The Student Loan Program and The Impact of Consolidation on Default Rates

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Abstract

The current study focuses on the repayment behavior of borrowers under the Federal Student Loan Program (FSLP) and the effects on repayment incentives of the recent reform proposal to eliminate the consolidation program. I use the Baccalaureate and Beyond (B&B) 93/97 data set to look at the repayment behavior for college graduates who borrowed for their undergraduate education under the current regulations. I develop a dynamic stochastic model and calibrate it to the US economy to replicate the observed data facts. The model quantitatively and qualitatively explains the repayment pattern observed in the data. I use the model to run experiments to test implications for repayment behavior of the consolidation program proposal.

1 Introduction

Borrowing and repaying student loans has become an important issue to consumers, creditors and policy makers alike. More than 10.3 million loans were

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taken out under the Federal Student Loan Program (FSLP) in 2001 to finance college education, for a total of $54 billion (1). When repaying college loans, borrowers face a menu of repayment schedules. The plans available for payment are standard, income, graduated and extended. Borrowers start repaying their loans six months after graduation under the standard plan which is assigned by default. If they do not make any payments within 270 days, they are generally considered in default. The rate on education loans is set by the government, based on the 91 days Treasury bill rate, and it fluctuates as the market does.

College graduates have the opportunity to consolidate their education loans. The design of the current consolidation program allows them to switch repayment plans or lock in low interest rates. The original motivation behind introducing the consolidation program in the first place was to decrease the default rate. Since the program was introduced in late 80’s, the default rate declined from a high of 22% in 1990 to 5.4% in 2001, the lowest default rate ever, as indicated in figure 1. Currently, college graduates can consolidate at rates as low as 3.5 percent, for years to come. But when market rates rise above that fixed rate, the government is obliged to make up the difference, guaranteeing lenders a certain profit. So, the more students choose to consolidate, the more expensive a proposition it becomes for the federal government, especially when interest rates rise. In fact, according to the General Accounting Office, the cost of consolidation rose to $2.1 billion in the 2003 fiscal year from $650 million the previous fiscal year.

Concerned that the cost will only continue to rise, legislators have recently proposed ending the consolidation program. The proposal aims to eliminate

1In the same year the unsecured consumer debt amounted to $692 billion (7).
2The standard and extended schedules suppose payments fixed up to the Treasury Bill interest rate fluctuations for a period of 10 years and 25 respectively. The graduated and income plans assume fluctuating payments contingent on income, hence give the borrower payment relief when his income is lowest (details on schedules are provided in the appendix).
3Bankruptcy is declared under chapter 13, one of the reorganization chapters in the Bankruptcy Code.
4HR 4283 to amend the HEA 1965, section 425.
The cohort default rate represents the percentage of borrowers who entered repayment in a fiscal year and defaulted by the end of the next year. Source: Department of Education

The current study focuses on the repayment behavior of borrowers under the FSLP and the effects on repayment incentives of eliminating the consolidation program. I use the Baccalaureate and Beyond (B&B) 93/97 data set to look at the repayment behavior for college graduates who borrowed for their undergraduate education under the current regulations. According to the data, three years after graduation, all borrowers who do not default on their debt choose to consolidate: 95.4% of them remaining under the standard plan, and only 4.6% switching to the income plan. The data also provides risk sharing
evidence: borrowers with financial hardships opt for the income-sensitive plan. The income average for the borrowers who choose the income-sensitive plan is about 2/3 of that for the standard schedule payers, as figure 2 suggests. Also, unemployment spells are much higher for the income sensitive plan. The average debt for the income plan payers is $12181 compared to only $7904 for standard consolidated payers. Data suggests that the higher the debt burden, the more likely the borrower will choose the income-contingent plan (figure 3).

There is clear evidence that borrowers can risk-share and smooth consumption across states and periods. This implies that the availability of different repayment plans and the possibility of locking-in low rates contributes to the decrease in default. In this context, the current proposal regarding discontinuing the consolidation program might damage the default pattern.

I develop a dynamic stochastic model and calibrate it to the US economy to replicate the observed data facts. The model accounts for the consolidation pattern observed in the data. The model predicts 100% consolidation and matches the repayment plan choice for non-defaulters, predicting that 95.8%

\footnote{Facts are robust when conditioned on different savings technologies, loan amount quantiles and majors (see details in the appendix).}
Figure 3: Debt By Repayment Plans

The model also delivers the risk-sharing evidence found in the data. It quantitatively and qualitatively explains the repayment sorting evidence with respect to debt levels: the mean of debt for borrowers within the income plan is $12617 compared to only $7465 for those under the standard plan. Although the model overestimates the magnitude of the difference between earnings averages for the two groups of payers, it can qualitatively account for the fact that agents with lower income levels choose income consolidation. The average income for income-plan payers is 1/3 the average for the standard-plan payers. The model predicts that the higher the debt burden is relative to the income, the more likely the agent switches for income consolidation. The agents hedge against both rate and income risks through consolidation, and their repayment behavior is contingent on their debt levels accumulated in college.

I use the model to run a counterfactual experiment to provide quantitative and a qualitative assessment of the effects of the consolidation proposal on default rates, one of the questions raised during the policy debate. Results show that the proposal to shut down the consolidation program will make
graduates less likely to repay, increasing the default rate from 10.7% in the benchmark model to 18.7%. The additional default is accounted for by lower income quantile borrowers. One might conclude that, given a high cost to bail out delinquent borrowers, the case for shutting down the standard consolidation option might have been overstated. The model suggests, however, that the cost from the extra default rate could be avoided by tightening default punishments only by a small amount. With appropriate adjustments of the bankruptcy rules, the government could save the funds needed to subsidize the program at no cost. Even with no penalties adjustments, the cost of the additional default is not high, given the nondischargeability feature of student loans. There might be some supportive grounds for the proposal on a cost-benefit basis, but the model suggests a 6.2% welfare loss in the case the program is discontinued. Moreover, the absence of the possibility to hedge against rate fluctuations might deter students from entering the program in the first place. I will consider these issues in future research concerned with education decision and borrowing under the program for prospective and current college students.

Earlier work in the area has abstracted from analyzing the repayment behavior under the student loan consolidation program. The human capital literature is very rich, but not until recently has the focus turned to student loans. The literature on higher education financing programs has exploded in recent years, but most of the current research is empirical and has ignored issues related to the structural changes under the student loan program. An exception is a study by Dynarski (2001), who looked at the effect of the HEA Amendment in 1992 on college education decisions. She analyzed the impact of decreasing the expected family contribution, and she found a positive impact on college attendance. My study differs from hers in two ways: first, I focus on

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6Important contributions by Becker (1964), Heckman (1976), Cameron and Taber (2001), Carneiro and Heckman (2002).
program changes that affect repayment decisions and hence I concentrate on the decision of college graduates to repay their loans rather than the decision of prospective students to attend college. Second, she presents an empirical approach of the problem. The lack of theory precludes her from making policy recommendations. The current paper takes a theoretical approach to answer the relevant questions.

An important contribution is the work by Lochner and Monge (2003) who look at the interaction between borrowing constraints, default and investment in human capital in an environment based on the U.S. Guaranteed Student Loan (GSL) program. They develop a model to explain empirical findings regarding the characteristics of defaulters. They do not incorporate the available repayment schedules or the opportunity to consolidate and lock in the loan rate in their model. Both are present in my model. However, as my study suggests, both represent important channels to hedge against different market risk and have direct consequences on the default decision: they should be taken into consideration. Their study does not address quantitative assessments about repayment behavior, default or policy implications, focusing only on qualitative results.

