The Implications of Student Loans in Bankruptcy

5/17/2021

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I study the implications of a reform that allows student loan debt to be discharged in the same bankruptcy chapter as other unsecured consumer credits. To quantify the results, I build a quantitative model of education, student loans and unsecured credit with a bankruptcy option. The model is calibrated to replicate aggregate student debt, revolving credit and bankruptcy in the United States. I find that allowing student debt to be discharged in bankruptcy results in more college education, but a significant rise in consumer bankruptcies. However, the policy more than pays for itself in the sense that the increase in tax revenue from more higher education offsets the losses from more bankruptcy. Moreover, the policy leads to significant welfare gains where low-productivity and moderately wealthy households experience the largest gains.

1 Introduction

Even in the short period of time in which the Flow of Funds has recorded student loans, the aggregate balance of student debt has substantially increased in the United States. In 2006, the student debt to GDP ratio was 3.8%, and it increased to 7.7% by 2019. As of 2010, student loan debt has surpassed credit cards to become the second largest form of consumer credit in the United States. This significant secular trend has coincided with numerous policy changes such as the 2008 increase in the borrowing limit on Stafford Loans.[1] The increase in student debt has also sparked much debate about potential future policy changes. For example, the Consumer Bankruptcy Reform Act of 2020 proposes a reform to bankruptcy laws to allow student loan debt to be discharged in bankruptcy courts. In this paper, I analyze the implications for aggregate quantities and household welfare of allowing student loan debt to be discharged in the same bankruptcy claim that is available for other unsecured consumer credits. I find that this change in bankruptcy policy would significantly increase the number of people seeking a college education, but it would also lead to a substantial rise in consumer bankruptcies. I find that the change in policy would pay for itself in the sense that the increased income tax revenue from more college educated workers would more than pay for the lost payments associated with student bankruptcy.

To address the research question raised in this paper, I build a quantitative, overlapping generations model of education, long-term student borrowing and short-term unsecured consumer credit with a bankruptcy option. The bankruptcy option is modeled to depict a chapter 7 bankruptcy in the United States.[2] Importantly, only short-term credit and not student loan debt can be discharged in a bankruptcy claim. Student loans are long-term meaning that they take multiple periods to be repaid. Households with outstanding student debt can be delinquent on their payment, but there is no way to discharge the remaining

[1] Before 2008, the borrowing limit for independent students was $46,000 and since 2008 it has been $57,500.
[2] Chapter 7 is the liquidation chapter of consumer bankruptcy law.

balance. Agents can experience financial distress resulting in a form of default or delinquency because they are subject to idiosyncratic productivity shocks. These shocks are estimated in Irwin and Kim (2020) to exhibit the earnings risk experienced by individuals based on their education level. Households can insure themselves by utilizing debt or by saving in the capital market. The idiosyncratic risk coupled with incomplete asset markets gives rise to a rich distribution of households in the spirit of Aiyagari (1994) and Huggett (1996).

I calibrate the model to depict the U.S. economy in 2007. I choose 2007 as the target year because it is after the effects of the 2005 Bankruptcy Abuse Prevention and Consumer Protection Act. As in chapter 1, I calibrate to match the total revolving credit balance and the bankruptcy rate among households in the U.S. economy. I also use data from the Flow of Funds to match the aggregate balance of student loan debt. I choose to match the aggregate balance of student debt so I can depict the total debt burden outstanding in 2007. The alternative would be to match the average debt burden of college graduates.[3] I also calibrate the model to match the borrowing limits on Stafford Loans and the average tuition costs for 4-year colleges in the economy. Data on tuition costs is available from the National Center for Education Statistics (NCES). The calibrated model economy provides an environment that facilitates the study of counterfactual policy changes and future potential policy changes relevant to this paper.

The interaction of student loan debt with credit card borrowing and default decisions is a key mechanism driving results in the model economy. The menu of prices on short-term unsecured credit is determined such that financial intermediaries earn zero profits in expectation in the form of Chatterjee et al. (2007) and Livshits et al. (2007). Therefore, changes in the balance of student loans change the bankruptcy behavior of households and in turn impact the terms of credit offered by intermediaries. This explains why it is imperative

[3] I have calibrated the model using the alternative approach, and it doesn't not significantly change the implications of the policy experiments.

to simultaneously model student loans and credit card debt in the benchmark economy. To measure the implications of dis-chargeable student loans, it is first necessary to have a calibrated model economy that can match borrowing and bankruptcy behavior on unsecured credit. Furthermore, it allows me to measure how other changes in bankruptcy policy impact education and student loan decisions. I show that a decrease in the costs of bankruptcy result in more college education, more delinquency on student loans, and a negligible change in average borrowing by college graduates. These results suggest that an increase in the costs of bankruptcy, such as the 2005 BAPCPA, could have led to a small drop in college education and delinquency on student loans.[4]

Before measuring the implications of student debt in bankruptcy, I first quantify the impact of the 2008 increase in the borrowing limits on student loans. Specifically, I study a 25% increase in the borrowing limits on student loans. The increase in borrowing limits leads to substantial increases of 20.7% in outstanding student loan debt and 65.6% in delinquency rates. This is not surprising because the increased borrowing limits allow constrained households to borrow more against future earnings while in school. However, there is a negligible increase of 0.1% in college education. These results suggest that few households are borrowing constrained when actually making a college education decision. Furthermore, the increased borrowing limits lead to a small drop in unsecured consumer credit and bankruptcy. This occurs because households with more student loan debt borrow less (or save more) with short-term securities to insure themselves against their higher long-term debt payments.

In the main policy experiment run in this paper, I allow long-term student loan debt to be discharged in the same bankruptcy claim that is available for other unsecured consumer credits. This represents the main policy change suggested in the Consumer Bankruptcy Reform Act of 2020. Households still have access to government-subsidized student loans with

[4]The 2005 BAPCPA raised the costs of bankruptcy. The experiment I run is too stylized to say that it measures the implications of this specific law.

a fixed interest rate and borrowing limit. However, the terms of credit offered by financial intermediaries adjust to the new bankruptcy behavior of households with dis-chargeable student loans. Specifically, I show that the discount prices are worse for a given level of student loan debt. The economy with dis-chargeable student loans experiences a substantial rise 14.4 percentage point rise in the college-educated work force. However, there is also over a 34.0% rise in household bankruptcy rates. This is not surprising because the policy would more than double the balance of unsecured credit that is eligible for bankruptcy in the economy.

In addition to aggregate quantities, I also measure the impact of student debt in bankruptcy on household welfare. Specifically, I measure the consumption that a new household would be willing to give up to have access to the policy change. I find that the initial distribution of households would be willing to give up an average of 2.8% of life-time consumption to have access to dis-chargeable student loan debt. However, the benefits vary significantly based on initial characteristics. I find that low-productivity households experience the largest gains. This occurs because low-productivity agents are most likely to utilize a bankruptcy at some point in their life. Also, moderately wealthy households experience the largest gains because high-wealth agents do not need student loans and low-wealth agents are less likely to attend college. Overall, there are large gains to college education and welfare from the policy change. However, there are significant costs from the increase in bankruptcy. Importantly, I show that the policy more than pays for itself. The increase in tax revenue from more college educated workers more than pays for the lost payments associated with bankruptcy on student loans.[5]

This paper is significantly related to a series of papers dating back to Becker (1964) that study how credit constraints affect human capital accumulation. Work by Keane and Wolpin (2001) uses data largely from the 1980s (NLSY79) to show that family income played a small

[5]This assumes that the government pays the costs of student loan bankruptcies, and that there are no indirect costs such as securitized assets of government student loan debt sold to commercial banks.

role in education decisions. However, using data from the early and mid 2000s (NLSY97), Belley and Lochner (2007) showed that family income is playing an increasingly important role in individuals seeking a higher education. This has led to a recent increase in the study of credit constraints on education attainment from papers such as Lochner and Monge-Naranjo (2011) and Hai and Heckman (2017). The most related work from this literature to the current paper is by Abbott et al. (2018). This paper studies how endogenous parental transfers and education policies feed back into aggregate outcomes of the economy. My work adds to this literature by quantifying how borrowing limits and bankruptcy reform impact education attainment.

