Evaluating the Public Cost, Relative Subsidy, and Repayment Burden of Selected U.S. Student Loan Repayment Options

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American students are graduating from college averaging tens of thousands of dollars in debt, leading to substantial repayment burdens and potentially inefficient shifts in spending patterns and career choices. A political trend towards austerity coupled with the rising student debt make effective allocation of federal higher education resources a high priority. The repayment option students currently start in after graduation, standard, was the cheapest option, and the only one estimated to impose a significant repayment burden on the borrower, ranging up to 12 percent of pretax income for people in the poorest income quintile. Of the three income-contingent repayment options modeled, the Student Loan Fairness Act (SLFA) is estimated to be the most expensive, with an average subsidy of $16,630 for the lowest income quintile. The net present value of loan repayment for SLFA is 42 percent of the amount repaid in the standard scheme, reducing government revenues. To evaluate robustness and demonstrate the impact of rapidly growing student debt, individuals were allocated debt at 1993 and 2008 levels, which significantly increased the relative public cost of every income contingent plan. The evidence gathered indicates student loan repayment design is heavily influential in both individual ability to repay the loans and government capacity to finance the scheme.

Table of Contents

Acronyms

Adjusted **G**ross **I**ncome
Baccalaureate **&** **B**eyond
Congressional **B**udget **O**ffice
Cross-**S**ectional
Federal **D**irect **S**tudent **L**oan **P**rogram
Federal **F**amily **E**ducation **L**oan **P**rogram
Federal **P**overty **L**ine
Guaranteed **S**tudent **L**oan
Income **B**ased **R**epayment
Income **C**ontingent **L**oan
National **L**ongitudinal **S**urvey of **Y**outh
Pay-**A**s-**Y**ou-**E**arn
Parent **L**oan for **U**ndergraduate **S**tudents
Student **L**oan **F**airness **A**ct

Figures

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Introduction

The rising costs and debt levels associated with a college degree have pushed institutions, policymakers and grassroots organizations to prioritize the reform of student financial aid systems and loan repayment structures. In 2011 federal disbursements for student loans constituted $104 billion, grants $34.8 billion, and tax benefits for tuition and college expenses $14.8 billion (Congressional Budget Office, 2011).[i] Total outstanding student debt grew to $870 billion in 2011, putting it beyond credit card ($693 billion) and automotive ($730 billion) debt (van der Klaauw, et al., 2012). Members of Congress have sustained student loan reform in the policy agenda with multiple proposals in 2012 and 2013 (Petri, 2012; Bass, 2013). Further, President Obama specifically mentioned college debt in his 2013 State of the Union noting, "skyrocketing costs price too many young people out of a higher education, or saddle them with unsustainable debt." Petitions regularly circulate for student loan reform, including citizen requests for mass forgiveness of student debt. The Bill and Melinda Gates Foundation granted $3.3 million in funds to over a dozen organizations to research new methods of making college more affordable and support student degree attainment (2012). The clarion call rings clear for reform to ease the burden of student loan debt on individuals and the economy.

American institutions of higher education have been increasing tuition and fees at a rate greater than the United States government has been increasing student financial grants. State funding for higher education has also declined precipitously in recent years (Sigritz, 2012). The aforementioned trend is helping to drive federal investment in student loan programs as a method to bridge the gap, pushing more students into debt at graduation. In 2012, the U.S. invested more in student loans than all other student financial aid programs combined (College Board Advocacy & Policy Center, 2012). The individual amount of student debt continues to grow faster than inflation, with the average student loan debt for a college graduate of the class of 2011 at $26,600 (Reed & Cochrane, 2012). Student loan payments can be an onerous obligation for low and moderate income earners and can depress personal consumption and household formation (Mishoy & O'Sullivan, 2012). Debt burdens are currently high enough to cause some

economists with the Federal Reserve Bank of New York to argue it is significantly decreasing home and car purchase rates (Brown & Caldwell, 2013). A secondary effect is the reduced willingness of indebted graduates to seize an innovative or entrepreneurial opportunity because they cannot bear the increased payments or any further risk. Once students graduate or drop out, they are initially placed in a "standard" mortgage-style repayment plan with fixed payments over a 10 year cycle. The significant size of these payments has caused many students to seek alternative repayment options; some plans have per cycle payments and loan durations contingent on individual income. These income contingent loans can be diverse in their relative cost to higher or lower income brackets, depending on the specific structure of the plan. The current format of U.S. student loan repayment options is complicated and diverse, with little understanding of the impact of the repayment plans available for new graduates.

This thesis examines the average cost and relative subsidy size by income quintile of representative U.S. student loan repayment schemes to better grasp the implications of using a mortgage-style instead of income contingent repayment structure. In order to calculate the results, annual data was collected from the National Longitudinal Survey of Youth '79 until 2010. Then, to reach a complete 25 years of wages ending in 2013, missing and unobserved data are simulated based upon an individual's previous wages. Because student debt levels are not included in this data set, they had to be simulated and were set to be comparable to the debt levels of graduates at two points in recent history, 1993 and 2008. The repayment options of standard, income based repayment (IBR), Pay-As-You-Earn (PAYE) and a recent legislative proposal titled the Student Loan Fairness Act (SLFA) are estimated for both debt levels, although sufficient data is unavailable for exact replication. Prior to estimating repayment schemes all financial data, from debt levels to individual wages, were inflated to 2010 prices. Variation in individual subsidies and average costs derived from the repayment options are modeled by income quintile.

The results provide insight on how loan design can alleviate repayment burdens on an annual and lifetime basis for low income U.S. college graduates and shield the taxpayer from excessive costs. First, the standard loan repayment option is found to contain no implicit subsidy and instead a small profit to the government, given the assumptions surrounding interest rates

and debt levels. The standard option also has no variation in repayment by lifetime or annual income, imposing the largest burden on low income borrowers. Next, the IBR option is shown to have a substantially lower repayment burden than the standard option through the forgiveness of long term debt as well as an interest rate subsidy. PAYE and SLFA are similar to IBR but with significantly more progressive and generous terms, benefiting lower income quintiles relatively more and costing the public a similar sum. The amount of debt held by a graduate significantly alters the scale of the subsidy in an income contingent program, illustrated by the fact that an average graduate with SLFA would have 28.7 percent of the loan value subsidized using 1993 debt levels, rising 160 percent to 45.8 percent with the higher 2008 debt, all at constant 2010 dollars.

While other researchers have looked at the impact of similar student loan repayment structures in other countries, few have attempted to express this in the United States (Vandenberghe & Debande, 2007; Shen & Ziderman, 2009; Chapman & Lounkaew, 2010). Available U.S. research on student loan repayment structure is both outdated and restricted by the use of limited earnings paths (Dresch & Goldberg, 1972; Nerlove, 1975). I have constructed salary paths from collected data for 502 actual U.S. college graduates concluding in 2013. This data permits individuals to be ranked according to their income and distributed into one of five income quintiles. The analysis which follows gives an estimate of the average portion of the loan balance repaid as well as the repayment burden of the different student loan repayment schemes. While Ionescu (2009) conducted an analysis of the effect of income contingent loans on default rates and individual earnings, my presented models instead focus on the financial impact of varying repayment terms within an ICL. With the pooling of individuals into income quintiles, the literature is advanced with a U.S. analysis of the progressivity and redistributive nature of the varying education reform options previously only utilized in an international context (Dearden, et al., 2006; Johnston & Barr, 2013). Lacking in the literature are pooled and disaggregated estimates of subsidy levels for the IBR and PAYE repayment schemes, as well as any discussion of the SLFA. Shifting more borrowers to either of these schemes would have significant implications for individual and aggregate costs of college. The literature provides no guidance on the impact of these repayment schemes on varying income brackets. Disaggregated, the results

permit the identification of which modifications to the design of student loans increase the cost to all borrowers or only those in certain quintiles, based upon the level of loan forgiveness and the interest rate subsidy.

The next section reviews the literature on student loan design and its distributional and fiscal effects. A missing markets framework defining the imperfections within the student loan market is first introduced to outline the public role in subsidizing loans for college students. The following section introduces the empirical framework and data used to assess the four loan designs, including assumptions used for the data simulations. Next, the results are presented and the three options are compared in terms of progressivity and cost-effectiveness by assessing the fiscal and distributional costs and benefits. Concluding the thesis is a discussion of the policy implications for U.S. student loan repayment design.

Literature Review and Theoretical Framework

Quality higher education for a population is a uniquely challenging public policy issue, which most developed nations have addressed by incorporating varying degrees of public finance of students tuition and fees. Without sufficiently generous student loan repayment terms, or guarantees against risk, low income students are likely to avoid potentially profitable human capital investments. There are a variety of choices available to policy makers who want to address an assumed shortage of funding for higher education. Individual-specific human capital contracts are introduced and rejected on economic and ethical grounds. Some nations have had success with a program which provides free higher education for their citizens, but they are usually limited in size and population. A graduate income tax avoids many of the aforementioned problems, but suffers from a fatal messaging flaw, being called a tax. The final national strategy considered is income contingent loans, which are determined to be the superior balance between repayment burdens for borrowers and cumulative program cost. Application of the framework is conducted following an explanation of the U.S. student financial aid context. Emphasis is placed on the different types of student loan repayment schemes in the U.S. to conclude this section.

Governments in most developed (and some developing) countries have a system of public student loans, with over 70 nations federally subsidizing student loans (Shen & Ziderman, 2009). A variety of reasons are consistently used to defend and explain government intervention in the credit market for higher education finance. First, college degrees provide skilled employees which improve economic output and national productivity. If a nation's workforce is undereducated then potential economic growth and productivity are lost (Cigno & Luporini, 2009). Moreover, when higher education has an upfront cost, access may be determined by ability to pay rather than academic ability. The cost of such a system is an underutilization of human capital potential, further reducing economic output (Chapman, 2006). Barr (2004) notes technological advancement has further increased the demand for high-skilled workers and, at the same time, per capita productivity must increase to counter the demographic aging of the

workforce. A pertinent example of the trend is seen in the drop in production and increased health expenses potentially resulting with the retirement of the "Baby Boomer" generation. Both of the aforementioned trends contribute to the growing need for the U.S. workforce to be more highly educated. Second, there are positive externalities from a more educated population, such as lower crime rates and improved health outcomes (Lochner & Moretti, 2004; Cigno & Luporini, 2009). Another positive externality mentioned is the increase in tax payments resulting from the increased individual earnings, titled a "tax dividend" (Barr, 1993).

