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CERTIFICATE OF APPROVAL

PH.D. THESIS

This is to certify that the Ph.D. thesis of

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To my family.

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ABSTRACT

This dissertation contributes to studies in macroeconomics, microfinance, entrepreneurship, financial technology innovation (FinTech), and economic development. In particular, I study unbanked problems and evaluate microfinance programs.

Chapter 1 studies quantitatively how a microfinance program in the U.S. affects occupational choice, firm size, credit access, wages, output, inequality and welfare. The general equilibrium model has heterogeneous agents, a bank with a minimum loan size requirement and a microfinance institution (MFI) with a loan interest rate that exceeds the bank's. Four microfinance program policies are evaluated: alternative minimum loan size requirements, changes in the loan cost wedge (due to innovation or regulation), changes to the level of the government subsidy, and alternative MFI sustainability requirements. We find that MFIs can have significant welfare effects for some individuals.

In Chapter 2, I introduce a microsavings program for low-wealth individuals in a general equilibrium model with heterogeneous agents. The model incorporates that (i) traditional banks require a minimum savings deposit size, causing some individuals to become "unbanked," and (ii) banks and non-profits partner to offer microsavings programs to the unbanked. The paper finds that microsavings programs increase the percentage of entrepreneurs by providing collateral that the previously unbanked can use to start firms, and wages increase which benefits workers. Second, government subsidies for microsavings programs expand the size and number of firms, but output and workers may decline when funding the program requires higher income taxes. Third, bank sector deregulation (i.e., lower transaction costs in the financial sector) leads to higher output per capita, wages, and firm numbers, and possibly lower income inequality among entrepreneurs. Finally, technological innovations that decrease deposit transaction costs, such as mobile banking, reduce funding pressure on microsavings programs, but have little effect on the percentage of entrepreneurs, firm size, entrepreneur returns or wages.

PUBLIC ABSTRACT

This dissertation contributes to studies in macroeconomics, microfinance, entrepreneurship, financial technology innovation (FinTech), and economic development. In particular, I study unbanked problems and evaluate microfinance programs.

The motivation of this thesis is the fact that 7.7% of households in the U.S. were unbanked (who have no bank accounts) in 2013 and that 20% of households were underbanked (who have a bank account but also use alternative financial services like payday loans) (FDIC). In addition, 25 million people have no credit score, which makes them invisible to the mainstream U.S. financial system (Forbes (2013)). Microfinance, which is a form of financial service for small businesses that lack access to traditional banking services, could be a potential solution for these issues.

Chapter 1 studies quantitatively how a microfinance program in the U.S. affects occupational choice, firm size, credit access, wages, output, inequality and welfare. The general equilibrium model has individuals that are different in initial wealth and managerial ability, a bank with a minimum loan size requirement, and a microfinance institution (MFI) with a loan interest rate that exceeds the bank's. Four microfinance program policies are evaluated: alternative minimum loan size requirements, changes in the loan cost wedge between loan interest rate and deposit interest rate (due to innovation or regulation), changes to the level of the government subsidy, and alternative MFI sustainability requirements. We find that MFIs can have significant welfare effects for some individuals.

Chapter 2 focuses on U.S. microsavings programs, especially programs directed at individuals who save to invest in small businesses. Microsavings is a branch of microfinance that is growing fast. Aggregate data on Individual Development Accounts is used to theoretically and quantitatively explore the effects of microsavings programs on occupational choice, firm size, and income inequality. This chapter introduces a microsavings program for low-wealth individuals in a general equilibrium model with individuals that are different in initial wealth and managerial ability. The model incorporates that (i) traditional banks require a minimum savings deposit size, causing some individuals to become unbanked, and (ii) banks and non-profits partner to offer microsavings programs to the unbanked. I find that microsavings programs increase the percentage of entrepreneurs by providing collateral that the previously unbanked can use to start firms, and increase wages which benefits workers. Second, government subsidies for microsavings programs expand the size and number of firms, but output and workers may decline when funding the program requires higher income taxes. Third, bank sector deregulation (i.e., lower transaction costs in the financial sector) leads to higher output per capita, wages, and firm numbers, as well as possibly lower income inequality among entrepreneurs. Finally, technological innovations that decrease deposit transaction costs, such as mobile banking, reduce funding pressure on microsavings programs, but have little effect on the percentage of entrepreneurs, firm size, entrepreneur returns or wages.

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CHAPTER 1
MICROFINANCE IN THE U.S.

1.1 Introduction

Microfinance is a form of financial service directed at small businesses that lack access to traditional banking services. The U.S. Small Business Administration (SBA) defines microenterprises as businesses with less than five employees. These firms need small loans because they operate at a small scale.[1] Microfinance was introduced in developing countries in the 1970s. The fact that the U.S. has microfinance may be surprising in view of its well developed financial markets. According to the Federal Deposit Insurance Corporation (FDIC) Household Survey, 9.6 million households (7.7%) in the U.S. were unbanked in 2013 and 24.8 million households (20%) were underbanked.[2] In addition, 25 million people have no credit score, "which makes them invisible to the mainstream U.S. financial system."(Forbes (2013)) U.S. microfinance Institutions (MFIs) target these people who want business or other loans but lack access to traditional banking services.

MFIs offer micro loans that require no collateral and lower business profits than banks. They also help borrowers build a credit history. Using the U.S. Microenterprise Census, MicroTracker estimates that in 2012 the U.S. microenterprise industry served 329,538 individuals and disbursed 36,963 micro loans. The total dollar value of these

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[1] The SBA Microloan program provides loans up to $50,000. The average microloan is about $13,000. See: SBA Microloan Program.

[2] Unbanked households have no bank accounts. An underbanked individual has a bank account but also uses alternative financial services (AFS) outside of the banking system.

micro loans was \$292,149,870. The share of such "nonbank lenders," who charge significantly higher interest rates than banks, grew to 26% in 2014 compared to 10% a decade ago. In 2015 big U.S. banks further reduced loans to small businesses due to tighter lending standards and high costs associated with small business borrowing; see Simon (2015). Banks claim that it is difficult to identify small companies, underwrite and manage the accounts, and that small loans are not as profitable as other bank products.

The microfinance industry follows two main lending approaches: poverty and commercial lending, see Robinson (2001). Both approaches aim to make financial services available to lower income people, but the first approach focuses on reducing poverty through credit and other services provided by MFIs that are funded by donor and government subsidies, especially for the poorest of the poor. The second approach focuses on improving access and services provided by commercial financial intermediaries. The U.S. Microfinance industry mainly uses the commercial lending approach, focusing on start-ups and small businesses. The funding bases of banks and MFIs differ, however. Banks typically fund loans through saver deposits. In contrast, most U.S. MFIs do not have saving programs due to high regulation costs. Instead, U.S. MFIs raise funds for loans and operating expenses from investors, donations and government subsidies. The programs generally are directed toward low moderate income individuals, who are not below the poverty line.[3] Microfinance borrowers tend

[3]The general definition of low moderate is cash-income of 140% of the area' median income and low income is 80% of the median set by the U.S. Department of Housing and Urban Development. Microfinance services were introduced to the poor as an economic

to be minorities, recent immigrants, women, or others with limited access to traditional credit. The goal is to increase the number and scale of micro entrepreneurs by relaxing their credit constraints.

The paper addresses the following question - Is there a role for MFIs in an economy with a highly developed financial system such as the U.S.? We build a model that is consistent with stylized facts from the U.S. Microenterprise Census and the Accion U.S. Network,[4] the largest nonprofit microfinance institution in the U.S. We use the model to assess the quantitative effects of alternative microfinance programs and financial frictions on occupational choice, firm size, wages, income inequality and welfare. Computational experiments show that there is a role for MFIs. Appropriately structured government loan subsidies; minimum loan size requirements; and MFIs jointly funded through private sector donations, government subsidies and loan interest repayments can all increase policy targets such as the number and size of small firms, as well as welfare. We find that the welfare gains associated with providing microenterprises with access to financial services can be significant, ranging from zero to about 12 percent of consumption among relatively high ability but low

experiment by Dr. Mohammad Yunus in developing countries in the late 1970s (Yunus (1999)) and exploded into an industry in the 2000s. The Microfinance Information Exchange dataset recorded nearly 1,100 MFIs in 100 countries in 2008 (MIX (2009)). Currently, microfinance is a $70 billion industry with 200 million clients (CGAP), affecting 533 million borrowers and their households. See Buera, Kaboski, and Shin (2014b) for an excellent analysis of development aspects of microfinance.

[4]The Accion U.S. Network unites five independent micro lending organizations (Accion East and Online, Accion Chicago, Accion New Mexico - Arizona - Colorado, Accion Texas, and Accion San Diego) to form the largest microfinance and small business lending network in the U.S. (Accion U.S. Network, (2014); Weber, (2014))

wealth individuals.[5]

We construct a general equilibrium model with heterogeneous agents with two financial frictions, intermediation costs and contract enforcement. Entrepreneurs operate a project that uses capital and labor. They can borrow from either a bank, which requires collateral, or from a microfinance institution, which does not require collateral, but charges a higher interest rate than the bank. Entrepreneurs face an endogenously determined upper limit on loans borrowed from a bank, as in Antunes et. al (2008). In our model, borrowers also face a lower bound, motivated by the fact that traditional banks do not offer loans below a certain amount due to the high cost of micro loans.[6] Microfinance institutions provide micro loans to these borrowers.

Buera, Kaboski, and Shin (2014b) model the microfinance sector as a financial intermediation technology that guarantees access to full repayment of capital up to a limit.[7] Microfinance is a permanent innovation that makes it feasible to provide

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[5]This result is consistent with Buera, Kaboski, and Shin (2014b). They find welfare gains from microfinance of up to 14% for individuals with relatively high ability.

