potency of these concerns.

A recent study by Looney & Yannelis (2015) documents that loan performance has deteriorated, with default rates doubling between 2000 and 2011. They show that increased borrowing among students with strong job prospects, such as graduate students, is not associated with poor loan performance, whereas students attending proprietary schools show both higher loan balances and deteriorating loan performance. Students from less selective public schools also show some decline in loan performance, but have lower levels of borrowing. These findings both raise overall fiscal questions about the program and also focus attention on the role of proprietary and less-selective schools. Whereas the latter, including community colleges, may provide access to under-served students and communities, proprietary schools have received further scrutiny of their growing role in debt and default problems.

Although the cost of the program to taxpayers generally rises with higher defaults, there are two mediating factors. First, loans in default may still be repaid because of the federal government's ability to collect past-due payments. The actual recovery rate is less than the reported 80% collection rate because of delayed and costly recoveries.[1] Moreover, the nonprice concessions noted above likely reduce defaults, but also reduce recoveries in the event of default. Second, to the extent that the increase in lending and defaults owes to the financial crisis and the ensuing recession of 2008–2009, Lucas (2016) points out that the increased lending played the role of a shadow stimulus to the economy and may have had positive macroeconomic effect by supporting both consumption and education. Nonetheless, the rising cost of the program focuses attention

[1]The Department of Education budget request for fiscal year 2013 lists the net present value of the recovery rate net of collection costs for defaulted Stafford loans as between 78% and 82%. These estimates assume a 40-year recovery window and discount expected cash flows at the risk-free rate (Department of Education 2012).

on its structure and on how well it is targeted to achieve its educational objectives at lowest cost to taxpayers.

Turning to incentive issues, the literature on optimal lending in the presence of asymmetric information focuses on the moral hazard in debt contracts, which ultimately argues for greater underwriting or the use of collateral to improve incentives in the student loan market, as in other consumer markets. (For a thorough review of the existing literature and policy options, see Lochner & Monge-Naranjo 2014.) Undergraduates, however, tend to have little credit history to support underwriting and also little collateral to offer. The experience of differentiated lending products for students underscores these difficulties. The private loan market was strongest in graduate loans (Lucas & Moore 2010), where students were more likely to have a credit history. Cosigners could also effectively provide alternative forms of collateral when students did not meet the requisite credit standards. Given the goal of educational access, most government student lending is not underwritten, although some programs (notably parent loans through the PLUS program) utilize cosigners and are available to any student enrolled in an accredited institution of higher education. Without underwriting at the beginning of the loan process, government programs instead have unique collection capabilities, including garnishing wages and withholding payments, such as tax refunds and Social Security payments. Because government loans are disbursed through schools, there have been increasing calls for loan counseling through financial aid offices, as students take on debt early, whereas the consequences may be more apparent later. Moreover, these effects are magnified as debt has risen and loan performance has declined.

Another incentive issue in both government-guaranteed and direct lending programs is that lenders and schools do not bear the full risk associated with loan performance, including risk associated with employment outcomes or, even worse, failure to graduate at all. The rise of for-profit schools (analyzed in more detail in Section 4) with sharper incentives to maximize their financial performance heightens the risk associated with this agency problem. Although nonprofits can face a similar issue, those with selective admissions have more "skin in the game" because of their reputations for academic performance. In some sense, the admissions offices of selective schools perform the filtering and selection that a loan underwriter cannot: choosing students (and potential borrowers) based on their future potential. The for-profit sector, which often has more nontraditional students, challenges both the selection and performance mechanisms. Nonselective institutions by definition provide no filtering/underwriting of students (nor are they intended to), and nontraditional students are more likely to face poor income prospects. These students are also more likely to attend community colleges and for-profit institutions, so there is a confluence of the riskiest students and the institutions with the sharpest monetary incentives.

An additional factor is that student loans are not readily dismissed in bankruptcy. Although this policy directly benefits repayment and ex ante incentives, it also leaves borrowers in true distress, with few options to modify their debt. The main exception is income-based repayment (IBR) programs, which are available to some federal borrowers and which cap the borrower's repayment at a percentage of income. IBR allows loan modifications in a preplanned and predictable way, which may increase repayment and reduce the burden on those in true distress by better aligning income flows and loan payments, as suggested by Eberly & Krishnamurthy (2014) for mortgage programs. We discuss IBR (and other alternatives to debt) further below in the context of risk-sharing.

2.3. Risk Sharing in Student Lending

Recently, IBR mechanisms have garnered much attention as a way of sharing risk between the government and student borrowers (and often their families). These programs also shift students' income risk to the government by tying repayment explicitly to individual income. Many observers

have pointed out the moral hazard created by this feature (e.g., Dynarski & Kreisman 2013, Brooks 2016). There is also potential for adverse selection to jeopardize the sustainability of the loan program with IBR, as low-income borrowers might embrace this feature, driving up the cost to the government, whereas higher-income borrowers might seek lower-cost traditional loans from private lenders who do not provide IBR.

In broad terms, the IBR programs in the United States set the loan payment amount at a prespecified percentage of income above a poverty threshold. If a loan is not repaid within a predetermined period, the balance is forgiven, although the forgiven amount might be taxable. The repayment percentage and the maximum repayment window are affected by several factors, such as the time of debt issuance and the type of employment (e.g., public or private sector). However, all of the IBR variants aim to provide insurance to borrowers against adverse income shocks.

Like any insurance program in a setting with asymmetric information, IBR contracts give rise to joint problems of moral hazard and adverse selection. The former can be manifested by students not putting forth the optimal effort in their studies or by students selecting fields of study that, although rewarding intellectually, are not necessarily remunerative. The latter can take the guise of lower-ability students choosing to enroll in college, as their expectations of low earnings now carry an offsetting benefit of lower loan payments. Finally, IBR contracts also redistribute wealth from students with good income draws (whether random or expected) to those with bad income draws.

Studying the relative strength of these effects and their associated welfare implications typically requires computational evaluations of fully specified equilibrium models. One recent strand of literature provides some evidence in this regard. In particular, Ionescu (2009, 2011) evaluates the effect of various insurance provisions in student loan programs on college enrollment and welfare. These provisions include various forms of loan consolidation, IBR-like repayments, or partial dischargeability of debt in bankruptcy. Although estimated magnitudes vary across policies, in general offering insurance against adverse postgraduation outcomes leads to higher enrollment and welfare gains. Chatterjee & Ionescu (2012) also study the effects of providing insurance against failure to complete college, while allowing for both moral hazard and adverse selection on the part of the students. They show that full forgiveness of loans for students that fail to graduate leads to sizable welfare gains. Extending loan forgiveness to students who quit voluntarily is also welfare-improving, and it increases enrollment and graduation rates. However, because the indiscriminate forgiveness program succeeds in attracting more marginal students, it raises the insurance premia paid by the entire student body, which attenuates welfare gains.

Eckwert & Zilcha (2012) and Hanushek, Leung & Yilmaz (2014) evaluate the effect of different repayment provisions in a three-period overlapping generations (OG) setting. In these models, agents have heterogeneous abilities, face labor income risk, and cannot borrow to finance consumption. Eckwert & Zilcha (2012) consider an IBR-like insurance scheme in which repayment is tied to realized income, as well as a scheme in which each ability group has its own risk-sharing arrangement. They show that the latter variant generates higher welfare gains relative to the no-sharing benchmark, as it precludes redistribution from high- to low-ability students. Hanushek, Leung & Yilmaz (2014) also consider IBR schemes, although their study focuses on other, nonloan forms of educational aid. They, too, point out that IBR contracts that are tied only to postgraduate income realizations force high-ability, low–(parental) wealth students to subsidize low-ability and possibly high–(parental) wealth students.

Although funding mechanisms such as IBR focus on the contract between the government and the borrower, the incentives created by the government guarantee extend to education providers and lenders as well as to students and their families. IBR does not address these incentive problems and other implementation hurdles, to which we turn in Section 5. Moreover, given the scale of education financing and the debt obligations now outstanding, questions have been raised about

the potential macroeconomic impact of the rise in student debt, which we address in a generational equilibrium in Section 3.

3. MACROECONOMIC AND INTERGENERATIONAL IMPLICATIONS OF STUDENT DEBT

The aggregate amount of student loan debt now stands at $1.2 trillion, according to calculations from the Federal Reserve Bank of New York (FRBNY 2015) using their credit panel data. This benchmark, along with the relatively rapid rate of increase following the financial crisis, has raised concerns about the sustainability of the student loan financing model and its impact on the rest of the economy. Research addressing the impact of debt on household choices has obtained mixed results; some work finds an effect on career choices and household decisions, whereas other work finds more limited, if any, impact. (For studies of links between students loans and small business formation, auto loans, household formation, and long-term financial stability, see, respectively, Ambrose, Cordell & Ma 2015; Brown & Caldwell 2013; Bleemer et al. 2014; Gicheva & Thompson 2015.) In many cases, there are offsetting effects, because students who borrow to go to school also increase their human capital, and although the debt may suppress spending and household formation (for example), higher human capital tends to increase it. The aggregate data confound these effects, and they are difficult to identify separately in microeconomic data. [Dynarski (2016) argues that this explains the finding that student loan debt is negatively associated with homeownership. Using microeconomic data that include educational status (which the credit bureau data do not include), she argues that homeownership is driven by educational attainment, and that failure to control for education confounds the student debt finding.] The macroeconomic impact of student debt has been the subject of some speculation, largely through a consumption or household formation mechanism. The impact, however, depends on what the alternative regime would have been. If student loans facilitate education that would not have otherwise occurred, then the offsetting effects above are in play. Alternatively, if student loans finance education that was previously financed in some other way, then human capital remains the same and only financing changes. The fact that the increase in student borrowing occurred around the financial crisis of 2008–2009 suggests that at least some of the increase in borrowing stemmed from constraints on other forms of borrowing and financing.

