This Version: March 19, 2023
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EDUCATION

2024*	Ph.D. in Management (Economics, Finance, & Accounting Area) (* = expected) MASSACHUSETTS INSTITUTE OF TECHNOLOGY, SLOAN SCHOOL OF MANAGEMENT *Dissertation Committee*: David Thesmar, Jonathan A. Parker, Lawrence D.W. Schmidt, Taha Choukhmane, Eric C. So
2021	M.S. in Management MASSACHUSETTS INSTITUTE OF TECHNOLOGY, SLOAN SCHOOL OF MANAGEMENT
2018	B.A. in Financial Economics and Applied Mathematics (Dual Major), *magna cum laude* CLAREMONT MCKENNA COLLEGE *Thesis Advisor*: Fan Yu
2015	Summer Program in Economic Statistics THE LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE

RESEARCH INTERESTS

Household Finance, Macro-Finance, Asset Pricing, Behavioral Economics, Public Finance

OTHER AFFLIATIONS

2022-2023	Visiting Researcher, Australian National University *Sponsors*: Nicholas Biddle, Andrew Norton
2022-2023	Honorary Appointment, University of Technology Sydney *Sponsor*: Anna Bedford

WORKING PAPERS

1. "Noise in Expectations: Evidence from Analyst Forecasts" with David Thesmar

   Revise and Resubmit at the *Review of Financial Studies* (2nd Round)

   Abstract: Analyst forecasts outperform statistical forecasts in the short run, but underperform in the long run. We develop a framework to decompose these differences in forecasting accuracy into differences in information, forecast bias, and forecast noise. Noise and bias strongly increase with the horizon, while analyst information advantage decreases very fast. Quantitatively, this generates a reversal in the sign of the Coibion and Gorodnichenko (2015) regression coefficient at long horizons, independently of over-reaction/underreaction. Finally, we show a parsimonious model with bounded rationality and a noisy cognitive default à la Patton and Timmermann (2010) jointly matches the term structures of noise and bias.

2. "What Drives Investors' Portfolio Choices? Separating Risk Preferences from Frictions" with Taha Choukhmane

   Abstract: We study the role of risk preferences and frictions in portfolio choice using variation in 401(k) default investment options. Patterns of active choice in response to different default funds imply that, absent participation frictions, 94% of investors prefer holding stocks, with an equity share of retirement wealth declining with age—patterns markedly different from their observed allocations. We use this quasi-experiment to estimate a lifecycle model and find relative risk aversion of 2, EIS of 0.4, and a $200 portfolio adjustment cost. Our results suggest low stock-market participation is due to participation frictions rather than non-standard preferences such as loss-aversion.

3. "Losing is Optional: Retail Option Trading and Earnings Announcement Volatility" with Eric C. So and Kevin C. Smith

   Abstract: We document the growth of retail options trading over time and provide evidence that retail investors are drawn to options by anticipated spikes in volatility. Using data on options trades by clientele groups, we show retail investors purchase options in a concentrated fashion before firms' earnings announcements, particularly those expected to trigger greater abnormal volatility. In doing so, retail investors engage in a trio of wealth-depleting behaviors: they overpay for options relative to realized volatility, incur enormous bid-ask spreads, and are slow to respond to predictable post-announcement declines in volatility. This combination of behaviors translates to retail losses of 5-to-9% around earnings announcements on average, and 10-to-14% for high expected volatility announcements. Market makers are the primary beneficiaries of these patterns, particularly in recent years coinciding with the COVID pandemic, resulting in large capital flows from retail to market makers.