[6]For example, U.S. Bank requires a $100,000 minimum on business loans and Bank of America requires $25,000.

[7]Buera, Kaboski, and Shin (2014a) evaluate the effects of Asset Grant Programs on occupational choice and wealth mobility in developing countries. They focus on asset grants made by poverty alleviation programs to the very poor. Instead of having microfinance institutions who lend to the poor borrowers, the programs directly make grants that are financed by a one-time tax on the wealthiest individuals. Developing countries face a zero interest rate and the model is mapped into data from Bangladesh, India, and rural Pakistan. They show that the grants have a negative impact on aggregate capital. Wealth redistribution reduces capital used in production because not all of the poor who receive grants become entrepreneurs. Antunes, Cavalcanti and Villamil (2015) evaluate a credit program in Brazil, which subsidizes the interest rate on loans and requires a fixed application cost. They show that the program, as designed, fails to solve misallocation problems. The interest credit subsidy policy has no significant effect on output, but it can negatively effect wages. The program is largely a transfer from households to a small group of entrepreneurs

fixed small size loans with the same interest rate as a bank. Their loan funding comes from banks' deposits. In contrast, we model microfinance as a sector that determines the interest rate on micro loans based on the MFI's overhead costs, donations and government subsidies. Private donors decide whether to provide existing funds to the MFI or an outside alternative, and we take this donor decision as given. The MFI faces a risk of not getting donations next period, and consequently uses interest earned from loan repayments to partially cover some operation costs. U.S. MFIs do not offer saving programs due to regulations, which we also take as given. The micro loan funding base is provided by "social investors" instead of from bank deposits, with funds provided at below market interest rates. Loan sizes are endogenous.

Overall the results show that policies consistent with U.S. microfinance can increase the percentage of entrepreneurs, firm size, output and wages, but also have small negative effects on the capital to output ratio and the credit to output ratio. The main reason is that funds from "social investors" allow MFIs to offer micro loans to borrowers who were previously excluded from the financial system. Although these funds are a "helicopter drop" calibrated to the U.S. economy, they are not uniformly beneficial. The policies lead to higher wage payments and crowd out the demand for credit by high-productivity firms.[8] We focus on four specific policies: Reducing bank loan size restrictions, reducing MFI overhead costs, directed credit, and the ability of

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with minor aggregate effects.

[8] Higher wages cause more productive firms to have lower profits. This causes the entrepreneurs to invest less, which decreases the capital stock. At given input costs, the demand for credit from banks declines.

MFIs to generate internal funds (i.e., self-sustanability).

First, if banks' reduce the minimum size restriction on bank loans this increases the percentage of entrepreneurs and the wage, but output per capita does not change. The intuition is that entrepreneurs who previously borrowed from MFIs switch to banks for a lower interest rate. However, firms must now pay a higher wage, which offsets the lower cost of loans. There are more, but less productive, entrepreneurs, which leads to a increase in income inequality.

Second, reducing MFI overhead costs increases the percentage of entrepreneurs because this policy lowers the interest rate on micro loans relative to the baseline. However, general equilibrium effects lead to a small increase in the wage, which offsets the effect on output per capita. In the past decreasing MFIs' operational costs has been difficult, due to expensive screening and monitoring costs. Currently, innovative scoring and lending techniques are being developed to lower these costs. For example, Silicon Valley-backed startups like Branch and InVenture are testing smartphone screening methodologies in developing countries such as Kenya. The programs target individuals who do not have credit scores, but use a smartphone app that can evaluate client behavioral patterns that correlate with repayment or default. The hope is that such innovations will reduce the cost of lending dramatically (Dwoskin, WSJ).[9]

Third, policy targets are more sensitive to policy changes regarding government subsidies than directed credit (soft loans). Government subsidies for operational

[9]Branch.co in Kenya reduced the interest rate from 25% to 6-12% by using an Android app on clients' smartphones.

costs help MFIs increase output per capita, the percentage of entrepreneurs, and also the wage by reducing the microloan interest rate. However, a higher government subsidy also increases the wage tax, which transfers a small amount of capital from workers to these low moderate income micro entrepreneurs who borrow from MFIs. The after tax wage is larger due to a smaller supply of workers. Overall, an increase in the government subsidy to MFIs will increase aggregate output, the number of firms, as well as the aggregate payoff for all individuals. On the other hand, increasing government directed credit (soft loans) generates more revenue for the government, which decreases the wage tax. The after tax wage increases, which slightly reduces the number of entrepreneurs. The impact of government directed credit on the aggregate economy is minuscule since the micro loan interest rate does not depend on government directed credit. Also, government directed credit increases the supply of capital, but the real interest rate is determined by the international capital market.

Fourth, the experiment on sustainability shows that output per capita, the wage, the percentage of entrepreneurs and the entrepreneurs' income Gini coefficient are sensitive to the MFI's self-sustainable level. The self-sustainable level is the percentage of operational costs that are covered by program earned revenues (Mendoza (2013)). For example, if a MFI can fully cover operational costs using interest earned without using any donations and subsidies, then this MFI is fully self-sustainable. MFIs try to increase their self-sustainable level since outside donations are not stable. For a given operation level and government subsidies, when the MFI has a large level of self-sustainability, the costs are mainly paid by interest earned from micro loans. A higher level of self-sustainability leads to a higher interest rate on micro loans, which discourages entrepreneurship.

In the remainder, section 2 summarizes stylized facts. Section 3 describes the model, the bank and microfinance institution problems, an entrepreneur's problem, and specifies the occupational choice decision. Section 4 calibrates the model to match U.S. data, discusses model fit, and analyzes the effects of microfinance. Section 5 contains the quantitative policy experiments. Section 6 concludes.

1.2 Stylized facts about microfinance in the U.S.

The U.S. Small Business Administration (SBA) defines a microenterprise as a business with five or less employees. U.S. microfinance institutions provide small loans and services to such enterprises, which lack access to traditional credit services. Microfinance institutions are different than other lending programs such as banks, peer-to-peer lenders (e.g., Prosper), credit unions, and Payday loans. Table 1.1 provides a comparison among these programs[10]. Banks charge a lower interest rate on (larger) business loans, typically about 5 - 6%, while the interest rate banks charge small businesses on credit cards is on average 12.85% (cf., Creditcards.com). Online lenders such as Kabbage Inc. charge an average interest rate of about 39% to small businesses with good credit. Banks prefer firms that are at least 10 years old, but banks partner with, invest in, and provide grants to nonprofit lenders that provide

[10]See Simon (2015), usbank, and Bank of America Features and Terms for information on Banks; See Accion East and Online Learn for MFIs; See Eiger and Mandell (2015), and Cunningham (2015) for P2P; See Public Service Credit Union and Bundrick (2014) for Credit Union; And see Melzer, (2011) and CFA for Payday loan.

credit to small businesses; see Simon (2015). MFIs fill a market niche by providing small, short-term loans to businesses that lack credit histories and collateral.

We wish the model to be consistent with several stylized facts from the U.S. microfinance industry.

Fact 1: *Interest rates on micro loans exceed bank loan rates.*

The wedge for MFIs is higher than in the banking sector for several reasons. First, MFIs operate at a small scale and the cost of managing one hundred $1000 micro-loans is much higher than the cost of managing one $100,000 bank loan due to high costs of screening and monitoring MFI clients (Rosenberg et. al, (2009)). Second, MFI borrowers are "sub-prime;" they lack collateral and have low or no business profits and credit scores. Third, MFIs lack deposits and loan collateral. As a consequence, MFIs charge a higher loan interest rate compared to banks in order to pay for these higher screening, monitoring, operational and other costs. Nonetheless interest rates offered by MFIs are still much lower than the rates offered by other lenders because MFIs are not-for-profit, and government subsidies and private donations offset MFIs' inherent cost disadvantages.[11] Therefore, MFIs are important for borrowers who need funds to finance a microenterprise but cannot get loans from banks.

Fact 2: *Banks require minimum loan sizes.*

Traditional banks do not offer loans below a certain amount due to the high

[11] We do not consider informal financial services in this paper.

Table 1.1: Comparison of different lending programs

	Banks	MFIs	P2P	Credit Union	Payday loan
Accept Deposit	Yes	No	No (platform)	Yes	No
Collateral	Yes	No	No	Yes	No
Credit Score	High	No or low	640+		No or low
Loan interest rate	Low	8-15%	6.6-35.9%	Very low	400%+
Loan type	Consumer, business	Business	Consumer, business	Consumer	Consumer
Loan term	Up to 3-5 yr	6 m - 2 yrs	3-5 yr		2-4 weeks
Loan size	$25,000+	avg $7,000	$1000-35,000		$100-1000
Other requirements	experience (5-10 years), financial statements		U.S. Citizen, bank account, live in state with P2P		

Note: P2P companies match lenders directly with borrowers online for individual or business unsecured loans. Credit Unions focus on consumer loans such as mortgage and car loans. Few Credit Unions offer business loans (American Banker Association). Payday loans are small, unsecured, loans for consumers with previous payroll and employment records.

cost of micro loans. For example, U.S. Bank requires business loans to exceed $100,000 and Bank of America provides business loans above $25,000.

Fact 3: *U.S. MFIs generally do not have savings programs.*

U.S. regulations make MFI savings programs prohibitively expensive. Christen, Lyman and Rosenberg (2003) note that banks face regulations such as rules that govern their operations, minimum capital requirements, consumer protection and fraud prevention requirements, credit information services, secure transaction requirements, interest rate limits, foreign ownership limitations, and tax and accounting requirements. In order to provide savings programs, MFIs would need to hire experts to comply with these legal and reporting requirements. Many of these costs are fixed and therefore prohibitive at a small scale. Ledgerwood and White (2006) report that the costs to transform from a credit-focused MFI to a regulated financial intermediary with savings programs range between $700,000 and $1.5 million. As a consequence most U.S. MFIs do not offer savings accounts to their clients and, unlike traditional banks, U.S. MFI's loans are not funded by deposits. Some U.S. MFIs sponsor savings programs, but the savings are deposited in a partner bank and the MFI does not have access to the deposits for microloan funds.