To examine this possibility, we develop an OG model based on the work of Drazen (1978). This framework was originally developed to examine whether human capital investment is sufficient to maintain the intergenerational linkages required for an operative bequest motive and, hence, Ricardian equivalence. [Abbott et al. (2013) offer a very different approach to the study of education financing policies and human capital investment in an OG framework.] Here we use the OG framework with human capital to examine generational investment in education (parents for their children) and how it can be disrupted by an adverse shock to parents' ability to pay for school. Government debt plays a particular role in the model because it facilitates lending across generations that would not be enforceable with private contracts. In practice, the government's collection powers are only one component of the government's role in student lending. Using credit programs to support education also allows for credit subsidies (negative–net present value loans) and the ability to spread losses and other risks widely across borrowers and taxpayers using fiscal instruments and policy.

3.1. Overlapping Generations Model with Human Capital

Agents in the model live for two periods, a working period (youth) and a retirement period. The return on capital is r, and agents consume c_1 and c_2, respectively, in the two periods of life. The

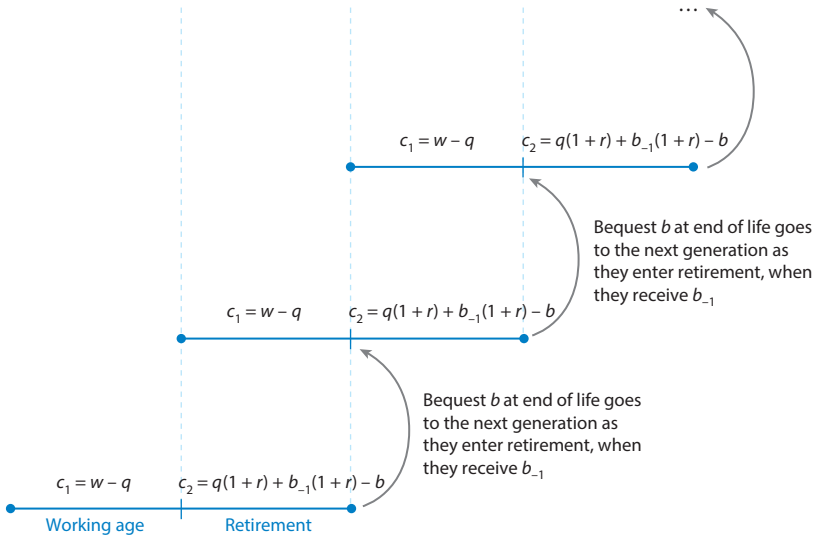

Figure 1

Overlapping generations with bequests.

agent has real wage w during youth, and receives a bequest of b_{-1} at the end of youth. The value of capital is q. Before we introduce education, we set up a model of capital accumulation and bequests. Saving is used to buy capital, and bequests b are left at the end of retirement, the second period, so the budget constraints in the first period (youth) and the second period are

$$w = c_1 + q \quad \text{and} \quad (1 + r)q + (1 + r)b_{-1} = c_2 + b. \tag{1}$$

Note that bequests are received at the beginning of retirement, so they can be used to fund second-period consumption but not first-period consumption. **Figure 1** illustrates the timing and structure. Assuming that parents are motivated by their children's welfare, the child's utility is an argument in the parents' utility function

$$U_i = U_i\left(c_1^i, c_2^i, U_{i+1}^*\right), \tag{2}$$

where U^* denotes the maximized value of utility and i indexes the individual agent. The agent chooses the four decision variables $\{c_1^i, c_2^i, q, b\}$ as functions of w, r, and b_{-1}.

To aggregate the economy, we assume that the population of size N is homogeneous and grows at rate g, so a bequest is divided among $1 + g$ children. The model is closed by assuming constant returns to scale and perfect competition on the production side, so that per-capita output, y, is exhausted by factor payments

$$y = rk + w, \tag{3}$$

where k is the capital–labor ratio. Real wages grow at rate μ. Drazen shows that if $r > \mu$, there will be positive bequests, as parents value their children's utility and the rate of return on capital (saving) exceeds what the child will receive by wage growth alone (μ) if the utilities are equally weighted. If, however, parents discount their children's utility relative to their own, then there is a role for negative bequests; because there is growth in the model, parents may want to consume some of the (higher) income of their children in order to smooth utility across generations. However, this is not possible with the basic specification of the model, because there is no mechanism to

transfer these resources back in time. This creates a new role for government bonds: The parent generation is able to consume out of government bond issues while their children repay them through future taxes. Once government bonds are introduced, the parents in the model are able to borrow from their children. We would not argue that this is the only, or even the primary, function of government bonds broadly or government-backed student loans specifically. Indeed, other long-term contracts are enforced, even without collateral, including private student loans. This structure highlights the intergenerational aspects of student loans, so it is convenient and emphasizes the scope for a public role.

With this background, now consider the role of human capital and financing intergenerationally. Suppose that young parents spend h on the education of the children and may be paid back in their old age by h_{+1}. In the timing of the model, the working-age (young) generation spends h on human capital during youth, and the next generation of young commences working age with human capital h. They may pay back h_{+1} on their human capital investment to their parents at the end of youth. With human capital spending, the budget constraint of a generation becomes

$$w = c_1 + q + h \quad \text{and} \quad (1+r)q + h_{+1} = c_2. \tag{4}$$

We follow Drazen in assuming that gifts to parents earn no interest, but this is not essential. Because the intergenerational transfers now occur as gifts to parents, rather than bequests to children, we modify the utility function so that children can receive utility from their parents' welfare.[2] Children choose the transfer to parents to maximize parents' second-period utility, taking their first-period utility as given (as it has already taken place):

$$U_i = U_i\left(c_1^i, c_2^i, \widehat{U}_{i-1}\right), \tag{5}$$

where $\widehat{U}_{i-1}$ represents the maximized utility of parents, and children choose their consumption, saving, and gifts to their parents to maximize utility (we omit their own children's utility for now to focus on parents' utility). The agent chooses the four decision variables $\{c_1^i, c_2^i, q, h\}$ as functions of w, r, and h_{+1}. With discounting or the zero interest rate on gifts, it is immediate that the reverse bequest motive will be nonoperative if parents' utility is equally weighted, as children would have to transfer first-period consumption to their parents' second-period utility, which would only occur if children value their parents' utility more than their own. Hence, if parents' utility is equally weighted or discounted, then $h_{+1} = 0$.

3.2. Equilibrium Without Government Bonds

We assume there is no market in human capital (other than the spot market in labor; hence, human capital cannot be collateralized). Although government bonds can impose a liability on future generations, there is no other market mechanism to enforce such a liability. These assumptions are clearly too strong, in that private mechanisms do exist to enforce long-term contracts and private student loans have been used to support human capital investment. We employ these assumptions for simplicity and in recognition of the ability of government to enforce contracts that might be more difficult or more expensive to enforce privately.[3] In practice, the presence of

[2] We could introduce a general utility function where agents receive utility from the welfare of their children and from the welfare of their parents, or two-sided altruism. This introduces a double recursion that is not central to the current problem, so instead we consider only one-sided altruism, as in Drazen (1978). For two-sided altruism, see, for example, the results of Kimball (1987) and Altig & Davis (1993).

[3] Typically such loans are in small amounts (credit cards, for example) or in the context of long-term enforceability (such as credit bureaus and access to future loans). Where these characteristics do not exist (such as for international students), student loans typically require a cosigner.

government debt also allows the government to absorb losses, spread risk, and provide subsidies for human capital formation.

We assume a skill premium associated with education, so that $w = w(e)$, with $w'(e) > 0$, $w''(e) < 0$, and $w(0) = 0$. The implicit return to education, r^e, is assumed to exceed that to physical capital for some level of investment, so that $r^e(e) > r$ for $e < \bar{e}$. It is immediate that parental transfers should take the form of education for transfers less than or equal to $\bar{e}$, and the form of financial bequests for amounts in excess of $\bar{e}$.

To close the model, Drazen assumes education is labor-augmenting (Harrod-neutral), so that labor can be transformed into efficiency units. Define $\widehat{l}$ as efficiency units of labor per capita, with $\widehat{l}(e)$ a function of education and $\widehat{l}'(e) > 0$, $\widehat{l}''(e) < 0$, and $\widehat{l}(0) = 0$ (consistent with the symmetric assumption on wages). Assume homogeneity in capital and physical units of labor. The wage rate is then $\widehat{w}$ per effective unit of labor and $w = \widehat{w}\widehat{l}$ per physical unit.