WORK IN PROGRESS

4. "Optimal Risk-Sharing in Higher Education" **Job Market Paper**
5. "The Actions-Expectations Channel" with Pierfrancisco Mei
6. "DGP-Agnostic Dynamic Programming via Reinforcement Learning" with Marc de la Barrera
7. "Optimal Default Asset Allocations with Choice Frictions" with Taha Choukhmane

PUBLICATIONS

8. "Are Volatility Expectations in Different Countries Interdependent? A Data-Driven Solution to Structural VAR Identification for Implied Equity Volatility Indices" *Undergraduate Economic Review*, Vol. 14(1), 2017.
   - Winner of Claremont McKenna College *Best Senior Thesis in Financial Economics*
9. "Is Google Search Behavior Related to Volatility? Incorporating Google Trends Data into a GARCH Model for Equity Volatility" *Undergraduate Economic Review*, Vol. 13(1), 2016.

SOFTWARE PACKAGES

`nndp`	Dynamic Programming with Neural Networks (joint with Marc de la Barrera) Source code: `GitHub`, `PyPi`

INDUSTRY EXPERIENCE

2017	Institutional Equity Derivatives Trading and Research, Morgan Stanley
2016	Quantitative Investment Researcher, Analytic Investors
2016-2018	Director, Claremont Consulting Group
2015-2016	Lead Consultant, Claremont Consulting Group

RESEARCH EXPERIENCE

2021-2022	Research Assistant for Professor Taha Choukhmane
2020	Research Assistant for Professor Eric C. So
2018-2019	Research Assistant for Professor Eben Lazarus
2016	Research Assistant at the Lowe Institute of Political Economy

TEACHING EXPERIENCE

Fall 2022	TA for 15.425: Corporate Finance (MFin) Professor David Thesmar, MIT Sloan Rating: Mean = 5.3/7, Median = 6/7
Spring 2022	TA for 15.453: Finance Lab (MFin) Professors Gita Rao and Bhushan Vartak, MIT Sloan Rating: Mean = 6.7/7, Median = 7/7
Spring 2022	TA for 15.539: PhD Seminar in Empirical Methods (PhD) Professors Eric C. So and Charles C.Y. Wang, MIT Sloan Rating: Mean = 7/7, Median = 7/7
Summer 2020	TA for 15.511: Financial Accounting (Sloan Fellows MBA) Professor Bala Dharan, MIT Sloan Rating: Mean = 6.3/7, Median = 7/7
Summer 2019	TA for 15.511: Financial Accounting (Sloan Fellows MBA) Professor Joe Weber, MIT Sloan Rating: Mean = 5.9/7, Median = 6/7
Spring 2018	TA for ECON101: Intermediate Microeconomics (undergraduate) Professor Saman Olfati, Claremont McKenna College Rating: N/A

CONFERENCE PRESENTATIONS

2023	American Finance Association Annual Meeting*
2022	NBER Behavioral Finance Spring Working Group Meeting*, CEPR Seventh European Workshop on Household Finance*, Western Finance Association Meeting, Society for Economic Dynamics Annual Meeting*, European Finance Association Annual Meeting*, Northern Finance Association Annual Meeting*, Texas Finance Festival*, BSE PhD Workshop on Expectations in Macroeconomics, Miami Behavioral Finance Conference*
2021	Transatlantic Doctoral Conference, SoFiE Annual Conference
2020	Stanford GSB Rising Scholars Conference
	(includes scheduled, * = presentation by co-author)

SEMINAR PRESENTATIONS

2023	Australian National University, MIT Sloan (x2), MIT Economics
2022	MIT Sloan (x4), MIT Economics, Quantbot Technologies, Inter-Finance PhD Seminar
2021	MIT Sloan (x2) , MIT Economics (x2)
2020	MIT Sloan (x2)
2019	MIT Sloan
	(includes scheduled)

INVITED PARTICIPATION

2022	NBER Behavioral Macroeconomics Research Bootcamp (Berkeley Haas), Yale Summer School in Behavioral Finance (Yale SOM), MFR Summer Session for Young Scholars (Chicago), MFR Workshop on the Financial Economics of Insurance (Chicago)
2021	Mitsui Summer School on Structural Estimation in Corporate Finance (Michigan Ross)
2019	Big Data Analytics for Accounting Research (MIT Sloan)