Fact 4: *U.S. MFIs fund loans mainly by borrowing from governments and investors. Most investors provide funds at concessionary rates.*

Pollinger et al. (2007) report that U.S. MFIs raise funds for loans from four sources: grants at no cost (i.e., donations); government programs (e.g., SBA government directed credit, which offers a below market interest rate of 1.3%); loans from investors such as banks and for-profits at an interest rate of 3%; or funds from the open market at a rate of 10.3%. The main source of loan funds is government directed credit and funds provided by private investors. According to MicroCapital (2007), three types of private investors provide funds to MFIs through Microfinance investment vehicles (MIV) - strictly commercial investors who expect high financial returns on investments, socially responsible investors who do not seek financial returns, and those in between. Most of the investors are social investors.

Fact 5: *MFI operating budget income is mainly the sum of interest earned on loan repayments, private donations, and government subsidies.*

MicroTracker (2012) reports for a sample of 75 U.S. MFIs, about 25% of total MFI expenses are covered by interest earned from micro-loans, 35% are covered by governments subsidies, and the remainder are covered by private donations.

Fact 6: *U.S. MFIs aim to "graduate" clients to banks.*

U.S. MFIs help clients graduate to the banking sector in two ways: First, MFIs assist start ups or expand clients' businesses until the microenterprises require larger loan sizes. Second, MFIs help build clients' credit scores so that they can access banks (Accion East and Online, (2015)). The majority U.S. MFIs do not target groups below the poverty line, but rather low-to moderate-income business owners who lack access to banks (MicroTracker (2012), Table 10).[12]

Overall, the facts show that U.S. MFIs rely on government subsidies, donations and investments, rather than the deposit base used by banks. MFIs also try to cover part of their operational costs through loan repayments in order to control the risk of not getting sufficient donations due to adverse shocks, and they charge a higher interest rate than banks. We now construct a model that is consistent with these facts.

1.3 Model

Consider an economy with a continuum of measure one individuals. Each individual lives for one period and reproduces another so population is constant. Time is discrete and infinite. A single good can be used for consumption or production, or left to the next generation as a bequest.

1.3.1 Preferences, endowments and technology

Individuals care about their own consumption and a bequest to the next generation. The utility function for a representative individual in period t is

$$U = (c_t)^{\gamma}(z_{t+1})^{1-\gamma}, \quad \gamma \in (0,1) \tag{1.1}$$

where c_t and z_{t+1} denote consumption and bequest.

Each individual is endowed with initial wealth b_t, which is a bequest from

[12] Internationally, "graduating" people is called "credit plus" offerings, see Morduch 2012. Barr (2005) notes that microfinance helps borrowers qualify for traditional financial sector loans by increasing income and assets. MFIs in developing countries often focus on poverty reduction.

the previous generation, and managerial talent x which is drawn from a continuous cumulative probability distribution function $\Gamma(x)$ where $x \in [0,1]$.

Individuals choose their occupation, either a worker or an entrepreneur. Entrepreneurs can only operate one project which has a technology that uses capital k and labor n to produce a single consumption good y, which is represented by

$$y = xk^{\alpha}n^{\beta}, \quad \alpha, \beta > 0, \quad and \quad \alpha + \beta < 1 \tag{1.2}$$

Capital fully depreciates between periods. Entrepreneurs employ workers and capital.

1.3.2 The capital market and microfinance sector

Individual have the following options to invest initial wealth:

- Bank: Competitively rent capital to a bank and earn deposit interest rate i_D. MFIs do not accept savings deposits, consistent with Fact 1.2.
- Private equity: Use their capital to fund a business. They may borrow additional capital from either a bank at interest rate i_L^B or from a MFI at rate i_L^M.

Consistent with Fact 1 , $i_L^M > i_L^B$ because it is more expensive to intermediate small loans.

1.3.2.1 Bank sector

A bank receives total deposits D^B, with individual deposits denoted by b^B. A bank makes two types of loans:

(i) The bank may lend directly to entrepreneurs in aggregate amount, L^B, with loans to individual entrepreneurs denoted by l^B.

(ii) The bank may also invest amount L^B_{dc} in the MFI as directed credit, receiving return i^B_{Ldc}. Consistent with Fact 4, return i^B_{Ldc} contains two components: a below market (socially responsible) interest rate i^B_{dc} paid by the MFI and the concessionary part mg. The concessionary part of the interest rate can occur, for example, because banks have tax advantages or build social capital with stakeholders (e.g., the public or regulators).

Transaction costs on financial intermediation generate a wedge between lending and deposit rates, given by overhead cost ovc^B and bank tax τ. Overhead costs include all ongoing bank expenses such as rent, utilities, legal fees, labor burden, repairs and supplies. The bank is required to pay financial taxes τ by regulation.

The problem of the representative bank is

$$\max_{i^B_L} \quad (1+i^B_L)L^B + (1+i^B_{Ldc})L^B_{dc} - (1+i_D)D^B - (ovc^B+\tau)(L^B+L^B_{dc}) \tag{1.3}$$

$$s.t. \qquad D^B = L^B + L^B_{dc} \tag{1.4}$$

$$D^B \geq L^B \geq 0. \tag{1.5}$$

Free entry implies zero profit in equilibrium for a bank, which implies:

$$i^B_L - i_D = ovc^B + \tau \tag{1.6}$$

$$i^B_{Ldc} - i_D = ovc^B + \tau \tag{1.7}$$

It follows that the returns from the bank's two alternative lending opportunities are equal, $i^B_L = i^B_{Ldc} = i^B_{dc} + mg$.

1.3.2.2 Microfinance sector

Microfinance institutions face a different problem than a bank because they do not accept deposits (Fact 3). In addition, MFIs issue loans only to micro businesses at a higher interest rate than the rate charged by a bank (Fact 1). Instead of deposits, MFIs raise funds from private donations and government subsidies to cover operational costs (Fact 5)[13] at a below market interest rate (Fact 4). We assume that banks and MFIs face the same tax rate τ on loans to borrowers.

Fact 5 indicates that operational costs are paid by three sources - interest earned from loan repayments, private donations, and government subsidies. Subsidies are mainly lump-sum direct payments, S^G, from the government[14] and donations S^D come from outside donors. We assume these donors are exogenous.[15] Fact 1 indicates that high MFI overhead costs make the lending interest rate at MFIs higher than at the banks. We denote the percentage of total operational costs covered by loan repayments by θ, and donations and subsidies cover the remainder. Note that $\theta = 1$ indicates that the MFI is fully self-sustainable, with revenue from micro loans covering all operational costs, and therefore not relying on private donors or the government. In general, interest earned from micro loans is exhausted after covering only a part of

[13] In practice, private investors include individual investors, banks, and for-profit companies. In our model, we assume all funds are managed by banks and we call this investment directed credit.

[14] Accion U.S. Network's annual reports indicate that government subsidies are fairly consistent over time.

[15] For example, we do not model the Gates Foundation's choice to fund MFIs versus health, the environment or other fields. We will determine funding base shares in accordance with Fact 1.2 when we calibrate the model.

operational costs and MFIs do not have deposits. Fact 4 indicates that MFIs receive their funding base from two sources: The government offers directed credit ("soft loans") L^G_{dc} to MFIs, with a very low interest rate i^G_{dc}. Banks also provide below market rate loans L^B_{dc} to MFIs at interest i^B_{dc}. Therefore, the MFI's total funding base, rather than deposits for a bank, is $L^M = L^B_{dc} + L^G_{dc}$.

The MFI's problem is

$$\max_{L^M} \; (1+i^M_L)L^M + S^D + S^G - (1+i^B_{dc})L^B_{dc} - (1+i^G_{dc})L^G_{dc} - (ovc^M + \tau)L^M$$

$$s.t. \qquad L^M = L^B_{dc} + L^G_{dc} \tag{1.8}$$

$$S^D + S^G = (1-\theta)[(ovc^M + \tau)L^M + i^B_{dc}L^B_{dc} + i^G_{dc}L^G_{dc}] \tag{1.9}$$

The zero profit condition implies that

$$\begin{aligned} i^M_L &= \theta(ovc^M + \tau + i^B_{dc}) \\ i^M_L &= \theta(ovc^M + \tau + i^G_{dc}) \end{aligned} \tag{1.10}$$

It follows immediately that $i^B_{dc} = i^G_{dc}$. Recall that $i^B_{dc} = i^B_L - mg$ and $i^G_{dc} < i^B_L$. Both the government and bank offer directed credit at a below market rate.[16] We assume that $i^G_{dc} = i^B_{dc} = i_D$. As θ increases, MFIs rely less on donations, which increases the required return from loan revenue. Therefore, the interest rate will go up given ovc^M and τ. Given i^M_L, we solve for l^M from individual's problem and obtain L^M.

[16]Pollinger et al. (2007) indicate that $i^B_L - mg = 3\%$ on average and $i^G_{dc} = 1.3\%$. The only measurement problem occurs on social responsibility component mg. All investment loans (from either banks or the government) have interest rates ranging from $0-4\%$ (AccionEast Financial Statement 2012, Note 7, page 14).

1.3.3 Optimal behavior

1.3.3.1 Entrepreneurs

The entrepreneur's problem is similar to Antunes, Cavalcanti and Villamil (2008), except the lending market has a bank and MFI. Individuals who decide to become entrepreneurs choose the level of capital and the number of employees to maximize profit subject to a technological constraint and a credit market incentive constraint. Given k and w, an entrepreneur solves the problem:

$$\pi(k, x; w) = \max_{n} x k^{\alpha} n^{\beta} - wn \tag{1.11}$$

Let a be the amount of self-financed capital (or, equivalently, the part of the loan that is fully collateralized by the agent's personal assets) and l be the amount borrowed from a bank or MFI (or, equivalently, the amount of the loan that is not collateralized).