Suppose first that parents' income and utility is such that parental transfers exceed $\bar{e}$ and parents provide both education and financial bequests to their children. In practice, the provision of education to the children could take the form of directly paying tuition or paying taxes to provide public education, financed by the savings of the parents. In this case, there are no negative bequests and no need for government bonds, as families finance education for their children and also leave positive financial bequests. There is no debt, nor any need for it, in this equilibrium. The dynamics illustrated in **Figure 1** are essentially unchanged, with the addition of human capital expenditures to the budget constraint in Equation 4.

3.3. A Role for Debt in Equilibrium

Now consider an alternative equilibrium (or an unanticipated shock) that results in a shift to student-financed education rather than parent-financed education. Although there are several ways to model this, here we consider a reduction in the value of parental resources w.

A lower value of w reduces parental resources, and hence parents reduce consumption, savings, and education investment. If w is low enough, investment in education, e, falls below $\bar{e}$ and the rate of return to education exceeds the rate of return to capital. Parents transfer education to their children, but are only able to do so at a level less than $\bar{e}$. For these families, the rate of return to education r^e exceeds the discount rate r, and hence their children would benefit from greater educational investment. Likewise, the parents would also benefit from greater investment at this higher rate of return. There is no contract, however, that commits the children to pay back the parents. Private contracts that allow children to borrow against their future income to finance education are typically prevented by the noncollateralizable nature of human capital and the attendant moral hazard. Similarly, borrowing from parents and promising to pay them a higher rate of return is not incentive-compatible. Drazen argues that the presence of government debt solves this problem by allowing parents to invest in a bond, the proceeds of which are used to finance education, and which imposes a repayment obligation on the younger generation. (This is the basis of Drazen's argument that government debt has value in this framework.) The intergenerational dynamics and bond flows of this equilibrium are illustrated in **Figure 2**. Working-age savers purchase the government bond, and the proceeds are used to finance education (or, equivalently, to fund student borrowing that is used to buy education) for the young. The young repay these loans, or the government bonds, when they are of working age, providing repayment to the bondholders, who are now in retirement. Hence, for families with insufficient wealth to both invest optimally (at least $\bar{e}$) in education and leave a financial bequest, government bonds facilitate the intergenerational transfer that allows higher investment in education. In other words, the existence of the government bond changes the set of possible allocations, as it allows parents to purchase a

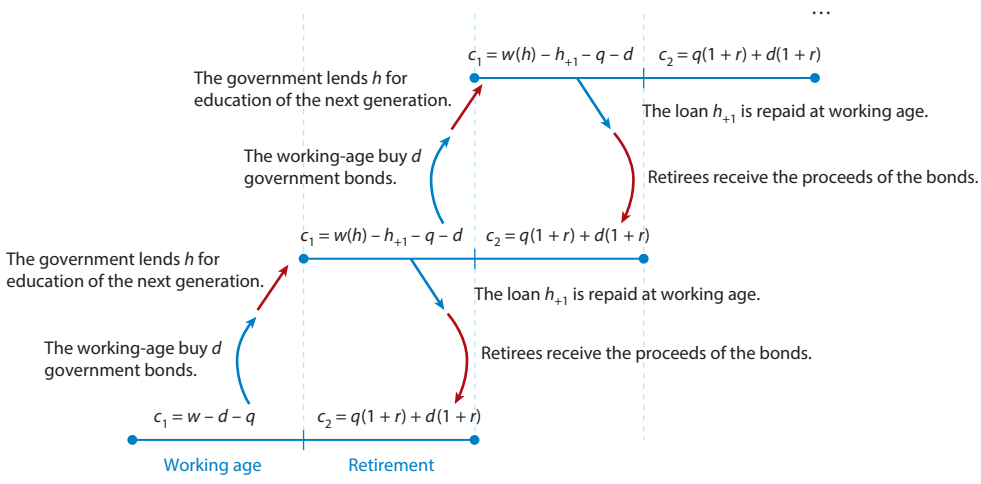

Figure 2

Overlapping generations with debt. Government inflows are blue; outflows are red.

claim on future output that would otherwise be unenforceable. Government-backed student loans, in principle, fill exactly this role, because the government has the power to impose collection on future human capital, whereas a private contract cannot.[4] This structure generates student loans as the solution to an intergenerational contracting problem. In practice, public student lending also allows for public subsidies of human capital formation. By loosening credit constraints on human capital, the government can also provide a subsidy to human capital formation, as we discussed in Section 2, and depending on how the loans are structured, there may be additional subsidies embedded in the pricing and nonprice characteristics of the loans.

3.4. Discussion

In this equilibrium, as Drazen notes, the introduction of government bonds lowers savings and crowds out physical capital in steady state, which typically reduces welfare. In the present model, however, government bonds allow for greater investment in a higher–marginal product form of capital; hence, although physical capital is lower in steady state, welfare is improved because human capital rises relative to the case without the student lending. (The finding that physical capital declines relies on the Harrod-neutral labor-augmenting assumption on education. If education also increased the returns to capital, then physical capital could eventually rise as well.)

But the equilibrium is permanently shifted. If the bonds take the form of student loans, students now carry debt into adulthood, which crowds out the savings they would make on behalf of their

[4]In a model without heterogeneity, student loans and government bonds are formally the same. The older generation (parents) buys the bonds and receives repayment in retirement, and the younger generation (students) has the repayment obligation, repaid during their working years. In practice, student loans avoid imposing the education liability on nonstudents (ignoring the implications of default, for now).

own children to invest in education. Thus, the education system shifts from a contemporaneously funded system, in which parents use their savings to pay for the education of their children, to a system in which students borrow to pay for their own education. These loans are repaid in adulthood, using savings that this generation would previously have accumulated to finance the education of their own children. Hence, the intergenerational (dynastic) linkages are broken in favor of self-funding financed by borrowing against future human capital. This economy exhibits lower steady-state savings and physical capital. Education is higher than in an equilibrium without student loans, but with loans, education should return to the threshold value $\bar{e}$, as in the higher-resource equilibrium (so long as the wage shock is not too large). We do not allow for this possibility here, but in a more general model with uncertainty, the young are also exposed to the increased risks associated with leverage.

If the shock to parental resources is temporary and affects only one generation, then the shift to loans is a way of smoothing the effect of the shock across generations. Parents transfer part of the impact of the shock to their children by shifting some of the cost of education to them. In adulthood, these children pay back the debt, but then issue a new generation of debt to be paid by their children, and so on. In this sense, the education system shifts from a funded system, where parents fund their children, to one that involves government-backed debt so that children can at least partially finance their own investment in human capital.[5]

Within the model, the distinction between government debt and student debt is not clear, as every child is a student. (In **Figure 2**, the government bond is issued to parents, who are repaid in retirement, financing their retirement consumption. The proceeds of the bond are used to pay for education of the young, who repay the bonds in their wage-earning adulthood years.) In practice, heterogeneity raises several interesting issues. First, it distinguishes between general government debt and student debt, as student loans must be spent on education. Student loans fill exactly the role envisioned in the model, whereas government bonds more generally need not. Second, there is no variation in the quality of education or of students. In the model, every student receives a wage premium by investing in education, whereas in practice, there is concern that greater investment in education may not pay off for all students, especially if they are ill-prepared. The model has decreasing returns to scale in education, which partially captures this feature. It is also worth noting that student debt is paid off by individual student borrowers, whereas government debt is repaid from the proceeds of a progressive tax system. The tax system thus provides some redistribution and insurance that is not present in student loans, although as we noted earlier, various features of the student loan program incorporate risk sharing.

The friction in the model driving these results is the absence of a market in human capital, so that education investment cannot be collateralized. As a result, students cannot credibly promise to repay their education loans. In this case, the actual student loan program, where the government has the power to garnish government payments and wages, is a mechanism to restore lending, but only if the government backs the loan with its ability to collect payments. In the model, all agents face this problem, and without heterogeneity there is no selection: All agents are equally qualified

[5] A related dynamic occurs in models of Social Security, such as that of Geanakoplos, Mitchell & Zeldes (1999), who examine changing from a fully funded system to a pay-as-you-go system. This change shifts funding responsibility for retirement from each generation saving for its own retirement to children paying for their parents' retirement. In the equilibrium, aggregate savings fall, and there is a windfall to the first generation, as they do not have to finance their own retirement. Here, the shift is from parents funding their children's education to children financing their own education. There is a windfall to the first generation of parents in the sense that they shift education financing to their children, and every subsequent generation follows suit. Hence, when the student debt is repaid by the young, the first generation can consume more in retirement than they otherwise would.

students. Variable ability, together with moral hazard, will play an important role when we look more carefully at the incentives faced by education providers in Section 4.

The acceleration of student debt in the past 10 years coincides with the financial crisis and the decline in mortgage debt and home equity borrowing; this suggests that there may have been some reallocation from parent financing of education to student financing, of the sort that occurs in the model. That is, when parental resources were limited, either because of lower resources per se or because of lower liquidity, the student loan program facilitated continued investment in education. The extent to which this occurred and student loans substituted for other forms of payment is an empirical question under study by Amromin, Eberly & Mondragon (2016). The aggregate implications of the acceleration in student debt depend on the extent to which it substitutes for other forms of debt and transfers those obligations across generations. Such a shift may be efficient, by financing high-return investment in human capital, but nonetheless changes the patterns of saving in the economy and, in turn, affects physical capital and other decisions.