This paper is also related to the literature that studies consumer credit and bankruptcy that occur endogenously in equilibrium. Seminal papers in this literature include Chatterjee et al. (2007), Livshits et al. (2007), and Athreya (2002). Recently, Chatterjee and Eyigungor (2012) and Kaplan et al. (2017) have extended this literature to include default pricing functions for long-term debt. The former studies the market for long-term debt in sovereign debt markets, and the latter studies long-term mortgages over the business cycle. I contribute to this literature by measuring how long-term student loan debt interacts with borrowing and default decisions for unsecured consumer credit.

There is a growing literature that studies student loan debt and default decisions. Notable works in this literature include Ionescu (2009), Chatterjee and Ionescu (2012), and Ionescu and Simpson (2016). Chatterjee and Ionescu (2012) studies how college dropout risk feeds back into default decisions on student loans. However, it is important to note that default in all the papers listed refers to a reorganization of debt with delayed repayment, not something resembling a chapter 7 bankruptcy filing. The most related work from this literature to the current project is a paper by Ionescu (2011) which studies the difference between liquidation and reorganization of student debts. This paper is meant to quantify a change in policy that occurred in the early 1980s. Although this literature is largely focused on reorganization of student loan debts, it is still significantly related to the current paper.

The rest of this paper is organized as follows. Section 1 describes the model economy where student loan debt is not dis-chargeable in bankruptcy. Section 2 outlines the calibration procedure to map the model to the U.S. economy in 2007. Section 3 details the results from the policy experiments. Finally, section 4 concludes.

2 Model

The model economy is populated by a distribution of households, financial intermediaries, a representative firm and a government. Households are subject to idiosyncratic risk and incomplete asset markets in the spirit of Aiyagari (1994) and Huggett (1996). Households differ with respect to age, productivity, assets, education and credit status. The households make a costly education decision early in life subject to borrowing limits on student loans set by the government. Financial intermediaries offer a menu of securities to households that facilitate borrowing or saving. The firm rents capital and labor to produce the single output good in the economy. In addition to lending student debt to households, the government also collect income taxes and pays for social security transfers. This section describes the problems solved by each economic agent, and it concludes with a description of the equilibrium.

2.a Households

Time is discrete, and there are J overlapping generations of households. Each period, a cohort of size ϕ_J dies, and a cohort of size ϕ_1 is born in the economy.[6] There is a measure one continuum of households such that $\sum_{j=1}^{J} \phi_j = 1$. New households draw their initial productivity and asset levels from the distributions E_0 and A_0 respectively. All age 1 households have good credit, no student loans and the opportunity to pursue higher education. These agents move

[6]All cohorts have the same size, therefore $\phi_J = \phi_1$.

through three phases of life: education, working and retirement. Each phase takes multiple model periods to complete. Households consume the single output good to generate utility $u(c)$, and future consumption is discounted at rate β.

Households are hired by firms and paid the marginal product of labor for each unit of productivity. An individual's productivity e has four components: an age-specific components, a persistent shock, a transitory shock and the skill premium. All four of these components are education specific. The age-component γ_j exhibits an empirically consistent hump-shaped profile over the life-cycle. This life-cycle earnings profile helps generate borrowing and default by young households in the model economy.[7] The persistent shock ϵ^h follows the AR(1) process with innovation η_h outlined in equation (2.1). I define the transition probabilities between persistent shocks as $\pi = Pr(\epsilon^h_{j+1}|\epsilon^h_j)$. Let ν^h be the transitory shock to productivity and ξ^h be the premium on earnings from higher education.

$$\log(e^h_j) = \gamma^h_j + \epsilon^h_j + \nu^h + \xi^h, \quad where \quad \log(\epsilon^h_{j+1}) = \rho^h \log(\epsilon^h_j) + \eta^h, \quad \eta^h \sim N(0, \sigma^2_{\eta,h}) \quad (1)$$

Starting at age 1, all households have the option to pursue higher education. This discrete choice is described in equation (2.2) where $h \in \{m, n\}$ is the resulting decision rule. This education choice persists for the first four-years of life. To become a high-skilled worked, the agent must complete all four years of education. I assume that an agent who chooses to not pursue higher education loses the opportunity to do so in the future.[8] While in school, students can borrow from the government using loans b. Students can also save or borrow using securities a offered by financial intermediaries. I allow students to carry credit card debt while in school because Giardelli et al. (2008) found that over 20% of surveyed

[7] See Livshits, MacGee and Tertilt (2007), Athreya, Tam and Young (2009), and Herkenhoff (2017) for discussions.

[8] I abstract from modeling individuals who return to college later in life after working because they should make a small fraction of total student borrowing.

students had at least \$1,000 in credit card debt.[9] These households also have access to the bankruptcy regime in the model economy as represented by equation (2.4).

$$V_j(\epsilon, a, b, s, m) = \max \Big[W_j(\epsilon, a, b, s), V_j(\epsilon, a, b, s, n)\Big] \tag{2}$$

$$h_j(\epsilon, a, b, s, m) = \begin{cases} m \quad if \quad W_j(\epsilon, a, b, s) \geq V_j(\epsilon, a, b, s, n) \\ n \quad otherwise \end{cases}$$

After making education and bankruptcy choices, students decide how much to borrow from the government, how much to save or borrow from intermediaries and how much to consume. Students work while in school, and I assume that they all have low-skilled productivity. Students only spend a fraction ω_h of there time working. They also pay tuition costs ψ_h and utility costs χ_h. The utility costs represent the dis-utility associated with schooling.[10] There is a borrowing limit $\underline{b}$ on the total amount of student debt that can be outstanding. I assume that students do not make loan payments and that student debt does not accrue interest while in school.[11] The formal problem solved by student with good credit is outlined in equation (2.3). The problem of a student who has bad credit is very similar, but the borrowing limit on a' is 0.

$$W_j(\epsilon, a, b, s) = \max_{c, b', a'} u(c) - \chi_h + \beta E\Big[V_{j+1}(\epsilon', a', b', s, m)|\epsilon\Big] \tag{3}$$

$$\text{s.t.} \qquad c + q_j(\epsilon, a', b', m)a' + (b' - b) = a + \omega_h(1-\tau)we_j^n - \psi_h + T, \quad b' \geq \underline{b}$$

When households are done with education, either by completing four years or deciding to not go, they begin a model period by realizing the idiosyncratic shock ϵ. The education

[9] In more recent years, a report by EVERFI and AIG found that over 36% of students surveyed had at least \$1,000 in credit card debt in 2019.

[10] This can be thought of as the lost utility of leisure by spending time doing school-related activities.