Unconstrained problem: An entrepreneur who does not need credit ($b > a$ and $l = 0$) solves[17]

$$\max_{k \geq 0} \pi(k, x; w) - (1 + i_D)k \tag{1.12}$$

Deposit interest rate i_D is the opportunity cost of investing one's own funds in the firm.

Constrained problem: If the entrepreneur borrows from a bank, then the loan contract must be self-enforcing because the entrepreneur cannot commit to repay, so

$$\phi\pi(a + l, x; w) \geq (1 + i_D + ovc^B + \tau)l$$

[17] Use the optimal $\pi(n)$ to solve for k.

The incentive constraint guarantees ex ante repayment and can be written as:

$$l(b,x;w,r) \leq \frac{\phi}{1+i_D+ovc^B+\tau}\pi(k(b,x;w,i_D),x;w) \tag{1.13}$$

The amount that a particular entrepreneur can borrow from a bank is increasing in the entrepreneur's bequest and managerial ability, b and x, and in general these loan sizes vary across entrepreneurs.

Banks do not offer loan packages below a certain amount (Fact 1.2). Let $\underline{l}$ denote this threshold. Individual that wish to borrow below the threshold can apply for microfinance loans from a MFI. Entrepreneurs can borrow loan amounts above $\underline{l}$ from MFIs, but they would prefer to go to a bank for a bigger loan due to the lower interest rate (Fact 1).

If an entrepreneur borrows from a bank, then the problem is to maximize net income:

$$\begin{aligned} V^B(b,x;w,i_D) = &\max_{a\geq 0,\ l^B\geq 0} \pi(a+l^B,x;w)-(1+i_D)a-(1+i_L^B)l^B \\ &st. \quad \underline{l} \leq l^B \leq \frac{\phi}{1+i_L^B}\pi(k(b,x;w,i_D),x;w) \\ &b \geq a \end{aligned} \tag{1.14}$$

In equilibrium, $1+i_L^B = 1+i_D+ovc^B+\tau$.

If an entrepreneur borrows from a MFI, then the problem is:

$$\begin{aligned} V^M(b,x;w,i_D) = &\max_{a\geq 0,\ l^M\geq 0} \pi(a+l^M,x;w)-(1+i_D)a-(1+i_L^M)l^M \\ &st. \quad 0 \leq l^M \leq \frac{\phi}{1+i_L^M}\pi(k(b,x;w,i_D),x;w) \\ &b \geq a \end{aligned} \tag{1.15}$$

where $1 + i_L^M = 1 + \theta(ovc^M + \tau + i_{dc}^G)$. Again, the loan contract with a MFI must be self-enforcing due to borrower inability to commit to repay, so

$$\phi\pi(a + l, x; w) \geq (1 + \theta(ovc^M + \tau + i_{dc}^G))l$$

Optimal policy functions $a(b, x; w, i_D)$ and $l^j(b, x; w, i_D, ovc^j, \theta)$ define the size of each firm: $k(b, x; w, i_D, ovc^j, \theta) = a(b, x; w, i_D) + l^j(b, x; w, i_D, ovc^j, \theta)$, where $j = B$ or M.

1.3.3.2 Occupational choice

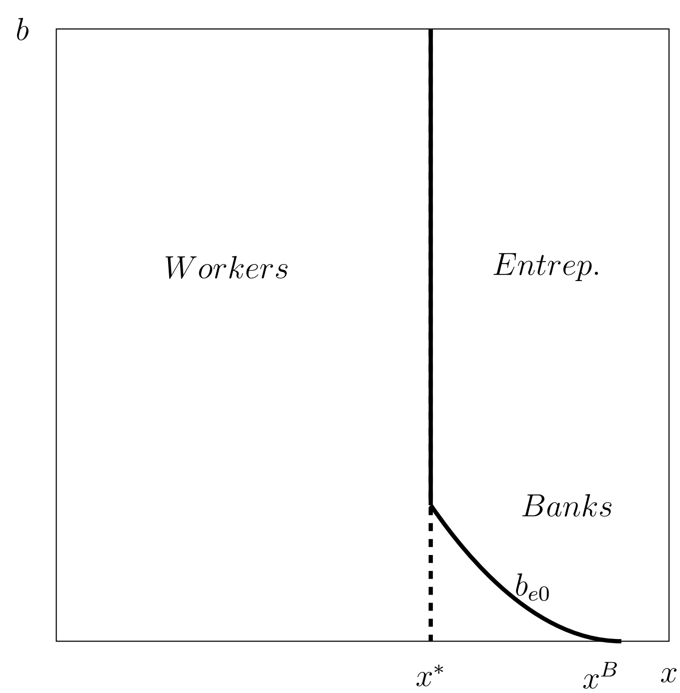

Figure 1.1: Occupational choice without MFIs

The occupational choice for each individual is derived from maximizing the agent's life time income. The figures provide the intuition for occupational choice.

They indicate that agents are workers when their managerial ability is low, i.e. $x < x^*(w, i_D)$. For $x \geq x^*(w, i_D)$ agents may become entrepreneurs, depending on whether or not they are credit constrained. If bequests are very low, agents are workers although their managerial ability is higher than $x^*(w, i_D)$.

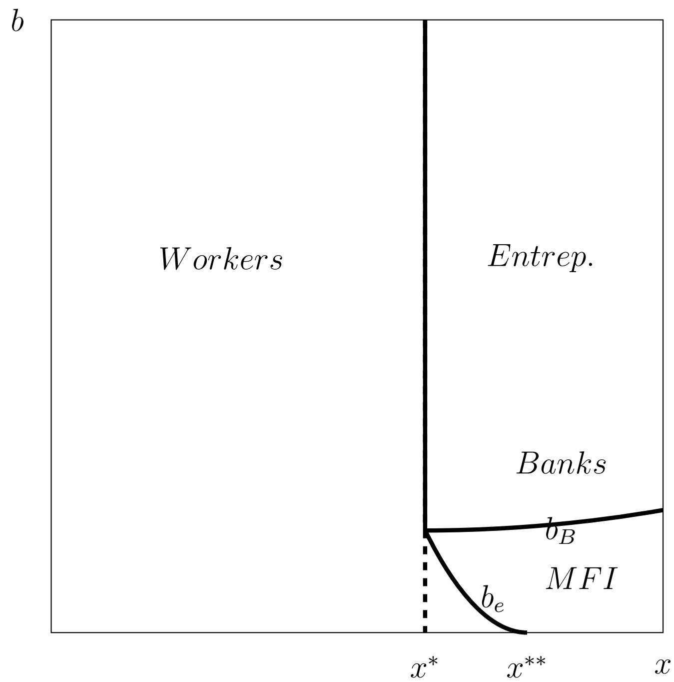

Figure 1.2: Occupational choice with MFIs

The MFI gives agents with relatively low bequests $b < b_B(x; w, i_D)$ but relatively high ability $x > x^{**}$, and cannot meet the minimum loan size required by banks, the opportunity to become entrepreneurs. As in Antunes, Cavalcanti and Villamil (2008), the negatively sloped b_e curve indicates that the some high ability agents may be credit constrained. Comparing Figure 1.1 and Figure 1.2, curve b_e with microfinance shows that government subsidies and concessionary private loans allow some high ability agents to switch occupation from worker to entrepreneur. The results are stated formally and proved in the appendix (cf., Lemma 2.1 and B.1).

1.3.4 Consumers

An individual's lifetime income is defined as:

$$Y_t = \max\{(1-\tau^w)w_t, V^j(b_t, x_t; w_t, i_{tD})\} + (1+i_{tD})b_t,\ j = B,\ M \tag{1.16}$$

Given lifetime wealth, the individual solves the following problem:

$$\begin{aligned} &\max_{c_t, z_{t+1}} U = (c_t)^\gamma (z_{t+1})^{1-\gamma}, \quad \gamma \in (0,1) \\ &s.t. \qquad c_t + z_{t+1} = Y_t \end{aligned} \tag{1.17}$$

The optimal consumption and bequest is thus $c_t = c(Y_t)$ and $z_{t+1} = b(Y_t)$ policy functions. The functional form of a consumer's preferences implies that individuals leave a proportion $1-\gamma$ of their lifetime wealth as a bequest. Bequests are non-negative since every individual can be a worker.

1.3.5 Competitive equilibrium

Let Γ_t be the bequest distribution at period t, which is endogenously determined across periods. The initial bequest distribution Γ_0 and government spending g are exogenously given. In a competitive equilibrium, an individual optimally solves their problem as described before, and all markets clear.