To my knowledge, this is the first study to develop a theoretical framework on the implications for default and repayment behavior of changes in the consolidation program. The rest of the paper is organized as follows: section 2 presents the model, optimization and the solution method, section 3, parametrization of the model; results are given in section 4, and section 5 concludes and discusses further research. Institutional details and data descriptions are provided in the appendix.
2 Model

2.1 Environment

The economy consists of heterogeneous agents who face an infinite horizon problem. Time is discrete and is indexed by $t$. Agents start with the debt they encountered in college, $d_o$ and some initial asset level, $a_o$.\(^8\) There are two sources of uncertainty in this economy: earnings and interest rate on loans. Both follow stochastic processes, which are described in the next section. Agents learn about earnings and the rate on loan at the beginning of the period, but the next period’s rate and earnings are uncertain. The available repayment plans are the standard and the income plan.\(^9\) In order to mimic the current program, agents start under no consolidation status, paying under the standard plan with fixed payments up to the fluctuations in TBill rate.\(^10\) Given the debt level, the income, and the rate they learn at the beginning of each period, agents face three options: not to consolidate and remain in the standard plan (this is called no consolidation in the model), to consolidate just to lock in the interest rate without changing the standard plan (simple consolidation from now on) or to consolidate and switch to the income-sensitive plan, for which the payment is given by a fraction of the agent’s earnings that period (income consolidation in the model).\(^11\) There is no choice of repeated consolidation and no cost to consolidate, features of the actual consolidation

\(^8\)Given robust risk sharing evidence by major, I will not choose this as a source of heterogeneity in the model.

\(^9\)I abstract from considering the other two available schemes since there is no information in the data for the extended plan. Also, the income sensitive plan shares the features of the graduated plan. They both allow for consumption smoothing through hedging against adverse shocks to income (see the appendix on institutional details).

\(^10\)Under the program, the standard schedule is the plan assigned by default, if not otherwise requested and is extended over 10 years.

\(^11\)Payments under this schedule are calculated as a percentage of the borrower’s adjusted gross income and increase only if the income increases. Payments are generally capped at an amount slightly less than the required under a standard schedule. The fluctuating payments contingent on income realizations give the debtor the possibility to smooth consumption across states and times.
program. Hence, once agents consolidate, they pay at the consolidation rate until the complete payment. Strategic consolidation is not possible here. Agents can not consolidate partially, they are only allowed to consolidate the full debt. In case the loan is not fully paid after a number of periods, the agent is exempt from the outstanding debt.

Corresponding to the three options above, there are three different payment types possible in the model:

\[ p_{nc_t} = \frac{d_t}{1 + \sum_{k=t+1}^{T} \frac{1}{\prod_{i=t+1}^{k} R_i}} \]  
no consolidation \hspace{1cm} (1)

\[ p_{sc_t} = \frac{d_t}{\sum_{i=0}^{T-1} \frac{1}{R_i}} \] simple consolidation \hspace{1cm} (2)

\[ p_{ic_t} = \gamma y_t \] income consolidation, \hspace{1cm} (3)

where \( d_t \) represents the period debt level and the \( R_i \)s are interest rates on the loan at period \( i \). For the income consolidation, \( y_t \)s are per-period earnings and \( \gamma \) is the fraction of the earnings that goes toward loan repayment.

Payments depend on the debt level each period, \( d \), the loan rate \( R \) and the number of periods until repayment is complete. \( T \) represents the number of periods of payment under the standard consolidation regardless of the consolidation time.

Agents have access to a savings technology at the riskless interest rate \( R_s \), and the debt evolves according to the following equation

\[ d' = (d - p)R \]  
(4)

\textsuperscript{12}There are no fees or credit checks in the actual program (see the appendix on institutional details).

\textsuperscript{13}Under the actual loan program, borrowers are allowed to consolidate one or two loans, but when they consolidate, they usually do so for all of their loans.

\textsuperscript{14}After 25 years under the income plan, the debtor is exempt of the rest of the debt under the program.

\textsuperscript{15}When consolidation takes place under the program, the borrower will lock in the rate of repayment, but also prolong the life of the loan to another 10 years.
where \( p \) is the payment in the previous period.

Constraints are given for each case above by:

- no consolidation

\[
c + p_{nc} + a' \leq y + R_s a
\]

(5)

- simple consolidation

\[
c + p_{sc} + a' \leq y + R_s a
\]

(6)

- income consolidation

\[
c + a' \leq y(1 - \gamma) + R_s a
\]

(7)

where \( c \) is consumption, \( y \) are earnings, \( R_s a \) are assets for the previous period and \( a' \) are current savings.

The preferences in the economy are standard with the lifetime utility:

\[
(1 - \beta) \sum_{t=0}^{\infty} \beta^t \frac{c_t^{1-\sigma}}{(1 - \sigma)}
\]

(8)

where \( \beta \in (0, 1) \) is the discount factor. The per period utility is CRRA with \( \sigma \) the coefficient of risk aversion.

2.2 Optimization

The problem of the agent is to choose the period of consolidation, the consolidation type, the savings and consumption path for the first \( T \) periods and savings, and consumption every period thereafter in order to maximize their lifetime utility (equation 8).

For every period before \( T \), three payment options are available, as long as the agent chooses not to consolidate in the previous period. Once he conso-
lidades and switches to the fixed rate under the standard plan or the income plan, he cannot undo the process; he is stuck with the new payment type for the rest of the loan’s life.\textsuperscript{16} Hence, for every period before \( T \), the agent can be in one of the following states:

- already consolidated under the standard plan
- already consolidated under the income plan
- not yet consolidated.

Corresponding to the three cases above, there are three value functions for periods \( 1, 2, \ldots, T \): the value after simple consolidation has occurred, the value after income consolidation has occurred and the value for the case in which the agent has not yet consolidated.

Case 1: Already consolidated under the standard plan

Once the agent consolidates, the process cannot be undone, so for an agent who has previously consolidated and is paying at the rate determined at the consolidation time, the value function is given by:

\[
V_{SC}(z, d, a, y, R) = \max_{a' \in A} \left\{ u(c) + E \beta [V_{SC}(z', d', a', y', R)] \right\}
\]

subject to

\[
\begin{align*}
& c + p_{sc} + a' \leq y + R_s a \\
& d' = (d - p_{sc}) R \\
& z' = z - 1 \\
& z > 0
\end{align*}
\]

The consolidation rate is fixed for the life of the loan. This protects the borrower from future increases in variable rate loans but prevents him from benefiting from future decreases in variable rates. Besides the levels of assets, debts, and the interest rate and earnings in each period, there is another state variable \( z \) in the value function. This represents the number of periods until

\textsuperscript{16}Once made, Federal Consolidation Loans cannot be unmade because the loans that were consolidated have been paid off and no longer exist.
full payment. In the case \( z = 0 \), the agent is in the last period of payment, so the function above is valid as long as \( z > 0 \). The expectation is over the earnings, since the next period’s rate is irrelevant after consolidation.

Case 2: Already consolidated under the income plan

The value function is similar to the case above with the difference that the payment represents a fraction \( \gamma \) of earnings.

\[
V_{IC}(z, d, a, y, R) = \max_{a' \in A} \{ u(c) + E \beta [V_{IC}(z', d', a', y', R')] \}
\]

subject to

\[
\begin{align*}
c + a' & \leq y(1 - \gamma) + R_s a \\
d' &= (d - \gamma y) R \\
z'(d) &= z(d) - 1 \\
d' &> 0
\end{align*}
\]  

As in the previous case, the function is valid as long as the agent has not finished repaying the loan, i.e. \( d > 0 \). When \( d' = 0 \), then \( z = 0 \), since there is no debt left for the next period, and the current period represents the last payment period. This constraint is similar to \( z > 0 \) in the case of simple consolidation.