[11] Both of these assumptions are consistent with subsidized Stafford Loans.

level h is now fixed for the rest of life. After realizing shocks, households with good credit s_g make a discrete bankruptcy decision. This choice is outlined in equation (2.4) where d is the resulting decision rule. Households of education level h decide whether to repay their debts p or declare bankruptcy ℓ. When a bankruptcy occurs, all securities a are dis-charged, but the level of student debt b is unaffected. Bankruptcy also results in an immediate transition to bad credit s_b.

$$V_j(\epsilon, a, b, s_g, h) = \max\left[V_j^p(\epsilon, a, b, s_g, h), V_j^\ell(\epsilon, 0, b, s_b, h)\right] \tag{4}$$

$$d_j(\epsilon, a, b, s, h) = \begin{cases} p & if \quad V_j^p(\epsilon, a, b, s_g, h) \geq V_j^\ell(\epsilon, 0, b, s_b, h) \\ \ell & otherwise \end{cases}$$

After making the bankruptcy decision, the household makes a discrete delinquency choice with respect to student debt repayment. The household chooses between making the current payment and carrying the level of debt over to the next period. Because student debt is modeled to be long-term, the current payment is only a fraction λ of the total outstanding debt level. Student debt also accrues interest r_b between model periods. Therefore, when a delinquency occurs, next periods debt obligations are $b' = (1 + r_b)b$. When a repayment occurs, next period debt obligations are $b' = (1 - \lambda)(1 + r_b)b$. This delinquency choice is represented by equation (2.5) where f is the resulting decision rule. Let χ_f be the utility cost of being delinquent on student loans.

$$V_j^d(\epsilon, a, b, s, h) = \max\left[V_j^{d,z}(\epsilon, a, b, s, h), V_j^{d,x}(\epsilon, a, b, s, h)\right] \tag{5}$$

$$f_j^d(\epsilon, a, b, s, h) = \begin{cases} z & if \quad V_j^{d,z}(\epsilon, a, b, s, h) \geq V_j^{d,x}(\epsilon, a, b, s, h) \\ x & otherwise \end{cases}$$

To finish the model period, a household that did not declare bankruptcy makes a consumption-savings decision. There are two value functions that need to be solved in this case $V_j^{p,z}$ and $V_j^{p,x}$. Equations (2.6) and (2.7) represent these two Bellman equations. The only differences between the two is that b' depends on the delinquency choice, and delinquency is accompanied by a utility cost χ_f. Households receive w per efficiency unit of productivity and pay taxes τ on those earnings. Financial intermediaries offer a menu of prices q_j for each possible quantity of the security a'. This discount price depends on the probability of a bankruptcy occurring next period, and I will discuss it more when the problem of financial intermediaries is covered. As is standard in the literature, the discount price is $\left(\frac{1}{1+r}\right)$ when there is a zero probability of a bankruptcy.[12]

$$V_j^{p,z}(\epsilon, a, b, s, h) = \max_{c,a'} u(c) + \beta E\Big[V_{j+1}(\epsilon', a', b', s_g, h)|\epsilon\Big] \tag{6}$$

$$\text{s.t.} \quad c + q_j^f(\epsilon, a', b', h)a' = a + (1-\tau)we_j^h + \lambda b + T, \quad b' = (1-\lambda)(1+r_b)b$$

$$V_j^{p,x}(\epsilon, a, b, s, h) = \max_{c,a'} u(c) - \chi_f + \beta E\Big[V_{j+1}(\epsilon', a', b', s_g, h)|\epsilon\Big] \tag{7}$$

$$\text{s.t.} \quad c + q_j^f(\epsilon, a', b', h)a' = a + (1-\tau)we_j^h + T, \quad b' = (1+r_b)b$$

Households that have declared bankruptcy make no further decisions within the model period. Equations (2.8) and (2.9) represent the value of declaring bankruptcy. Again, the only differences between these two equations deal with delinquency conditions. I assume that households cannot save in a period of bankruptcy representing the fact that an individual cannot save while declaring bankruptcy in the US.[13] Upon bankruptcy, agents pay the utility cost and move into bad credit next period. This represents the two key penalties of a

[12] In this model environment, all savings will have discount price $\left(\frac{1}{1+r}\right)$.
[13] See Chatterjee et al. (2007) for a discussion.

bankruptcy.

$$V_j^{b,z}(\epsilon, a, b, s, h) = u\Big((1-\tau)w\epsilon_j^h\gamma_j^h + \lambda b + T\Big) - \chi_d + \beta E\Big[V_{j+1}(\epsilon', 0, b', s_b, h)|\epsilon\Big] \tag{8}$$

$$V_j^{b,x}(\epsilon, a, b, s, h) = u\Big((1-\tau)w\epsilon_j^h\gamma_j^h + T\Big) - \chi_d - \chi_f + \beta E\Big[V_{j+1}(\epsilon', 0, b', s_b, h)|\epsilon\Big] \tag{9}$$

Households that enter the period with bad credit still begin by making a discrete delinquency choice on student debt outlined in equation (2.5). However, there is no borrowing or bankruptcy options when in bad credit. I assume that households return to good credit with probability θ after the turn. This allows me to represent the fact that a bankruptcy remains on an individuals credit history for multiple periods. Importantly, this makes the costs of bankruptcy persistent, and the agent must weight the future costs of losing access to credit against the benefits of discharging debt when solving equation (2.4). Formally, a households with bad credit solves equations (2.10) and (2.11).

$$V_j^z(\epsilon, a, b, s_b, h) = \max_{c, a'} u(c) + \beta E\Big[\hat{V}_{j+1}(\epsilon', a', b', s', h)|\epsilon\Big] \tag{10}$$

$$\text{s.t.} \quad c + q_j(\epsilon, a', b', h)a' = a + (1-\tau)we_j^h + \lambda b + T, \quad b' = (1-\lambda)(1+r_b)b, \quad a' \geq 0$$

$$V_j^x(\epsilon, a, b, s_b, h) = \max_{c, a'} u(c) - \chi_f + \beta E\Big[\hat{V}_{j+1}(\epsilon', a', b', s', h)|\epsilon\Big] \tag{11}$$

$$\text{s.t.} \quad c + q_j(\epsilon, a', b', h)a' = a + (1-\tau)we_j^h + T, \quad b' = (1+r_b)b \quad a' \geq 0$$

$$\text{where} \quad \hat{V}_{j+1}(\epsilon', a', b', s', h) = \theta V_{j+1}(\epsilon', a', b', s_g, h) + (1-\theta)V_{j+1}(\epsilon', a', b', s_b, h)$$

Equations (2.2) through (2.11) represent all of the Bellman equations solved by working age households. In period J_r, households retire. After retirement, households continue solving the same utility maximization problems, but they no longer work and receive labor earnings. I assume that households receive social security transfers from the government equal to a fraction ω_r of lost labor earnings. Agents continue to have access to unsecured credit and bankruptcy in retirement. However, both are much more readily used by young working-age households in equilibrium.

Because student loan debt is long-term and geometrically decaying, it is never completely paid off by the households.[14] Therefore, there needs to be a terminal condition in the final period of life to repay the remaining balance of student loans. I assume that households must repay the final balance as long as it does not violate the non-negativity constraint on consumption. If an agent cannot afford to pay the remaining balance, the balance is discharged. No household utilizes the discharge option in the equilibrium for this model economy.

2.b Financial Intermediaries

Financial intermediaries own all of the capital in the economy. They offer a menu of securities to households which facilitate all saving and borrowing. Each security is a one-period asset that offers a return of a' tomorrow when purchased at the discount price q today. I take the standard notation where $a > 0$ is savings and $a < 0$ is borrowing. Savings by households is the liability on the intermediaries balance sheet. Capital investment and borrowing to households serve as the two assets. Equation (2.12) describes the discount price q for the entire menu of securities. I assume that the market for intermediation is competitive and intermediaries are risk-neutral. Therefore, they determine the price q to make zero-profits on each security a' that is issued. Because there are two assets on the balance sheet, the expected return from a loan must equal the return on capital in equilibrium. Any increase in default probability results in a decrease in the discount price of that security. Because the

[14]However, after numerous period of regular repayment, the outstanding balance becomes small. In the current calibration, after 15 years of payments the balance is 17.3% of the initial value.

default probability on savings in this environment is zero, the discount price for any savings will be the inverse of the return on capital in the model economy.