1. Free entry into the bank and MFI sectors (zero profits in equilibrium)

$$i_L^B - i_D = ovc^B + \tau \tag{1.18}$$

$$i_L^M = \theta(ovc^M + \tau + i_{dc}^G) \tag{1.19}$$

2. The market clearing conditions for labor, capital and each type of intermediary are:

$$\iint_{z\in E(w_t,r_t)} n(x;w_t,r_t)\Upsilon_t(db)\Gamma(dx) = \iint_{z\in E^c(w_t,r_t)} \Upsilon_t(db)\Gamma(dx) \tag{1.20}$$

$$\iint_{z\in E(w_t,r_t)} k(b,x;w_t,r_t)\Upsilon_t(db)\Gamma(dx) = \iint b\Upsilon_t(db)\Gamma(dx) + L^G_{dc} \tag{1.21}$$

$$L^B = \iint_{z\in E^B(w_t,r_t)} l^B\Upsilon_t(db)\Gamma(dx) = \iint b^B\Upsilon_t(db)\Gamma(dx) - L^B_{dc} = D^B - L^B_{dc} \tag{1.22}$$

$$L^M = \iint_{z\in E^M(w_t,r_t)} l^M\Upsilon_t(db)\Gamma(dx) = L^B_{dc} + L^G_{dc} \tag{1.23}$$

3. The government budget constraint given wage, tax τ^w, intermediary tax τ, government directed credit interest rate i^G_{dc}, loan amount L^G_{dc}, government spending g and government MFI subsidy S^G:

$$\iint \tau^w wn(x;w_t,r_t)\Upsilon_t(db)\Gamma(dx) + \tau(L^B + L^M) + i^G_{dc}L^G_{dc} = g + S^G \tag{1.24}$$

Since the only connection between periods is the bequest, providing the law of motion for the distribution of bequests is important. Define $P_t(b_t, A) = Pr\{z_{t+1} \in A \mid b_t\}$, which assigns a probability for a bequest in $t+1$ for the descendant of an agent that has bequest b_t before known x_t. The law of motion of the bequest distribution is

$$\Upsilon_{t+1} = \int P_t(b, A)\Upsilon_t(db) \tag{1.25}$$

Now we will calibrate the model and quantitatively study the economy.

1.4 Measurement

In order to study the quantitative effect of microfinance on entrepreneurship, wage, output, and other variables, we must assign values for the model parameters. We calibrate to match key statistics in the United States, where financial markets are well developed and intermediation costs in the banking sector are small. Later, we will conduct policy experiments to study how government policies on MFIs, overhead costs and MFI self-sustainability, loan size restrictions, intermediation costs and contract enforcement affect the economy.

The baseline model is calibrated so that the equilibrium matches some key statistics of the U.S. economy. As in Antunes, Cavalcanti and Villamil (2008), the model period is 35 years. Assume that the cumulative distribution of managerial ability is given by $\Gamma(x) = x^{\frac{1}{\epsilon}}$ and $x \in [0, 1]$. When ϵ is one, entrepreneurial talent is uniformly distributed in the population. When ϵ exceeds one, the talent distribution is concentrated among low talent agents. Eleven parameters must be determined: two for technology(α, β), three for utility (γ, ovc^B, ovc^M), and six institutional and policy parameters (ϕ, τ^w, τ, S^G, g, L^G_{dc})

Following Gollin (2002), we set β and α so that in the entrepreneurial sector 55% of income is paid to labor, 35% is paid to capital, and 10% are profits. As in Antunes et. al (2013), intermediation costs are the sum of intermediary taxes and overhead costs. We assume that taxes are the same for banks and microfinance institutions, thus the tax as a percentage of total bank assets is 0.5% in the U.S. The overhead cost is measured as the total expenses of the financial institutions over its total assets. According to Beck and Demirguc-Kunt (2009), it is 2% in high income countries, which corresponds to banks' overhead cost in this paper. We assume that U.S. MFIs' overhead costs ovc^M are q times of the overhead costs of a bank, ovc^B. We use data from Accion's five U.S. offices' Annual Reports[18], and the tax is $\tau = (1 + 0.005)^{35} - 1 = 0.1907$. These differences in overhead costs between banks and MFIs generate an interest rate wedge (Fact 1), and we will do policy experiments in next section to assess their importance. The payroll tax $\tau^w = 0.33$ is set to match the average tax rate on labor income in the U.S. (Jones, Manuelli, and Rossi (1993)).

Banks also differ in the minimum loan sizes they require (Fact 2). For example, U.S. Bank requires that loans be at least $\$100,000$ and Bank of America requires the minimum loans size to be at least $\$25,000$. Some banks and organizations have loans that target small businesses, but even then, the minimum loan size is relatively large. For instance, the Goldman Sachs 10,000 Small Businesses program, partnered with PIDC requires loans to be at least $\$50,000$ for opening shop in Philadelphia. The U.S. Small Business Administration Dealer Floor Plan Financing Pilot Program has a minimum loan size of $\$500,000$. We choose a minimum loan size of $\$100,000$ for the baseline model and conduct policy experiments regarding loan size in section 5.

U.S. MFIs do not accept deposits (Fact 3) and borrow funds from government and private investors (Fact 4)[19]. Fact 5 indicates that MFI operating income is the

[18]Since the model period is 35 years, the target overhead cost is $ovc^B = (1+0.02)^{35}-1 = 1$, $ovc^M = q * ovc^B = 13.8$.

[19]We assume that all the private investors are socially responded, which means they

sum of the interest earned on loan repayments, private donations and government subsidies:

MFI operating budget income is 25% from $i_L^M L^M$, 40% from S^D, and 35% from S^G. MicroTracker 2012, Table 4 reports that MFIs' total operating expenses are $56,814,380 in 2011 and $64,251,167 in 2012. We take the average of the two years' total operating expenses and adjust operational costs for the 35 year model period and normalize by $10 million to get total operating costs = 211.86[20]. MicroTracker 2012, Page 11 (Fact 5) indicates that 25% of the total program cost is covered by interest earned from micro-loans, i.e., $\theta = 25\%$. MicroTracker 2012 Figure 10 indicates that the remaining 75% of the operational expenses are mainly covered by private donations (40%) and government subsidies (35%). We use equation (1.9) to calculate S:

$$S = S^D + S^G = (1-\theta)[(ovc^M + \tau)L^M + i_{dc}^B L_{dc}^B + i_{dc}^G L_{dc}^G]$$

We get $S = 211.86 * .75 = 158.9$ and $S^G = 211.86 * .35 = 74.15$.

According to Accion East and Online (2015), about one-third of loan funds are borrowed from the government and MicroTracker (2012), Page 1 indicates that total micro loans disbursements in the U.S. in 2012 were $\$292,149,870$. Therefore, we calculate the government directed credit amount to be $L_{dc}^G = 340.84$.[21] We will do

expect an concessionary interest return. In practice, 12% of microfinance investment funds came from commercial investors, about 63% of investors were socially responsible, from both public and private organizations (Armendariz and Morduch (2010) chapter 8), and the remainder require an intermediate rate in 2007 worldwide.

[20] Total operational costs = $[\frac{\$56,814,380+\$64,251,167}{2}/10,000,000] * 35 = 211.86$

[21] $L_{dc}^G = [\frac{1}{3} * 292,149,870/10,000,000] * 35 = 340.84$

sensitivity analysis on L_{dc}^G since it is not directly observable in the data and could be measured with error. Government spending g is simulated to be 564.331 to balance the budget for given τ^w, τ, i_{dc}^G, L_{dc}^G and S^G using government budget constraint.

Table 1.2 shows the value of each parameter.

Table 1.2: Parameter values, baseline economy

Parameters	Value	Comment/Observations
α	0.35	Capital share, Gollin (2002)
β	0.55	Labor share, Gollin (2002)
τ	0.005	Tax on loans, Demirguc-Kunt and Levine (1999)
τ^w	0.33	Payroll tax rate, Jones, Manuelli, and Rossi (1993)
ovc^B	0.02	Bank overhead cost, Beck and Demirguc-Kunt(2009)
q	13.8	MFI overhead cost $q * ovc^B$, Accion US Annual Reports (2012)
θ	0.25	Percent of operational costs covered by interest revenue (MicroTracker 2012)
$\underline{l}$	0.01	Normalized minimum Bank loan size (U.S.Bank)
γ	0.9364	Calibrated to match the U.S. historical Post-War return on government bonds (about 2%, International Financial Statistics)
ϕ	0.36	Calibrated to match the percent of entrepreneurs over the total population (about 7%) based on OECD outlook data 2009
ϵ	5.033	Calibrated to match the entrepreneurial earnings Gini index of 45% (Quadrini, 1999)

Three parameters remain to be determined: the fraction of total income left to the next generation, $1-\gamma$, the investor protection or the strength of financial contract

Table 1.3: Basic statistics, U.S. and baseline economy

	U.S. economy	Baseline model	No MFIs model
Yearly real interest rate(%)	2.0	2.0	2.0
Tax as a % of total bank assets	0.5	0.5	0.5
Overhead cost, % total bank assets	2	2	2
% of entrepreneurs(%)	7.0	6.99	6.41
Entrepreneurs' income Gini (%)	45	45.07	42.61
Capital to output ratio	2.55	2.31	2.32
Private credit to output ratio	2.03	2.03	2.13

enforcement, ϕ, and the curvature of the entrepreneurial ability distribution, ϵ. We choose them such that in the baseline model the real interest rate is 2%; the percent of entrepreneurs over the total employed population in the U.S. is 7% according to OECD data 2009 (OECD (2010)) and the Gini index of entrepreneurial earning is about 45% from Quadrini (1999). The calibrated value of $\gamma = 0.9363$ matches the historical risk-free rate of return on government bonds in the U.S., which indicates that agents in general leave about 6.4% of lifetime wealth to the next generation. The ratio of bequests to labor earnings in the steady state of our model is $(1-\gamma)/(1-(1-\gamma)(1+r)) = 0.073$, which falls into the intereval estimated by Gokhale and Kotlikoff (2000) where bequests account for 4-8% of labor compensation. The value of ϕ in the baseline economy is 0.36. This value is higher than the value of 0.26 found in Antunes, Cavalcanti and Villamil (2008) and is consistent with the intuition that micro loans require more enforcement. Recall that ϕ is equivalent to an additive utility punishment that reflects the strength of contract enforcement.

The model fits the U.S. economy fairly well. Besides the statistics that we calibrated, the capital to output ratio and the private credit to output ratio, which are not calibrated, also match well. Maddison (1995) shows that the U.S. capital to output ratio is about 2.55 and it is 2.31 in our model. The World Bank Development Indicators data shows that the average total private credit as a share of income in the U.S. was 2.03 from 1993 to 2013, and it is 2.03 in our model. The model does not match the income Gini where it is 40-44% in data, but the model predicts about 30%. This is a standard problem that occurs because workers in the model receive the same equilibrium wage, which should underestimate the real world income Gini.