Case 3: Not yet consolidated

This is the most interesting state, since this is the case where the agent has to choose among the available schemes. He will maximize over the three possible choices: being consolidated under the standard plan in the next period, being consolidated under the income plan in the next period or entering the next period not consolidated and facing the same problem. In this case, the expectation is with respect to both interest rates and earnings.

\[
V_{NC}(z, d, a, y, R) = \max_{a', d'} \{ u(c) + E \beta \max[V_{NC}(z', d', a', y', R'), V_{SC}(z', d', a', y', R'), V_{IC}(z', d', a', y', R')] \}
\]  

subject to
Consolidation has two implications: the first one is that payers can change the plan when they encounter financial hardship, hence it is a good channel to buffer the risk against bad income shocks. The second is that they can lock in the interest rate when the TBill rate is low. The model follows the program in allowing the borrowers to risk-share in both ways.

Additionally, I consider the no consolidation path. In this case the agent never chooses to consolidate: case 3 above should coincide with this path. The agent faces the first constraint, equation 5 and the value function is given by:

\[
W_{NC}(z, d, a, y, R) = \max_{a' \in A} \{u(c) + E[ W_{NC}(z', d', a', y', R') ] \} \tag{12}
\]
\[
s.t.: c + p + a' \leq y + R_s a \\
\quad d' = d(1 - p)R \\
\quad z' = z - 1 \\
\quad z > 0
\]

For periods after T, the agent’s problem is the standard consumption and savings one. After period T there is no payment, so no stochastic rate on loans, the expectation being over the earnings:

\[
V(a, y) = \max_{a' \in A} \{u(c) + E[ \beta V(a', y') ] \} \tag{13}
\]
\[
s.t.: c + a' \leq y + R_s a
\]

### 2.3 Solution Method

In order to solve for the agent’s optimal problem, I first solve the standard fixed point problem after period T numerically.

The functions \( V_{SC} \) and \( V_{IC} \) are then solved recursively, using \( V(a, y) \) in the
terminal node:

\begin{align*}
V_{SC}(0, d, a, y) &= \max_{a' \in A} \{u(y + R_s a - a' - d) + \beta V(a', y')\} \\
V_{IC}(0, d, a, y) &= \max_{a' \in A} \{u(y + R_s a - a' - d) + \beta V(a', y')\}
\end{align*}

When \( z = 0 \), the agent is in the last period of payment, so she will only choose consumption and savings for the remaining periods. In this case, if consolidation has not occurred so far, her path should be given by equation 12 above. For the terminal node then,

\[ V_{NC}(0, d, a, y) = W_{NC}(0, d, a, y) = \max_{a' \in A} \{u(y + R_s a - a' - d) + \beta V(a', y')\} \]

### 2.3.1 Simplified Example

For expositional purposes, I look at a two period model, where \( U(c) = (1 - \beta)\log(c) \). I consider first a version where the income plan is not allowed. The agent’s choice is given by:

- no consolidation, if \( R_1 > ER_2 \).
- simple consolidation, if \( R_1 \leq ER_2 \).

If she expects a higher rate next period, she will consolidate, otherwise she will not. Debt level or income are irrelevant in this case. However, when the income plan is allowed, the agent will choose the income plan if her current earnings are lower relative to the debt level she enter the period with, consistent with the data. Her decision is given by the following:

- no consolidation, if \( R_1 > ER_2 \) and \( \gamma(s_1R_s + Es_2) \geq \frac{d_0}{\phi_{nc}}(1 + R_s) \)
- simple consolidation, if \( R_1 \leq ER_2 \) and \( \gamma(s_1R_s + Es_2) \geq \frac{d_0}{\phi_c}(1 + R_s) \)
- income consolidation, if \( \gamma(s_1R_s + Es_2) < \frac{d_0}{\phi_{nc}}(1 + R_s) \) and \( \gamma(s_1R_s + Es_2) < \frac{d_0}{\phi_c}(1 + R_s) \)
As before, if the rate is expected to rise, the agent consolidates at the current rate, otherwise not. However, if the cost of payment under the income sensitive plan, \( \gamma(s_1 R_s + E s_2) \), is lower than that of consolidation if she stays with the standard plan, \( \frac{d}{\phi_c}(1 + R_s) \), then she will switch to the income plan. This option is optimal provided that the earnings today and those expected tomorrow are very low, for every debt level. This feature is consistent with the data: the mean of earnings for people that opt for the income sensitive group is lower in the data. The example is consistent with another data fact: those with high debt levels prefer the income plan, since the repayment costs under simple consolidation and no consolidation option are increasing functions of initial debt level, \( d_0 \).

2.4 Adding Default

I introduce the possibility of default, so I consider case 4 below, when the agent defaults on his loan.

Case 4: Already in default

The value function is similar to the cases above with the difference that there is no repayment. However, there are consequences to default modeled to mimic those in the data: a garnishment of a fraction \( \rho \) of the earnings and an increase of the debt by \( \alpha \). The agent loses his right to consolidate after default, so the next period he needs to enter repayment under the no consolidation path \(^{17}\) as given in equation 12.

\[
V_D(z, d, a, y, R) = \max_{a' \in A} \{ u(c) + E \beta W NC(z', d', a', y', R') \}
\]

subject to

\[
c + a' \leq y(1 - \rho) + R_s a
\]

\[
d' = d(1 + \alpha) R
\]

\(^{17}\) Under the program, default status is reported to credit bureaus, and the repayment plan is implemented together with a series of penalties on the defaulter (see the appendix for details).
$$z' = z - 1$$
$$z' > 0$$

This choice is possible as long as he is not consolidated \(^{18}\), so the case 3 above is extended to allow for the option to default and becomes:

$$V_{NC}(z, d, a, y, R) = \max_{a', d'} \{ u(c) + E \beta \max [V_{NC}(z', d', a', y', R'), V_{SC}(z', d', a', y', R'), V_{IC}(z', d', a', y', R'), V_D(z', d', a', y', R', R_s)] \}$$

subject to

$$c + p + a' \leq y + R_s a$$
$$z' = z - 1$$
$$z' > 0$$

### 3 Parametrization

The model is calibrated to the U.S. economy. The model period equals 1 year in data. The parameter values are given in table 1:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Target/Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\beta)</td>
<td>0.96</td>
<td>real avg rate=4%</td>
</tr>
<tr>
<td>(\sigma)</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>(R_s)</td>
<td>1.04</td>
<td>avg rate in 1994</td>
</tr>
<tr>
<td>(\gamma)</td>
<td>0.10</td>
<td>DOE</td>
</tr>
<tr>
<td>(T)</td>
<td>10</td>
<td>DOE</td>
</tr>
<tr>
<td>(\rho)</td>
<td>0.0655</td>
<td>10.7% def rate-DOE</td>
</tr>
<tr>
<td>(\alpha)</td>
<td>0.25</td>
<td>10.7% def rate-DOE</td>
</tr>
</tbody>
</table>