Additional problems arise from pure market provision in higher education finance, due to missing market problems in the absence of tangible collateral. The theoretical framework for human capital market failures began with economist Milton Friedman (1955), when he wrote of an imperfection in the human capital markets causing an underinvestment in higher education without government involvement. Because an education is intangible, unlike a house or car, it cannot be repossessed in the event of non-repayment, and therefore will not receive the same degree of investment from the capital markets and lenders, unless a high interest rate is charged. College degrees are risky investments, with differences across university, major, and time, among other traits, further complicating the situation for investors. The negative repercussion of the risk, loan default, has been increasingly likely in recent years, with the 2-year default rate on federal student loans at 9.1 percent for the 2010 student cohort, a near doubling from five years earlier (4.6 percent) (Department of Education, 2012). A recent analysis points out the numbers are attenuated because of the requirement for an individual to be past due for 9 months prior to being counted in the official default statistics, and argues a more accurate representation of the problem is 27 percent of student loan borrowers are past due (van der Klaauw, et al. 2012). Without collateral or assurance of income, students can rely on parents to assist in financing their higher education. This leaves students from poor families with limited options, and without government intervention they will be severely restricted in their ability to finance higher education (Cigno & Luporini, 2009). Research by one government organization, the Advisory Committee on Student Financial Assistance (2006), indicates 1.4 to 2.4 million bachelor's degrees will be lost because of the price barriers in place preventing capable low-income

students from attending college. In the end, the risk and poor information surrounding student loans will cause a widespread underinvestment in college education.

The problems with risk and poor information do not stop with the lender. Student borrowers do not know their income after graduation when first enrolling at a university, or sometimes even their field of study (Connor, et al., 2001). Individual financial aid packages often vary from year to year during a student's time in college, increasing the complexity and decreasing the availability of complete information for students. Some students do not graduate and hence do not receive the college degree wage premium to accompany the new debt. A particularly threatening problem for potential students is debt aversion, which Barr defines as when individuals, "under-estimate the benefits of higher education and/or over-estimate the costs, it might be rational for them, *given what they know*, to be unwilling to take out a loan," (2004, p. 17). The limitations on the information available to the individual to make the cost-benefit analysis are the cause of potentially irrational economic actions. Students from low income backgrounds are more likely to have less support and information from their family or community (King, 1996). Barr (2001) notes asymmetric information can cause a failure of the market to accurately insure certain investments and risks. Callender and Jackson (2005) have shown individuals from lower social classes are significantly more likely to be debt averse than other students. Further surveys all indicate students fear the cost of higher education as a reason not to enroll (Connor, et al., 2001; ISAC, 2003). Belzil & Leonardi (2007) found the impact of an individual's risk aversion was equivalent in strength to their parent's educational background in determining their decision to attend college. One reason given for the different perspective low income students have than their wealthier peers is their perception of student loan debt as a less worthwhile investment relative to the short term financial burden (Callender & Jackson, 2008). Students in one study were implicitly willing to pay 4 percent more to finance college through a contract than a loan, indicating a labeling effect (Caetano, et al., 2011). Hahn and Price analyze the results of a national U.S. survey and comment, "overwhelmingly, counselors and college-qualified students who did not enroll in college – non-college goers – pointed to college cost and the availability of aid as primary obstacles to college enrollment," (2008, p. 4). Improving the access of information on the benefits to a higher education is a worthwhile

investment because research indicates low income students underrate the potential increased wages from a college degree (Betts, 1995; Callender & Jackson, 2008). The U.S. financial aid system is decidedly complex, with the Federal Application for Financial Student Aid (FAFSA) having nearly as many questions as the individual income tax form (Dynarski & Scott-Clayton, 2006; Dynarski & Wiederspan, 2012). Given the myriad array of requirements and options it is no surprise students are routinely misinformed about financial aid they are eligible for (Scott-Clayton, 2012). The preceding avalanche of research on information and constrained flows of financial understanding for low-income students show quite clearly perfect information, and the capacity to process it, is not present in free credit markets for human capital. With this market failure, government involvement becomes necessary.

In remedying the problem, Friedman (1955) initially alludes to the possibility of private capital contracts which would allow individuals to buy "shares" in the labor income of an individual for a set duration. Perhaps recognizing the political toxicity of such a plan Friedman acknowledges its similarity to indentured servitude, but still provides an economic justification for his aversion. The administrative cost of coordinating as many unique human capital contracts is an implausibly expensive task and a natural monopoly may arise. Human capital contracts are still promoted as a route to address the underinvestment in higher education because the individual student capital contract can be designed to reflect differences in expected future earnings (Palacios, 2002). If borrowers have any issues affording the human capital contract payments, they would likely struggle to find agreement on refinancing the loan terms, locking borrowers into potentially unsustainable debts (Gillen, 2012). Other researchers have found human capital contracts and income contingent loans similar in their equitable effect (Vandenberghe & Debande, 2007). Human capital contracts have met with mixed applied success by student loan lenders, as previously prominent lender MyRichUncle went bankrupt during the onset of the recession in 2009 but another lender, Lumni Inc., continues to create these contracts at a much smaller scale.

On the opposite side of the spectrum, countries could provide free education for all of their citizens which would completely suppress the debt aversion issue and enhance positive

externalities. Some nations already provide free education for all capable of meeting minimal standards, such as Norway, Finland and Denmark (Johnstone, 2009). These nations significantly enhance access but also have unique political economies – small populations, large welfare states and substantial tax revenues – making "mass" public higher education possible. Barr (2004) notes this "Scandinavian model" treats the investment in rendering education free as both moral and a basic right, which he outlines may be infeasible for countries with larger populations and lower willingness to tax, such as the U.S. On equitable grounds, some have argued there is little reason to provide free education for all. Individuals with a college degree have sizable private returns in the form of higher wages across the lifecycle (Chenevert & Litwok, 2013; Carnevale, Rose, & Cheah, 2012). One estimate by U.S. Census Bureau researcher Tiffany Julian (2012) found a college degree increased average individual lifetime earnings by around $1 million and the amount which human capital boosts wages has been steadily increasing in recent decades. To give these borrowers a subsidy in excess of the difference between the cost and the private return would be a perverse redistribution with public and economic costs not benefits. This is particularly true of taxpayers who did not attend college and therefore receive no wage benefits but have to assist in repaying the debt of college graduates with higher wages. The end result would be a regressive taxpayer subsidy for relatively well-off college graduates, which Barr (2004) argues is far from an equitable public policy.

A variant of the free higher education for all option would be to have the government finance college for all of their citizens but charge all graduates an income tax surcharge to cover the cost. Commenting on the graduate tax, Friedman notes, "the free choice of individuals would tend to produce the optimum amount of investment," (1955). A graduate tax would socialize the gains and losses from federal higher education investment, potentially preferable to income contingent loans with limited opportunity for social gain (Holt & Delisle, 2012). The likelihood of a graduate tax being implemented in the U.S. is quite low given the political toxicity of tax increases. Transitioning from the current upfront payment system to a delayed repayment system with the chaotic variety of private and public institutions of all kinds would be a friction filled effort for U.S. institutions of higher education. When the tax code is utilized to conduct any policies outside of revenue collection, there are implicit risks to economic efficiency, which

Oosterbeek (1998) argues should not be ignored. There are also enormous upfront cost that may be hard to finance given the current fiscal climate, until the first graduates reach high enough incomes and hence sufficient repayment streams. Finally, it is very difficult to collect any revenue from a graduate income tax if the borrower is not earning any U.S. income because of emigration or unemployment (Vandenberghe V. , 2011).

A popular hybridization of the student loan system and the concept of a graduate tax are income contingent loans (ICL). Students receive a loan balance scaled with their time in school and efforts to decrease the cost of college through employment and scholarships, similar to a standard student loan. Instead of fixed payments every month over a 10 year period, as in a mortgage-style student loan, the income contingent loan payment is a percent of income over a certain threshold until the debt is repaid or loan forgiveness is initiated. Loans are forgiven after a debtor has made consistent payments for a set amount of time, typically between 10 and 30 years (or death). The ICL scheme reins in loan payments and dilutes the risk of low return-on-investment for student debtors (Dente & Piraino, 2011). ICLs are in place in the United Kingdom, Australia, New Zealand, Chile and Thailand, among other nations (Chapman, 2006). Some of the many repayment options for student loans in the U.S. are income contingent, although they are differ significantly from their international relatives. ICLs are favored because they match individual wage growth more closely, creating a smaller burden on individuals when they have the lowest income of their life-cycle. The validity of this hypothesis is tested in the results section to follow. Similar to the graduate tax, ICL removes the risk of default inherent in most credit markets, including those for mortgage-style student loans. The income contingent loan scheme assists in overcoming low-income student aversion to debt because the repayments would never be an unsustainable share of income nor drive a borrower into bankruptcy and default (Barr, 2004; Chapman, 2006).

Income contingent loan designs vary significantly. Governments can choose to cap the accumulation of interest while in repayment or subsidize the interest rate by keeping it below a ceiling or at a constant percentage. A common policy is to peg the interest rate at the government’s cost of borrowing plus a small percentage for operational expenses, as done in

New Zealand during the 1990s (Barr, 2004). Subsidizing the interest rate on an ICL has been shown to be a significantly costly public policy, estimated to cost between 25 percent and 30 percent of total borrowing depending on the estimated borrowing costs for the government in England (Johnston & Barr, 2013). Another option for an income contingent loan is to vary the threshold at which the income starts being included in the payment calculations. Likewise, a small increase in the percentage of income included in payment calculations can cause substantial variation in payments. These features are the primary drivers of variation in ICLs between nations and policy proposals, and help to determine the cost and generosity of the program (Dearden, et al., 2006; Shen & Ziderman, 2009). While numerous studies (Courtioux, 2008; Dearden, et al., 2008; Higgins, 2011; Johnston & Barr, 2013) have examined how ICL design influences the size and distribution of the loan subsidy, none have assessed the impact of ICL design on the subsidy levels provided in the United States. There is good reason for the dearth of research, given only one of the four schemes modeled in this paper was implemented prior to 2007 (standard), and one was proposed in 2013 (Student Loan Fairness Act).