FELLOWSHIPS, AWARDS, AND GRANTS

2023	Mark Kritzman and Elizabeth Gorman Finance PhD Research Fund, Stone Finance PhD Fund
2022	Mark Kritzman and Elizabeth Gorman Research Fund (joint with Taha Choukhmane)
2020	FARS Excellence in Reviewing Award
2018-2024	MIT Sloan PhD Fellowship
2018	Phi Beta Kappa, Robert Day School BA Scholar, International Honor Society of Economics (Omicron Delta Epsilon), Best Senior in Economics, Best Senior Thesis in Financial Economics, Dean's List (Top 15%)
2016	Best Sophomore in Economics, Athletic Director's Honor Roll
2015	Athletic Director's Honor Roll

PROFESSIONAL ACTIVITIES

Referee	*Quarterly Journal of Economics, Review of Economics and Statistics, Management Science, Journal of Financial Econometrics, Journal of Accounting and Economics*

SKILLS

Software	PYTHON, FORTRAN, OPENMP, MPI, GIT, BASH, SLURM, R, SAS, STATA, BLOOMBERG TERMINAL, GOOGLE ANALYTICS, LaTeX
Languages	English (native), Spanish (beginner)

OTHER ACTIVITIES

Auto Racing	*Team USA Scholarship* Nominee (2015), *Team USA Scholarship* Finalist (2016), 5x Formula 2000 Track Record Holder (2016-2017), Pacific F2000 Pro Series Champion (2016), *Mazda Road to Indy $250,000 Shootout* Competitor (2016), *Motorsports Magazine* Silverstone Classic Driver of the Weekend (2022)
Golf	Ocean League Conference Champion (2012, 2014), Member of CMS NCAA Division III Men's Golf Team (2014-2016), NCAA Division III National Team Champion (2016)

PERSONAL INFORMATION

Born: June 21st, 1996. Ethnicity: Sri Lankan, White. Citizenship: USA.

RISK-SHARING IN STUDENT LOANS

Tim de Silva*

March 20, 2023

Abstract

I study the design of government-provided student loans from the perspective of improving the sharing of income risk across borrowers. The optimal quantity of risk-sharing depends on individuals' labor supply responses to income-contigent repayments. I use policy variation in the structure of Australian income-contingent student loans to identify these responses. I then use this variation to estimate dynamic incomplete markets model, which decomposes the labor supply responses into substitution, income, liquidity, and learning-by-doing effects. Finally, I use the estimated model to study the welfare and fiscal impact of alternative financing contracts.

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Student loans represent the second-largest liability for households in the US at $1.75 trillion. Traditionally, these loans are debt contracts that feature no sharing of the risk associated with the investment in higher education: low-income individuals are required to make the same payments as those with higher incomes. A natural way to improve risk-sharing and reduce the burden these contracts place on lower income individuals is to use equity-like financing contracts with state-contingent features, such as the income-contingent loans introduced in the US in 2009 to which the Biden administration recently proposed modifications. However, the challenge with using these contracts to improve risk-sharing is they introduce the potential for moral hazard and adverse selection (e.g. Herbst and Hendren 2021).

The objective of my dissertation is to study the following question:

What is the optimal sharing of income risk in government-provided financing contracts for higher education?

This project has three parts. First, I show within a fairly general environment that the optimal financing contract from the perspective of a social planner equates the quantity of unshared risk with the labor supply responses induced by changing financing contract. These labor supply responses represent a fiscal externality: by making the contract contingent on income, individuals have an incentive to reduce their labor supply. If these responses are not present, then the optimal contract perfectly shares income risk across individuals. If these respones are large, then individuals are forced to bear most of the risk.

Next, I study the size and form of these labor supply responses empirically. The ideal experiment would be to randomize the structure of contracts across borrowers and compare their labor supply decisions. To approximate this ideal experiment, I study a policy change in Australia where the government changed the structure of their student loan contracts. This policy change increased the required payment by high-income individuals and decreased it for low-income individuals, which corresponds to an increase in income risk-sharing. I use this policy variation to estimate how individuals' labor income responds and how these responses vary with existing debt balances, wealth, and age.