4. THE SUPPLY SIDE OF EDUCATION FINANCING

In the OG framework, the inability to collateralize human capital creates a contracting problem, as students cannot promise to pay back even high-return investments in education. The government solves this market friction by introducing a contract that it can enforce but which has no private counterpart. (In the model, this market friction is solved through a government-enforced contract. As discussed in Section 2, real-world student loan contracts also subsidize lending through the use of general taxpayer revenue and, in the case of IBR, by transferring wealth from students with good income draws to those with bad ones.) Although this simple friction is useful for motivating the intergenerational implications of student lending, other frictions are also relevant and important in practice. In this section, we focus on a single generation of students but expand the set of actors and frictions. There has been substantial work on the contracting framework between borrowers and lenders, demonstrating the presence of moral hazard and adverse selection with collateral/borrowing constraints and heterogeneous borrowers. This work points to important borrower incentive problems when there is no underwriting and when government assumes the credit risk of loans. Here we reverse the usual approach by taking lending as given and parameterizing a government student loan program rather than a maximizing lender. The education providers are optimizing, rather than playing a largely passive role. Schools set pricing and enrollment policies in the presence of a government lending program. This framework illustrates the incentive problems that go beyond the borrower and potentially exacerbate the issues illustrated by the borrowers' problem alone.

4.1. Financing with Labor Income Risk and a Profit-Maximizing Educational Sector

As above, we start with a two-period model in the spirit of Lochner & Monge-Naranjo (2014) in which agents consume c_1 and c_2, respectively. Each agent is characterized by the initial wealth endowment W and ability a. Both W and a are positive, with W capturing all first-period resources, whether from own earnings, inter vivos parental transfers, or bequests. The agent chooses whether to acquire human capital h in period 1 at cost p that is exogenous to the agent. This decision is modeled as a discrete choice: $\{h = 0,\ h = 1\}$. [The model of student choice of Lochner & Monge-Naranjo (2014), however, evaluates human capital investment as a continuous choice of h.] The second-period wage depends on human capital and on the realization of an idiosyncratic income shock: $y(z, h; a) = zaf(h)$. The earnings function $f(h)$ is positive, strictly increasing, and concave.

The shock z is a continuous random variable described by a density function $\phi(z)$ with support $Z \in \mathbb{R}^+$. The agent is able to finance the investment in h either from W or by borrowing d from a government lender in the first period and paying back D in the second period. This lender does not price its loans to earn a competitive risk-adjusted rate of return. Rather, the government sets a borrowing cap of $\overline{d}$ and charges a time- and state-invariant gross interest rate R. (This is intended to capture a student lending program with a fixed interest rate and a per-student borrowing cap, to which students have access as long as they are enrolled in school.) Agents that choose to save earn the same rate of return R, and their saving is denoted by $d < 0$. This choice allows both first-period saving and borrowing choices to be captured by d, and both second-period returns and repayments to be captured by D. Holding R the same for borrowers and savers also eliminates the possibility of arbitrage among households able to finance the investment in human capital out of W. Government lending exists solely for financing of human capital investments. This setup gives rise to the following set of budget constraints:

$$\begin{aligned} c_1 &= W - p \times h + d, \\ c_2(z) &= zaf(h) - D, \\ D &= \begin{cases} Rd & \text{if no default,} \\ \gamma zaf(h) & \text{if default,} \end{cases} \\ d &= \min(p \times h, \overline{d}). \end{aligned} \tag{6}$$

The agent is assumed to have the ability to default on their student loan by surrendering a fraction γ of their second-period consumption. This share can represent income garnished by the government in lieu of repayment, or any cost incurred by the household as punishment for default. Note that the borrowing constraint implies that an agent that chooses not to invest in human capital is unable to smooth consumption by borrowing in the first period ($d \leq 0$). This, in turn, implies that default is a valuable option only to households that invest in education. This option is exercised whenever $Rd > \gamma zaf(1)$, so that $D = \min[Rd, \gamma zaf(1)]$. Consequently, there will be a threshold level of shock $\overline{z}$ such that $\overline{z} = \max[0, Rd/\gamma af(1)]$, and any realization of $z < \overline{z}$ results in default. Higher borrowing mechanically expands the set of shock realizations that lead to default. The default option offers partial protection to the agents exposed to labor income shocks. (We allow a default option in principle, but discuss the case in which default is not allowed, as economic default is limited in practice.)

In this setting, the subsidy inherent in government-sponsored student loans comes from two sources. First, the ability to default provides partial insurance to borrowers. This arrangement transfers second-period consumption from good to bad states and thus allows more risk sharing than self-insurance or simply borrowing from oneself intertemporally. Second, the cost of borrowing is assumed to be independent of the likelihood of default, which is a function of not only the amount borrowed, but also the student's ability.

As a starting point, let the education sector be described as a set of profit-maximizing institutions that set uniform tuition rates p and that have no means of supplementing student ability to pay other than allowing access to government lending, characterized by $\{\overline{d}, R\}$. Such institutions thus maximize

$$\pi = N(p) \times p - C[N(p)] = (p - c) \times N(p), \tag{7}$$

where $N(p)$ is enrollment and $C[N(p)]$ is the schools' cost function, which we assume to be linear in enrollment.

These institutions have a constant marginal cost of providing education services and have no capacity constraints. This structure loosely resembles the model of an online provider of

educational services that effectively faces no physical restrictions on enrollment.[6] We further assume that entry in this sector is limited by the need for costly certification requirements (or marketing, branding, or systems development expenses), which allows the existing institutions to earn rents. In this setup, the profit-maximizing condition simply sets tuition to equate marginal revenue and marginal cost. The former is directly affected by students' responsiveness to the cost of education, which is driven by their need and ability to borrow ($\overline{d}$, R, W), as well as the wage premium $a * [f(1) - f(0)]$. Note that in the current setting, the educational institution does not bear any cost of lending.

Let us first consider the solution to the student problem of choosing $\{c_1, c_2, h, d\}$ subject to the budget constraints above:

$$\begin{aligned} \max U &= U(c_1) + \beta \times EU[c_2(z)] \\ &= U(W - p \times h + d) \\ &\quad + \beta \left\{ \int_0^{\overline{z}} U\left[(1-\gamma) z a f(h)\right] \phi(z)\, \mathrm{d}z + \int_{\overline{z}}^{\infty} U\left[z a f(h) - Rd\right] \phi(z)\, \mathrm{d}z \right\}. \end{aligned} \tag{8}$$

Differentiating with respect to d yields

$$U'\left[W - ph^* + d^*(h^*)\right] = \lambda + \beta R * \int_{\overline{z}}^{\infty} U'\left[z a f(h^*) - Rd^*(h^*)\right] \phi(z)\, \mathrm{d}z. \tag{9}$$

In the set of cases where W is high enough that $d^* < 0$, the borrowing constraint does not bind and $\overline{z} = 0$. Then the optimal saving decision smooths consumption to satisfy the standard Euler equation by equating the marginal utility of consumption in the first period with the expected marginal utility of consumption in the second period. However, when the borrowing constraint binds ($\lambda > 0$), an agent consumes too little in the first period. This can occur for either choice of h^* (at different levels of W): The endowment W may be too low to smooth consumption effectively in the no-schooling case ($d \leq 0$) or too low to finance p and smooth consumption ($d \leq p$). Because h is assumed to be binary, some agents will not have enough flexibility to adjust consumption and investment to satisfy the Euler equation. Moreover, agents that borrow to finance human capital investment take into account their marginal utility of consumption only in nondefault states ($z \geq \overline{z}$) when choosing their optimal borrowing. [In default states of the world, their consumption is fixed at $(1 - \gamma)$ of realized income, which is independent of the amount borrowed.] Consequently, agents borrow more compared to the case in which no defaults are allowed and in which their second-period consumption is always a function of the amount borrowed.