The U.S. Student Aid Context

Since 1965, student loans have been a part of the federal financial aid mix, beginning with the Guaranteed Student Loan (GSL) program. These were private loans issued by banks, but guaranteed by the government in case of default. The GSL program was designed to be a government subsidization of student loans for low and middle income families, the only borrowers eligible for GSL, and incorporated a standard mortgage style repayment structure. GSL has been transformed over the years, initially by making it available to more students, and then back to being strictly means tested and receiving a name change to the Stafford Loan program. In 1992, the subsidized Stafford Loans were joined by unsubsidized, but still guaranteed, Stafford Loans, substantially broadening access to federal student loans (Orfield, 1992). The subsidized Stafford Loan accounts for 35 percent of total student loans, while the unsubsidized Stafford Loan is 41 percent in 2011 (College Board Advocacy & Policy Center, 2012). Later the Stafford loans were split into two varieties, one financed by the U.S.

government and the other by the private lenders, as before. The two loans, both still with standard repayment schemes, were given different names: privately financed Stafford loans were called the Federal Family Education Loan Program (FFELP), and the publicly funded variants were called the Federal Direct Student Loan Program (FDSLP). Both the public and privately financed Stafford loans were subsidized and unsubsidized, with subsidized loan eligibility means-tested. The interest rate was adjusted to 6.8 percent for unsubsidized Stafford loans and 3.4 percent for subsidized student loans in 2006, but the subsidization requires annual renewal, currently set to expire on July 1st, 2013. FFELP was eliminated in 2010 making the U.S. government the financer and servicer of all federally guaranteed student loans, potentially saving $68 billion between 2010 and 2020 (Congressional Budget Office, 2010). Currently, the William D. Ford Direct Loan program maintains the federal subsidized and unsubsidized student loan programs.

Figure 1: Federal Guaranteed Student Loan Interest Rates Applicable to Sample

Year	Nominal Interest Rate	91-Day T-Bill
1978	7.0%	*N/A*
1979	7.0%	*N/A*
1980	7.0%	*N/A*
1981	9.0%	*N/A*
1982	9.0%	12.1%
1983	8.0%	8.7%
1984	9.0%	9.9%
1985	8.0%	8.2%
1986	8.0%	6.6%
1987	8.0%	5.8%
1988	8.0%	6.4%
1989	8.0%	8.4%
1990	8.0%	7.9%
2010	4.8%	0.12%

Source: Authors calculations from CBO data (2013).

Outside of the Direct Loan program, the federal government also provides the small Perkins Loan program for high-need students, making up less than one percent of total student loans. Parent Loans for Undergraduate Students (PLUS), which are given to the parents of students to help cover the difference between the aid available to the student and the cost of college, are also unsubsidized and account for 16.5 percent of total education loans. Because this program is not targeted towards students but parents, it is largely ignored by the literature, although the PLUS loans are technically part of the Direct Loan program.

Once a student graduates from college with a mix of up to four different federal loans, they must determine how to repay the debt. Private lenders establish specific and unique payment terms with borrowers, often similar to the mortgage-style repayment scheme. Federal loans are eligible for eight different repayment options in 2013 (see Figure 2), although every debtor starts out in the standard repayment scheme. The repayment options can be split into two general categories: standard and income contingent. Borrowers can move between schemes during the repayment period, a potential complication not factored into this analysis. Were a borrower to shift to an income contingent loan at the end of a standard repayment cycle, they could have an increase in the total repayment burden since they are unlikely to reach the point of forgiveness yet would make smaller payments on the principal balance.

Standard loans have a minimum payment of $50 per month, and are repaid in identical monthly payments until the loan is fully paid. The maximum repayment duration of these loans is 10 years, which could compress large debt into unsustainable monthly payment levels for graduates with high debt. Researchers estimate student loan payments greater than 5 to 10 percent of pretax income would be considered too much debt (Scherschel, 1998; Baum & Schwartz, 2006). Pure standard repayment is a 10 year "fixed" payment structure similar to a mortgage style loan. This variant can be "extended" to 25 years, with the payments split over 300 instead of 120 months. Another standard category options is the "graduated" repayment structure, where the repayments start low but increase every 2 years until the total amount is still cleared in the standard repayment period of 10 years. "Graduated" repayment is also eligible for "graduated-extended," which increases the term to 25 years instead of 10, with the payments still growing biennially. Standard plans have a variety of methods to help low income borrowers by delaying repayment including: deferment, which postpones repayment and interest when the loan is subsidized, or forbearance, which stalls repayment but still incurs interest charges for all student loan types (Dept. of Education, 2013). In many cases this is not enough assistance, and debtors with low earnings and high debt run the risk of defaulting on their student loans, a growing concern. These mortgage-style loans are considered less responsive to the labor market than income contingent loans are (Dente & Piraino, 2011). To control the risk of default because

of the imbalance in earnings and debt many nations utilize a different scheme where payments are tied to individual income.

When looking at income contingent repayment plans, the discussion becomes more convoluted because the U.S. system only permits certain types of student loans from being included in different income contingent repayment plans, none of which will allow parent PLUS loans. Working through the plans in chronological order, the "income contingent" repayment plan was introduced in 1994 and only includes FDSLP loans. This option is the most complex, with the repayment calculation being the lesser of two options: the amount if the loan was repaid in twelve years controlled by an income factor, or 20 percent of discretionary income. Discretionary income is equal to an individual's adjusted gross income in excess of 150 percent of their federal poverty level. The "income sensitive" plan is similar, but includes only FFELP loans serviced by a private lender, and the terms are still based on a 10 year repayment plan with only modest income scaling. Next the "income based" plan, created in 2007, has payments set at 15 percent of an individual's discretionary income. After payments are successfully made in an "income based" or "income contingent" plan for 25 years, all remaining qualified student loan debt is forgiven. Pay-as-you-earn (PAYE), the newest entrant to the crowded repayment options market, was first implemented in 2012. While borrowers can include FDSLP subsidized, unsubsidized and consolidated loans, they must have started borrowing after October 1st, 2007, and received a loan disbursement after October 1st, 2011, severely restricting the pool of eligible borrowers. PAYE does have the most progressive repayment terms, with a 20 year forgiveness period coupled with only 10 percent of discretionary income due monthly. The IBR and PAYE plans have a provision which prevents student loan debt from increasing for the first three years of repayment, which is incorporated in to the following repayment analyses. Unfortunately, the austere fiscal climate gives no guarantee the PAYE program will be continued indefinitely. For example, in 2012 the House Budget Committee recommended significant reductions in the cost and progressivity of the income based repayment plan (Asher, 2012). A summary of all available student repayment options is provided in Figure 2.

Figure 2: Current Federal Student Loan Repayment Options in the United States

Option		Maximum Duration (Years)	Percent of Discretionary Income	Eligibility Restrictions
Fixed	Standard*	10	N/A	None
	Graduated	10	N/A	None
	Extended	25	N/A	>$30,000 debt
	Graduated-Extended	25	N/A	>$30,000 debt
Income Contingent	Income Based*	25	15	Means-Tested
	Income Contingent	25	20	None
	Income Sensitive	10	Contingent on Private Lender	None
	Pay As You Earn*	20	10	Means-Tested

Source: U.S. Department of Education, 2013.

* = Indicates an option is one of the three actual repayment options included in the models to follow.

In contrast to some members of the U.S. House of Representatives wanting to reduce the graduate benefit from repayment options, Representative Karen Bass (D-CA) has introduced a generous reform option (2013). The proposed legislation is called the 2013 Student Loan Fairness Act (SLFA), and although it does not have a high likelihood of passing, it is an interesting case. Forgiveness in the new income contingent loan scheme created by the SLFA occurs after 10 years of repayment, and only 10 percent of the income over the discretionary income threshold is repaid. Rep. Bass' proposal includes a cap on loan forgiveness, but fails to describe what would be done with the remaining balance. Also, all borrowers would be eligible, and the nominal interest rate is set at 3.4 percent (0.18 percent real rate) for all federal student loan debt, eliminating the divide between subsidized and unsubsidized federal loans[ii]. To display

the average fiscal and distributive impact of a highly progressive repayment option, the SLFA is modeled and tested later.

One caveat to the American income contingent options is the uniquely regressive requirement for forgiven student debt to be considered taxable income. In effect, if an individual earns low income for their entire career and received debt forgiveness after 25 years of repayment, they could well see a doubling or greater increase in income taxes without any new income (Lieber, 2012). Individuals who receive forgiveness would then likely need to cut back on consumption or succumb to tax debt instead of student loan debt, with far worse repayment terms. Rep. Bass' plan (SLFA) does not tax the forgiven loan balance, potentially increasing its redistributive magnitude relative to the current options.

Choosing to utilize income contingent loans instead of mortgage-style loans as a remedy for the human capital market failure is only the first step in designing a student loan repayment scheme. With budgetary and distributional consequences, the features which are important include: method for determining payment amount, interest rate, maximum amount, eligibility, and nature of the program (Barr, 2004; Dente & Piraino, 2011). Recent U.S. proposals for reforming the income contingent repayment schemes and student financial aid in general have varied widely. Many recommendations include decreasing the years of repayment until the loans are forgiven, with some proposals arguing it should be as quick as 10 years (Burd, et al., 2013; Bass, 2013). All proposals which shift the repayment period also adjust the percentage of income being repaid per month and the threshold where the income begins to count towards repayment, almost exclusively in the direction of greater economic progressivity. A more controversial proposal is to remove the interest rate subsidy on student loans and link it to the government cost of borrowing, because the subsidy is both regressive and redundant with income contingent loans (Johnston & Barr, 2013; Burd, et al., 2013; Abernathy, et al., 2013). Perhaps the least controversial reform to the student financial aid system is to make income contingent repayment the normal option students are immediately placed in after graduation to avoid adverse selection (National College Access Network, 2012; Shen & Ziderman, 2009; Doyle, 2013). Instead of depending on private loans which would fall outside of the ICL repayment scheme, the

maximum amount would need to be sufficient to cover the total cost of attending any university. Another option in ICL schemes is to collect the loan payment through an individual's paycheck or federal taxes. Implementing this policy would reduce administrative costs and repayment failures (Barr, 2002). Clearly, there are many options for reform, but those selected here are the most prominent and commonly modified internationally to achieve policy goals: interest, forgiveness and debt level. Income contingent loan repayment schemes are now modeled relative to the standard fixed repayment scheme.

Methods

To demonstrate differences between the loan repayment options, data must contain individual earnings every year after graduation and prior to full loan repayment or forgiveness. The selected dataset nearly fulfills this need, as it is missing some data, but interpolation permits continuation. After salary paths and student debt levels are measured, calculations of student loan repayments are estimated. Successful international analyses have first assessed differences between the original loan size and the actual repayments made over the life of the loan (Shen & Ziderman, 2009). Termed a hidden grant, it represents a subsidy for college graduates and an indirect cost for taxpayers. Initially, the grant will be made up of the difference in the government's cost to loan the money and the value of the interest payments plus default expenses. When loan schemes incorporate income contingency and debt forgiveness, the hidden grant is further devolved into two types of subsidy, the interest rate and the loan forgiven (Johnston & Barr, 2013). The average amount of the loan repaid and the portion of total income diverted to student debt repayments are also useful measures included to help compare loan design (Baum & Schwartz, 2006; Dearden, et al., 2008). Simply looking at mean values for these metrics is sufficient for a fiscal but not a distributional analysis, therefore the final assessment is split into income quintiles. With these five income categories, the analysis permits comparison of subsidy levels between low and high income college graduates.