\(^{18}\)Default after consolidation is not a possibility here since data suggests once borrowers consolidate, they will not choose to default.
the discount factor is $1/1.04$ to match the interest rate of 4% and the
coefficient of risk aversion is chosen as the standard one used in the literature.
The savings rate is 4% to match the average rate in 1994. The fraction of the
income used for the payment of the loan in the income sensitive plan is set to
10%. The punishments under default are set to match the default rate for the
1994 cohort, i.e. 10.7% (see figure 1). This is for college graduates that enter
repayment in the 1994 fiscal year and default by the end of the next fiscal
year.\footnote{Under the data set, the default rate for the cohort that entered repayment in 1994
through 1997 is 5.1%. The question asked was “Have you ever defaulted on your loan since
graduation till April 1997?” and one would expect a number of at least 10.7%. Since this is
not the case under the data, I conclude that there might be a problem in answering honestly
that particular question, so in the model I take as a target the default rate released by the
Department of Education for the same cohort as in the B&B data set.}

The rate on education loans is set to equal the TBill rate plus a threshold
of 3.2% to match the add up set by the government in 1994 to the TBill rate
(U.S. Department of Education). The rate follows a stochastic process, given
by a 2 by 2 transition matrix $\Pi(R', R)$ on $\{R, R\}$, calibrated to match the
TBill rate in the 90’s. To estimate the stochastic process for loan rates, I use
the time series for 3 month TBills for 1980-1996 adjusted for inflation rates. I
fit the real rate time series with the AR(1) process $R_t = \mu(1 - \rho) + \rho R_{t-1} + \varepsilon$, 
$\varepsilon \sim N(0, \sigma^2)$. The estimates of the two moments are given by $\rho = 0.9038$ and 
$\sigma = 0.7788$. I aggregate this to annual data and the autocorrelation is given by
0.297 and the unconditional standard deviation by 1.817. I have approximated
this process as a two state Markov chain. The support is $R \in \{1.038, 1.075\}$. 

The transition matrix is 
\[
\begin{bmatrix}
0.65 & 0.35 \\
0.35 & 0.65 \\
\end{bmatrix}.
\]

The earnings follows a stochastic process given by a 6 by 6 transition
matrix $Q(e', e)$ on the support $\{b, e1, e2, e3, e4, e5\}$. The stochastic process
for earnings is calibrated based on the annual earnings as of April 1994 and
1997 from the NPSAS data samples. The support consists in the benefit when
unemployed, as estimated from CPS data set for college graduates, and the
averages for the earnings quantiles in the B&B data set as presented in table
Table 2: Earnings

<table>
<thead>
<tr>
<th>Average salary levels</th>
<th>1997</th>
</tr>
</thead>
<tbody>
<tr>
<td>b</td>
<td>9400</td>
</tr>
<tr>
<td>e1</td>
<td>13740</td>
</tr>
<tr>
<td>e2</td>
<td>22555</td>
</tr>
<tr>
<td>e3</td>
<td>27192</td>
</tr>
<tr>
<td>e4</td>
<td>35567</td>
</tr>
<tr>
<td>e5</td>
<td>54843</td>
</tr>
</tbody>
</table>

2. The calibrated transition matrix for earnings is

\[
\begin{bmatrix}
0.04 & 0.31 & 0.27 & 0.17 & 0.13 & 0.08 \\
0.03 & 0.41 & 0.25 & 0.15 & 0.09 & 0.07 \\
0.03 & 0.30 & 0.31 & 0.21 & 0.09 & 0.06 \\
0.03 & 0.12 & 0.32 & 0.29 & 0.17 & 0.07 \\
0.04 & 0.07 & 0.13 & 0.27 & 0.29 & 0.20 \\
0.04 & 0.03 & 0.03 & 0.09 & 0.22 & 0.59
\end{bmatrix}
\]

This represents a three year calibrated earnings process. Since the model period is one year, I need to bring this to one year frequency, i.e have the third root of the matrix above. Since the eigenvalues are too small, the decomposition does not work, so instead I do the following: first, I use the PSID individual income data and estimate an annual frequency transition matrix for the income. Eventually, I raise that to the third power and compare it against the matrix estimated from the NPSAS. Since there are not too big differences, I use the PSID transition matrix in the calibration of my model.
This is given below:

\[
\begin{bmatrix}
0.30 & 0.47 & 0.07 & 0.07 & 0.045 & 0.045 \\
0.03 & 0.69 & 0.17 & 0.05 & 0.03 & 0.03 \\
0.04 & 0.15 & 0.61 & 0.12 & 0.05 & 0.03 \\
0.03 & 0.05 & 0.18 & 0.55 & 0.14 & 0.05 \\
0.02 & 0.02 & 0.04 & 0.19 & 0.64 & 0.09 \\
0.02 & 0.01 & 0.01 & 0.03 & 0.20 & 0.73
\end{bmatrix}
\]

4 Results

4.1 Benchmark model

The model predicts 100% consolidation and quantitatively explains the choice of repayment plans among college graduates who have not defaulted on their debt, as shown in table 3.

Table 3: Repayment Choice

<table>
<thead>
<tr>
<th></th>
<th>Data</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consolidation</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Simple</td>
<td>95.4%</td>
<td>95.8%</td>
</tr>
<tr>
<td>Income</td>
<td>4.6%</td>
<td>4.2%</td>
</tr>
</tbody>
</table>

In the model, all nondefaulters choose to consolidate. Among them, 95.8% will stay under the standard plan and 4.2% will switch to the income consolidation.

Second, the model delivers the sorting by repayment plans features of the data. The tables 4a and 4b show the earnings averages, debt and debt burden averages for payers under the available options both in the data and as predicted by the model.
Table 4a: Data

<table>
<thead>
<tr>
<th>Plan: Income Sensitive</th>
<th>Earnings Avg</th>
<th>Debt Avg</th>
<th>Debt Burden</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>19425</td>
<td>12181</td>
<td>0.85</td>
</tr>
<tr>
<td>Standard</td>
<td>29557</td>
<td>7897</td>
<td>0.44</td>
</tr>
</tbody>
</table>

Table 4b: Model

<table>
<thead>
<tr>
<th>Plan: Income Sensitive</th>
<th>Earnings Avg</th>
<th>Debt Avg</th>
<th>Debt Burden</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10573</td>
<td>12617</td>
<td>1.14</td>
</tr>
<tr>
<td>Standard</td>
<td>31094</td>
<td>7465</td>
<td>0.27</td>
</tr>
</tbody>
</table>

The model quantitatively and qualitatively explains the repayment sorting evidence with respect to debt levels: the mean of debt for borrowers within the income plan is $12617 compared to only $7465 for those under the standard plan. Although the model overestimates the magnitude of the difference between earnings averages for the two groups of payers, it can qualitatively account for the fact that agents with lower income levels choose the income consolidation. Hence, the model also predicts that higher the debt burden is, more likely the agents are to switch for income consolidation, while overestimating the difference. This can be explained by the fact that the model predicts that only unemployed agents and agents with earnings within the first quantile choose the income plan, hence the low average of earnings for the group in the income plan delivered by the model. Among these groups, the agents with lower debt levels will opt for the standard plan, given the lower debt burden. Agents with higher debt levels choose the income consolidation. Agents with higher earnings levels will choose the standard consolidation, regardless of their debt levels. This explains the difference in averages for the two groups of borrowers. The fact that unemployed agents will opt for the income consolidation is consistent with the data fact that unemployment spells
are higher for the payers under the income plan (see the appendix on data details).

Regarding characteristics of defaulters, the model predicts that those who default have lower income levels and higher debt levels than non defaulters, the debt burden being 0.84 for defaulters versus 0.31 for non defaulters (table 5a).