Compared to an economy without microfinance institutions, the economy with MFIs has a

- Higher percentage of entrepreneurs: one goal of MFIs is to help nascent micro entrepreneurs start micro businesses.
- Higher entrepreneur income Gini coefficient: among all entrepreneurs, there are more lower income micro entrepreneurs than without micro-lending.
- Higher output: With microfinance, relatively high ability but poor individuals join the entrepreneur pool. Meanwhile, rich but low ability individuals exit due to higher wages, which leads to a higher productivity level on average.
- Lower capital to output ratio and credit to output ratio [22]:

[22]Both the impacts of the microfinance program on output and capital results are consistent with Buera, Kaboski, and Shin's (2014b) results for the general equilibrium model extension in the small open economy case.

- MFIs provide more working capital due to external donations and government directed credit; ease the credit constraint for high ability and low resource individuals, and donations from outside of the economy help reduce the interest rate on micro loans which also encourages more borrowing.[23]
- A higher wage causes high-productivity firms to have less profits and to leave less wealth to their descendants, and the capital stock decreases. In order to keep the same input costs, the demand for credit from banks declines. Less investment leads to even less profits for high-productivity firms.
- The negative impact of wages on high-productivity individuals dominates the positive impact of microfinance on marginal individuals. The net effects on capital and credit are negative, but minuscule.

Table 1.3 shows that the aggregate differences among variables are small with and without microfinance, which means that the microfinance industry has a small influence on the U.S. macroeconomy in terms of occupational choice, income inequality and the capital to output ratio[24]. In this model, capital is redistributed from high savers to low savers. Everyone saves their initial bequest into banks and a part of the capital in the banks is lent to microfinance institutions. However, microentreprises,

[23]Microfinance has positive impacts on K and L, but since the additional entrepreneurs have lower ability (x^{**} is below x in figure 1.2), the effects are small quantitatively.

[24]The small change in income inequality overall is consistent with Hermes (2014) empirical study, although Hermes (2014) focus on developing countries and using 70 countries macro level data to test the relationship between microfinance intensity and income inequality.

which are the main clients of MFIs, are those businesses with less than 5 employees and their economic activities are at a very small scale. But microenterprises do contribute to the large economy by enhancing income, creating and sustaining jobs, which we save for future research projects.

1.5 Quantitative experiments

Quantitative experiments explore how the equilibrium properties of the model change when there are changes in (i) bank loan size restrictions, (ii) MFI overhead costs, (iii) subsidy/donations, and (iv) MFI self-sustainability.

1.5.1 Bank loan size restrictions $\underline{l}$

Table 1.4 reports the results from an experiment that varies the size of the minimum loan size at which entrepreneurs can borrow from a bank. The results show that regardless of the requirements on collateral, credit score, and business profits, easing the restriction on bank minimum loan sizes raises the wage, the percentage of entrepreneurs, and the aggregate payoff. The aggregate payoff is the weighted average payoffs to all individuals, which includes both workers and entrepreneurs.[25] The intuition is that more people can borrow from banks at a lower interest rate, which lead to a higher number of entrepreneurs. Since there is less supply but more demand for labor, the wage increases. In addition, output per capita does not change much because entrepreneurs can now borrow at a lower interest rate, but must pay

[25] Aggregate payoff = the percentage of entrepreneurs ∗ average business income + the percentage of workers ∗ after-tax income.

for a higher wage to workers, which offsets the effect on output of the lower minimum loan size requirement from banks.

Table 1.4: Bank experiments: Lower limit on loan size $\underline{l}$

	Output per Capita %	Wage %	% of entrep	Entrep income Gini	Aggregate payoff
Baseline $\underline{l}$ =\$100k	100	100	6.99	45.07	100
$\underline{l} = 5 * \underline{l}_{base}$ SBA DFP	98.7	99.1	6.95	49.57	99.4
$\underline{l} = \frac{1}{2} * \underline{l}_{base}$ Goldman Sachs	100	100.4	7.55	46.42	107.3
$\underline{l} = \frac{1}{4} * \underline{l}_{base}$ BOA	99.8	100.5	7.73	47	109.7

1.5.2 MFIs overhead cost ovc^M

The motivation for the experiment on overhead costs is to assess the effects of recent innovative scoring and lending techniques that are being developed to lower these costs. For example, fin-tech startups are testing a smartphone screening methodology in Kenya, developed for people who lack credit scores. The smartphone app could evaluate clients' patterns of behavior that correlate with repayment or default, which could reduce the cost of lending dramatically (Dwoskin, WSJ)

Table 1.5 shows the results of an experiment that varies MFIs' overhead costs. The ratio of the overhead cost of MFIs and banks in our baseline model, q, is calculated from the Annual Reports of all five U.S. Accion offices and bank overhead cost from Beck and Demirguc-Kunt (2009). Without having more accurate data on U.S. MFIs

Table 1.5: Microfinance experiments: Overhead cost ovc^M

	Output per Capita %	Wage %	% of entrep	Entrep income Gini	Aggregate payoff
$ovc^M_{base} = q * ovc^B$	100	100	6.99	45.07	100
$ovc^M = 4 * ovc^M_{base}$	99.7	99.7	6.41	42.61	91.2
$ovc^M = 2 * ovc^M_{base}$	99.7	99.7	6.42	42.64	91.3
$ovc^M = \frac{3}{4} * ovc^M_{base}$	100	100.5	7.62	46.23	110.4
$ovc^M = \frac{1}{2} * ovc^M_{base}$	106.6	104.8	8.1	46.4	150.2

overhead cost, we would like to do a sensitivity analysis. It is possible that MFIs improved technology on screening and monitoring clients which reduce the cost (but it is hard to have such improvement due to high labor intensive requirements on screening and monitoring).

When overhead cost is two times of the cost in the baseline model, the interest rate is high enough that almost no one can afford borrowing from MFIs. When the overhead cost is half of the cost in our baseline model, the interest rate of borrowing from a MFI is lower than borrowing from a bank ($i^B_L = i^M_L$ implies that $ovc^M = 0.5487 * ovc^M_{base}$). Therefore, if MFIs could improve their technology so that the overhead cost is close to 1/2 of the cost in the baseline model, then MFIs can improve outcomes without challenging the banking sector.

1.5.3 Government policy experiments

1.5.3.1 Government subsidy S^G

Table 1.6 shows that increasing government support S^G to an MFI in order to cover operational costs has positive effects on output, the percentage of entrepreneurs, the wage and the aggregate payoff. The government raises funds for S^G by imposing a tax on workers' wages. See (1.24), where τ, g and L^G_{dc} are assumed to be constant in this experiment and τ^w adjusts to balance the government's budget constraint.

As government subsidies rise, this reduces the pressure on using earned interest to pay the operating costs. Therefore, the percentage of operational costs covered by interest, θ, declines. However, higher government subsidies for the microfinance industry increases the wage tax, which transfers a small amount of capital from workers to these low to moderate income micro entrepreneurs who borrow from MFIs. Thus, there is a distributional effect. For instance, if S^G increases by 10%, then θ decreases from 0.25 to 0.215, but the wage tax rate rises by 0.96%. A lower θ leads to a lower i^M_L, which encourages more agents to become entrepreneurs by borrowing from MFIs. An increase in the number of microenterprises causes the entrepreneur Gini coefficient to rise. More small firms means the demand for workers increases and the supply of workers drops, which leads to an increase in wage. However, when S^G increases by about 30%, θ decreases to 0.145 where $i^M_L < i^B_L$, which causes the bank sector to collapse. Note that, $i^M_L = i^B_L$ implies that

$$\theta(ovc^M + \tau + i^G_{dc}) = ovc^B + \tau + i_D \tag{1.26}$$

which in turn implies that $\underline{\theta} = (1 + 0.1907 + 1)/(13.8 + 0.1907 + 1) = 0.146$, is the

Table 1.6: Microfinance experiments: Government subsidy S^G

	Output per Capita %	Wage % (After tax wage %)	% of entrep	Entrep income Gini	Aggregate Payoff
Given interest rate i_D. Intermediation cost $\tau_{base} = 0.005$. Enforcement $\phi = 0.36$					
$S^G = 0$ $\tau^w = 24.39\%$, $\theta = 0.6$	99.5	88.5 (99.8)	6.41	42.59	91.18
$S^G = 0.5 * S^G_{base}$ $\tau^w = 28.63\%$, $\theta = 0.425$	99.66	93.8 (99.8)	6.42	42.64	91.3
$S^G = 0.8 * S^G_{base}$ $\tau^w = 31.24\%$, $\theta = 0.32$	99.8	97.2 (99.8)	6.51	43.05	92.7
$S^G = 0.9 * S^G_{base}$ $\tau^w = 32.11\%$, $\theta = 0.285$	100	98.4 (99.68)	6.73	44.15	95.9
Baseline $\tau^w = 33\%$, $\theta = 0.25$	100	100 (100)	6.99	45.07	100
$S^G = 1.1 * S^G_{base}$ $\tau^w = 33.96\%$, $\theta = 0.215$	100.11	101.7 (100.3)	7.36	45.97	105.8
$S^G = 1.2 * S^G_{base}$ $\tau^w = 34.86\%$, $\theta = 0.18$	100.56	103.5 (100.6)	7.78	46.27	113.6
$S^G = 1.3 * S^G_{base}$ $\tau^w = 35.18\%$, $\theta = 0.145$	103.3	106 (102.6)	8.14	46.29	135.6

critical θ at which banks are driven out.