Data

Earnings data for the same individuals over 20 to 25 consecutive years after graduation is needed to conduct any useful analysis on student loan repayment. Such data is largely unavailable for long enough periods of time. One method used to avoid this limitation is by creating small groups of people in 5 or 10 year increments throughout the life cycle; then stacking these to create a synthetic earnings profile by matching individual characteristics in each group from 25 to 64 years of age (Kantrowitz, 2007). The U.S. Census provides an occasionally updated

analysis of the return to a college degree and utilizes this tactic with 10 year bins until 2002, when the method was improved to five year bins by 2011 (Day & Newburger, 2002; Julian & Kominski, 2011; Julian, 2012). Carnevale, Rose and Cheah also utilize this approach in their lifetime earnings analysis, because "no data source exists with a large number of cases that tracks individuals through their career by earnings, […] and this approach is the only viable one to construct even a rough estimate of lifetime earnings," (2012, p. 21). These studies give up the logical and statistical consistency gained from having the same individual's earnings data over a career path and instead combine many individuals to simulate one.

The National Longitudinal Survey of Youth (NLSY) 1979 is a panel survey with actual wage data from the point of college graduation to 2010, for all years surveyed. Individuals within the NLSY '79 sample are men and women born between 1957 and 1965 and living within the U.S. when the survey began (Bureau of Labor Statistics, 2005). Only individuals with exactly 16 years of education were included to maintain the income effects for individuals who earned a college degree and restrict the debt distribution to undergraduate education. During mostly annual interviews, substantial data was collected, including labor income (hereafter referred to as wages). While other options were assessed, the NLSY '79 was identified as best suited for the needed analysis.[iii] Nonetheless, the more complete salary paths provided by the NLSY' 79 are tied to graduates who left college in the 1980s and 1990s, when college debt levels were relatively low. Hence, employment decisions (and therefore wage outcomes) may be under less strain from college debt, relative to employment decisions being made by current graduates. Greater detail on the NLSY '79 is included in the appendix.

Student debt at graduation is a vital but omitted variable in the NLSY '79 dataset. Actual federal student debt is distributed depending on the results of the FAFSA, which varies mainly with parental and individual income but assumes all families meet the expected contribution level. This expectation makes simulating debt with parent wealth problematic, because the distribution of debt by income is much flatter than expected.[iv] I created a proxy system of assessing college debt, initially based upon the 1993 Baccalaureate & Beyond (B&B) Study, which was selected because it was closest to when the NLSY '79 graduates completed college

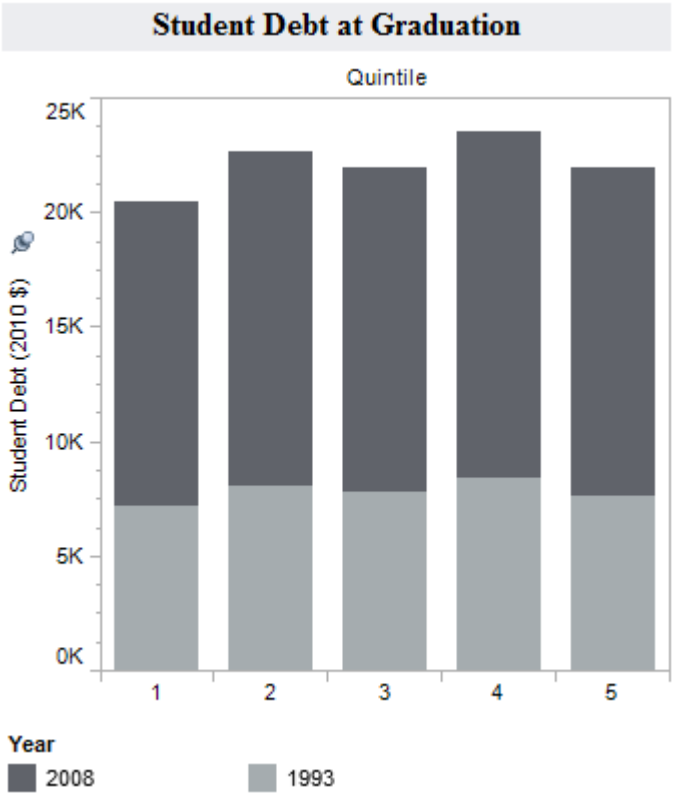
(National Center for Education Statistics, 2003). Every individual in the sample is given a debt level, whereas in reality many students do not take out any debt to graduate college (College Board, 2013). The individuals who avoid any student loan debt are not borrowers, and are not of interest in this analysis of student loan repayment design. Debt levels at graduation for five thresholds were extracted, including modest (25th, 50th, 75th) and extreme percentiles (10th, 90th). These debt levels were randomly and uniformly distributed to the graduates to match the B&B '93 distribution. The resulting randomization causes variation in the average student debt in each quintile, visible in Figure 3. The year of a student's actual college graduation was incorporated to deflate the debt amount from 1993 to their proper year of graduation.

The clamor to reform student loan repayment has garnered growing public and policy interest partly because of the surge in tuition and student debt over the previous couple of decades. Student debts shift has been sudden and dramatic, with the nominal level of student debt increasing 511 percent from 1999 to 2011 and the real price of college tuition more than doubling between 2000 and 2011 (Hacker & Dreifus, 2011; Deritis, 2011). Figure 4, from the aforementioned paper by Deritis, clearly depicts the growing trend. If this analysis were limited to the debt data from 1993, a decade and a half of real growth in tuition and education expenses would be ignored. To evade this flaw, student debt levels from 2008 are also utilized from a newer version of the B&B survey conducted in 2009 (National Center for Education Statistics, 2009). An average graduate with 1993 debt levels has $7,771 in student loans the year after graduation, with the 90th percentile at $13,432, controlled to 2010 prices. The average debt for a graduate is raised to $23,025 at the 2008 level, with the 90th percentile up to $47,963, also inflated to 2010 prices.[v] To reiterate, different student loan repayment options are estimated for two different points, representative of student loan debt levels in 1993 and 2008, and the difference is significant.

Total student debt instead of federal debt was utilized to represent equivalence between standard and ICL schemes as well as removing the maximum on student loan debt (Ionescu, 2009).[vi] Similar to recent improvements in the Australian system which covers more of the total cost of education through income contingent repayment; all student debt would be repaid on an

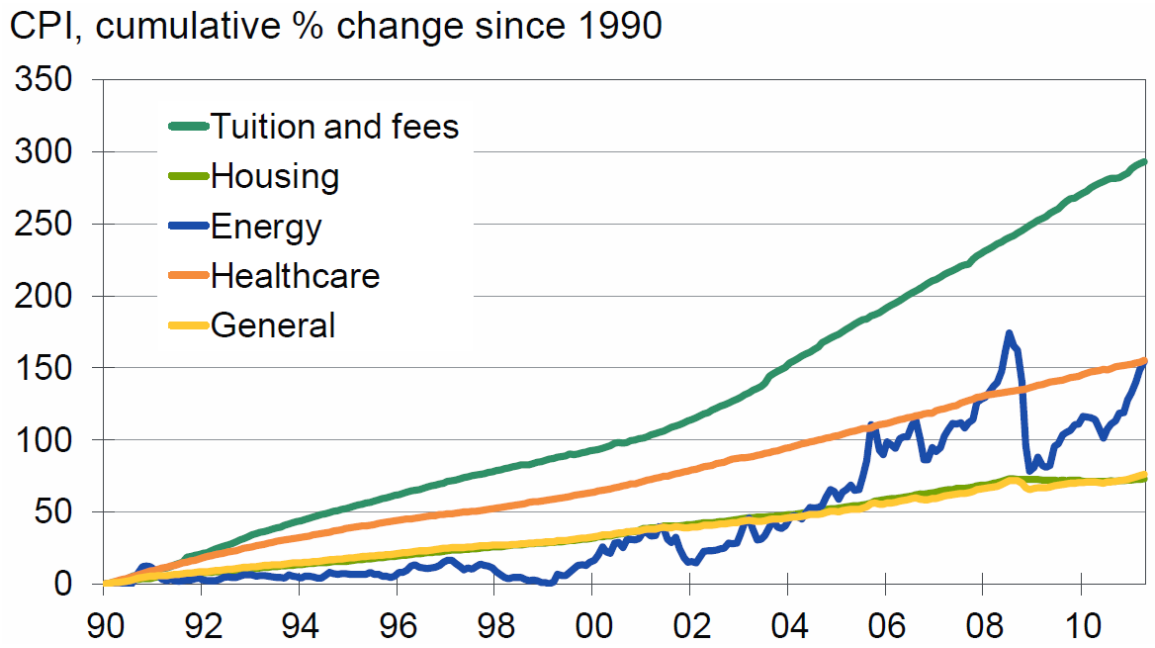
income contingent scheme instead of two separate repayment mechanisms, resulting in decreased transaction costs and repayment burdens (Chapman, 2006). Recent analyses indicate increased access to financial aid does not increase the cost of tuition, countering a common complaint (Government Accountability Office, 2011). While it is acknowledged this is a simplified distribution of student debt, information on type of institution, i.e. private or public, and location of institution, was unavailable. Later analysis of the hidden grant will describe the repayment effects under both the 1993 and 2008 debt levels.

Figure 3:



Source: Baccalaureate and Beyond 1993 and 2008.

Figure 4: Comparison of Inflation Growth in Different Indices, 1990-2011



Source: Deritis (2011) used Bureau of Labor Statistics data to create this graph.