In the final part of this project, I develop and estimate a dynamic heterogeneous agent incomplete markets model using this policy variation. I use to the model to decompose my empirically estimated labor supply responses into four effects: a substitution effect, an income effect, a liquidity effect, and learning-by-doing. I then study the welfare and fiscal impact of various existing policies, in addition to optimal policy under different information constraints.

1 Setting and Data

The objective of my empirical analysis is to estimate how labor supply responds to changes in the degree to which student loan payments are contingent on income. To do so, I leverage administrative data and policy variation from Australia's Higher Education Loan Program (HELP). In addition to the presence of policy variation, a key advantage of studying Australia relative to the US is the limited room for adverse selection due to the lack of alternative financing options. This allows me to focus clearly on the trade-off between improving risk-sharing and providing incentives, which I hope will provide useful insights for US education financing policy where both adverse selection and moral hazard are present.

Description of HELP. In Australia, higher education is primarily financed using government-provided student loans through the Higher Education Loan Program (HELP). Australia citizens have the choice of either borrowing through HELP or financing the education themselves, with around 90% doing the former. Initial HELP "debt" is equal to the tuition of the degree program individuals choose, minus any up-front payments they decide to make, and any contributions from the government. In later years, debt balances grow at inflation, net of required payments. The required repayment is equal to $r(y) * y$, where y denotes taxable income and $r(\cdot)$ is an income-dependent repayment rate that increases in taxable income and adjusts each year based on inflation.

Policy variation. The policy change I exploit is the 2004-2005 change in repayment rates shown in Figure 1. The blue line shows the required repayment rate as a function of taxable income, $r(y)$, prior to the 2005 tax year. This repayment structure already featured some degree of risk-sharing as repayment rates increased with income. However, in 2005 the amount of risk-sharing increased further: high income individuals repayment rates increased by around 2% and many low-to-middle income individuals had their repayment rate reduced from 3-4% to 0%. This policy change applied to all new and existing debt balances.

Data sources. I use three data sources. First, individual income tax returns from the Australian Tax Office, which contain salary and wages, HELP balances and repayments, and basic demographics. Second, administrative data from the Department of Education, Skills, and Employment that contain individuals' field and level of education. Finally, administrative data from the Australian Bureau of Statistics with detailed information on individuals' employer, job, and occupation. A merged version of these three datasets for the universe of Australian taxpayers is available from 2001-2020 through MADIP. I have obtained an affiliation with the Centre for Social Science Research and Methods at Australian National University and received approval for data access.

2 Empirical Analysis

Preliminary analysis: bunching at repayment threshold. Because access to MADIP requires physical presence in Australia, I obtained access to a 10% random sample of individual tax returns known as ALife that can be accessed remotely for preliminary analysis. Figure 2 shows the income distributions of debt and non-debtholders in three years surrounding the policy change. The dark vertical lines in each plot represent the threshold at which individuals transition from repaying 0% of their income to the lowest repayment rate in Figure 1, which is 3% in 2004 and 4% in 2005 and 2006. The results show substantial bunching of individuals around this lowest repayment threshold in all three years. Individuals respond quickly to the policy change, but the bunching does increase over time consistent with adjustment frictions affecting labor supply.

Future analysis. The funding provided by this grant would support travel to Australia to work with MADIP and extend my analysis in two main directions. First, I will leverage variation the change in repayment rates across individuals to estimate how labor supply responses vary with existing debt balances, age, and wealth (proxied by capital income). These moments, coupled with the model I develop below, allow me to decompose these labor supply responses into substitution, income, liquidity, and learning-by-doing effects. Second, I will explore the mechanisms underlying the bunching in Figure 2 in more detail, such as hours-worked ad-

justments, occupation switching, extensive margin responses, or income-shifting (e.g. through adjusting retirement contributions).

3 Structural Model

In the final part of this project, I estimate a dynamic incomplete markets model and use it as a laboratory to study the welfare and fiscal effects of various policies.