An important characteristic about this setup is that borrowing limits on households are endogenous. The borrowing limit faced by a household in a specific period is $\underline{a} = \min\left[q_j(a')a'\right]$. This allows for the terms of credit to respond endogenously to changes in student debt levels and delinquency decisions.

$$q_j(\epsilon, a', b', h) = \left(\frac{1}{1+r}\right) \sum_{\epsilon_{j+1}} \pi(\epsilon_{j+1}|\epsilon_j) \left[1 - d^f_{j+1}(\epsilon_{j+1}, a', b', h)\right] \tag{12}$$

$$\text{where} \quad b' = \begin{cases} (1-\lambda)(1+r_b)b \quad if \quad f_j(\epsilon_j, a, b, s, h) = z \\ (1+r_b) \quad otherwise \end{cases}$$

2.c The Firm's Problem

The representative firm hires labor and rents capital from intermediaries in order to produce the single output good in the model economy. The firm maximizes profits described by equation (2.13). Therefore, the returns to capital and labor are equal to their marginal products in the aggregate production function. Let δ_K be the depreciation rate of capital. Equations (2.14) and (2.15) describe the market clearing conditions for capital and labor respectively. Total labor in the economy is the total productivity of all working age households.

$$\Pi_F = \max_{K,L} F(K, L) - rK - \delta_K K - wL \tag{13}$$

$$K' = \sum_{j=1}^{J} \sum_{\epsilon,b,s,h} \int_{\infty}^{\infty} g_j(\epsilon, a, b, s, h)\, \mu_j(\epsilon, da, b, s, h) \tag{14}$$

$$L = \sum_{j=1}^{J_R} \sum_{\epsilon,b,s,h} \int_{\infty}^{\infty} \gamma_j^h \epsilon_j^h \nu^h \xi^h \, \mu_j(\epsilon, da, b, s, h) \tag{15}$$

2.d The Government

The government serves two main purposes in the model economy: execute the fiscal policy affecting households and facilitate the market for student loans. The borrowing limit $\underline{b}$ and the interest rate on loans r_b are institutional features of the market. Loans are long-term such that a fraction λ are repaid each model period. Households can miss payments through delinquency, but the debts can never be discharged in bankruptcy. I assume that student loans do not begin to accrue interest while in school.

The government also taxes the income earned by households. Income taxes and loan repayments are the two sources of revenue for the government. The government uses this revenue to issue new student loans. There are also subsidies offered to retired households and subsidies to all households in the model economy.[15] The government consumes the remaining resources subject to equation (2.16). G is government expenditures resulting from excess revenues.

$$G = \hat{\tau} + \hat{B}_r - \hat{B}_0 - \hat{\tau}_{ss} - T \tag{16}$$

$$\hat{\tau} = \sum_{j=1}^{J} \sum_{\epsilon,b,s,h} \int_{\infty}^{\infty} \tau w e_j^h \, \mu_j(\epsilon, da, b, s, h)$$

$$\hat{B}_r = \sum_{\epsilon,b,s,h} \int_{\infty}^{\infty} \sum_{j=5}^{J} \mathbb{1}_{\{f_j^h = z\}} \lambda b \, \mu_j(\epsilon, da, b, s, h) + b\mu_J(\epsilon, da, b, s, h)$$

$$\hat{B}_0 = \sum_{j=1}^{4} \sum_{\epsilon,b,s} \int_{\infty}^{\infty} \left(b' - b\right) \mu_j(\epsilon, da, b, s, m)$$

$$\hat{\tau}_{ss} = \sum_{j=J_R}^{J} \sum_{\epsilon,b,s,h} \int_{\infty}^{\infty} \omega_r (1-\tau) w e_j^h \, \mu_j(\epsilon, da, b, s, h)$$

[15] The level of the universal subsidy T is chosen to match government expenditure in calibration section.

2.e The Distribution of Households

The idiosyncratic risk coupled with the incomplete assets market gives rise to a rich distribution of households over productivity, assets, student debt, education and credit status. In this section, I describe how the distribution of households over state variables μ evolves in the model economy. Each period, households move deterministically to the next age in the life-cycle $j+1$. This makes it such that the fraction of households in each generation is the same at any point in time. Agents are born into the economy at $j=1$ with no student debt, good credit, and an education opportunity. This means that each household initially has education level m. They also draw a productivity level ϵ_1 and an asset level a_0. In period 1, households decide whether or not to pursue education. Therefore, equation (2.17) describes the fraction of households that choose to not pursue education, and immediately enter the work-force as low-skilled workers. The households who choose $h_j = m$ remain in school. The initial assets are calibrated to capture contributions towards college education. Therefore, agents who decide to not go to college lose their initial asset offer. After period 1, individuals who remain in higher education continue solving (2.17) through period 4. Additionally, households decide how much student debt to borrow which determines b'.

$$\mu_1(\epsilon, 0, 0, s_g, n) = \sum_{\epsilon} \int_{\infty}^{\infty} \mathbb{1}_{\{h_j=n\}}\, \mu_1(\epsilon, da, 0, s_g, m) \tag{17}$$

After education, households move through the life-cycle making consumption, savings, delinquency and bankruptcy decisions. The fraction of households who move from good credit to bad each period is determined by bankruptcy decisions. For households that begin age j in bad credit, they return to good credit with probability θ. Therefore, a fraction $(1-\theta)$ remain in bad credit moving forward. This means that the total fraction of households in bad credit next period is determined by equation (2.18). This accounts for new defaulting households and households that remain in bad credit moving forward. Similarly, equation

(2.19) shows that households in good credit next period is those who did not default this period, added to those who move from bad credit back to good. In both of these equations b' is determined by borrowing decisions for students and by delinquency decisions by all other households.

$$\mu_{j+1}(\epsilon_{j+1}, a', b', s_b, h) = \sum_{\epsilon_j, b, h} \int_{\infty}^{\infty} \pi(\epsilon_{j+1}|\epsilon_j) \mathbb{1}_{\{g_j = a'\}} \Big[\mathbb{1}_{\{d_j = \ell\}} \overline{\mu}_j(s_g) + (1-\theta)\overline{\mu}_j(s_b) \Big] \tag{18}$$

$$\mu_{j+1}(\epsilon_{j+1}, a', b', s_g, h) = \sum_{\epsilon_j, b, h} \int_{\infty}^{\infty} \pi(\epsilon_{j+1}|\epsilon_j) \mathbb{1}_{\{g_j = a'\}} \Big[\mathbb{1}_{\{d_j = p\}} \overline{\mu}_j(s_g) + \theta\overline{\mu}_j(s_b) \Big] \tag{19}$$

$$\text{where} \quad \overline{\mu}_j(s) = \mu_j(\epsilon_j, da, b, s, h)$$

2.f A Recursive Equilibrium

A Stationary Recursive Equilibrium is a set of functions for value V, W, quantities g, c, b, discrete choices h, f, d and prices r, w, q and the distribution μ such that:

1. The decision rules g, c, b, h, f, d solve the household problem from value functions V, W described by equations (2.2)-(2.11).

2. Financial intermediaries offer a menu of prices q to earn zero profits in expectation described by equation (2.12).

3. Firms choose aggregate capital K and labor L to maximize profits in equations (2.13).

4. The distribution of households evolves such that it is consistent with individual decisions described by equations (2.17)-(2.19).

5. The markets for capital and labor clear in equations (2.18) and (2.19). The market for credit clears due to the zero profit condition for intermediaries, and the market for goods clear from equation (2.20) where $\hat{A}_0$ is the total initial transfer of assets.

$$C + K' + G = F(K, L) + (1 - \delta_K)K + \overline{A}_0 \tag{20}$$

3 Model to Data

The parameters for the model are chosen in a three-step process. First, some parameters are chosen because they are commonly used in the literature or because they explicitly represent a feature of the economy I want present in the model. Then, a set of parameters are taken from estimates in the data. As I will discuss in section 2.b, many of theses parameters are estimated in a different research project. Finally, I calibrate the remaining parameters of the model to match key moments seen in the data. The model is calibrated to depict the US economy in 2007 after the immediate effects of the Bankruptcy Abuse Prevention and Consumer Protection Act.