Table 5a: Default versus Nondefault

<table>
<thead>
<tr>
<th>Model</th>
<th>Percentage</th>
<th>Earnings</th>
<th>Debt</th>
<th>Debt Burden</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default</td>
<td>10.7%</td>
<td>13688</td>
<td>11291</td>
<td>0.84</td>
</tr>
<tr>
<td>Nondefault</td>
<td>89.3%</td>
<td>30230</td>
<td>7652</td>
<td>0.31</td>
</tr>
</tbody>
</table>

Table 5b: Default versus Nondefault

<table>
<thead>
<tr>
<th>Data</th>
<th>Earnings</th>
<th>Debt</th>
<th>Debt Burden</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default</td>
<td>27071</td>
<td>9943</td>
<td>0.50</td>
</tr>
<tr>
<td>Nondefault</td>
<td>29040</td>
<td>8363</td>
<td>0.47</td>
</tr>
</tbody>
</table>

Note that the model predicts that borrowers who choose to default have lower debt levels on average relative to those that pay under the income plan, but higher than those under the standard plan. This is consistent with data. When I restrict attention to the small group of defaulters under the data, I find that those who default have higher debt levels and lower earnings on average relative to nondefaulters as table 5b shows (for details see table A-6 in the appendix). The mean of debt for defaulters is below that for the standard payers, but above that for payers under the income plan. The defaulters in the sample are situated in the intermediate range in terms of debt still
owed for education as the model predicts. As before, the model overestimates the difference in the debt burden between the two groups, but it qualitatively accounts for the fact that defaulters have higher debt burdens relative to those who do not default.

These results can be explained by the fact that the model delivers debt thresholds $d_*(a, y, R)$ and $d^*(a, y, R)$ for different choices as the following figure suggests.

The picture is for median asset level and unemployed benefit income level. For $d > d^*$ the income consolidation is chosen and no default occurs and for $d < d^*$ the standard one is chosen and no default occurs. The default option is preferred for the intermediate range. The agents will choose standard consolidation in the case of low debt burdens. However in the case they are constraint in their ability to repay, given higher debt levels, they choose to default until some level, when the default becomes too costly, so the income consolidation is preferred instead.\textsuperscript{20} Therefore the value function for unemployed agents is a combination of the three value functions above across different debt levels.

\textsuperscript{20}The default punishments are increasing in both earnings and debt.
with kinks at the thresholds, as the next figure shows.

![Value function when unemployed](image)

**Figure 4:**

The threshold that makes the default preferable to standard consolidation is declining in the interest rate given that the standard consolidation is less attractive. Both thresholds are increasing in earnings. Given that the agent is less constraint in his ability to repay, he needs more debt to trigger default. Figure 5 shows the thresholds for an agent within the first earnings quantile relative to an unemployed agent. For higher earnings levels there are no such thresholds. Thus the value function for an agent within the third quantile of earnings presents no kinks, given that his choice is the standard consolidation regardless of the debt level (see figure 6).

If the exogenous parameters of the model are changed, the thresholds change accordingly. For instance, if the fraction of the income that is paid under the income plan is increased, the threshold that makes income plan more preferred will increase. More debt is needed to determine the agent to switch to the income plan which is less attractive.
Figure 5:

Value functions for the 3rd quantile

Figure 6:
4.2 Policy Proposal

In this section I look at the consequences of the current policy proposal for default rates and repayment behavior. To simulate this, I eliminate the standard consolidation option, case 2 in the model. Keeping everything else the same, case 3 becomes:

\[
V_{NC}(z, d, a, y, R) = \max_{\alpha', d'} \{ u(c) + E \beta \max[V_{NC}(z', d', a', y', R'),
V_{IC}(z', d', a', y', R'), V_{D}(z', d', a', y', R')] \}
\]

subject to
\[
c + p + \alpha' \leq y + R_s a
\]
\[
z' = z - 1
\]
\[
z > 0
\]

The model predicts that 18.7% will default in this case, an increase of 8% from the benchmark model. Table 6a below presents the details of this experiment.

<table>
<thead>
<tr>
<th></th>
<th>Percentage</th>
<th>Earnings</th>
<th>Debt</th>
<th>Debt Burden</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default</td>
<td>18.7%</td>
<td>14449</td>
<td>10789</td>
<td>0.77</td>
</tr>
<tr>
<td>Nondefault</td>
<td>81.3%</td>
<td>30608</td>
<td>7524</td>
<td>0.25</td>
</tr>
</tbody>
</table>

The debt burden of defaulters is lower compared with the case when locking in the interest rate is possible. Among those who do not declare bankruptcy, the model predicts a lower average of earnings and a higher debt burden for the income group.

<table>
<thead>
<tr>
<th></th>
<th>Percentage</th>
<th>Earnings</th>
<th>Debt</th>
<th>Debt Burden</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income Consolidation</td>
<td>6.5%</td>
<td>11243</td>
<td>13169</td>
<td>1.2</td>
</tr>
<tr>
<td>No Consolidation</td>
<td>93.5%</td>
<td>32035</td>
<td>7099</td>
<td>0.25</td>
</tr>
</tbody>
</table>
If the standard consolidation is not allowed, 93.5% choose not to consolidate. There is not much change in the percentage of payers under the income plan relative to benchmark model, suggesting that most of the “new defaulters” in the experiment would have locked in the rate, in case that option had been still available. In the benchmark model 3.7% of all agents in the economy opt for the income plan and in the experiment 5.3%. The thresholds discussed in the previous section imply that for bottom income quantile borrowers, agents with very high debt burdens will choose the income plan, those with intermediate burdens will default and those who have very low debt burdens relative to their earnings will pay under the standard plan. Hence if the standard consolidation is not available, those under the standard plan are mostly affected. Most of them will choose to stay under the standard plan paying at a variable rate, but those at the margin will enter the default range given a slight increase in the debt burden relative to earnings under variable rates. For higher income quantiles, since there are no such thresholds, the elimination of the standard consolidation will not induce additional default. Hence, additional default comes from borrowers within low income quantiles and relatively lower debt burdens.

Given the absence of the possibility to lock in the interest rate, the model predicts that agents will be more inclined to default. A common criticism of this proposal has been that the government might spend a lot to bail out delinquent borrowers. There are two ways one can approach this issue. First, to offset this increase in the default rate, one can make default punishments more severe in order to deter borrowers from default. This could avoid the cost of bailing out defaulters, but might trigger less enrolment given tightened repayment rules. However, the model predicts only a small increase in the punishments in the case of default. In order to recoup the benchmark default rate, the model predicts that 7% of earnings should be garnished in the case of bankruptcy, instead of 6.55% in the benchmark case. With appropriate adjustments of the bankruptcy rules, the government could save the funds needed to subsidize the program at no cost. Second, one can estimate the cost
from additional default in the case the consolidation program is discontinued.\textsuperscript{21} I also run an experiment in which I do not allow for income consolidation. In this case, the default rate surges to 25.4\% and more severe bankruptcy rules are needed to recoup the 10.7\% of default. The model suggests that even though not many borrowers are risk sharing via the income contingent plan, this is an important channel to keep down the default rate under the program. The model suggests that the payers under the income plan would more likely have defaulted in the case this option had not been available.

5 Conclusion

The objective of this paper was to develop a standard theoretical model able to replicate the repayment behavior for 92/93 college graduates who borrowed for their undergraduate education and use it to study the impact of a recent government proposal of discontinuing the consolidation program by June 2006.