The net present value costing approach permits the comparison of different schemes over the repayment period as if they existed today. By converting all data to 2010 prices with the consumer price index the analysis is in real terms. For the years 2011, 2012 and 2013, a 2 percent growth rate in wages was incorporated (Dresch & Goldberg, 1972; Jacobs, 2002). The real interest rate on student loan repayment is calculated at 1.58 percent, based on an average of the subsidized and unsubsidized federal student loan interest rates weighted by program participation (College Board, 2012).[vii]

Salary Paths

Surveying for the NLSY ’79 is no longer annual after 1996; therefore 8 years of in-sample data must be imputed for any lifecycle analysis to be possible. To acquire sufficient information, future wages also had to be simulated, because the individuals surveyed have not

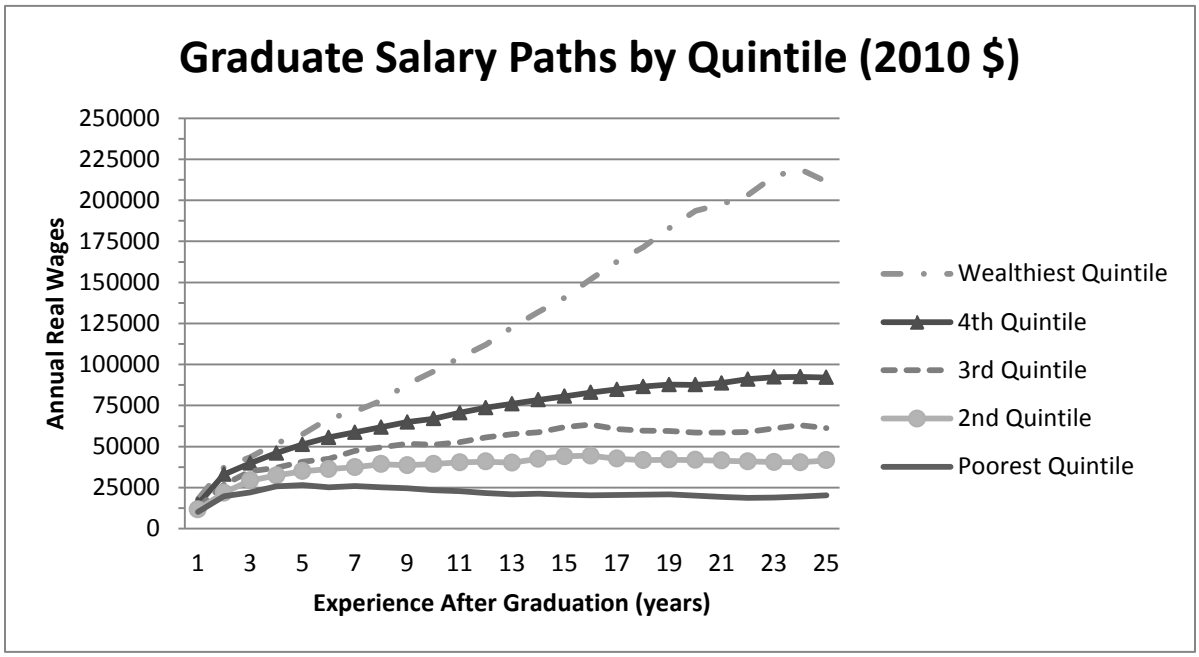
worked long enough to pay off the student debt. Beyond structurally missing cases where everyone was not interviewed, the data also has individuals who were not interviewed in certain years. Any individuals missing 5 or more years of wage data, not including systemically missing years, was dropped from the analysis to avoid inaccurate imputation. Because of the longitudinal nature of the NLSY data, many individuals missed a small amount of survey years in the past three decades, so complete cases analysis would bias the results. One option for panel data imputation is to simply insert the last observed value for the particular individual. While this method is plausible, it has the consequence of understating the variability of the data and ignoring all of the data except for the most recent case (Horton & Kleinman, 2007). Instead, linear interpolation was utilized which averages the observations on either side of the missing year.[viii] In the sample individuals required some wages to be extrapolated, which utilized a similar method to interpolation in the calculation of wages from 2011 to 2013. While this moderates the natural variation in employment, the method is conducted individually which should provide a consistent estimate of individual income (Heckman, et al., 2009).

Summary graduate salary paths are estimated by quintile and presented in Figure 5 below. After imputation and extrapolation there are 502 individuals, 241 females and 261 males, with at least 25 years of wage data after college graduation. The starting wages for all quintiles are very similar, corresponding to the temporal challenge of matching a graduate's skill set with an employer who properly values their experience and education (Rubenstein & Weiss, 2006). Once graduates have had a chance to prove their ability and motivation, the rate of wage growth separates significantly amongst college graduates. Similar to the findings of Johnston & Barr (2013), the lowest quintile is 88 percent female, which is expected as women are more likely to have lower wages than men and are more likely to leave the labor force to raise children. Males, who are more likely to be the primary wage earning spouse, represent 80 percent of the highest earning quartile.

The salary paths by quintile paint a picture of significant inequality and a widening gap between the top quintile and the rest. Research on the Panel Survey of Income Dynamics (Guvenen, 2007; Huggett, et al., 2010) and NLSY '79 (Hoxby & Terry, 1999) all suggest the

time period sampled had an increase in wage inequality among college graduates, a trend reinforced and visible in Figure 5. An individual in the top 20 percent of lifetime income earned an average of $1.37 million more than an individual in the next best paid quintile, and $2.59 million more than someone in the poorest quintile, all in 2010 prices. The divide is most pronounced at the end of the repayment cycle, with the highest income quintiles wages 237 percent larger than the next highest paid quintile in the final year of wages.

Figure 5:



Source: Authors calculations from National Longitudinal Survey of Youth, 1979.

Repayment Simulations

Current income contingent repayment schemes utilize a complex formula to create student loan repayments each year. For IBR and PAYE, the repayments are an established percent of annual discretionary income, which is adjusted gross income (AGI) in excess of 150 percent of the federal poverty line (FPL), based on family size. On the standard (1040) 2012 U.S. federal

income tax form calculating AGI after wages requires 30 lines of additional information, amounting to 39 percent of the entire tax return (IRS, 2010). AGI as a tool for determining student loan repayments could cause economic inefficiencies by promoting a process with unduly high transaction costs (Johnstone, 2009). For example, an individual needs to file up to 11 additional forms to complete those 30 lines and identify their student loan repayment amount for the next year. Krueger and Bowen noted, "An alternative to AGI is personal wage and salary earnings, which avoid the joint filing and nonlabor income issues, and could be collected by the IRS," (1993, p. 197). Internationally, individual annual earnings are the most common determinant of repayment level (Chapman, 2006; Shen & Ziderman, 2009). Annual wages are used here, instead of discretionary income, for two reasons: AGI calculations are complex and can be subject to inefficient rent-seeking behavior through manipulating tax deductibles, and there is no publicly available longitudinal data for individual AGI.

The United States utilizes 150 percent of the FPL as the repayment threshold for individuals in certain income contingent schemes. Only the percent of AGI over the threshold is incorporated into the repayment amount. The FPL changes annually and increases relative to the size of a borrower's family. For a borrower living alone, 150 percent of the FPL is $16,755 in 2012, for a family of four the amount over doubles to $34,575 (Dept. of Health and Human Services, 2012). Scaling individual student loan repayments with family size could cause individuals to start families sooner than would otherwise be optimal. In the analysis to follow, a flat threshold of $21,855 is instead used, representing 150 percent of the federal poverty line for a family of two in 2010, to keep the time values of money consistent.[ix] A flat and transparent income threshold is consistent with successful ICL programs in other developed nations (Vandenberghe & Debande, 2007; Chapman, et al., 2010). Individuals in the NLSY '79 with families of three or more people will have higher monthly payments in this simulation than they would actually have when the adjustable federal poverty line is used as the threshold; single people, however, are simulated at a less expensive payment than they would currently face.

The default scheme, standard, is the first option to be modeled. Closely following current policy, the total loan is split into 120 equal monthly amounts and forgiveness is never a factor.

The standard repayment option has opportunities for forbearance and deferment, which help low income students but also have punitive effects. With standard repayment, insufficient income can cause loan default, which is not considered here but can be very costly to the public (Barr, 1993; Ziderman & Albrecht, 1995; Ionescu, 2008). Option 2 is designed to be similar to income based repayment (IBR), an ICL style scheme currently available in the U.S. IBR charges 15 percent of income over the threshold and forgiveness occurs after 25 years of repayment. The next option (3) is loosely based off of the newest repayment scheme put into law, Pay-As-You-Earn (PAYE). With PAYE, the income charged over threshold is 10 percent, and the forgiveness level is down to 20 years. Finally the fourth option, based upon the SLFA, is modeled. The SLFA has a lower real interest rate, repayments at 10 percent in excess of the threshold and forgiveness after only 10 years of consistent repayment. Option 4 is the only one of the schemes modeled which does not tax the forgiven loan balance, making it less expensive for low income earners.

Figure 6: Modeled Student Loan Repayment Options (2010 $)

Option	Name	Real Interest Rate (%)	Income Threshold (150%/FPL)	Repayment Rate (%)	Forgiveness Threshold (years)	Forgiven Debt Taxed
1	Standard	1.58	$21,855	N/A	N/A	N/A
2	Income Based Repayment (IBR)	1.58	$21,855	15	25	Yes
3	Pay-As-You-Earn (PAYE)	1.58	$21,855	10	20	Yes
4	Student Loan Fairness Act (SLFA)	0.18	$21,855	10	10	No

Source: Author calculations from U.S. Department of Education (2013).

Note: Names above are not meant to indicate the options are identical to the similarly named U.S. student loan repayment options. They are, however, as close as estimable given the data constraints.