On the other hand, when governments offer fewer subsidies to MFIs to covering operational costs, the after tax wage does not change much. However, output per capita, percentage of entrepreneurs, entrepreneurs income Gini, and aggregate payoff all decline. Table 1.6 shows that when only half of the baseline subsidy is offered, the interest rate is high enough that almost no one would borrow from MFIs.

Overall, more government subsidies are better for the economy until a point that crashes the economy.

1.5.3.2 Government directed credit L_{dc}^{G}

MFIs do not accept deposits. As a consequence, MFIs get part of their funding base by borrowing funds from the government at below market interest rate i_{dc}^{G}. In this experiment we analyze what happens if the government alters the amount of government directed credit from the baseline level (Fact 5).

Table 1.7 shows that varying the amount of government subsidized loans to MFIs has a small effect on output, the percentage of entrepreneurs, and the wage. The amount of credit L_{dc}^{G} that the government offers does not change the loan interest rate on microfinance loans as long as the government directed credit price i_{dc}^{G} is constant. An increase in the quantity L_{dc}^{G} generates more revenue for the government, and this leads to a lower wage tax rate in (1.24). But a lower wage rate may cause the after tax wage to be higher than before, which discourages marginal individuals from becoming entrepreneurs.[26] In other words, an increase in the government directed credit size reduces the percentage of entrepreneurs. However, all these aggregate changes are small because these are micro loans to microenterprises (i.e., small).

In reality, the government supports the microfinance industry by offering government directed credit and banks also provide funds to MFIs at below market returns. This experiment shows that the macroeconomy is more sensitive to policy

[26] After tax wage = (1-tax rate)*wage. When both the tax rate and wage decrease, it may cause the after tax wage to increase, e.g. $L_{dc}^{G} = 10 * L_{dcbase}^{G}$ case.

changes that vary the government subsidy than government directed credit.[27]

Table 1.7: Microfinance experiments: Government directed credit amount L^G_{dc}

	Output per Capita %	Wage % (After tax wage %)	% of entrep	Entrep income Gini	Aggregate Payoff
Given interest rate i_D. Cost recovery $\theta = 0.25$					
$L^G_{dc} = 1/10 * L^G_{dcbase}$ $\tau^w = 33.62\%$	100	100.96 (100)	6.996	45.065	99.98
$L^G_{dc} = 1/2 * L^G_{dcbase}$ $\tau^w = 33.37\%$	99.8	100.64 (100)	6.995	45.06	99.98
Baseline $\tau^w = 33\%$,	100	100 (100)	6.99	45.07	100
$L^G_{dc} = 2 * L^G_{dcbase}$ $\tau^w = 32.43\%$	99.8	99.25 (100)	6.99	45.05	99.95
$L^G_{dc} = 10 * L^G_{dcbase}$ $\tau^w = 27.44\%$	99.6	92.4 (100.2)	6.989	45.03	99.89

1.5.4 MFIs self-sustainability θ

Parameter θ measures what is often referred to as "self-sustainability," the percentage of total MFI expenses that are covered by interest repayments earned from micro loans. These payments are self-sustainable in the sense that they are generated

[27]Policy changes on the government subsidy affect the economy by changing the micro loan interest rate through equation (1.9) ($S = S^D + S^G = (1-\theta)[(ovc^M + \tau)L^M + i^B_{dc}L^B_{dc} + i^G_{dc}L^G_{dc}]$) and wage tax through government budget constraint Equation (1.24). But policy changes on the government directed credit only changes wage tax through government budget constraint. We fixed the market interest rate i_D due to an open economy, and so the varies of the government directed credit amount will not affect capital market price.

Table 1.8: Microfinance experiments: Self-sustainability θ

	Output per Capita %	Wage %	% of entrep	Entrep income Gini	Aggregate payoff
Baseline $\theta = 0.25$	100	100	6.99	45.07	100
$\theta = 2.6 * \theta_{base}$	99.77	99.78	6.41	42.61	91.2
$\theta = 2 * \theta_{base}$	99.77	99.78	6.42	42.64	91.27
$\theta = \frac{1}{2} * \theta_{base}$	108.6	107.6	7.99	46.38	167.9
$\theta = \frac{1}{20} * \theta_{base}$	204.3	164.5	7.18	51.27	2382

by the MFI and do not depend on funds from the government or private sector, where the later could vary due to changes in political and economic conditions, or donor preferences. According to MicroTracker (2012), MFIs' self-sustainability level θ is measured by cost recovery, which is calculated by interest earned from loan revenues divided by total expenses. The microfinance program operating income sources are mainly interest earned, donations S^D and government subsidies S^G (Fact 5). Operating income covers total expenses, which is different from loan funds (borrowing from banks and the government).[28]

Table 1.8 shows the results of an experiment that varies the level of self-sustainability θ, keeping fixed interest rate i_D and overhead costs. A larger θ means the MFI relies more on interest earned from loan repayments, which necessarily means that the fraction of donations is smaller for given operational costs and government subsidies. When MFIs are heavily reliant on donations and government subsidies

[28]The interest earned + $S^G + S^D$ = total expenses (Fact 5). In the data, operating income is slightly bigger than total expenses, but here we assume that total expenses are just covered.

($\theta \to 0$, which is equivalent to increasing S^D), the table shows that there are more entrepreneurs due to a lower interest rate on micro loans ($i_L^M = \theta(ovc^M + \tau + i_D)$).

The entrepreneurs income Gini coefficient is higher because there are more lower income microenterprises that join the ranks of entrepreneurs. In contrast when MFIs are close to fully self-sustainable ($\theta \to 1$)[29], donations are close to zero and MFIs try to cover all operational costs from interest repayments, which requires a higher i_L^M compared to i_L^B. This decreases the percentage of entrepreneurs since less people are willing to borrow from MFIs and the entrepreneurs income Gini declines due to fewer microenterprises. When interest earned from loan repayments must cover more than half of operational costs, then i_L^M is already sufficiently high that the results are similar to an economy without a microfinance program. This experiment implies that the results are sensitive to the MFI's self-sustainable level. In other words, more private donations and government subsidies directed toward microfinance increase the number of micro entrepreneurs, affect the entrepreneur income Gini, and raises output and wages.[30] Also, private donations and government subsidies cannot cover more than 85.6% [31] of operational costs, otherwise the bank sector will collapse. Note that this occurs in the last two rows of table 1.8.

[29]2.6 times of baseline θ is when donations are zero and the government subsidy stays the same.

[30]This result differs from Antunes, Cavalcanti and Villamil (2015) in which subsidies are effectively a transfer from workers (who pay the higher taxes) to a few high income entrepreneurs. This program is targeted at lower income individuals.

[31]0.856=1 - 0.146, where $\underline{\theta} = 0.146$.

1.5.5 Welfare loss without microfinance

Finally, we analyze the welfare effects of microfinance, which has strong distributional implications for a small (target) group of individuals. The welfare change is measured as the fraction of consumption and bequest that is left for the next generation that an individual of a given ability is willing to pay in order to switch to the economy without access to microfinance. This conditional welfare change is calculated in the following way: Denote by $\bar{\omega}(x,b)$ how much an agent is willing to pay to avoid a change, where

$$u([1+\bar{\omega}(x,b)]c_t^*, [1+\bar{\omega}(x,b)]z_{t+1}^*) = u(\hat{c}_t, \hat{z}_{t+1})$$

For utility $u(c_t, z_{t+1}) = (c_t)^\gamma (z_{t+1})^{1-\gamma}$, we can use homogeneity of the utility function and simplify the equation to

$$[1+\bar{\omega}(x,b)](c_t^*)^\gamma (z_{t+1}^*)^{1-\gamma} = (\hat{c}_t)^\gamma (\hat{z}_{t+1})^{1-\gamma} \tag{1.27}$$

$$\bar{\omega}(x,b) = \frac{(\hat{c}_t)^\gamma (\hat{z}_{t+1})^{1-\gamma}}{(c_t^*)^\gamma (z_{t+1}^*)^{1-\gamma}} - 1 \tag{1.28}$$

Figure 1.3 shows the welfare impact of microfinance across the marginal distribution of managerial ability in equilibrium. If the economy switches to a world without microfinance, then the indicated group of people will be worse off. It is clear that those people with intermediate managerial ability benefit from microfinance. [32]

Figure 1.3 shows: (a) the welfare impact when the microfinance sector shuts down and the economy does not receive donations S^D targeting microfinance anymore.

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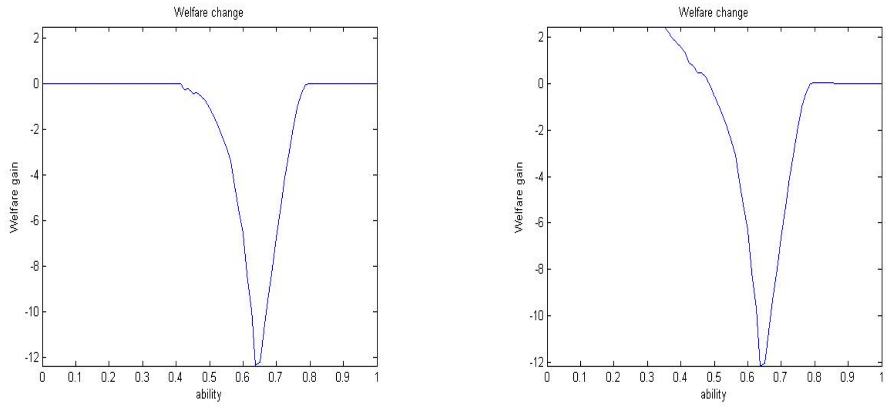
[32]This result is consistent with Buera, Kaboski, and Shin (2014b).