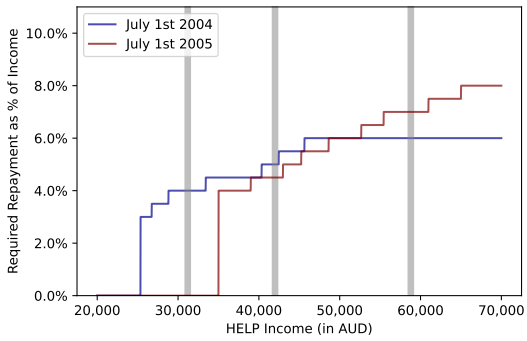
Model description. Overlapping generations of individuals are born with ex-ante heterogeneity in financial wealth, ability, debt balances, and wage profiles that covary with initial debt balances. Individuals solve a life cycle problem in which they choose consumption and labor supply to maximize lifetime utility, subject to a borrowing constraint. In each period, pre-tax income is the product of labor supply and the wage rate. The wage rate depends on an individuals' ex-ante type, the stock of human capital, and a transitory shock. Human capital evolves according to an AR1 process with a persistent shock and depends on past labor supply decisions via learning-by-doing (Keane 2011). Figure 2 shows a non-trivial fraction of individuals have incomes just above the lowest repayment threshold. The mass of individuals in this "dominated" region coupled with the fact that bunching increases over time suggest the presence of frictions limiting short-run adjustment to labor supply (Chetty 2012). I thus assume individuals only reoptimize their labor supply if they are hit by a Calvo shock.

Estimation. I plan estimate the model via simulated minimum distance, minimizing the distance between empirical and (simulated) model moments. The most important parameters are the labor supply elasticity, Calvo adjustment parameter, and learning-by-doing. I identify the labor supply elasticity by targeting the mass of individuals below the threshold in Figure 2. The Calvo adjustment parameter is identified by the mass above the threshold, similar to Kleven and Waseem (2013). The extent of learning-by-doing is then identified by how bunching varies with age: more learning-by-doing implies a larger labor supply response of older relative to younger individuals. After estimating these three parameters, I will be able to decompose the labor supply responses into substitution, income, liquidity, and learning-by-doing effects.

Counter-factuals and policy analysis. After estimating the model, I will use the model to answer the following questions:

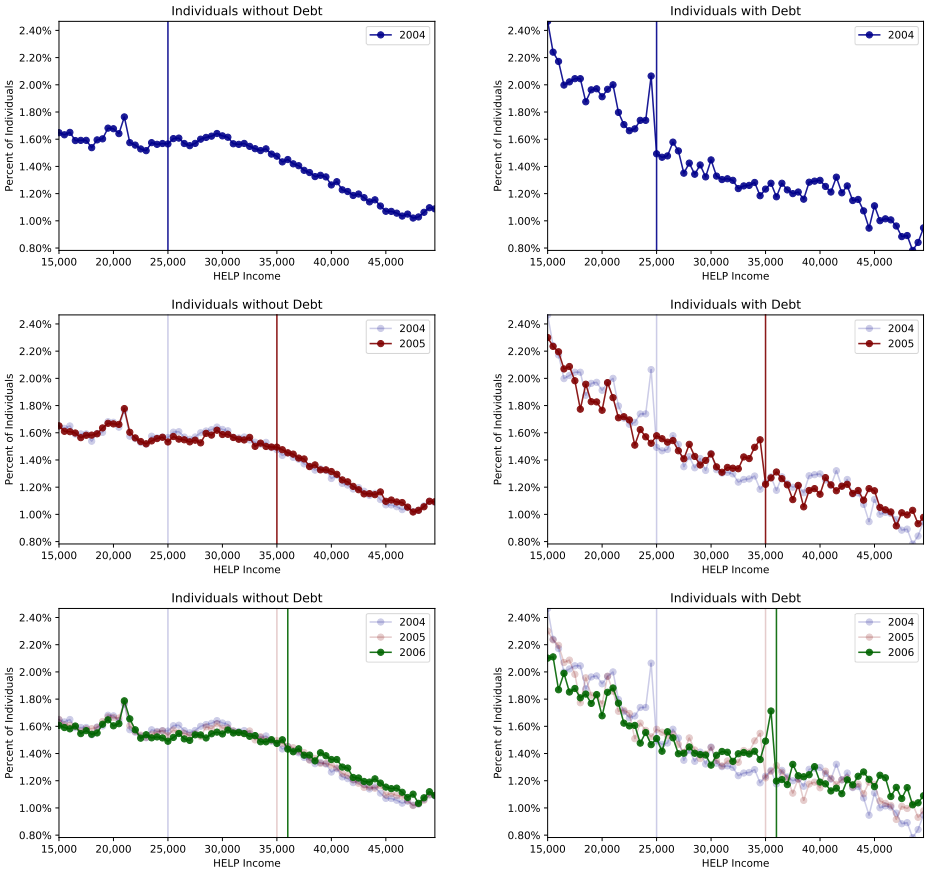
1. How do the various repayment contracts used in both the US and Australia compare in terms of welfare for borrowers and expected costs to the government?
2. What is the optimal income-contingent repayment contract from the perspective of a social planner with a fixed budget?
3. How does the optimal contract vary with the degree of learning by doing and the tightness of the borrowing constraint?
4. What are the welfare gains of making repayments conditional on age? Learning-by-doing makes distorting labor supply while young costly, while the presence of a borrowing constraint makes insurance more valuable at younger ages.