Results

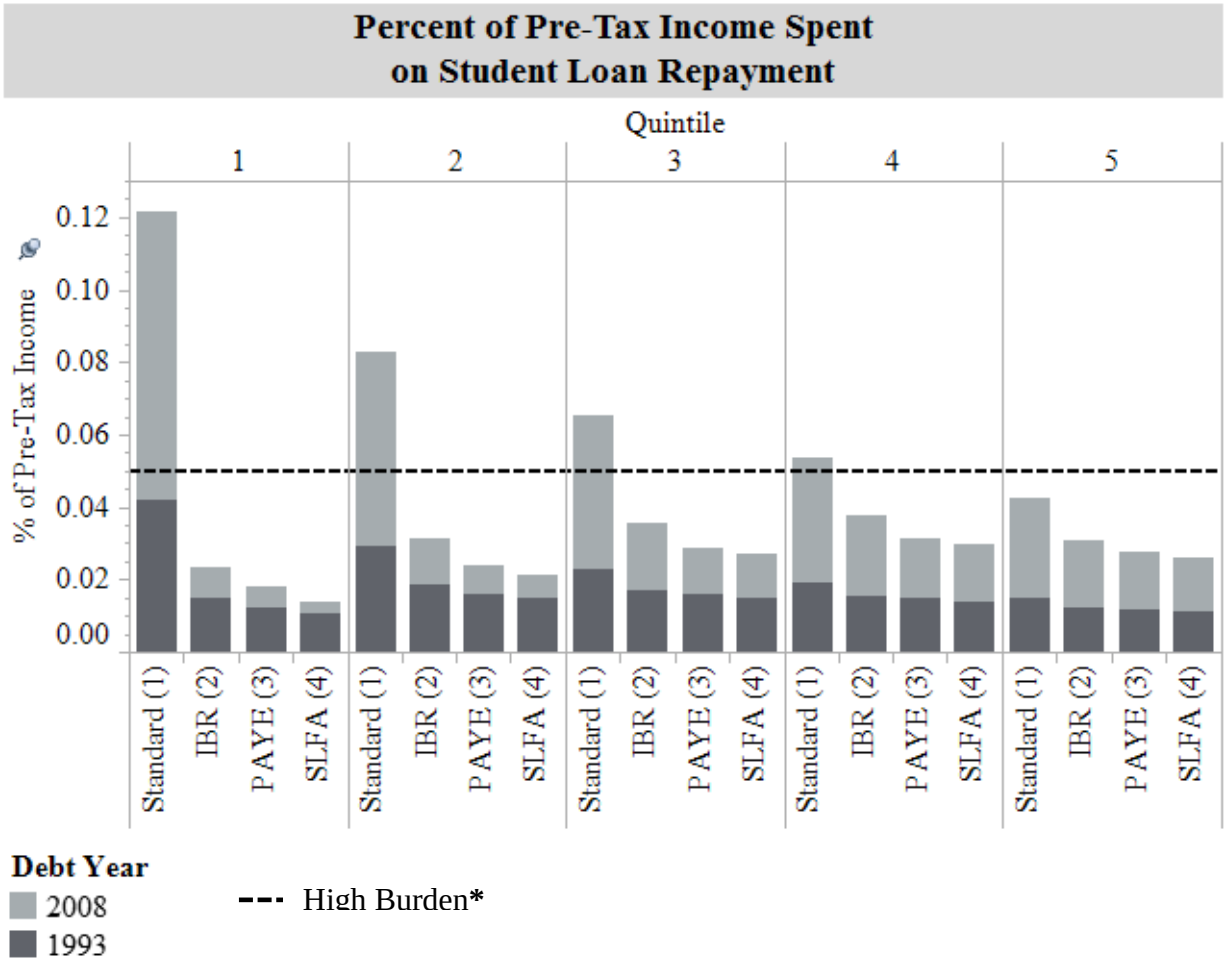
Initially, the repayment burdens of the four options are presented for the average student loan borrower, to explore if there is sufficient need for income contingent schemes, given 1993 or 2008 debt levels. Positive results indicate the burden is significant for individuals of even average wages and the other three options are valid policy alternatives. First, the baseline category of standard repayment is modeled. For the repayment options, particular attention is paid to the proportion of the loan balance financed by the taxpayer as well as the relative amount for different income quintiles. Next, the three income contingent repayment options are displayed in order of generosity and chronology, with the newest and most expensive policy option, SLFA, presented last. Distinctions are made for each repayment option in the value derived through the interest rate and forgiveness subsidies.

Given student debt and repayment schemes are fully simulated, caution should be taken in interpretation. All extrapolated wages are not inflated and therefore kept in real 2010 prices. The results are estimates conditional on the assumptions, not direct predictions of real life. Further, the model has no method for capturing individual behavioral shifts, including loan consolidation or accelerated repayment (Johnston & Barr, 2013). Voluntary repayments by borrowers will decrease the subsidies and cause repayment burdens to increase. Another potential and unobserved behavioral effect is for individuals to select different occupations to maximize wages and avert student debt default. Interest charged while students are in school is captured by the total debt levels used because they come from the graduate's total debt after graduation, not amount borrowed annually. The Congressional Budget Office (CBO) uses a 10-year bond equivalent rate of 5.2 percent to assess and discount the budgetary impact of federal student loans, a standard maintained here (2013). The inflation rate used is 3.22 percent, set at the historic average from 1913 to 2013 (McMahon, 2013). Although some analyses have used the post-war average interest rate, the "Great Inflation" period of the 1970s puts this measure at an unusually high level and the longer time period is a more stable inflation estimate (Primiceri, 2005).

Repayment Burden: The First 10 Years

When the standard repayment scheme has low monthly payments, much of the need for income contingent repayment disappears. As previously mentioned, a loan repayment of 5-10 percent of pretax earnings could be considered too burdensome (Scherschel, 1998; Baum & Schwartz, 2006). In this analysis the standard repayment scheme resulted in an average of 2.56 percent of total pre-tax income paid to student loan debt over the first 10 years of repayment, while Options 2, 3 and 4 were all below 1.6 percent at the 1993 debt level. With the 1993 debt level, none of the repayment plans including standard were above the 5 percent threshold at any quintiles. The average monthly payment for borrowers in standard repayment with the 1993 debt level was a manageable $70, and the net present value was $8407, both in 2010 dollars. For the lowest income bracket the standard repayment option was 4.2 percent of annual wages diverted to student loan repayment, and IBR was 1.6 percent (see Figure 7). When the debt is raised to 2008 levels the standard repayment burden increases substantially to an overall average of 7.3 percent of pretax wages or $186 monthly. This equates to 12.2 percent of income for the poorest quintile of borrowers, and all but the richest quintile is at risk of repayment difficulty. The higher debt levels do not raise the burden of the income contingent options nearly as much as the standard repayment option; the most burdensome ICL averages 3.2 percent of pretax income, corresponding to a monthly payment of $47 during the 1st year, rising to $160 during the 5th year (option 2, IBR). The magnitude of the debt and design of the scheme are clearly important, with the 1993 debt levels not provoking any significantly burdensome repayment obligations while the 2008 debt levels are significant for only the standard repayment scheme.

Figure 7:



***** : Dotted line is 5 percent of pretax wages, a potential point of high repayment burden (Baum & Schwartz; 2006).

Source: Authors calculations from National Longitudinal Survey of Youth (1979) and Baccalaureate & Beyond (1993; 2008).

Option 1: Standard

Subsidies occur mostly within the interest rate for the standard repayment scheme, as there is no write-off subsidy outside of default or bankruptcy. Assuming the government were to borrow through bond markets every dollar lent to students for the student loan program, the interest rate

paid would be the governments cost of borrowing. When the government can borrow at a lower real rate than the interest rate charged on student loans, the public is no longer subsidizing student loans and instead potentially taxing them. Consider in 2013 the CBO estimated that the U.S. government would profit $51 billion off of student loan interest payments (2013). The average cost of borrowing for the 2010 class would be 0.52 percent, based on actual and forecasted rates; although this amount is far below the rate actually used, the historic nominal average of 4.45 percent, derived from the 91 day U.S. Treasury bond equivalent rate averaged over 1983 to 2012 (CBO, 2013; Bureau of Labor Statistics, 2013). After adjusting for inflation, the real government cost of borrowing is only 1.23 percent, below the real interest rate of 1.58 percent. The difference, 0.35 percent in interest revenue, is expected to cover the cost of default and forbearance. One recent estimate showed the cost of default alone nearly balancing the added revenue secured by charging an interest rate beyond the government's cost to borrow (Delisle, 2012). Because the default estimates can be highly variable, they are not factored into the cost estimates included here. Average real interest charged over the standard 10 year repayment cycle is $635 for the 1993 debt level, rising to $1,806 with the 2008 debt. This equates to a public revenue increase of 8.1 percent of the original loan balance, a negative subsidy that is equal across all income brackets because it is purely interest dependent and ignores individual annual wages. Adjusting for the government's cost of borrowing at the 91-day Treasury bill rate results in estimated real government revenue of just under $144 per average student loan borrower over the 10 year repayment period, growing to $408 for the 2008 debt levels.

Option 2: Income Based Repayment (IBR)

When student loan repayments are income based instead of fixed, the likelihood for default is much smaller because the required payment scales with individual wages. Utilizing the IBR option, similar to the one currently offered for student loan repayment, the percentage of income over the threshold is set at 15 and the debt is not forgiven until repayments are continuously made for 25 years. Using 1993 debt levels, the average subsidy from the IBR repayment plan is

$1,411 per person, equal to 16.16 percent of the loan value for the average individual. To deconstruct this figure, $1,084 is from the interest rate subsidy (12.83 percent) and $327 is from the loan forgiveness subsidy (3.33 percent). Low student debt with the IBR scheme prevents forgiveness from having any impact outside of the poorest quintile, where the forgiveness subsidy is 16.72 percent, worth $1,641. The total subsidy achieved relatively large amounts for the poorest quintile at $2,477. When the debt is raised to 2008 levels, still with constant 2010 dollars, the forgiveness subsidy becomes substantially more influential and is up to $2,258 (8.2 percent) for the average graduate and $10,869 for the lowest quintile (40.34 percent). Matching the results found in Johnston & Barr (2013), the interest rate subsidy is found to be strong for all income quintiles including the highest income bracket, with the subsidy averaging $1084 (12.83 percent) at 1993 debt levels and $3,771 (15.9 percent) with 2008 debt levels. Figures 9, 10 and 11 have the disaggregation into interest and forgiveness subsidies for the 1993 and 2008 debt levels. When assessing the higher income quintiles, something to consider is that they are receiving a subsidy mostly because the debt is permitted to rise when they have low income, after the third year of repayment, then they rapidly repay the amount later in their career as their wages rise. IBR has the additional burden of including the forgiven loan balance as earned income for federal income taxes. The average tax increase for individuals in the lowest quintile was $99 with 1993 debt and $657 with the 2008 debt levels.[x] Individuals in the 2nd income quintile were taxed $68 with the 2008 debt levels to correspond with the quintile average forgiveness after 25 years of $465. The IBR model will be utilized as the baseline for comparing repayment options 3 (PAYE) and 4 (SLFA).