3.a Chosen Parameters

A model period is set to one year. Although this adds to the state-space of the model, it allows the overlapping generations framework to account for annual movements in credit, default and education. Table 2.1 outlines the parameters of the model that were chosen outside of the model solution. The model economy contains a utility function with a constant coefficient of relative risk aversion and a Cobb-Douglass aggregate production function. Parameters such as the coefficient of risk aversion and the capital share of production are commonly used in the literature. I choose τ from Mendoza, Razin and Tesar (1994) who estimate the income tax rate to be 30% in the US economy. The replacement or earnings in retirement is set at 40% to match the replacement rate from social security in the US. I set ω_h to 0.65 so students spend 65% of their time working while in school. This is consistent with the NCES data on

Description	Parameter	Value	Source
Coef. Risk Aversion	σ	2.00	Common Literature
Capital Share	α	0.33	Common Literature
Income Tax	τ	0.30	Common Literature
Duration Bad Credit	θ	0.10	Bank. Institution
Student Interest Rate	r_b	6.80%	Stafford Loan Rate
Retirement Replacement	ω_r	0.40	Social Security Rate
Student Work Rate	ω_h	0.65	NCES
Repayment Fraction	λ	0.17	Stafford Loan Duration
Total Generations	J	57	
Retirement Period	J_R	48	
Education Periods	J_h	4	

Table 1: **Chosen Parameters**

Notes: Cobb-Douglass aggregate production function and a utility function with constant coefficient of relative risk aversion.

average work hours by full-time college students. I set the fraction of student loans paid off each period at 17%. This ensure that over 11% of the loan's premium is paid off each period. Stafford Loans have fixed payments set for 10 years. Because I use geometrically decaying debt, there is not a direct one-for-one comparison between the model and data. The fraction of repayment chosen insures that the average borrower only has an annual payment equal to 3.9% of average earnings after 10 years of payments.[16]

Table 2.1 also outlines the demographic parameters that control how a household moves through different life-cycle phases. I assume that education lasts 4 years. I choose this value because the model is meant to match 4-year college attendance. Households are born at age 18 so I assume that the first year of retirement is in period 48. Households then live in retirement for 10 years before death at model age 57.

[16] This is equivalent to about $1,445 in 2007.

Description	Parameter	Value
Std Dev Initial Productivity	σ_e	0.963
Mean Initial Assets	μ_a	1.039
Std Dev Initial Assets	σ_a	1.667

Table 2: **Initial Characteristics**

Notes: Data from the NLSY97 survey. I use the distribution of ASVAB scores for productivity and parental contributions to college for initial assets. Values are in logs.

3.b Parameters Estimated from the Data

There are two sets of parameters that are estimated from the data: the initial characteristics and the parameters that control the earnings process. For the initial characteristics I use data from the NLSY97. This data set is a nationally representative sample of 8,984 men and women born between the years 1980 and 1984. The survey begins collecting data in 1997 when all respondents were between the ages of 13 and 17. All NLSY respondents take the Armed Services Vocational Aptitude Battery (ASVAB) test. I use the standard deviation σ_e of the ASVAB to get the initial distribution of productivity in the model economy. I assume that the distribution is normally distributed and the mean is the same as the mean for the productivity process. The NLSY also reports the contributions of parents towards college education. I use the mean μ_a and standard deviation σ_a of parental contributions to pin down the initial distribution of assets. As stated in section 2.1.a, because these are contributions to college, households only get the assets if they attend college. Table 2.2 describes the parameters determining the initial characteristics of households.

For the parameters of the productivity process, I use estimates from the working paper Irwin and Kim (2020). We use data from the PSID 1968-2011, and all values are in logs. There are four classes of parameters that need to be found: the age-component of earnings, the persistent shock process, the transitory shocks and the skill premium on wages. Table 2.3 outlines the parameters from the estimation. We assume that the age-component of

Description	Parameter	Value
Age-Component	ϕ_1^m	$3.60e^{-2}$
Age-Component	ϕ_2^m	$5.11e^{-4}$
Age-Component	ϕ_1^n	$2.86e^{-2}$
Age-Component	ϕ_2^n	$5.05e^{-4}$
Persistent Shock	ρ^m	0.972
Persistent Shock	σ_η^m	0.248
Persistent Shock	ρ^n	0.983
Persistent Shock	σ_η^n	0.230
Transitory Shock	σ_ν^m	0.255
Transitory Shock	σ_ν^n	0.288

Table 3: **The Earnings Process**

Notes: parameter estimates from Irwin and Kim (2020). High-skilled workers represented by superscript m and low-skilled by n.

earnings take the the following form.

$$\gamma_j^h = \phi_1^h j - \phi_2^h j^2$$

The age-component exhibits a hump-shape over the life-cycle. High skilled workers experience a more pronounced hump-shape in earnings. For the persistent component we measure both the persistence of the process ρ^h and the volatility in the innovations σ_η^h. We also measure the volatility of the transitory shock to earnings σ_ν^h. Most notably, low-skilled workers experience more volatility in their transitory shocks. This is consistent with evidence that low-skilled workers experience more short-term unemployment spells resulting in transitory changes to annual earnings. Finally, we choose the skill premium for high-skilled workers to be 1.4.

3.c Calibrated Parameters

The remaining parameters of the model are chosen to match key moments from the data. I choose 2007 as the calibration target so the model can depict the US economy after the Bankruptcy Abuse Prevention and Consumer Protection Act (BAPCPA). I assume that households differ with respect to their discount value. Specifically, a newborn household draws a discount factor from one of two possible values. Let π_β depict the fraction of agents with a low beta (impatient). I assume that the discount rate is constant throughout the entire life of a household. This allows the model to simultaneously match the aggregate level capital and the revolving consumer credit in the model economy in 2007.[17] Additionally, I choose the depreciation rate on capital to match the investment to capital ratio, and I choose the level of lump-sum transfer T to match the ratio of government expenditures to GDP.

There are three different dis-utilities that allow me to further calibrate the model. I choose the disutility from bankruptcy χ_d to match the annual bankruptcy rate reported by the Administrative Office of the U.S. Courts. I choose the disutility from a student loan delinquency χ_f to match the aggregate level of student loans in the model economy. The key mechanism that allows me to match this statistic, is that as delinquency becomes more costly, households are likely to borrow less during college years. They are also less likely to attend college, but I use the disutility from education χ_h to match the graduation rate from 4-year schools in 2007 as reported by the National Center for Education Statistics (NCES). Finally, I calibrate the parameters that determine the tuition cost for college and the borrowing rate on student loans. The borrowing limit on unsubsidized Stafford Loans in 2007 was \$46,000. To map the model to the data, I choose ψ_h to match the ratio of borrowing limits to average earnings in the economy. I use average net compensation reported by the Social Security Administration as the empirical counter-part to average earnings. I use the same procedure to pin down the tuition cost ψ_h. The average tuition cost at 4-year colleges in 2007 was \$13,826 which is 35.67% the size of average net compensation in the same year.

[17]Data on capital comes from the BEA Fixed asset tables, and data on revolving consumer credit comes from the Flow of Funds.

Description	Parameter	Target	Data	Model
Discount 1	β_1	Capital:GDP	266.64%	269.32%
Discount 2	β_2	Revolving Credit:GDP	6.77%	6.71%
Share of β_1	π_β	Share of Net Borrowers	41.00%	40.12%
Capital Depreciation	δ_K	Investment:Capital	7.90%	7.90%
Bankruptcy Cost	χ_d	Bankruptcy Rate	0.45%	0.53%
Delinquency Cost	χ_f	Ed Loan: GDP	4.08%	4.01%
Education Disutility	χ_h	High-Skill Share	27.17%	26.66%
Lump-Sum Transfer	T	Gov Exp:GDP	19.37%	17.43
Tuition Cost	ψ_h	Tuition:Avg Earnings	35.67%	35.29%
Borrowing Limit	$\underline{b}$	Borrowing Limit:Avg Earnings	118.68%	119.93%

Table 4: **Calibrated Parameters**

Notes: Calibration target in the data is 2007. Sources for data include NIPA tables, Fixed Asset tables, Flow of Funds data, NCES, SSA and federal policies for student loans.