Suppose for the moment that h is continuous. Differentiating with respect to h and combining the first-order conditions yields

$$\left(E[z] \frac{a f'(h^*)}{p} \right) \times \frac{E\left[z U'(c_2(z))\right] - \gamma \Phi(\overline{z}) E\left[z U'(c_2(z)) \,|\, z < \overline{z}\right]}{E[z] \times [1 - \Phi(\overline{z})] \times E\left[U'(c_2(z)) \,|\, z \geq \overline{z}\right]} = R, \tag{10}$$

where

$$c_2(z) = z a f(h^*) - Rd^*(h^*) \quad \text{if } z \geq \overline{z} \tag{11}$$

[6] Although the profit-maximizing sector spans a diverse group of institutions, the archetype of a large-scale online provider is the empirically relevant case. Deming, Goldin & Katz (2012) document the phenomenal growth in the sector from 5% of overall enrollment in 2000 to 13% of enrollment in 2009. They show that this growth was led by large, publicly traded institutions providing online courses, which accounted for 87% of the rise in enrollment and 80% of the increase in student loan volumes. The authors state that their "growth has been largely due to an extension of a business model that has emphasized the special client base of the for-profits combined with the ability to 'clone' successful programs using web technology and the standardization of curriculum for traditional in-person courses" (Deming, Goldin & Katz 2012, p. 148).

and

$$c_2(z) = (1-\gamma)zaf(b^*) \quad \text{if } z < \bar{z}. \tag{12}$$

The first term in Equation 10 captures expected returns to education. It can be shown that in the case of fully state-contingent debt repayment schedules $D(z)$, where $D(z) < 0$ is possible, the first-best allocation equates expected returns to education with the return on savings (Lochner & Monge-Naranjo 2014). In the current setting, however, the second term drives a wedge between the two returns. Before analyzing the properties of this term (denote it by Q), note that the binary nature of b^* suggests that an agent chooses to go to school if

$$\left(E[z]\frac{a(f(1)-f(0))}{p}\right) \times Q \geq R.$$

Consider first those cases where $d^* < 0$, so that there is no borrowing, which simplifies Q to

$$\frac{E\left[zU'(c_2(z))\right]}{E[z]E\left[U'(c_2(z))\right]}.$$

In this case, $Q < 1$, as the marginal utility of consumption and labor income shocks are negatively correlated when payments D are not fully state-contingent. This, in turn, implies that even for high-wealth, unconstrained agents, exposure to labor income shocks lowers the likelihood of going to school relative to the first-best case. This is a pure effect of earnings process risk without leverage.

As the wealth endowment declines, the agents will find it optimal to borrow to finance schooling. Choosing $d^* > 0$ means that $\bar{z} > 0$ and $z < \bar{z}$ is not an empty set. This brings two additional effects to the wedge Q. The agents lose a fraction γ of their income in default states with $z < \bar{z}$, which discourages borrowing and investment in schooling. However, their marginal utility in nondefault states increases, as consumption there declines with loan repayments. Although the overall effect of changes in borrowing on Q cannot be signed in general, it appears likely that $\partial Q/\partial d < 0$. This suggests that households that need to borrow to attend school are characterized by higher ability, which increases the direct return to schooling and narrows the range of shocks that trigger default. Athreya & Eberly (2013) explore this effect quantitatively and show iso-enrollment curves that demonstrate this trade-off between ability and wealth.

However, the presence of the default option pushes in the opposite direction, as it lowers the cost of bad income states and encourages lower-ability agents to invest in education. Unlike in the work of Lochner & Monge-Naranjo (2014), student debt here is not priced to capture the default risk. As a result, this setup lacks a mechanism for raising the implied interest rate on debt and lowering schooling. In this sense, government-sponsored student debt, as set up above, encourages schooling and transfers the cost of potential losses to taxpayers.

4.2. Loss-Sharing Provisions

Taking the implicit demand for $b = b(p, d, a, W)$ from the first-order conditions above, the education sector sets tuition to maximize profits. A standard set of conditions produces a familiar result where p is set to equate marginal revenue and marginal costs: $p + N(p)/N'(p) = c$. Here, $N(p)$ is given by the sum of agents for whom $b^*(p, d, a, W) = 1$. As tuition rises, its contribution to marginal revenue is tempered by the possible withdrawal of households from school. Higher p has a direct negative effect on expected returns to schooling, $E[z]a(f(1) - f(0))/p$. It also discourages schooling indirectly by increasing d^*. The strength of this effect of higher tuition varies with both a and W.

To illustrate how optimal borrowing varies with tuition, consider first the case of an agent that borrows less than the legal limit, $d^* < p \leq \overline{d}$, and chooses $h^* = 1$. An increase in p (assuming that h^* stays at 1) raises the right-hand side of the first-order condition (Equation 9) with respect to d. This suggests that the left-hand side of Equation 9 must rise as well, implying that the new financing gap, $(p_{\text{new}} - d^*_{\text{new}})$, must exceed the old financing gap, $(p - d^*)$, which is equivalent to $\partial d^*/\partial p < 1$. Agents that borrow the maximum amount possible, $d^* = p$, cannot increase their borrowing by more than the increase in tuition. At the other extreme, agents with high enough wealth and $d^* = 0$ will not change their borrowing in response to a marginal increase in tuition. Consequently, $0 \leq \partial d^*/\partial p \leq 1$, with the strength of the response moving inversely to W, holding all other parameters fixed.

To summarize, in the setting with incomplete markets and labor income risk, the existence of government-sponsored lending expands educational opportunities by weakening the link between initial wealth and the decision to go to school. Allowing default partially insures agents from income shocks and possibly increases investment in schooling. However, when education lending is not priced to reflect the risk of default, agents accommodate tuition increases by borrowing more than they otherwise would. Their investment (i.e., school enrollment) decisions also become less sensitive to borrowing (and to tuition increases).

In this setting, the profit-maximizing education sector does not bear the cost of defaults and thus has no reason to screen out low-ability or low-wealth students. Consequently, this regime produces higher enrollment in profit-maximizing schools, higher debt, and higher defaults than would be the case with explicitly priced loans or internalization of default losses by the education sector. At first glance, this is consistent with recent empirical evidence documented in Looney & Yannelis (2015). They show rapid increases in for-profit college enrollment between 2002 and 2011, as the sector added 1.4 million students over that period. Moreover, despite for-profit enrollment shares never exceeding 10%, students in these institutions accounted for about 25% of growth in the aggregate student debt over this period. This subset of students was also responsible for the lion's share of subsequent defaults. [Specifically, Looney & Yannelis (2015) report that borrowers who attended for-profit institutions and nonprofit two-year programs accounted for 70% of all those who started loan repayment in 2011 but had fallen into default by 2013.]

To illustrate the potential importance of loss-sharing provisions, assume that the education sector is required to bear a fraction κ of losses that occur when a student defaults. These losses are given by $Rd^* - \gamma z a f(1)$, and the augmented profit function in Equation 7 is described by

$$\pi = (p - C) \times N(p) - \kappa \left\{ \sum_{i=1}^{N(p)} \int_0^{\infty} \min\left[0,\, Rd_i^* - \gamma z a f(1)\right] \phi(z)\, \mathrm{d}z \right\}. \tag{13}$$

The introduction of (partial) responsibility for losses presents profit-maximizing colleges with a set of trade-offs. On the one hand, they want to raise tuition to compensate for default costs. On the other hand, doing so will increase the likelihood of default for all of the inframarginal students whose decision to attend is unaffected by higher tuition, as it leads to higher borrowing without a compensating increase in the wage premium. Higher tuition will also make losses from default higher (recall that $\partial d^*/\partial p \geq 0$).

More importantly, adding a cost component that is directly affected by tuition and student characteristics provides colleges with an incentive to screen applicants. Because schools in this environment are not allowed to vary the terms of student loans, they would like to screen out low-ability applicants for whom income shocks of a given magnitude are more likely to trigger default. Whether profit-maximizing schools choose to deal with exposure to credit risk by raising

tuition or screening out low-ability applicants, imposing loss sharing unambiguously decreases enrollment.

4.3. Institutional Background on Loss Sharing

One could argue that the current institutional setup places very few loss-sharing demands on the educational sector. Since the late 1980s, institution-specific cohort default rates served as the main lever for regulating school eligibility for access to the federal student loan program. An institution whose two-year cohort default rate exceeded 40% (or remained above 25% for three years) became ineligible to obtain federal loans for its students.[7] However, some institutions kept the two-year default rates low by aggressively utilizing loan deferment and forbearance provisions of the federal loan program. To discourage such practices, the Higher Education Opportunity Act expanded the default window to three years, starting with the 2012 cohort. According to Deming, Goldin & Katz (2012), implementing this change during the 2005–2008 period would have increased the number of schools failing the threshold test by more than tenfold, with the vast majority of the failing institutions coming from the for-profit sector. This episode suggests the relative ease of avoiding loss sharing and effectively shifting the entire cost of the government loan program onto taxpayers.

The apparent lack of incentives to maintain ex post performance of student loans is also evidenced anecdotally in recruiting and marketing strategies by some for-profit institutions. In a recent example, Education Management Corporation (EDMC) agreed to a $90 million settlement with the Department of Education over allegations of a per-capita incentive compensation scheme for its recruitment employees. Such compensation arrangements are explicitly prohibited by the Department as a safeguard against enrollment of unqualified students. Yet EDMC followed a policy of enrolling anyone with a "pulse and a Pell" (Saul 2015).

The Department of Education attempted to correct this situation by imposing school program–level gainful employment standards. Under the latest definition of these standards, the average annual loan payment must not exceed 8% of average annual earnings of program graduates, and the median annual payment must not be greater than 20% of the median discretionary income. The main innovation of these standards was to attempt to bring both loan costs and earnings into determination of whether an educational program generates value for the student and for taxpayers. However, this approach proved controversial, as it applies primarily to for-profit educational programs and focuses exclusively on earnings shortly after program graduation.[8] The gainful employment statistics require time to compute and disseminate and are backward-looking by design, which potentially conflates effects of the business cycle, changes in student body composition, and the educational program itself.