Figure 1. Policy Change in Repayment Rates



Notes: This figure shows HELP repayment rates as a percentage of taxable income for different levels of taxable income. The blue line shows repayment rates in 2004 prior to the policy change and the red line shows repayment rates in 2005 after the policy change. The gray bars correspond to the 40th, 60th, and 80th percentile of the income distribution in 2004.

Figure 2. Bunching at Lowest Repayment Threshold



Notes: This figure shows the income distributions of individuals who have a positive debt balance in 2004, 2005, and 2006 in the right panels and those with no debt balance in the left panels using data from ALife. The dark line in both panels represents the income threshold above which the required debt payment increases from 0% to 4% of individuals' taxable income, which changes over time and only affects individuals with positive debt balances. The change from 2004 to 2005 is due to the policy change. The change from 2005 to 2006 occurs because the threshold is indexed to inflation. The top, middle, and bottom panels show the distributions in 2004, 2005, and 2006, respectively.

References

Chetty, Raj (2012), "Bounds on Elasticities With Optimization Frictions: A Synthesis of Micro and Macro Evidence on Labor Supply." *Econometrica*, 80, 969–1018.

Herbst, Daniel and Nathaniel Hendren (2021), "Opportunity Unraveled: Private Information and the Missing Markets for Financing Human Capital." *Working Paper*.

Keane, Michael P (2011), "Labor Supply and Taxes: A Survey." *Journal of Economic Literature*, 49, 961–1075.

Kleven, Henrik J. and Mazhar Waseem (2013), "Using Notches to Uncover Optimization Frictions and Structural Elasticities: Theory and Evidence from Pakistan*." *The Quarterly Journal of Economics*, 128, 669–723.

Itemized Budget

A primary focus of this project is on improving the design of education financing contracts to reduce the burden they place on low income individuals. I believe this focus makes it a good fit for a *NBER Household Finance Grant*, given the recent regulatory interest in the re-design of US education financing contracts. The funds provided by this grant would likely be used to cover the expenses listed below. The exact amounts of some of these expenses are still subject to uncertainty.