First, I examined the data from B&B 93/97 on repayment, consolidation and default decisions for college graduates who borrowed for undergraduate education under the GSL program. Next, I constructed a theoretical model and calibrated it to the US economy to replicate the observed data facts. The model accounts for both the repayment plan choice and the consolidation pattern observed in the data. It qualitatively and quantitatively explains the borrowers’ characteristics among different groups of payers. It predicts 100\% consolidation and matches the repayment plan choice for nondefaulters. It also explains the sorting evidence by earnings and debt in 1997: borrowers with lower earnings levels will opt for the income consolidation and those with higher earnings levels for the standard consolidation. Also, the payers under

\textsuperscript{21}I simulate the economy for 10000 agents to estimate costs and benefits when the proposal is implemented. My results suggests that the cost of subsidizing standard consolidation is $3.1 mil, saved in the case this option is not allowed. The cost from the additional default and income consolidation under the proposal is negligible ($162070 with only $8786 form additional default). In terms of welfare, however, there is a decline of 6.2\% from the benchmark level when the program is discontinued.
the income plan have higher debt levels relative to those under the standard plan and hence higher debt burdens relative to their earnings.

The model is used to run experiments to test implications of the recent consolidation program proposal for repayment behavior. Results show that the proposal to end the consolidation program will make graduates less likely to repay, increasing the default rate by 8% from the current level. The additional default is accounted for by lower income quantile borrowers. The cost from the extra default rate could be avoided by tightening default punishments only by a small amount. With appropriate adjustments of the bankruptcy rules, the government could save the funds needed to subsidize the program at no cost. Even with no penalties adjustments, the cost of the additional default is not high, given that the loans are not dischargeable. The model also suggests that the income contingent plan contributes to keeping the default rate low.

The absence of the possibility to hedge against rate fluctuations might deter students to enter the program in the first place. Subsequently, couple of questions arise. How is the enrollment decision affected among different income groups? How should the government allocate funds to correct for both types of market imperfection: the one that arise in the pre-college period and the one in the post college period? I will consider these issues in future research extended to incorporate enrollment and borrowing decisions under the program. Future work would explore alternative policy designs that allow for the reallocation of the education budget among graduates and prospective students in a model that endogenize the human capital investment and borrowing decisions of college students along with their repayment incentives after graduation.

References


A Appendix

A.1 Institutional Details: Background on the Student Loan Repayment Program

A.1.1 Repayment Options

The borrower under the Student Loan Program faces a menu of repayment schedules: standard, graduated, income contingent and extended repayment. Given a preliminary budget development, he can choose together with a counselor the best plan for him by comparing the total cost to repay with monthly payment amounts for the given repayment schedules. If he does not fully honor his obligation after 25 years, he is exempt of the rest of the payment.

The standard schedule is the plan assigned by default, if not otherwise requested. This is extended over 10 years and payments are fixed up to the TBill interest rate fluctuations.

The extended one is similar in the sense that it consists in fixed monthly payments up to the fluctuations of TBill rates, but it supposes lower required payments, since it extends over a larger number of periods: 25 or 30 years. The borrower has the choice to occasionally make extra payments. The downside is that the total amount of interests paid is significantly increased over the life of the loan. The borrower can combine the advantages of the lower cost
of the standard plan with the benefit of lower monthly payment requirements of the extended plan, by choosing the extended repayment, but paying at the monthly rate as under the standard plan. He can pay off the loan in about 10 years, but he will have the flexibility to make only the lower required payment if emergency expenses arise.

The graduated plan allows for intertemporal consumption smoothing. This schedule gives the borrower payment relief when his income is lowest, starting with low payments immediately after graduation and incremental increases periods thereafter. This is accomplished by requiring only the interest to be paid for an initial fixed period, followed by principal and interest payments over the remainder of the term. The payment amount increases in several steps. When the payment amount levels off, it is higher than it would have been under a standard schedule to make up for the amount that were not paid earlier. Young agents, more likely constraint in their ability to borrow are allowed to redirect available funds toward other purchases and once they accumulate income later on in their lives, they can deliver higher payments towards their education loans.

The income-sensitive plan is particularly interesting since it provides a good way to hedge against income shocks. This schedule is a variation of the graduated plan, and the payments are computed as a percentage of the borrower’s adjusted gross income. They increase only if the income increases. Payments are generally capped at an amount slightly less than the required under a standard schedule. As with the graduated plan, lower initial payments are balanced by inflated payments later. The fluctuating payments contingent on income realizations give the debtor the possibility to smooth consumption across states and dates.

A.1.2 Default And Bankruptcy Laws

Until early 90’s, the students facing adverse shocks to their income could have discharged on their loans when declaring bankruptcy under Chapter 7, “The
Liquidation Chapter”. After 1990, students declaring bankruptcy have been asked to repay even after they have suffered adverse shocks. Currently the borrower of student loans declares bankruptcy under Chapter 13, ”Adjustment of the Debts of an Individual With Regular Income”, one of the “Reorganization Chapters” under the Bankruptcy Code. The most significant distinction between them is in regard to the administration of the estate. Rather than a disposal of the assets through liquidation sale, the purpose of the reorganization chapters is to preserve and protect the integrity of assets from the claims of creditors, so as to permit the debtor an opportunity to reorganize and restructure its assets and liabilities and to become economically viable. However, the indebted defaulter is required to reduce consumption to finance at least partial repayment of his obligations.

Students need to start repaying their loans six months after graduation. If they do not make any payments within 270 days, they are generally considered in default, unless an agreement with the lender is reached. Default for a FFEL or Direct Loan occurs if you become 270 days delinquent (if monthly payments are required) or 330 days delinquent if less often than monthly payments are made. Default status is reported to credit bureaus and the repayment plan is implemented together with a series of penalties on the defaulter such as: garnishment of up to 10% of the wage, seizure of federal tax refunds, possible hold on transcripts, ineligibility for future student loans. Institutions with high default rates are also penalized. Upon default, borrowers lose their rights to consolidate their education loans.

A.1.3 Consolidation Program

Currently, education loan payers have the opportunity to consolidate their education loans. A Consolidation Loan is designed to help student borrowers consolidate several types of federal student loans with various repayment schedules into one loan. All FFEL and Direct Stafford Loan borrowers are el-

\[22\text{For a Federal Perkins Loan, default occurs if the debtor does not make an installment payment when due or does not comply with the promissory note other terms.}\]
eligible to consolidate after they graduate, leave school, or drop below half-time enrollment. All the FFEL repayment plans are available to FFEL Consolidation Loan borrowers. For Direct Consolidation Loan borrowers, most of the Direct Loan repayment plans are available, except that Direct PLUS Consolidation Loans are not eligible to be repaid under the Income Contingent Repayment Plan and might not be eligible for some discharge/cancellation benefits. Borrowers who are delinquent (30 days or more late in making a loan payment) or in default (270 days or more late) must meet certain requirements before they may consolidate their loans.

Repayment of Consolidation Loans begins within 60 days of the disbursement of the loan. The payback term ranges from 10 to 30 years, depending on the amount of education debt being repaid and the repayment option selected. There are no application fees or prepayment penalties for consolidation. Also, under FFEL Consolidation Loans, no credit checks are required, even for PLUS borrowers. Under Direct Loan consolidation, PLUS borrowers are subject to a check for adverse credit history. Upon consolidation, the debtor should take into account the impact of losing any borrower benefits offered under non-consolidated repayment plans. Borrower benefits, which may include interest rate discounts, principal rebates, or some loan cancellation benefits can significantly reduce the cost of repaying his loans.