In comparison with gainful employment standards, loss-sharing requirements can be applied universally and offer an important advantage of bringing market insight to evaluating the risk of lending to students in a particular institution. In practice, requiring colleges to pay for part of realized defaults generates a need to demonstrate their ability to do so, which could be generated with a form of surety bond. If funded in private capital markets, the resulting bond price would

[7]Exclusion from the federal loan program nearly always leads to the affected institution shutting down its operations. The implementation of the default threshold led to a wave of closures among private, for-profit trade schools in the early 1990s (Deming, Goldin & Katz 2012).

[8]A public comment by Guryan & Thompson (2014) on the intial version of the proposed gainful employment rules provides an exhaustive review of possible flaws. The final version, released five months later in October 2014, addresses some of the criticisms, notably by removing the metric of cohort default rates.

produce a signal about the quality of education provided by a given school.[9] For example, a bond posted by an institution with a proven track record would be inexpensive, whereas that posted by a riskier program would be priced accordingly. This signal, along with the attendant need for colleges to disclose relevant information, would be of value to both students and policymakers. To avoid internally funded bonds (that is, a simple escrow account, which might be less costly for colleges), a sensible policy might require each college to fund a bond sized at a predetermined fraction of its guaranteed loan fundings. This feature would also reflect the propensity of students to borrow, as institutions whose students fund themselves primarily through loans would be required to insure larger loan portfolios.

However, loss-sharing provisions as sketched above have the potential to overemphasize the role of defaults. Low default rates in and of themselves do not characterize an optimal system of education finance. Students may not know their true ability until they commence their studies, and giving such high-risk students an opportunity to discover their type (i.e., insure against type) is an important element for completing education finance markets. Moreover, some low-ability students may reap sizable benefits from higher education even though in level terms they still fare worse than higher-ability students. Consequently, institutions that attract students of lower (or uncertain) ability should be evaluated on the basis of value added and not simple levels of ex post defaults. A potential solution would allow loss-sharing parameters, and hence the size of the public subsidy, to vary with the type of the institution and/or its student body.

4.4. Adding Nonprofit Educational Institutions to the Framework

The initial model setup can be readily augmented with another set of educational institutions that not only seek to maximize their net earnings, but also are concerned with the ability of their incoming student body. The objective function of such institutions, labeled here as nonprofit, can be described loosely following Fu (2014):

$$\pi = N(p) \times p - C(N(p)) + \sum_{i=1}^{N(p)} q a_i. \tag{14}$$

Here a_i represents the ability of student i, and q is the value placed by the nonprofit college on student ability relative to that placed on net tuition revenue. The addition of the last term to the nonprofit sector objective function can be motivated in various ways. There could be spillovers from higher-ability students generating higher wage premia, or nonprofits could be interested in creating amenities associated with being surrounded by students with high learning ability. Most straightforwardly, ability may be a proxy for future earnings, which translate into higher contributions to school endowments. In this case, having student ability in the objective function simply represents delayed future revenue flows. Importantly, nonprofit colleges are assumed to be brick-and-mortar, campus-centered institutions, which therefore face a hard aggregate capacity constraint, $N(p) < \overline{N}$, at least in the short run.[10]

[9] An example of such an approach to bringing in private capital for price discovery and risk sharing is provided by the Credit Risk Transfer securities issued by Fannie Mae and Freddie Mac to private investors, starting in 2013. These securities receive payments tied to the performance of a reference pool of mortgage loans that were recently securitized by Fannie and/or Freddie. As a result, private investors bear some of the credit risk, and the price they are willing to pay reveals their assessment of risk in the underlying mortgage pool.

[10] This distinction between two types of institutions is motivated by observed differences in screening intensity between selective and nonselective schools. Theoretical archetypes notwithstanding, a profit-maximizing school may care about the learning ability of its students if it allows it to advertise higher earnings of graduates and thus to justify higher tuition. Similarly,

In this setting, it is clear that nonprofit colleges will engage in positive selection of high-ability students. This can be done by screening on the basis of observable student characteristics, such as exam scores and grades. Empirically, selective nonprofit colleges generate much higher earnings premia relative to for-profit schools (Barrow & Malamud 2015). However, even in the absence of higher earnings premia, nonprofit schools can attract higher-ability students by offering lower net tuition through tapping their endowment assets. This channel is unavailable to for-profits, which have few, if any, endowment resources.[11] The resulting equilibrium allocation matches up to $\overline{N}$ highest-ability students with nonprofit colleges and matches the rest of students, for whom $h^*(p_{\text{for-profit}}, d, a, W) = 1$, with profit-maximizing institutions.

However, this makes matters even worse for profit-maximizing schools. These schools end up serving an adversely selected student body, so that borrowing, poor labor market outcomes, and subsequent defaults are concentrated among their students. Still, absent loss-sharing provisions, profit-maximizing schools have little incentive to screen for preparedness in admissions policies in this setting.

How would the presence of selective nonprofits affect the response of the for-profit sector to loss sharing? Raising tuition generates a stronger demand response in an adversely selected pool of potential students. Rather than raising tuition and ending up with a smaller set of wealthier (but relatively less prepared) students, these for-profit schools would have a stronger incentive to impose admissions criteria. Put differently, faced with a worse distribution of potential students' ability, for-profit schools are more likely to respond to loss sharing by implementing some selectivity in admissions. Note that loss sharing can take many forms. For example, need-based financial aid, typically provided only by nonprofit institutions, also functions as skin in the game. Similar to loss sharing as modeled in Section 4.2, need-based aid forces a school to directly fund at least part of students' education. If schools benefit from their students' future success, as suggested earlier, then financial aid also ties schools financially to students' success.

One could also consider adding nonselective public schools as an intermediate educational sector, as done, for instance, by Fu (2014). This set of schools faces an exogenous upper limit on tuition imposed by local governments, which partially fund them, and an overall capacity constraint. As long as public school tuition is lower than tuition in the for-profit sector, for-profit schools will become even more adversely selected. This, in turn, will generate an even stronger incentive to screen out lowest-ability and lowest-wealth students, decreasing college enrollment.

5. MORE GENERAL CONTRACTS

By focusing on loans with noncontingent repayment schedules, we have effectively restricted the set of contracts for education financing to pure debt instruments. A large literature on optimal contracts shows that first-best allocations are obtained with contracts that are fully state-contingent (for this result in the context of education loans, see Lochner & Monge-Naranjo 2014). Such Arrow securities are hard to implement in a world with asymmetric information and limited enforcement. Yet there are many other contract possibilities spanning the space between fully-contingent contracts and pure debt.

a nonprofit institution may have its share of incentive problems if it incorporates empire-building or athletic accomplishments into its objective function.

[11] Epple, Romano & Sieg (2006) develop a structural model in which colleges with different endowments compete for students of varying quality by optimizing their admissions and financial aid policies. Fu (2014) expands this environment by adding imperfect information on student ability, costly search, and public colleges with different objective functions to study a richer equilibrium setting.

5.1. Security Design with Asymmetric Information

A voluminous literature in corporate finance has studied questions of optimal security design in environments with asymmetric information and conflicts of interest. This literature has focused on using security structure to signal private information to the market or on using it to ameliorate agency conflicts between various parties, e.g., firm managers and outside investors (for a survey of the different strands in this field, see Harris & Raviv 1991). Although this approach has been productive in understanding firm capital structure, the case of human capital investment is special. Here, the enterprise is the people themselves. The investment that will generate future uncertain cash flows cannot be repossessed by the investor, and the property rights to the cash flows themselves are incomplete. The security has to elicit optimal effort, but also needs to provide some insurance to make the investment possible in the first place. Finally, the investment generates not only private, but also social returns, which would ideally also be captured by the contract design.

In keeping with the centrality of insurance provision, the seminal paper by Townsend (1979) considers the framework of income-contingent repayments in cases of low income realizations. This framework is motivated by the idea of costly state verification, and the optimal contract is one in which a lender agrees to accept realized income less verification costs as full payment. The repayment schedule in the nonverification region remains fixed. The costlier it is to verify income, the smaller is the range of outcomes over which income-contingent repayments can be offered.

Lochner & Monge-Naranjo (2014) highlight various key characteristics that need to be satisfied by optimal student loan contracts. Unlike fully contingent securities that provide full insurance and equate marginal returns on human capital and the cost of lender capital, optimal contracts that come anywhere close to reality need to deal with a multitude of incentive conflicts. From the borrower side, these include limited commitment to full repayment (discussed above) and unobservable effort that creates moral hazard. From the lender side, these include lack of incentives to internalize the cost of defaults (discussed above) and lender ability to renegotiate contracts and avoid defaults when state verification is costly.

5.2. Alternative Student Loan Policies in Practice

In practice, most countries in which governments provide student loans for higher education offer only a limited number of contingencies for repayment. These contingencies typically allow for deferment and/or forbearance of repayment in cases of severe financial hardship. Explicit links between income and repayment exist in the United Kingdom, Australia, New Zealand, Canada, Hungary, the Netherlands, Chile, and South Africa (OECD 2014, table B5.3). In the United States, IBR programs have become the focal point of recent policy changes.