4 Results

The results in this paper are organized into three main sections. The first section describes results that are meant to better help understand the mechanisms at work in the model economy. This improves the interpretation of results in later sections. Additionally, some of the reported findings in this section are not readily available in the data meaning a structural model is the only way to gain a better understanding of the economy in these areas. The second section measures the implications of a 25% increase in the borrowing limits on student loans. This is consistent with the increase in Stafford Loan borrowing limits in 2008. Because the model is calibrated to 2007, it provides an effective environment to quantify the effects of this policy change. In the third section, I measure the implications of allowing student debt to be discharged in the same bankruptcy claim available for other unsecured consumer credits. Because there is one chapter of bankruptcy accounting for both unsecured consumer credits, the environment studied closely resembles the proposal in The Consumer Bankruptcy Reform Act of 2020

4.a Understanding the Mechanics of the Model

By modeling credit card debt and student loan debt simultaneously, I can study how these two types of unsecured credit impact each other. I begin this section by studying how changes in the outstanding balance of student debt impacts equilibrium discount prices on new unsecured credit. Figure (2.1) outlines the menu of loan prices offered by intermediaries to households with no student debt and those with average student debt balances. The most striking feature of the graph is that the terms of credit offered to those with student debt is substantially worse than those with no borrowing. This indicates that student loans increase the probability of a bankruptcy even though they cannot be directly discharged in a bankruptcy claim. This is not an obvious answer because student loans could increase the value of maintaining access to credit cards. There are some elements of the real economy that are not directly modeled in this setting. For example, households do not have a credit score which improves with credit use. This could be an important channel for future research into the impact of student debt on credit access.

I also measure the differences in borrowing decision rules across households with different levels of student debt. Figure 2.2 outlines the borrowing decisions of an age 30 (model period 12) household with one standard deviation below average productivity. Figure 2.2 shows that the impact of student loans on credit card borrowing is not linear. Constrained households borrow less if they have student debt. This is most likely explained by figure 2.1 where we showed that the terms of credit are worse for agents with outstanding long-term loans. However, unconstrained households with moderate levels of credit card balances to begin the period borrow more when they have student loans. Agents with small levels of credit card debt borrow less with student loans. Unconstrained households with high levels of credit card debt are further constrained by their student loans and borrow more today against future earnings. With low levels of credit card debt, households are willing to forego current

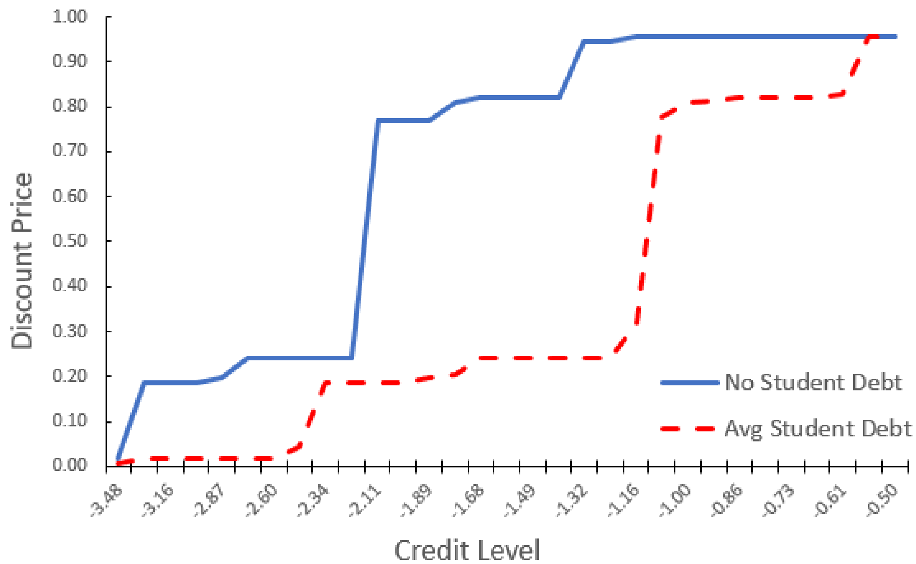

Figure 1: **Discount Prices with Student Debt**

Notes: Discount prices offered by financial intermediaries to households with different levels of student debt.

consumption to insure themselves by borrowing less.

As previously stated, a strength of this model is that we can measure the interaction of credit card debt with student loans. This logical relationship can move in either direction. For example, I measure how a change in the penalties of bankruptcy χ_d impact student debt decisions at the aggregate and individual levels. Specifically, I measure the impact of a 10% decrease in the costs of filing for bankruptcy. Although this is a stylized exercise, it sheds some light on how bankruptcy reform like the 2005 BAPCPA can impact student debt. The main outcome of the 2005 BAPCPA was an increase in the costs of filing for bankruptcy. Because my model is calibrated to 2007, I move backwards by measuring a decrease in χ_d.

Table 2.5 outlines the aggregate results from a decrease in the cost of filing. The model predicts the standard results in consumer credit markets: an increase in bankruptcies and a decrease in total credit. Novel results show that a decrease in the cost of filing results in more high-skilled workers. This would suggest that the BAPCPA resulted in a drop

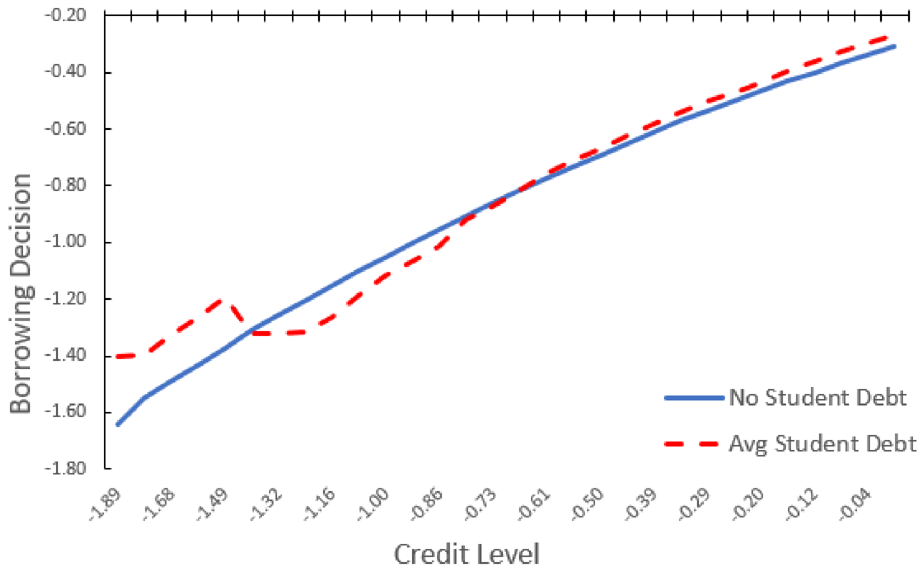

Figure 2: **Borrowing Decisions with Student Debt**

Notes: Borrowing decisions by an age 30 household with below average productivity and different levels of student debt..

in college education. It would require a detailed empirical analysis to see if this were the case. However, looking at data from the NCES in figure C.1, we can see that after the 2005 BAPCPA there was a slight drop in college enrollment rates. This exercise also suggests that a drop in the costs of filing result in more student debt. However, the average debt of college graduates actually decreases so most of the effect is coming from the increase in college graduation. A drop in the costs of filing also result in a significant increase in the delinquency rate on student loans. This indicates that households are more likely to roll-over their long-term student debt when they know that there is a relatively cheaper bankruptcy option available to smooth consumption in the event of a negative shock.

