Optimal Taxation Under Heterogeneous Labor Market Entry: The Role of Student Loan

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We study optimal taxation in an environment in which agents choose schooling and enter the labor market subject to observable shocks. The observation that motivate the idea is the well-known result that labor market conditions upon entry, i.e. when students graduate from schools and look for jobs, substantially affect life-time earnings. (Altonji et al. (2016); Oyer (2006); Oreopoulos et al. (2012); Liu et al. (2016); Kahn (2010); Bedard and Herman (2008)) On the other hand, as a major source of financing higher education, student loan interest rate does not correlate with aggregate labor market conditions. Rather, it is determined at the time of receipt by the students and fixed throughout its repayment period.

Imagine we have two same students in terms of ability who have the same amount of student loans and repayment contract. The only difference is that one enters the labor market in boom and the other in recession. Now the student who is lucky and enter the labor market at a good time is going to have higher expected life-time earnings than the other unlucky guy. But their loan repayment contract is the same, which implies that the unlucky student is more likely to face difficulty repaying the loan hence more likely to default. Default can trigger other negative labor market outcomes, making the unlucky guy even more unlucky.

The root of the problem is a lack of insurance *between* cohorts. Several countries have income contingent student loan repayment which can be viewed as insurance *within* cohorts. However, cohorts who enter the labor market in recession consistently earn low life-time earnings compared to cohorts that enter in good times, yet the design of the student loan repayment plan does not take this aspect into consideration: the first column in table 1 shows that the interest rate of the federal unsubsidized student loan (it is the largest

student loan program) is uncorrelated with contemporaneous unemployment rate. It is not correlated with future unemployment rate either.

Table 1: Student Loan Interest Rate and Unemployment Rate

	Unemployment rate	GDP growth
Contemporaneous	0.019	0.19
	(0.14)	(0.2)
1-Year lead	0.12	0.01
	(0.13)	(0.17)
2-Year lead	0.20	0.07
	(0.14)	(0.17)
3-Year lead	0.18	0.21
	(0.15)	(0.19)
4-Year lead	0.04	0.39**
	(0.16)	(0.16)

There is scant evidence that student loan interest rate is correlated with GDP growth rate, as shown in the second column in table 1. Intrinsically the design of a fixed interest rate at the time of loan receipt cannot adjust for aggregate labor market conditions upon entry because different cohorts could receive student loans at the same time hence face the same interest rate but different future labor market conditions.

The goal of the paper is then thinking about the optimal Mirrleesean taxation in an environment with education and different aggregate labor market conditions upon entry and trying to show how an alternative student loan design could implement the optimal taxation. I am going to adopt an applied mechanism design approach and explore both analytically and numerically the interaction between optimal taxation and heterogeneous cohorts and how student loan design can implement such system.

As far as I know, there has not been any paper discussing the design of student loan under heterogeneous time of labor market entry. Findeisen and Sachs (2016) discuss income-contingent student loan repayment but there is no heterogeneous labor market entry con-

ditions. As discussed above, we focus on between cohort insurance rather than within cohort insurance. They also only have a two period model while I will calibrate a life-cycle model to the US economy to discuss optimal student loan repayment design over the life cycle.

The model is similar to Kapicka (2015). We augment the model with education decision under limited education resource and *observable* aggregate shock σ. Individuals differ by their ability θ which is private-information. The labor decisions are non-separable which I derived using a Ben-Porath model.

The agent maximizes

$$\sum_{t=0}^{T} \beta^t c_t(\theta,\sigma) - W(z_1(\theta,\sigma), z_2(\theta,\sigma), ..., z_T(\theta,\sigma)) \tag{1}$$

where $\{c_t(\theta,\sigma)\}_{\{0\leqslant t\leqslant T\}}$ is life-time consumption and $W(\{z_t(\theta,\sigma)\}_{\{0\leqslant t\leqslant T\}}$ is disutility from labor input. From now on I suppress the dependence on (θ,σ) if no confusion arises.

I derive the planner's problem using a first order approach and show its validity under a monotonicity condition. The planner's problem is similar to Kapicka (2015) with two key differences. First, there are different cohorts labeled by σ which is observable to the planner. The planner hence tries to minimize the cost of delivering promised utility to the agents with no restriction on cross-subsidization. In other words, the planner can tax one cohort more and another cohort less, depending on the aggregate entry condition σ which affects labor productivity with can be used with labor z_t to produce output $y_t = \theta\sigma z_t$.

I then write down a three-period Ben-Porath economy with two cohorts to derive the labor cost function W. I derive analytically the optimal taxation and educational fee. Two results stand out. The first result is that there is indeed cross-subsidization in the sense that the cohort facing good labor market condition upon entry should face higher tax rate than the cohort that enters at a bad time. The second result is that if the distribution of the education resource does not depend on the aggregate condition, i.e. if the planner does

not give the high ability agent less resource in a good time, the total educational fee should be higher in a good time versus a bad time.

I discuss how to implement the optimal taxation in this simple economy with a income contingent tax rate and a student loan interest rate that varies with labor market conditions upon entry. The intuition is that tax rate conditioned on aggregate labor market condition upon entry is controversial, so we set the tax rate to be equal the optimal tax rate the unlucky cohort faces and use student loan interest rate as the tool for between cohort insurance.

My next steps are three-fold.

1. Life-cycle fluctuation of labor tax is missing in my simple three-period example with two working periods. I will calibrate the model to the U.S. economy with long periods and study the life-cycle pattern of the optimal taxation.

2. I will try to motivate the labor disutility function W using another economy with unobservable savings.

3. I will try to discuss other implementations that are variations of current labor tax and student loan design system in the numerical analysis and compare them with the optimal taxation to estimate the welfare gain.

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