The recent adoption of IBR programs has begun to generate new empirical research. Although it cannot estimate the welfare effects of IBR contracts, it can characterize the likely winners and losers under these programs. Akers & Chingos (2014), for example, use a representative sample of bachelor's degree recipients in 1993 and augment their survey-reported earnings in 1996 and 2002 to project future income paths. In line with the theoretical literature described above, they find substantial distributional consequences of IBR contracts. An additional and important insight is that the bulk of redistribution occurs because of loan forgiveness and not because of accommodation of labor income shocks. In particular, it is the students who attended high-cost colleges but did not get marketable degrees that benefit most from the current IBR setup. These are not the low-ability students of the setup of Hanushek, Leung & Yilmaz (2014), but rather students whose field of study is supported by a modest wage distribution but whose cost of studying is the same as that of everyone else. In equilibrium, this arrangement might lead students to overinvest

in education. Left unexplored is the question of whether the education obtained by this group of students has high social value as opposed to market value and hence whether subsidies of some form could be warranted.

An additional set of concerns with IBR is purely practical in nature. In their current form, IBRs in the United States rely crucially on market intermediaries. Although the Department of Education funds the vast majority of loans directly, the day-to-day operations, such as collecting payments and implementing deferral and forbearance schedules, are outsourced to a small number of private firms, known as loan servicers. Importantly, student loan servicers determine borrower eligibility for IBR programs and are responsible for collecting the documentation needed to implement them. This institutional framework shares much in common with servicing of securitized home mortgage loans. Just like student loan servicers, mortgage servicing firms have decision-making power in choosing whether and how to modify nonperforming loans, whether to foreclose on the mortgaged property, and, in some cases, what refinancing terms to offer. The recent financial crisis laid bare deep deficiencies in an institutional arrangement that interjects an intermediary between the borrower and the lender when the intermediary's incentives are imperfectly aligned with those of either of the principals. (For a thorough analysis of incentive conflicts in mortgage servicing, see Levitin & Twomey 2011.) For instance, research has found that mortgage servicers of securitized loans were less likely to modify delinquent loans, choosing to foreclose instead (Piskorski, Seru & Vig 2010; Agarwal et al. 2011). They were also more likely to modify loans in ways that preserved the unpaid principal balance, which is the basis for servicer compensation (Agarwal et al. 2011). Finally, relying on a market intermediary to implement policy introduces the risk of not only incentive but also organizational capacity constraints. These constraints can be quantitatively important as well, as demonstrated by Agarwal et al. (2016) in the context of the Home Affordable Modification Program (HAMP). They show that HAMP would have induced about 70% more permanent modifications if servicers with low renegotiation intensity rate (traced to their preprogram organizational design) had been able to renegotiate their loans at the median rate.

Similar organizational and incentive problems appear to exist with student loan servicing. A recent report by the Consumer Financial Protection Bureau (CFPB 2015) highlighted numerous servicing concerns, including difficulties in assessing IBR options or other alternatives to avoid default. In response, the CFPB, the US Department of Education, and the US Treasury outlined a set of principles meant to impose common servicing standards and to tighten enforcement of servicing contracts.

A more streamlined alternative, outlined by Dynarski & Kreisman (2013), would eliminate private-sector intermediaries altogether, integrating student loan payments with other payroll withdrawals such as Social Security and Medicare taxes. This arrangement would likely reduce the administrative costs of collecting payments and verifying income flows in the case of IBR programs. More importantly, this arrangement automatically aligns loan payments with earnings, making IBR the default approach to loan repayment.[12] Declines in income are automatically accommodated, providing additional insurance to borrowers without cumbersome and costly intermediation. Similarly, increases in income trigger higher repayment contributions. In essence, the superior collection technology available to the government in cases of default is harnessed to collect payments in nondistressed states and to make defaults less likely by automatically bundling in the income-contingent insurance component. Many other countries that offer

[12]The Dynarski–Kreisman proposal also calls for progressive repayment schedules that commit a larger share of wages toward loan payments when earnings are high and a lower share when earnings are low. The proposal also allows students to voluntarily commit extra funds to loan repayment, akin to adjusting income tax withholdings. The overall repayment period is capped at 25 years. The progressivity of IBR schedules is a key component in the Canadian student loan system.

income-contingent repayment plans (e.g., Australia, New Zealand, and the United Kingdom) rely solely on their tax systems for program administration.

6. CONCLUSION

The rising levels of borrowing by students and the increasing share of students who borrow raise questions about the impact and sustainability of the financing model for higher education in the United States. Typically, students complete their program of study, begin employment, and repay their loans. However, a growing fraction of students do not experience this favorable sequence of outcomes. These students fail to graduate, find employment unstable, struggle with loan repayment, or experience some combination of these. Some research points to the critical role played by student preparedness, starting with early-childhood education. [Elango et al. (2015) review the early-childhood education literature and reanalyze the key studies in a common framework.] However, even well-prepared students may experience negative shocks, and a robust system of education finance should account for this possibility. The very adverse labor market of the Great Recession increased pressure on educational finance with both increased enrollment and higher loan defaults. This experience laid bare weaknesses in the public financing system and in loan-based student funding.

Much work has tried to examine the effect of rising debt on student borrowers, encompassing both their repayment experience and the impact of debt on other life choices. Although there is some evidence of a debt effect, it can be difficult to isolate from the effect of education itself or from the selection of students into schools and borrowing. Nonetheless, there is rising concern about the costs of a debt-based approach for students and for taxpayers who fund the loan programs. Although government-supported collection partially insulates taxpayers from defaults, this also means that the government collects from students who may be in financial distress, instead of providing insurance, which is a common role of the public sector. Alternative forms of contracts that are state-dependent and provide more insurance are a natural direction in which to proceed, and IBR programs are becoming more common in the United States, as they are in the rest of the world. These approaches, however, are subject to both moral-hazard and adverse-selection problems, which can also greatly increase the cost to taxpayers and create adverse incentives and cross-subsidies.

This discussion, however, focuses on the interaction between the lender and the borrower, as in traditional financing models. Education is unusual, however, in that the investment is explicitly noncollateralized (so that contracting is difficult) and in that there is another form of intermediary. Because education is not a physical capital investment, but instead a service that is capitalized into human capital, schools are also part of the borrowing and lending transaction. (In the loan guarantee program, some schools explicitly took on the school-as-lender model.) Here, we flip the traditional approach: We specify passive lending by a government student loan program with given parameters, and we model maximizing schools as providers of education in a market with a public lending program.

We explicitly consider the role of schools, allowing for both nonprofit and for-profit models as well as both selective and nonselective admissions. We show that the presence of a government-guaranteed lending program insulates schools from their own pricing and enrollment decisions, in the sense that schools will tend to increase both tuition and enrollment beyond the levels they would choose if they internalized the cost of default. The traditional public policy objective, to promote access to higher education for qualified students, is confounded by these incentives. The government guarantee promotes both expanded enrollment and higher pricing. Despite that

higher enrollment may seem to promote the access objective, if students are unprepared and do not graduate, higher enrollment may in fact be counterproductive. Higher pricing both deters enrollment and increases the payment burden on students. Selective schools may have reputational reasons for admitting and educating students who eventually graduate, are employed, and pay back their loans. Nonselective schools, or those without reputational or other incentives, may instead have better-aligned incentives if they have a pecuniary stake in the educational outcomes of their students (and in their students' loans). Although we do not model differential education quality by schools, schools' incentives to admit and graduate qualified students would also extend to an incentive to produce a high value–added education for those students.

We also show that although the loan program may increase welfare by facilitating education that would not otherwise occur, a shift to a student-based loan program shifts debt to the young and can reduce overall savings in the economy. Hence, a shift to loans that holds the level of education fixed (and hence is only a financing shift) is welfare-decreasing. Because these effects are intergenerational, they can be long-lasting, even if the initial shock is temporary.

The frameworks we develop here suggest some avenues for reform. One is to recognize that the loans are not only a contract between a student and the public. Providing incentives for schools to admit, educate, and graduate students prepared to succeed may also be part of a more rationalized funding program. Whether the loan is held by the parent or the student also matters for savings and intergenerational transfers. Young borrowers need to be prepared for this responsibility, and even when the loan is fully paid, this is a form of savings that crowds out other savings in the economy. Further research on education financing that takes into account the incentive and economic effects of payment mechanisms and government financing should help to balance the social and economic benefits of education with the incentive and insurance problems associated with existing and proposed financing mechanisms.

DISCLOSURE STATEMENT

The authors are not aware of any affiliations, memberships, funding, or financial holdings that might be perceived as affecting the objectivity of this review. The views expressed here are only those of the authors and do not reflect those of the Federal Reserve Bank of Chicago or the Federal Reserve System.

LITERATURE CITED

Abbott B, Gallipoli G, Meghir C, Violante G. 2013. *Education policy and intergenerational transfers in equilibrium*. Discuss. Pap. 1887, Cowles Found. Res. Econ., Yale Univ.