The interest rate for FFEL and Direct Consolidation Loans is set according to a formula established by federal statute. The fixed rate is based on the weighted average of the interest rates on the loans at the time of consolidation, rounded up to the nearest one-eighth of a percent. The interest rate does not exceed 8.25 percent. The consolidation rate is fixed for the life of the loan, which protects the borrower from future increases in variable rate loans but prevents him from benefiting from future decreases in variable rates since once made, Federal Consolidation Loans cannot be unmade because the loans that were consolidated have been paid off and no longer exist.
A.2 Data

I use the NPSAS data set, specifically Baccalaureate and Beyond Surveys (B&B) to analyze patterns in the repayment behavior of borrowers under the program a few years after they graduated from college. The data set is nationally representative and it is comprised in students, parents and institutions. School information is transcript based and student information is based on interviews. The survey has followed a random sample of 11,000 individuals who received their baccalaureate degree during the 1992-1993 academic year through 1997. There is an initial survey at graduation time and two follow up interviews in 1994 and 1997. I look only at subjects for whom repayment plan choice, consolidation, and default variables exist both in 1994 and 1997 surveys. I restrict my attention to the graduates that borrowed for undergraduate education under the FFELP and FDLP programs and graduated from college in the period 1992/07 - 1993/06.23 I do not take into account students who went to graduate school because those continuing to graduate school are eligible for deferments in their loan repayment and I can not observe their repayment decision properly. I clean data for outliers and unreasonable observations for the variables of interest: income, unemployment spell, and debt levels. For characteristics of borrowers as of 1994, the sample size is 3021, but when I follow graduates in 1997, I loose data given missing observations for my variables of interest. Hence, my main sample in 1997 consists of 961 undergraduate borrowers who graduated from college in 1992-1993 and did not pursue a graduate career. They have answered for my variables of interest in both follow up interviews. All of them were under no consolidation status, paying under the standard plan in 1994.

Earnings in the sample are given as of the interview date in 1994 and 1997 respectively, unemployment spells represent continuous number of months unemployed since graduation. I also look at their annual income from job only and total income as subjects declared for years 1993 and 1996. Repayment

\footnote{23These are the programs of interest for which the policy proposal is studied.}
decisions are given in 1994 for the first loan only.\textsuperscript{24} In 1997 through consolidation, they combined all loans in a single one.

Tables A-1 and A-2 report background characteristics for my sample of borrowers\textsuperscript{25}.

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Mean</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>debt for college</td>
<td>3021</td>
<td>10388</td>
<td>7062</td>
</tr>
<tr>
<td>debt still owed in 1997</td>
<td>971</td>
<td>8398</td>
<td>6839</td>
</tr>
<tr>
<td>job annual income 1993</td>
<td>3021</td>
<td>15402</td>
<td>10013</td>
</tr>
<tr>
<td>total annual income 1993</td>
<td>3021</td>
<td>16275</td>
<td>10539</td>
</tr>
<tr>
<td>household income 1993</td>
<td>3021</td>
<td>24520</td>
<td>21008</td>
</tr>
<tr>
<td>earnings as of April 1994</td>
<td>3021</td>
<td>21892</td>
<td>9894</td>
</tr>
<tr>
<td>annual income 1996</td>
<td>971</td>
<td>3002</td>
<td>16074</td>
</tr>
<tr>
<td>total annual income 1996</td>
<td>971</td>
<td>30827.8</td>
<td>16345</td>
</tr>
<tr>
<td>household annual income 1996</td>
<td>971</td>
<td>45856.5</td>
<td>27886</td>
</tr>
<tr>
<td>earnings as of April 1997</td>
<td>971</td>
<td>31873</td>
<td>21867</td>
</tr>
<tr>
<td>monthly burden 1994</td>
<td>3021</td>
<td>103.4</td>
<td>80.5</td>
</tr>
<tr>
<td>unemployment spell form BA till 1994</td>
<td>3021</td>
<td>1.46</td>
<td>2.95</td>
</tr>
<tr>
<td>unemployment spell from BA till 1997</td>
<td>971</td>
<td>2.32</td>
<td>4.18</td>
</tr>
<tr>
<td>nr of dependents</td>
<td>971</td>
<td>0.58</td>
<td>0.94</td>
</tr>
<tr>
<td>GPA college</td>
<td>3021</td>
<td>3.15</td>
<td>0.42</td>
</tr>
</tbody>
</table>

Earnings include unemployment benefits for those who declared they were unemployed at the two interview dates: 7.9\% in 1994 and 6.97\% in 1997. I estimate the unemployment benefit for the two years using CPS data set for college graduates.\textsuperscript{26}

Table A-4 reports information about students repayment behavior by debt, earnings, unemployment, and number of dependents.\textsuperscript{27} The earnings averages

\textsuperscript{24}I used this variable since 52\% of the sample had only one loan and from the rest, most of them had the same repayment plan for the rest of the loans as for the first one.

\textsuperscript{25}For each variable the appropriate sample was used.

\textsuperscript{26}My estimates from the CPS are 6330 and 9400 for the two years based on weekly wages of 487 and 717 respectively.

\textsuperscript{27}The tables presents the choice for all repayment schedules existing in the data, not only for those modeled in the paper.
Table A-2: Sample Background Characteristics for Undergraduate Borrowers

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Perc</th>
</tr>
</thead>
<tbody>
<tr>
<td>savings 1994</td>
<td>3021</td>
<td>0.72</td>
</tr>
<tr>
<td>savings 1997</td>
<td>971</td>
<td>0.689</td>
</tr>
<tr>
<td>other debt 1997</td>
<td>971</td>
<td>0.675</td>
</tr>
<tr>
<td>default till 1994 (N=2936)</td>
<td>3021</td>
<td>0.0181</td>
</tr>
<tr>
<td>default till 1997 (N=740)</td>
<td>971</td>
<td>0.0514</td>
</tr>
<tr>
<td>consolidation 1994</td>
<td>3021</td>
<td>0.94</td>
</tr>
<tr>
<td>consolidation 1997</td>
<td>971</td>
<td>1.0</td>
</tr>
<tr>
<td>repayment standard plan 1994</td>
<td>3021</td>
<td>0.93</td>
</tr>
<tr>
<td>repayment income plan 1994</td>
<td>3021</td>
<td>0.025</td>
</tr>
<tr>
<td>repayment graduated plan 1994</td>
<td>3021</td>
<td>0.045</td>
</tr>
<tr>
<td>repayment standard plan 1997</td>
<td>971</td>
<td>0.85</td>
</tr>
<tr>
<td>repayment graduated plan 1997</td>
<td>971</td>
<td>0.10</td>
</tr>
<tr>
<td>repayment income plan 1997</td>
<td>971</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Table A-4: Averages for Earnings, Debt Level and Unemployment by Repayment Choice