4.b An Increase in Borrowing Limits

In 2008, the U.S. government increased the borrowing limit on unsubsidized Stafford Loans from $46,000 to $57,500. Presumably, this increase in borrowing limits results in an increase

Variable	Benchmark	Reduced Cost	Percent Change
High-Skill Share	26.66%	27.87%	4.54%
Total Student Debt	0.179	0.186	4.04%
Total Credit	0.299	0.291	-2.79%
Avg Debt at Graduation	2.780	2.769	-0.41%
Bankruptcy Rate	0.53%	0.56%	5.26%
Delinquency Rate	2.53%	2.62%	3.56%

Table 5: **Reduction in the Cost of Bankruptcy**

Benchmark is modeled to 2007. Reduced cost sees a 10% reduction in the cost of bankruptcy χ_d.

Variable	Benchmark	Increased Limit	Percent Change
High-Skill Share	26.66%	26.69%	0.10%
Total Student Debt	0.179	0.216	20.73%
Total Credit	0.299	0.297	-0.52%
Avg Debt at Graduation	2.780	2.955	6.29%
Bankruptcy Rate	0.53%	0.52%	-2.43%
Delinquency Rate	2.53%	4.19%	65.61%

Table 6: **Increase in Borrowing Limits**

Notes: The aggregate implications fro a 25% increase in the borrowing limits on student loans. The matches the rise on Stafford Loans in 2008.

in college education and an increase in aggregate student borrowing. However, it is not directly clear how this policy change will impact borrowing and bankruptcy on unsecured consumer credit (credit cards). Further, it isn't clear who across the distribution of households will benefit most for the policy. I use the model economy to test the implications of a 25% increases in the borrowing limits on student loans. Table 2.5 outlines the aggregate results from the tested increase in borrowing limits. Surprisingly, the model predicts that an increase in borrowing limits has a very small impact (0.10%) on the fraction of high-skilled workers. However, the increase in borrowing limits leads to a substantial increase (20.73%) on the outstanding balance of student loans. The model also predicts more than a 65% increase in the rate of delinquency on student loans.

I now perform a welfare analysis to further analyze the impact of an increase in borrowing

Productivity Quintiles					
Q5	0.016%	0.015%	0.014%	0.014%	0.012%
Q4	0.009%	0.036%	0.029%	0.018%	0.012%
Q3	0.010%	0.010%	0.072%	0.040%	0.012%
Q2	0.012%	0.012%	0.015%	0.020%	0.017%
Q1	0.075%	0.128%	0.462%	0.234%	-0.004%
	Q1	Q2	Q3	Q4	Q5
	Asset Quintiles				

Figure 3: **Welfare Gains from Extended Limits**

Notes: Welfare gains across the initial distribution of households from a 25% increase in borrowing limits.

limits on the distribution of households. Specifically, I measure the amount of lifetime consumption a new household would be willing to give up to have access to the increase in student borrowing limits. I find that the initial distribution of households would give up an average of 0.05% of lifetime consumption to have access to extended borrowing limits. The welfare gains on average are quite small because only a fraction of households go to college and borrow the maximum level of debt. However, certain households experience large welfare gains. Figure 2.3 shows a heatmap outlining the welfare gains across the initial distribution of households. The heatmap displays a few key results. First, the wealthiest quintile of households see the smallest gain from borrowing limits. This is not surprising because the wealthiest households do not borrowing using student loans. Also, moderately productive households see the largest gains from borrowing limits. This occurs because low productivity agents are less likely to go to college, and high productivity agents are less likely to rely on student loans while in school. The fact that some households are willing to give up over 0.46% of lifetime consumption to have extended borrowing limits shows that this policy has a significant impact on some households despite yielding small welfare gains on average.

4.c Student Loans in Bankruptcy

In this section, I analyze the impact of a bankruptcy reform that allows student loan debt to be discharged in bankruptcy. The motivation for this analysis comes from the Consumer Bankruptcy Reform Act of 2020. One of the main provisions in this Bill creates a new chapter of bankruptcy that allows all unsecured consumer debts (including student loans) to be discharged in a bankruptcy filing. This is precisely the exercise I measure here.[18] In the model environment, the only change I make is to the discrete bankruptcy decision. Now, student loan debts are discharged in equation (2.4) in addition to any short-term consumer credit. I assume that the penalties associated with bankruptcy remain the same. Households still have the option to be delinquent on student loans, but it is very uncommon in equilibrium when a bankruptcy option is available.

Table 2.7 outlines the aggregate results associated with the bankruptcy reform analyzed in this section. Allowing student loans to be discharged in bankruptcy yields large changes to aggregate quantities. The fraction of college graduates in the economy increases from just under 27% to 41%. Also, the total student loan debt in the economy increases by over 61%. It is important to note that increasing borrowing limits had a small effect on college education because households were still reluctant to take on larger balances of debt that they could never discharge. However, changing the quality of that debt through bankruptcy reform allows much more college education because households are more willing to take on student loans. The model also predicts that the reform more than pays for itself. The increase in college education and student borrowing generates more revenue for the government from income taxes and student loan repayments to more than pay for the lost payments resulting from bankruptcy on student loans. This occurs without even raising the tax rate in the economy.[19]

[18] I hesitate to say this analysis provides a quantitative assessment of the Bankruptcy Reform Act as a whole. I choose to focus on measuring the implications of a specific provision in the Bill.

[19] The increase in tax revenue should be even more substantial in a model with a progressive income tax

Variable	Benchmark	Bankruptcy Reform	Percent Change
High-Skill Share	26.66%	41.09%	54.13%
Total Student Debt	0.179	0.289	61.45%
Total Credit	0.299	0.301	0.67%
Avg Debt at Graduation	2.780	4.416	58.85%
Bankruptcy Rate	0.53%	0.71%	33.96%
Delinquency Rate	2.53%	0.17%	-93.28%

Table 7: **Student Loans in Bankruptcy**

Notes: The aggregate implications of allowing student loans to be discharged in a bankruptcy claim.

In addition to aggregate quantities, I measure the impact of bankruptcy reform on the welfare of new households. I find that the initial distribution of agents in the economy would be willing to give up 2.84% of lifetime consumption to have access to dis-chargeable student loans. The welfare gains are on average substantially higher than those of increased borrowing limits. Figure 2.4 outlines the welfare gains across the initial distribution of households. Low productivity households gain the most from the bankruptcy reform. This occurs because they are the agents most likely to utilize bankruptcy on student loans. Even though middle-productivity households do not typically file bankruptcy, they still experience welfare gains because they have the bankruptcy option in the event of a persistently low shock to productivity. It is also clear that households with moderate levels of wealth experience the largest gains. As stated in the previous section, these are the agents who are most likely to pursue education and take out student loans.

5 Conclusion

I studied a provision of the Consumer Bankruptcy Reform Act of 2020 which allows student loans to be discharged in bankruptcy. To quantify the implications of this policy change, I developed a quantitative, overlapping generations model of long-term student loan debt and short-term unsecured consumer credit. Importantly, households can declare bankruptcy on

system because high-skilled workers pay a higher tax rate on their higher earnings.

Productivity Quintiles	Q1	Q2	Q3	Q4	Q5
Q5	0.36%	0.29%	0.17%	0.08%	0.03%
Q4	0.99%	1.63%	1.29%	0.67%	0.14%
Q3	1.05%	2.09%	3.60%	2.37%	0.65%
Q2	2.02%	3.57%	5.78%	5.50%	2.08%
Q1	4.09%	7.53%	11.40%	9.97%	4.12%

Asset Quintiles

Figure 4: **Welfare Gains from Bankruptcy Reform**

Notes: Welfare gains from a reform that allows student loans to be discharged in bankruptcy.

unsecured credit, but delinquency is the only default option for student loans. Households also make a college education choice which can be financed in part by student loans. I calibrate the model to data from the U.S. economy in 2007.