Agarwal S, Amromin G, Chomsisengphet S, Ben-David I, Evanoff DD. 2011. The role of securitization in mortgage renegotiation. *J. Financ. Econ.* 102(3):559–78

Agarwal S, Amromin G, Chomsisengphet S, Piskorski T, Seru A, Yao V. 2016. Mortgage refinancing, consumer spending, and competition: evidence from the Home Affordable Refinancing Program. *J. Polit. Econ.* In press

Akers B, Chingos MM. 2014. *Student loan safety nets: estimating the costs and benefits of income-based repayment*. Brown Cent. Educ. Policy, Brookings Inst., Washington, DC

Altig D, Davis SJ. 1993. Borrowing constraints and two-sided altruism with an application to Social Security. *J. Econ. Dyn. Control.* 17:467–94

Ambrose BW, Cordell L, Ma S. 2015. *The impact of student loan debt on small business formation*. Work. Pap. 15-26, Fed. Reserve Bank Phila., Philadelphia

Amromin G, Eberly J, Mondragon J. 2016. *Substitution between parents' home equity and students' borrowing: evidence from the housing boom and bust*. Work. Pap., Northwest. Univ.

Athreya K, Eberly J. 2013. *The supply of college-educated workers: the roles of college premia, college costs, and risk*. Work. Pap. 13–02, Fed. Reserve Bank Richmond, Richmond, VA. **https://www.richmondfed.org/publications/research/working_papers/2013/wp_13-02r**

Avery C, Turner S. 2012. Student loans: Do college students borrow too much—or not enough? *J. Econ. Perspect.* 26(1):165–92

Barrow L, Malamud O. 2015. Is college a worthwhile investment? *Annu. Rev. Econ.* 7:519–55

Belley P, Lochner L. 2007. The changing role of family income and ability in determining educational achievement. *J. Hum. Cap.* 1(1):37–89

Bennett WJ. 1987. Our greedy colleges. *New York Times*, Feb. 18, p. A27

Bleemer Z, Brown M, Lee D, van der Klaauw W. 2014. *Debt, jobs, or housing: What's keeping millennials at home?* Staff Rep. 700, Fed. Reserve Bank N.Y., New York

Brooks JR. 2016. Income-driven repayment and the public financing of higher education. *Georget. Law J.* 104:229–289

Brown M, Caldwell S. 2013. Young student loan borrowers retreat from housing and auto markets. *Liberty Street Economics Blog*, April 17

Brown M, Scholz JK, Seshadri A. 2012. A new test of borrowing constraints for education. *Rev. Econ. Stud.* 79(2):511–38

Cameron SV, Taber CR. 2004. Borrowing constraints and the returns to schooling. *J. Polit. Econ.* 112:132–82

Carneiro P, Heckman JJ. 2002. The evidence on credit constraints in post-secondary schooling. *Econ. J.* 112(482):705–34

CBO (Congr. Budg. Off.). 2010. *Costs and Policy Options for Federal Student Loan Programs*. Washington, DC: CBO

Cellini SR, Goldin C. 2014. Does federal student aid raise tuition? New evidence on for-profit colleges. *Am. Econ. J.* 6(4):174–206

CFPB (Consum. Financ. Prot. Bur.). 2012. *Private Student Loans*. Washington, DC: CFPB **http://files.consumerfinance.gov/f/201207_cfpb_Reports_Private-Student-Loans.pdf**

Chatterjee S, Ionescu F. 2012. Insuring student loans against the financial risk of failing to complete college. *Quant. Econ.* 3(3):393–420

Deming DJ, Goldin C, Katz LF. 2012. The for-profit postsecondary school sector: nimble critters or agile predators? *J. Econ. Perspect.* 26(1):139–64

Department of Education. 2012. *Student Loans Overview: Budget Request 2013*. Washington, DC: US Department of Education. **https://www2.ed.gov/about/overview/budget/budget13/justifications/r-loansoverview.pdf**

Drazen A. 1978. Government debt, human capital, and bequests in a life-cycle model. *J. Polit. Econ.* 86(3):505–16

Dynarski S. 2003. Does aid matter? Measuring the effect of student aid on college attendance and completion. *Am. Econ. Rev.* 93(1):279–88

Dynarski S. 2016. *The dividing line between haves and have-nots in homeownership: education, not student debt*. Evidence Speaks Rep., Brookings Inst., Washington, DC

Dynarski S, Kreisman D. 2013. *Loans for educational opportunity: making borrowing work for today's students*. Hamilton Proj. Discuss. Pap. 2013–05, Brookings Inst., Washington, DC

Eberly J, Krishnamurthy A. 2014. Efficient credit policies in a housing debt crisis. *Brookings Pap. Econ. Act.* Fall: 73–125

Eckwert B, Zilcha I. 2012. Private investment in higher education: comparing alternative funding schemes. *Economica* 79(313):76–96

Elango S, Garcia JL, Heckman JJ, Hojman A. 2015. *Early childhood education*. NBER Work. Pap. 21766, Cambridge, MA

Epple D, Romano R, Sieg H. 2006. Admission, tuition, and financial aid policies in the market for higher education. *Econometrica* 74(4):885–928

FRBNY (Fed. Reserve Bank N.Y.). 2015. *Quarterly Report on Household Debt and Credit, Q3 2015*. New York: FRBNY. **https://www.newyorkfed.org/medialibrary/interactives/householdcredit/data/pdf/HHDC_2015Q3.pdf**

Fu C. 2014. Equilibrium tuition, applications, admissions and enrollment in the college market. *J. Polit. Econ.* 122(2):225–81

Geanakoplos J, Mitchell O, Zeldes S. 1999. Social Security money's worth. In *Prospects for Social Security Reform*, ed. OS Mitchell, RJ Myers, H Young, pp. 79–151. Philadelphia: Univ. Pa. Press

Gicheva D, Thompson JP. 2015. The effects of student loans on long-term household financial stability. In *Student Loans and the Dynamics of Debt*, ed. Brad Hershbein, KM Hollenbeck, pp. 287–316. Kalamazoo, MI: Upjohn Inst. Employ. Res.

Guryan J, Thompson M. 2014. *Report on the proposed gainful employment regulation*. Rep., Charles River Assoc., Boston

Hanushek EA, Leung CKY, Yilmaz K. 2014. Borrowing constraints, college aid, and intergenerational mobility. *J. Hum. Cap.* 8(1):1–41

Harris M, Raviv A. 1991. The theory of capital structure. *J. Finance* 46(1):297–355

Heckman JJ, Lochner L. 2000. Rethinking education and training policy: understanding the sources of skill formation in a modern economy. In *Securing the Future: Investing in Children from Birth to College*, ed. S Danziger, J Waldfogel, pp. 47–83. New York: Russell Sage Found.

Ionescu F. 2009. The Federal Student Loan Program: quantitative implications for college enrollment and default rates. *Rev. Econ. Dyn.* 12(1):205–31

Ionescu F. 2011. Risky human capital and alternative bankruptcy regimes for student loans. *J. Hum. Cap.* 5(2):153–206

Kimball M. 1987. Making sense of two-sided altruism. *J. Monet. Econ.* 20:301–26

Layard R, Psacharapoulos G. 1974. The screening hypothesis and the returns to education. *J. Polit. Econ.* 82(5):985–98

Levitin AJ, Twomey T. 2011. Mortgage servicing. *Yale J. Regul.* 28:1–90

Lochner L, Monge-Naranjo A. 2011. The nature of credit constraints and human capital. *Am. Econ. Rev.* 101(6):2487–529

Lochner L, Monge-Naranjo A. 2014. *Student loans and repayment: theory, evidence and policy*. Work. Pap., Univ. West. Ont.

Looney A, Yannelis C. 2015. A crisis in student loans? How changes in the characteristics of borrowers and in the institutions they attended contributed to rising loan defaults. *Brookings Pap. Econ. Act.* Fall:1–89

Lucas D. 2016. Credit policy as fiscal policy. *Brookings Pap. Econ. Act.* Spring

Lucas D, Moore D. 2010. Guaranteed versus direct lending: the case of student loans. In *Measuring and Managing Federal Financial Risk*, ed. D Lucas, pp. 163–205. Chicago: Univ. Chic. Press

Lucca DO, Nadauld T, Shen K. 2015. *Credit supply and the rise in college tuition: evidence from the expansion in federal student aid programs*. Work. Pap., Fed. Reserve Bank N.Y., New York

Mezza A, Ringo DR, Sherlund SM, Sommer K. 2016. *On the effect of student loans on access to homeownership*. Work. Pap., Finance Econ. Discuss. Ser. 2016-010, Fed. Reserve Board, Washington, DC

NCES (Nat. Cent. Educ. Stat.). 2013. *Digest of Education Statistics: 2013*. Washington, DC: NCES

OECD (Org. Econ. Coop. Dev.). 2014. *Education at a Glance 2014: OECD Indicators*. Paris: OECD. **http://www.oecd.org/edu/Education-at-a-Glance-2014.pdf**

Piskorski T, Seru A, Vig V. 2010. Securitization and distressed loan renegotiation: evidence from the subprime mortgage crisis. *J. Financ. Econ.* 97(3):369–97

Rothstein J, Rouse CE. 2011. Constrained after college: student loans and early-career occupational choices. *J. Public Econ.* 95:149–63

Saul S. 2015. For-profit college system expected to pay millions. *New York Times*, Nov. 15

Stinebrickner T, Stinebrickner R. 2008. The effect of credit constraints on the college drop-out decision: a direct approach using a new panel study. *Am. Econ. Rev.* 98(5):2163–84

Townsend RM. 1979. Optimal contracts and competitive markets with costly state verification. *J. Econ. Theory* 21(2):265–93