- $4000 in data access fees required in order to setup an environment for data access
- $3500 to cover round-trip flights Boston to Sydney
- $500 to cover train, bus, and Uber travel expenses between Canberra, Sydney, and Melbourne
- $3500 in lodging expenses at AirBnBs in Canberra, Sydney, and Melbourne
- $3000 in computing expenses for running code on a cluster computing environment, which allows me estimate a rich model with several mechanisms driving labor supply responses

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Danny Martin
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March 31, 2023

Re: Recommendation for Tim de Silva for NBER Pre-Doctoral Fellowship

I writing in support of Tim de Silva's application for a research grant in household finance. Tim is an exceptionally good PhD student here at MIT Sloan who has excelled at every stage and who has an extremely exciting and promising current research project that could benefit from funding. Specifically, he is using confidential administrative data on student loans from Australia and travelling to and staying in Australia is not cheap.

First let me say that I know Tim quite well. I taught him in our PhD field course in finance and I have been advising him on his current research project from early days. Unusually, he came into the finance group through the accounting PhD program, but he has taken many of the economics PhD courses and the complete finance field and we have now accepted him into our finance PhD program. While accounting as a research field is often a lot like a subfield of finance or economics (about information disclosure in markets for example), we would generally not accept transfer students from accounting, and I am not aware of any other Sloan accounting PhD students who have ever just made the transition into finance. The fact that we have welcomed (even recruited Tim) to finance is largely based on his obvious potential and the strength of this specific research project. I am not sure if I am chair of Tim's committee, but I would be proud to be – he is at this stage as good as the best students I advise from economics and finance.

Turning to the specific research project, Tim is measuring how households respond to student loan repayment schedules and incentives, using administrative data on loan repayment, an unexpected, large one-time policy change in repayment rules, and a lifecycle model of consumption, saving, debt payment, and labor supply. The project has the potential to answer many of the current important questions we have about the costs and benefits of reforming repayment schedules of existing borrowers in the US (and other countries). Student debt is a major burden on consumers, and is approaching $2 trillion in the US, and is concentrated on middle-income households. It finances one of the largest assets that households have, their human capital. Student debt is subsidized by the government. Repayment has been postponed though the pandemic, continuing through at least 2022, is hard to shed through bankruptcy, and the Biden Administration is deep into trying to forgive substantial amounts of student debt (an executive order that is going through the courts at the moment).

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There are lots of ways to fund education, from debt, to defaultable debt, to income share payments, etc., and Tim's project uses big administrative data of student loan balances and repayment, unexpected changes in repayment policies in Australia, and a structural model to measure how best to fund education. Australia has a repayment schedule in which borrowers re-pay a fraction of their incomes until the debt is repaid or until they stop working. Thus, when households earn little income over their lives, they pay less in loan payments, and some of the loan is partly or even largely forgiven. If a household were certain to be in this situation, then repayment is a pure tax. In this case, student loan repayment provides insurance: people with low earnings do not have to fully repay. But this insurance also created moral hazard in that the repayments are pure losses, and so lower the incentive to earn, leading to a classic insurance vs. incentives trade-off. If instead, a household will pay off the loan, then higher income leading to higher payments means re-paying the loan faster and so in theory has a much lower or non-existent distortion on labor supply (broadly defined). Finally, there are notches in the repayment schedule where earning a little more lowers after-repayment income. Thus, household optimal decisions are driven by concerns over liquidity (consumption smoothing) as well as total wealth (lifetime present-discounted value of income less repayments).

Rather than simply fitting a lifecycle consumption and labor supply model to a static system and observed behavior, Tim estimates the model parameters using a large reform in the Australia system that changed the repayment schedule -- it changed the share of income that was repaid at different income levels – and so moved peoples likelihood of repaying during their lifetime vs. not as well as the time-pattern of repayments. Thus, Tim is estimating the distortionary effect of the (implicit) debt forgiveness and its insurance benefit using both bunching type estimators based around the changes in notches in the repayment structure and a structural lifecycle model. Tim describes the project nicely in his submitted proposal, so let me just add that Tim has all the tools and skill to pull this off. Funding would be very helpful. I my highest recommendation that this be funded.

Please do not hesitate to contact me if I can be of any further help.

Regards,



Jonathan A. Parker

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Department of finance, Sloan School of Management

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