Using the model I show that a 25% increase in student loan borrowing limits results in a significant increase in aggregate student loans, but it has a negligible effect on education. Increased borrowing limits have a small effect on education decisions because relatively few households in the benchmark economy choose to not pursue education because they are borrowing constrained. These results suggest that the increased borrowing limits can partially explain why we have seen an increase in student debt but a stagnation in college enrollment rates since the increased borrowing limits of 2008.

I then use the model study the implications of allowing student loans to be discharged in bankruptcy. I show that this policy change would result in over a 14 percentage point increased the fraction of high-skilled workers, and over a 61% increase in the total balance of student debts. However, the policy change would result in over a 58% increase in the bankruptcy rate in the economy. Despite increasing the number of bankruptcies, the policy more than pays for itself from the government's point of view. The increase in college education generates enough extra tax revenue to pay for the student loan defaults. I study the implications of this policy across the distribution of households and I show that low productivity households see the highest welfare gains because they are the agents who are most likely to file for bankruptcy at some point in life. Across the distribution of assets, moderately wealthy households see the largest gains in welfare because they are most likely to attend college and borrow to pay for part of the tuition.

The modeling framework in this paper provides a lot of opportunities for future research because there has been almost no work combining credit card debt and student loan debt into the same environment. Future research could use this framework to measure how secular trends in education and student loans impact borrowing and bankruptcy trends in credit card debts. This is an important avenue for future research because we have seen such a strong positive trend in student borrowing in recent history. Future work could also study how different student loan repayment plans can impact credit card borrowing and default decisions.

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[Education Data]Appendix A: Education Data

Figure C.1 outlines annual enrollment rates in 4-year college as reported in the National Center for Education Statistics (NCES). College enrollment has risen fairly steadily over the 45 years accounted for the graph. The increase was most substantial in the 1980's and 1990's. After the 2005 BAPCPA, there was a non-trivial drop in college enrollment. Afterwards, the rate of growth has stagnated. Further empirical work would need to be done to measure the roll of bankruptcy reform on college education.

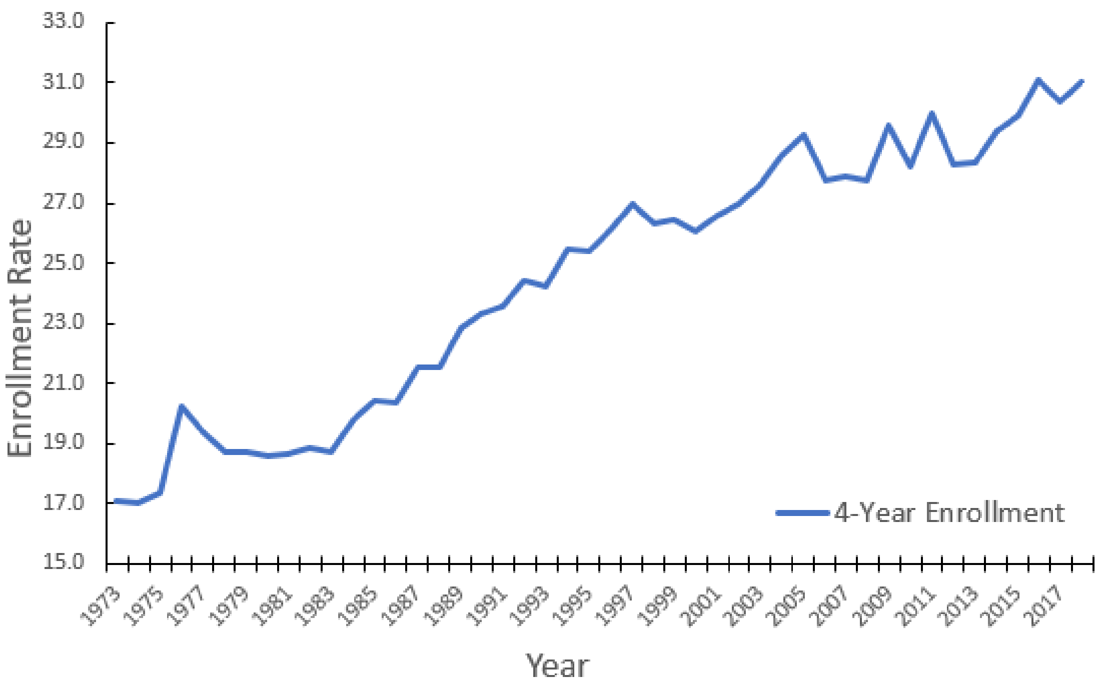

Figure 5: **Enrollment Rates**

Notes: Annual enrollment rates in 4-year college as reported by the NCES.

Figure C.2 outlined the outstanding balance of student loan debt in the United States. Data is from the Flow of Funds memo of outstanding consumer credit balances and begins in 2006. There has been a steady increase in the balance of student loans over the measured period. However, the percent change in the aggregate balance has been decreasing since 2008. This is most likely due to the stagnation in enrollment rates seen in figure C.1. Importantly

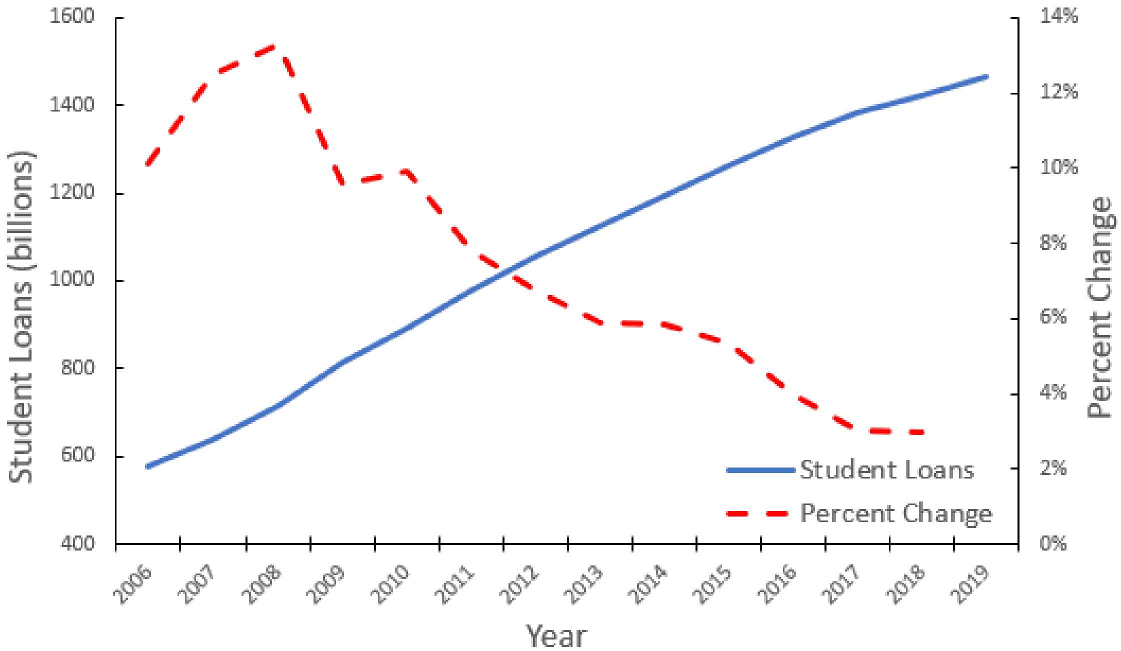

Figure 6: **Student Loan Balance**

Notes: Real balances of student loan debt. Data from the Flow of Funds.

for our analysis, the largest growth in student loan debt occurred during 2007-2009 which is the same time as the increase in Stafford borrowing limits. From the graph, it is not clear if the increase is due to the policy change, the start of the Great Recession or some combination of the two. For this reason, I turn to the model in section 3 to measure the impact of the increase in borrowing limits.