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Standard Plan</th>
<th>Graduated Plan</th>
<th>Income Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Debt in college</td>
<td>10206</td>
<td>10945</td>
<td>11684</td>
</tr>
<tr>
<td>Debt still owed in 1997</td>
<td>7897</td>
<td>11712</td>
<td>12181</td>
</tr>
<tr>
<td>Annual income 1993</td>
<td>15453</td>
<td>15040</td>
<td>14152</td>
</tr>
<tr>
<td>Annual income 1996</td>
<td>29557</td>
<td>27426</td>
<td>19425</td>
</tr>
<tr>
<td>Total income 1993</td>
<td>16315</td>
<td>16277</td>
<td>14765</td>
</tr>
<tr>
<td>Total income 1996</td>
<td>31369</td>
<td>27982</td>
<td>25290</td>
</tr>
<tr>
<td>Earnings as of April 1994</td>
<td>21922</td>
<td>21476</td>
<td>21546</td>
</tr>
<tr>
<td>Earnings as of April 1997</td>
<td>32013</td>
<td>32184</td>
<td>28334</td>
</tr>
<tr>
<td>Unemployment spell till 1994</td>
<td>1.46</td>
<td>1.71</td>
<td>1.15</td>
</tr>
<tr>
<td>Unemployment spell till 1997</td>
<td>2.27</td>
<td>2.66</td>
<td>2.71</td>
</tr>
<tr>
<td>Nr of dependents in 1994</td>
<td>1.64</td>
<td>1.73</td>
<td>1.85</td>
</tr>
<tr>
<td>Nr of dependents in 1997</td>
<td>0.58</td>
<td>0.5</td>
<td>0.74</td>
</tr>
</tbody>
</table>
for both job and total income values vary across the three plans. The group in the income sensitive plan has a lower income mean than those in the graduated and standard plan and higher unemployment spells. The feature is robust when the salary levels as of the interview dates are taken into account. However, the differences are more significant when looking at their reported income levels for the previous year. This is the relevant variable for the repayment decision they made by April 1994 and 1997 respectively. Note that in 1997, the differences in earnings and total income among repayment plans are seizable compared to those for 1994, given that all borrowers in the sample have consolidated by 1997 and have chosen the right repayment plan given income. The table suggests a good estimation of future income and number of dependents at the graduation time by borrowers. However, regarding the unemployment spell college graduates’ predictions were less correct. The unemployment spell sorting by repayment plans improve in the second follow up interview, when most of the borrowers consolidated and updated their plans. The income sensitive group also have more number of dependents on average. Payers with more than 1 dependent usually opt for the income sensitive plan. The income sorting evidence works quite well when conditioned on loan amount quantiles with the exception of the third quantile. Also, as table A-5 shows, sorting evidence is robust when conditioned on major and access to different savings technologies. For majors, there is an exception (math/eng/cs), but this might be explained by the reduced number of observations within groups (for this major there are only 2 borrowers paying under the income sensitive plan). The income by repayment plan profile is the same regardless of savings or having other debt. However, the means for the income sensitive plan are lower for those who save or have other loans relative to those who do not, for both the job and the total income.

Under the data set, the default rate for the cohort that entered repayment

\footnote{This variable is based on the matrix of values with unemployment status for all months since graduation till the interview date.}
Table A-5: Repayment Choice -mean of Earnings By Major, SAT/ACT Quartiles, Debt Quantiles Savings Behavior

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Standard Plan</th>
<th>Graduated Plan</th>
<th>Income Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Debt</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quantile 1</td>
<td>32903</td>
<td>28124</td>
<td>29083</td>
</tr>
<tr>
<td>Quantile 2</td>
<td>30891</td>
<td>33715</td>
<td>14000</td>
</tr>
<tr>
<td>Quantile 3</td>
<td>28887</td>
<td>26000</td>
<td>32214</td>
</tr>
<tr>
<td>Quantile 4</td>
<td>27586</td>
<td>25143</td>
<td>16634</td>
</tr>
<tr>
<td>Quantile 5</td>
<td>32450</td>
<td>27184</td>
<td>23318</td>
</tr>
<tr>
<td>Major</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bs/Mn</td>
<td>30213</td>
<td>37592</td>
<td>20083</td>
</tr>
<tr>
<td>Ed</td>
<td>22948</td>
<td>25334</td>
<td>20875</td>
</tr>
<tr>
<td>Eng/Math/Cs</td>
<td>35869</td>
<td>23509</td>
<td>41000</td>
</tr>
<tr>
<td>Health</td>
<td>43081</td>
<td>25892</td>
<td>39500</td>
</tr>
<tr>
<td>Hum/soc sc</td>
<td>28369</td>
<td>24939</td>
<td>22813</td>
</tr>
<tr>
<td>Others</td>
<td>30441</td>
<td>30625</td>
<td>23651</td>
</tr>
<tr>
<td>SAT/ACT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quantile 1</td>
<td>30857</td>
<td>26864</td>
<td>29228</td>
</tr>
<tr>
<td>Quantile 2</td>
<td>27604</td>
<td>27474</td>
<td>16841</td>
</tr>
<tr>
<td>Quantile 3</td>
<td>29776</td>
<td>29325</td>
<td>21200</td>
</tr>
<tr>
<td>Quantile 4</td>
<td>32522</td>
<td>28067</td>
<td>26625</td>
</tr>
<tr>
<td>Quantile 5</td>
<td>32704</td>
<td>24455</td>
<td>19100</td>
</tr>
<tr>
<td>Savings(68.9%)</td>
<td>32232</td>
<td>28408</td>
<td>22919</td>
</tr>
<tr>
<td>No savings(31.1%)</td>
<td>26704</td>
<td>24236</td>
<td>25194</td>
</tr>
<tr>
<td>Other debt(67.5%)</td>
<td>30196</td>
<td>27508</td>
<td>24766</td>
</tr>
<tr>
<td>No other debt(32.5%)</td>
<td>31180</td>
<td>27164</td>
<td>24400</td>
</tr>
</tbody>
</table>
Table A-6: Characteristics of defaulters versus nondefaulters

<table>
<thead>
<tr>
<th>Variable</th>
<th>Default Mean</th>
<th>Default Standard Error</th>
<th>Nondefault Mean</th>
<th>Nondefault Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Debt from college</td>
<td>13178</td>
<td>8953</td>
<td>11669</td>
<td>7025</td>
</tr>
<tr>
<td>Debt still owed</td>
<td>9943</td>
<td>7437</td>
<td>8341</td>
<td>6686</td>
</tr>
<tr>
<td>Job annual income</td>
<td>28145</td>
<td>19256</td>
<td>30192</td>
<td>15747</td>
</tr>
<tr>
<td>Total income</td>
<td>28564</td>
<td>18963</td>
<td>30995</td>
<td>16055</td>
</tr>
<tr>
<td>Earnings as of April '97</td>
<td>33110</td>
<td>21160</td>
<td>33595</td>
<td>21500</td>
</tr>
<tr>
<td>Household income</td>
<td>35091</td>
<td>23141</td>
<td>46204</td>
<td>28223</td>
</tr>
<tr>
<td>Debt burden</td>
<td>0.47</td>
<td>0.50</td>
<td>0.36</td>
<td>0.43</td>
</tr>
<tr>
<td>Unemployment spell</td>
<td>3.34</td>
<td>5.16</td>
<td>2.25</td>
<td>4.07</td>
</tr>
<tr>
<td>Nr. of dependents</td>
<td>0.84</td>
<td>1.17</td>
<td>0.57</td>
<td>0.94</td>
</tr>
<tr>
<td>Savings</td>
<td>0.47</td>
<td>0.51</td>
<td>0.7</td>
<td>0.49</td>
</tr>
<tr>
<td>GPA</td>
<td>3.02</td>
<td>0.49</td>
<td>3.16</td>
<td>0.43</td>
</tr>
</tbody>
</table>

in 1994 through 1997 is 5.1%. The data shows the following characteristics of defaulters versus nondefaulters as given in table A-6. Those who default have higher debt levels and lower earnings on average. The mean of debt for defaulters is below that for the standard payers, but above that for payers under the income plan. The defaulters are situated in the intermediate range in terms of debt still owed for education. Also, unemployment spell and number of dependents are higher on average for defaulters.

29The question asked was “Have you ever defaulted on your loan till April 1997?”.