Option 3: Pay As You Earn (PAYE)

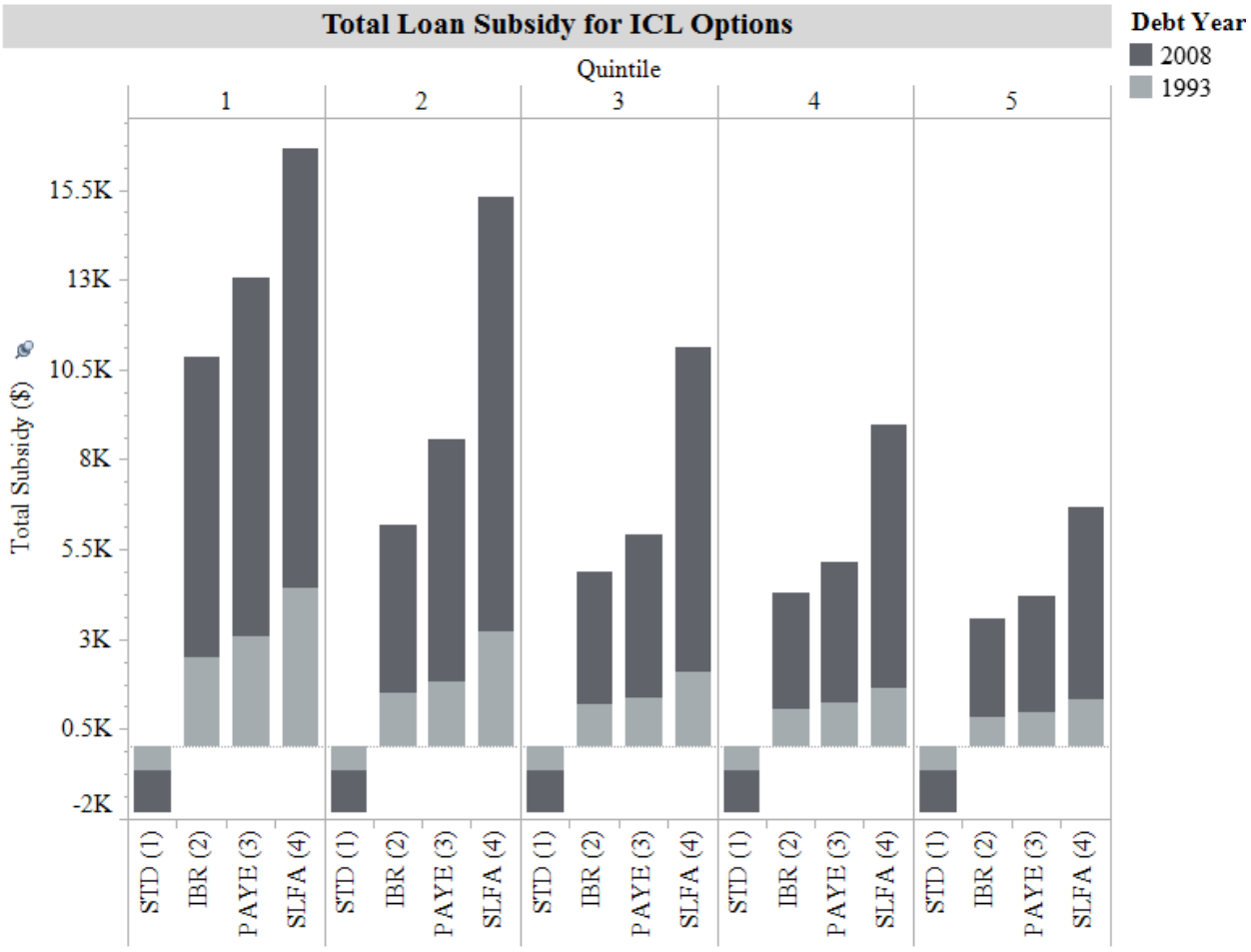
With the third option, the threshold and interest rate are unchanged, but the percent of income over the threshold is lowered to 10 and the point of forgiveness is reduced to 20 years of repayment, relative to IBR. The result is a more generous scheme, with the average loan subsidy up to $1,690 or 19.1 percent of the total loan, an increase of $279, using the 1993 student debt levels. For the lowest quintile of graduates, the loan scheme subsidized 36.52 percent of the

average loan cost, at $3,084, and $2,620 represents the forgiveness subsidy. With the PAYE scheme, forgiveness extends into the middle quartiles, but is effectively irrelevant, making up little more than $100 on average. The interest rate subsidy is even more significant for higher incomes in PAYE than IBR, with the average subsidy up $252 to $982 (1993 debt) for individuals averaging $193,559 in annual income during the 20th year of repayment. Incorporating the higher 2008 debt levels pushes up the average subsidy to 29.28 percent of the total loan, a 10.2 percentage point ($5,674) increase from the 1993 debt levels. Forgiveness increases substantially with the 2008 debt, to 14.12 percent for the average borrower and 57.77 percent for the lowest income quintile (Figure 10). The effect is once again increased for the lowest quintile relative to the average for loan forgiveness. The increased tax burden for the lowest quintile with PAYE is treated identical to IBR; but with PAYE the total forgiven balance is higher and so the tax is also higher for low income individuals, mitigating the progressivity of the 3rd option. Borrowers in the lowest quintile would pay on average $158 (1993 debt) / $ 905 (2008 debt) more in federal income taxes from the forgiven loan balance after 20 years.

Option 4: Student Loan Fairness Act (SLFA)

Estimates indicate the SLFA is the most costly option modeled for taxpayers. The average subsidy with the 1993 debt is $2,538 (28.67 percent), $1,127 more than the IBR option (2). Even more valuable is the benefit to low income earners, with the poorest quintiles subsidy at 54.79 percent of the loan balance, equal to $4,443. All of these impacts increase significantly when the 2008 debt levels are factored in. Average subsidies increase to $11,722 (45.8 percent), and the subsidy for the lowest income quintile is $16,630 (65.97 percent). SLFA also has the unique trait of placing the real student loan interest rate (0.18 percent) below the real government cost of borrowing (1.23 percent), which has substantial cost implications. The lost tax revenue from the SLFA not including the forgiven loan balance as earned income costs the government an average of $759 per borrower with the 2008 debt levels. An average individual in the 2nd quintile would have to pay an extra $1,651 on their income taxes, if SLFA taxed forgiveness.

Figure 8:



Source: Authors calculations from National Longitudinal Survey of Youth (1979) and Baccalaureate & Beyond (1993; 2008).

Conclusion and Discussion

Throughout the information presented, the average and income bracket specific effects have been considered for four different student loan repayment options. The thesis began with a theoretical structure developed to outline the public's strategic interest in encouraging and subsidizing higher education investment by individuals. Within the literature review, a brief presentation of the U.S. system framed the policy options proposed and in law. The four different repayment options were then described in their current, nuanced form. Next, the benefits and limitations in the NLSY '79 dataset were clearly delineated along with descriptions and assumptions of the salary paths and debt levels. Results indicate the cost and progressivity of student loan schemes are highly volatile and sensitive to small changes in the loan design and level of student debt.

There is a distinct shift in cost sharing between the standard and income contingent schemes. The standard option initially results in a very small subsidy, while the income contingent schemes are considerably more expensive to the taxpayer and subsequently generous to the borrower. As the repayment percent over the income threshold increases, the loan schemes become more expensive. Student loan interest subsidies benefit all borrowers, including middle and upper income students, while the loan forgiveness subsidy only helps lower to lower-middle income borrowers. Therefore a market interest rate with loan forgiveness and a cap on annual increases in the loan value would be less expensive for poorer income quintiles. As seen in the SLFA estimation (option 4) operating with a low real interest rate and the lowest percentage of monthly income repaid toward debt increases the total cost of the repayment options. Keeping an interest rate positive in real terms is an important component to offset the cost of forgiveness in a student loan repayment scheme. By maintaining lower repayment burdens on all graduates early in their income life-cycles, and specifically the poorest income bracket, income contingent schemes are a more effectively distributed collection method. Instead of diminishing consumption and altering investment behaviors, income contingent loans can free young graduates to maintain historically consistent levels of economic output. Working against this positive trend, the taxation of student loan forgiveness amounts can be significant with higher

debt levels, resulting in a poorly designed public policy with an inefficient incentive. Policy makers who remove this rule will be promoting a more rational yet modestly more generous system. Restraining skyrocketing tuition and educational expenses needs to be a priority because rising debt is estimated to increase the proportion of the loan value subsidized, compounding the public expense. For example, the average debt levels are estimated to increase $14,322 between 1993 and 2008, doubling in 15 years, while average proportion of loan balance repaid dropped by 14.2 percentage points.

The political partisanship in student loan repayment is rampant. A Democrat has proposed the most progressive option examined, while the less progressive IBR and PAYE options are perceived as too costly by many in the Republican majority (Asher, 2012; Bass, 2013). The policy challenge appears to be in balancing the repayment burden for graduates over the life cycle with the total cost to taxpayers. Standard repayment schemes are too burdensome to repay, especially at or above the 2008 debt levels when the lowest quintile was paying 12.2 percent of their pre-tax income to federal student loan debt. The SLFA repayments are only equal to 72 percent of the next most generous option (PAYE), with 2008 debt levels, making it an arduously expensive option. One untested policy option is to have the percent of income over the repayment threshold scale with the amount an individual earns over the income threshold. In this way, people with higher incomes would pay a growing share of their wages over the threshold. Depending on a legislator or governments priorities, lowering the income threshold, percent of income over threshold towards repayment and interest rate on debt will all make the program more generous and costly, and almost always more beneficial to lower income quintiles. When student debt levels increase, forgiveness becomes more valuable and the total subsidy cost can rise rapidly.

Future Research

Researchers should look down three avenues to improve on these conclusions. First, data limitations caused the quantity and variety of assumptions to grow. A new and more complete

data set with continued methodological accuracy in the forecasting of wage data would allow for statements more relevant to current policies, rather than the careers of students who graduated college during the 1980s. Given a few more years of wage data, for individuals to establish unique earnings patterns, then the NLSY ’97 may be sufficient. Second, psychometric or behavioral economic methodology which incorporates dynamic effects including the impact of different repayment burdens on choices involving employment, field of study and rate of repayment would be an improvement in capturing secondary effects of significant importance. Finally, different variations on repayment terms can be modeled to represent the newest and most relevant repayment schemes. An example of this could be U.S. President Barack Obama’s fiscal 2014 budget which pegs new student loan interest rates at the 10 year bond rate instead of 90 day and adds a surcharge depending on if the loan is subsidized (0.93 percent) or unsubsidized (2.93 percent) (2013). Freshman Senator Elizabeth Warren (D-MA) has proposed a bill to set all of the student loan interest rate equal to the rate used to loan to banks (0.75 percent) (2013). The new schemes, although for political reasons unlikely to become policy, are intriguing variants for study. Running up against another deadline, the U.S. Congress has until July 1st to pass an extension of subsidized student loan interest rates, or new loans disbursed will all have a 6.8 percent interest rate. Integrating the new, considerably higher, interest rate with the methods used here would be a valid and pertinent policy extension. The novel results discovered within the previous analysis provide ample opportunities for continued research on the distributive and fiscal nature of student loan repayment design.

Appendix

The NLSY ’79 is a short panel, with asymptotic individuals and finite time, although the data has a modest duration with 25 years included. Interviews were conducted annually from 1979 until 1994, when the NLSY ’79 converted to a biennial schedule from 1996 through the most recent interviews in 2010. The original survey technique was an in person interview until 1987, when budget constraints forced the NLSY to switch to 86 percent telephone interviews. Years 1988-2000 saw a resurgence of in person interviews, lasting until 2002 when telephone interviews regained dominance and maintained it through the most recent interview period in 2010 (BLS, 2005). In 2006, 96.1 percent of those interviewed were also interviewed in 2008, and the wave-to-wave correlation has never dropped below 91.8 percent (Schoeni, et al., 2013). Retention rates in the survey have remained around 90 percent for most of the iterations and have yet to drop below 76 percent, one of the reasons why the NLSY ’79 is so widely used. 4 percent of the original sample has died, implicating survivor bias as a potential but small issue.

There are some problems with the publicly available NLSY ’79 data used. The need to maintain anonymity for all respondents restricted some responses. The method used to circumvent the anonymity challenge within the NLSY ’79 was to top-code income (BLS, 2005). The wages of respondents in the top income quintile will be downwardly biased, making the estimates of distributional effects to the highest-income individuals less costly to borrowers than the true values. An example of this effect is how an individual making $1,000,000 annually would only be recorded as having earned $100,001 in 1988 (BLS, 2005). Beyond the issue with top-coding, the NLSY ’79 dataset also omits data the literature indicates could be relevant, including information on student debt, details on individual motivation and learning ability, and comprehensive family financial information (Cameron & Heckman, 1999; Card, 2001; Huggett et al., 2010).

Figure 9:

Total Loan Subsidy for ICL Options

	1993								2008							
	STD (1)		IBR (2)		PAYE (3)		SLFA (4)		STD (1)		IBR (2)		PAYE (3)		SLFA (4)	
Quintile	$	%	$	%	$	%	$	%	$	%	$	%	$	%	$	%
1	-635	-8	2,477	30	3,084	37	4,443	55	-1,806	-8	10,844	45	13,041	55	16,630	73
2	-635	-8	1,519	17	1,815	20	3,202	33	-1,806	-8	6,168	23	8,543	32	15,291	57
3	-635	-8	1,173	13	1,364	15	2,070	22	-1,806	-8	4,882	19	5,916	23	11,113	41
4	-635	-8	1,050	11	1,215	13	1,659	18	-1,806	-8	4,298	16	5,139	19	8,952	32
5	-635	-8	841	10	982	12	1,329	16	-1,806	-8	3,579	15	4,222	17	6,657	26

Source: Authors calculations from National Longitudinal Survey of Youth (1979) and Baccalaureate & Beyond (1993; 2008).

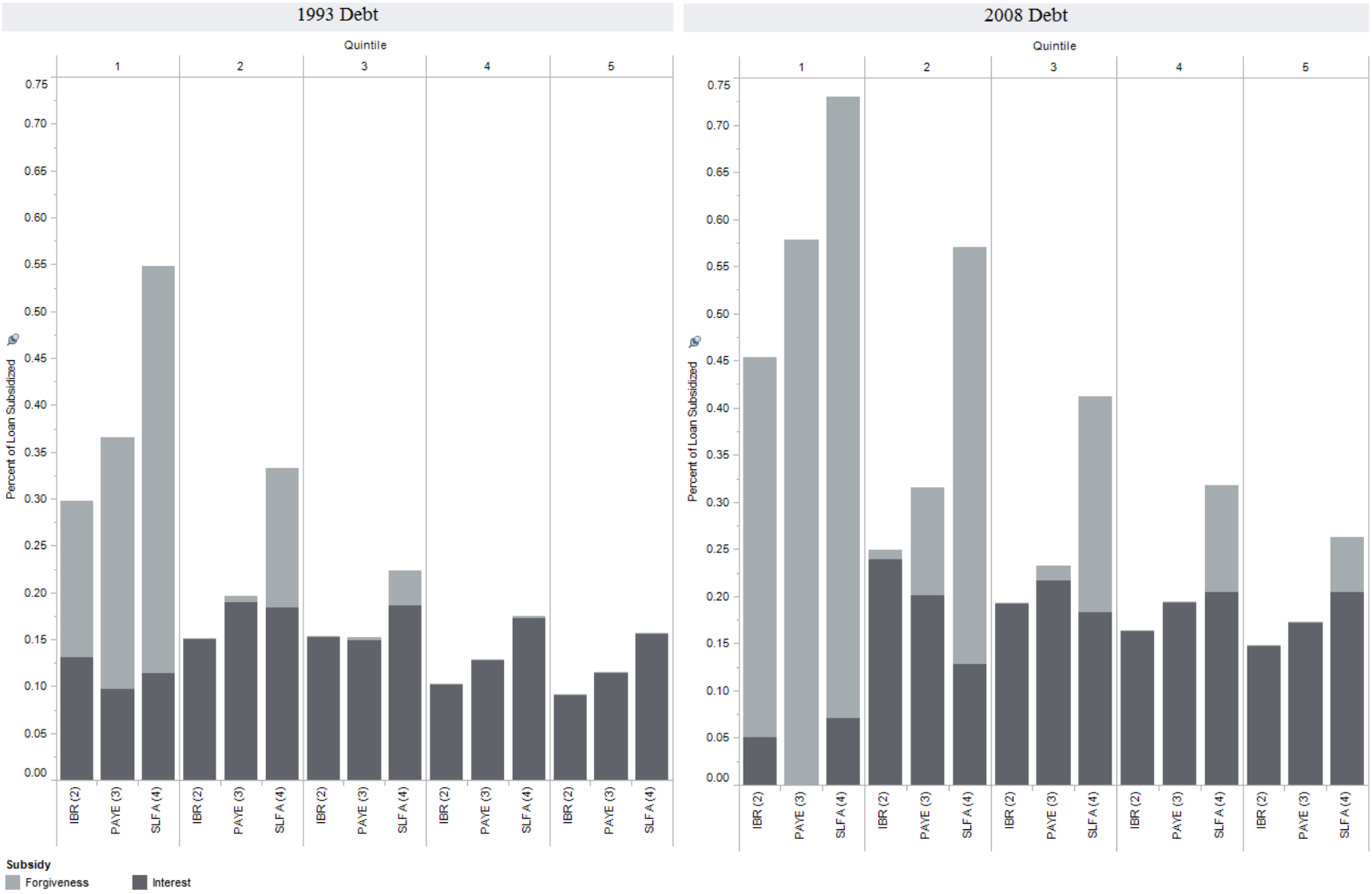
Figure 10:

Disaggregate Loan Subsidies

	1993						2008					
	IBR (2)		PAYE (3)		SLFA (4)		IBR (2)		PAYE (3)		SLFA (4)	
Quintile	Forgiveness	Interest	Forgiveness	Interest	Forgiveness	Interest	Forgiveness	Interest	Forgiveness	Interest	Forgiveness	Interest
1	16.7%	13.1%	26.8%	9.7%	43.4%	11.4%	40.3%	5.0%	57.8%	-2.8%	66.0%	7.1%
2	0.0%	15.1%	0.6%	18.9%	14.9%	18.4%	1.0%	24.0%	11.5%	20.1%	44.2%	12.8%
3	0.0%	15.3%	0.3%	14.9%	3.7%	18.6%	0.0%	19.4%	1.6%	21.6%	22.9%	18.3%
4	0.0%	10.3%	0.0%	12.8%	0.2%	17.3%	0.0%	16.3%	0.0%	19.4%	11.3%	20.4%
5	0.0%	9.1%	0.0%	11.5%	0.0%	15.7%	0.0%	14.8%	0.0%	17.3%	5.8%	20.4%

Source: Authors calculations from National Longitudinal Survey of Youth (1979) and Baccalaureate & Beyond (1993; 2008). Standard omitted because of no variation in forgiveness and interest, see Figure 9.

Figure 11:


1993 Debt
2008 Debt
Quintile
1
2
3
4
5
Percent of Loan Subsidized
0.75
0.70
0.65
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
IBR (2)
PAYE (3)
SLF A (4)
Subsidy
Forgiveness
Interest

Source: Authors calculations from National Longitudinal Survey of Youth (1979) and Baccalaureate & Beyond (1993; 2008). Standard omitted because of no variation in forgiveness and interest, see Figure 8.

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[i] Includes both undergraduate and graduate student aid.

[ii] The SLFA has a provision which prevents unpaid interest from expanding the loan balance to beyond 10 percent of the amount borrowed (Department of Education, 2013).

[iii] One option considered, the NLSY '97, has too few years of data. The Panel Survey of Income Dynamics (PSID) was a plausible option but did not have as many individuals who met the sample selection criteria nor years of income. Therefore the NLSY '79 is the best option, because it is a fairly recent panel data source with a sufficiently large number of cases and years.

[iv] One potential result of explicit cost-sharing by a student's family is when some high income students are excluded from grant aid, but do not actually receive any resources from their family, and end up with higher debt loads than individuals from lower income families. A reverse example would be low income students who fail to submit a FAFSA, making them temporarily ineligible for grants and subsidized student loans they otherwise would be utilizing to minimize the cost of college.

[v] This is the most recent information with any degree of distributional nuance to the data. For comparison, the graduating class of 2011 had an average student loan debt of $2,238 more in real terms than the 2008 graduates (Reed & Cochrane, 2012).

[vi] The maximum subsidized and unsubsidized federal Stafford loan amount towards undergraduate college degree was $57,500 in 2013, effectively beyond the limit of debt distributed in this paper (Smole, 2008).

[vii] Federal subsidized (3.4 percent) and unsubsidized (6.8 percent) student loans have significantly different levels of participation year to year and were adjusted to real terms with the average historic inflation rate at 3.22 percent (McMahon, 2013).

[viii] Pairwise correlation coefficients on year-to-year wages never drop below .77 with complete cases even during the biannual survey period, validating the use of interpolation.

[ix] The other threshold considered, representing the point at which a student becomes automatically eligible for need-based Pell grants, was only $305 more in 2012, a negligible difference (Department of Education, 2013).

[x] The forgiveness amount is taxed at the average income tax rate closest to the mean for that percentile in 2010. The rate used for the first quintile is 5.7 percent, second quintile 12.8 percent and third quintile 16.9 percent (Urban-Brookings Tax Policy Center, 2011).