(a) No donation (S^D) (b) Lump-sum transfer S^D

Figure 1.3: Welfare loss without MFIs

While Figure 1.3 (b) the welfare impact when there are no MFIs, but the economy keeps the same amount of donations and lump-sum transfers to all the individuals. Since both welfare experiments close the microfinance sector, the wage decreases due to a general equilibrium effect. The government does not need to provide subsidies, and so the wage tax rate declines in order to balance the government budget. Overall, the after tax wage is slightly (1.6%) higher without microfinance. Therefore, it is hard to tell from Figure 1.3 (a), but the welfare gain is positive for agents with low ability (0.0057). Low managerial ability individuals have higher welfare gains and the relatively high ability individuals have slightly smaller welfare losses in Figure 1.3 (b) compared to (a) since they receive extra benefits directly from outside of the economy.

1.6 Conclusion

This paper studies the quantitative effects of varying key features of a program that resembles microfinance lending in the U.S. We conduct policy experiments to examine specific aspects of the program on output, wages, occupational choice, and inequality when intermediation is costly.

We obtain the following policy experiments results:

The first experiment is to ease the restriction on a bank's minimum loan size. Reducing the lower limit on bank loans leads to increases in the percentage of entrepreneurs and wage, but little change in output per capita. The intuition is that entrepreneurs who used to borrow from MFIs switch to banks for a lower interest rate, but firms must pay a higher wage which offsets the lower loan cost.

The next experiment shows that output, the wage, the percentage of entrepreneurs, and aggregate payoffs all increase when we decease operating costs. Lower MFI overhead costs reduce the interest rate on micro loans, but the wage increases which offsets the effect of the lower overhead costs on output per capita.

The experiments on governments' activities have two parts. First, we increase the level of the government subsidy S^G ceteris paribus, and find that increasing government support to cover operational costs above the baseline level initially increases output, entrepreneurs, the wage,[33] and the aggregate payoff. However, when government subsidies exceed about one third of the MFI's funding base, then further

[33]The wage tax increases to pay for the program, which transfers a small amount of capital from workers to low and moderate income micro entrepreneurs who borrow from MFIs. However, less workers causes a higher wage that leads to a higher after tax wage.

increases cause the banking system to collapse because the interest rate offered by the MFI falls below the interest rate charged by the banking system. Second, if we instead increase the amount of government directed credit funding provided by the government ceteris paribus, then this has only a small effect on output, the percentage of entrepreneurs, the wage and payoffs. This occurs because the interest rate faced by micro entrepreneurs does not change.[34] Thus, the targets are more sensitive to policy changes that vary the government subsidy than government directed credit.

Moreover, increasing MFI self-sustainability as long as it remains below a level that leads to a crash in the banking system $\underline{\theta}$ also increases output, the wage, the percentage of entrepreneurs, and aggregate payoffs. The MFIs' self-sustainable level, meaning how much the MFI relies on interest earned to cover operational costs, is driven by the micro loan interest rate.

Finally, we show that differences in welfare for some agents in an economy with and without MFIs can be significant. The strong distributional effects are due to the underlying heterogeneity in the economy. Some high ability but low asset individuals can now get loans and switch occupation from worker to entrepreneur.

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[34]Increasing government directed credit generates more government revenue from interest repayments, which decreases the wage tax. The after tax wage increases, which slightly reduces the number of entrepreneurs, but the impact of changes in government directed credit remains minimal.

CHAPTER 2
MACROECONOMIC EFFECTS OF MICROSAVINGS PROGRAMS FOR THE UNBANKED

2.1 Introduction

Microsavings is a branch of microfinance that is growing fast. This financial service is directed at "unbanked" or lower-income individuals. The goal is to enable these individuals to save small amounts to accommodate adverse shocks, pay for higher education or operate small businesses. The unbanked lack bank accounts completely,[1] while "underbanked" individuals have bank accounts and also use alternative financial services outside the traditional banking system, i.e. payday loans. This paper evaluates microsavings programs that partner with traditional banks to encourage low income individuals to save, with particular focus on investment in small businesses. The paper addresses two questions: How do microsavings affect occupational choice, firm size, wages, and the unbanked in the U.S., a highly developed financial system? What are the effects of counterfactual changes in government subsidies for microsavings, financial transaction costs, and the extra costs that banks face to administer small accounts?

According to the Federal Deposit Insurance Corporation Household Survey, 9.6 million households (7.7%) in the U.S. were unbanked in 2013 and 24.8 million households (20%) were underbanked. In addition, 25 million people have no credit

[1] According to FDIC (2013), 39.1% of households that have family income below $30,000, 20.5% of African Americans, 17.9% of Hispanics, 30% of women, and 22.7% of foreign-born non-citizens were unbanked.

score, "which makes them invisible to the mainstream U.S. financial system." see Forbes (2013). Among the reasons people report for being unbanked the most common are, "Do not have enough money" or "Account fees are high or unpredictable." In other words, the main reason that many individuals in the U.S. do not save at traditional banks is that these banks require minimum balances and the banks impose fees if account balances fall below the minimum. For example, Citibank requires savers to keep at least $1500 in a Basic Banking Package to avoid maintenance fees. Lack of access to formal financial services causes people to rely on their own assets or use informal savings to invest in small businesses; see Quadrini (2000). Limited access to saving services can also contribute to income inequality and slower economic growth; see Demirguc-Kunt and Klapper (2013).

Microsavings programs were introduced in the U.S. in the late 1990s along with Individual Development Accounts (IDAs).[2] Non-profit microsavings programs partner with traditional banks to offer IDAs and other small savings accounts.[3] These programs serve low-income people, minorities, recent immigrants, women, disabled people and those who lack access to traditional deposit services for other reasons.[4] A

[2]The Personal Responsibility and Work Opportunity Reconciliation Act of 1996 (federal legislation) created IDAs (National Association of Social Workers 1996), and IDAs are now available in more than 40 U.S. states (Center for Social Development 2010).

[3]CFED general eligibility guidelines for IDA savers require (all or some of these conditions): Maximum income levels below 200% of the federal poverty guidelines or the area median income; all or part of IDA savings are from earned income including a paycheck, welfare, disability, social security, or unemployment; and household assets, such as a car, home, savings, are less than $5,000. The programs often include financial training courses.

[4]For example, at microsavings provider EARN, the average annual household income at enrollment is $21,000; 71% of clients are women and 90% of savers self-identify as a person

key feature of IDAs is that savers receive a dollar match (or more) for every dollar saved. Both savings and match money can be used only to purchase a first house, pay for post-secondary education, or invest in small businesses (Community Affairs Department 2005). In the last decade, more than 500 IDA programs were launched, with more than 85,000 accounts opened. This resulted in 9,400 new homeowners, 7,200 educational purchases and 6,400 small business start-ups and expansions (CFED).

I study the structure of the microsavings industry in the U.S. and document six important stylized facts about microsavings, which are described in detail in section 2. Broadly, (i) banks require minimum balances; (ii) minimum deposit balance requirements (which result in high account fees) are the main reason people are unbanked; (iii) microsavings programs partner with banks to avoid high bank regulation costs; (iv) microsavings programs offer a one-to-one match rate; (v) extra transaction costs for small deposits and match money are funded by government and donor partnerships; and (vi) microsavings programs are targeted at low-income individuals. I take the fact that the unbanked and microsavings programs exist as given, and evaluate the effect of alternative microsavings programs on wages, income inequality, welfare, and other macroeconomics indicators.

I extend an otherwise standard general equilibrium model of occupational choice, between entrepreneurship and work, to include unbanked individuals and a microsavings program. In the general equilibrium model individuals choose to be either an entrepreneur or a worker. Two factors determine occupational choice:

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of color.

the ability to manage a firm and access to capital. Productivity across firms is heterogeneous and depends on entrepreneurs' managerial ability and access to capital. I use the terms microsavings and IDAs synonymously because they serve similar groups of people and are both partnerships between traditional banks and non-profit organizations designed to offer small savings accounts.

The microsavings programs are modeled as follows: access to microsavings/IDA programs permit individuals to save small amounts with low or no fees and also accumulate collateral to borrow for small businesses. To isolate the effect of microsavings, I assume that banks operate all lending activities, including traditional lending and microlending at the same interest rate. Because of the high cost of managing small savings accounts, traditional banks do not accept savings of less than a minimum amount. Therefore, some low wealth individuals lack access to saving services and are unbanked. In order to provide saving services to the poor, banks partner with microsavings programs, and receive government subsidies and private donations to cover the match money and extra transaction costs on small deposit accounts.[5]

In quantitative exercises, I first calibrate the model to match the percentage of the U.S. unbanked population, the percentage of entrepreneurs in the total population, and the entrepreneurial income Gini index. I next introduce a microsavings program, which has a positive effect on the percentage of entrepreneurs (by design),

[5]If microfinance institutions transformed from traditional banks, fixed cost is a "downscaling" cost that includes opening special branches, advanced risk management, market research, changing the organizational structure and financial methodology, increasing human resources, and adjusting the policy environment; see Bounouala and Rihane (2014). Non-profit organizations that partner with banks avoid this cost.

firm size, output, and wages. The main reason is that with government and donor support, microsavings programs allow poor individuals to save and provide additional match money to micro-savers. Micro-savers have the opportunity to become entrepreneurs because they now have savings they can pledge as collateral for a loan. This leads to more entrepreneurs and fewer workers, which induces a higher wage, ceteris paribus. Higher wage payments reduce firm profit, especially for large firms, and hence the demand for capital. This effect dominates the increase in the number of microenterprises, which tend to have smaller profits compared with large firms. Therefore, microsavings programs decrease the entrepreneurs' income Gini index.

Microsavings programs are designed to help the unbanked, individuals who also tend to be poor. By the nature of the program, individuals with low initial wealth are able to save and receive match money to either consume or invest in a business. The program gives low wealth individuals the opportunity to become entrepreneurs because microsavings provide collateral for a loan. The wage increases as a result of having more entrepreneurs and fewer workers. As a consequence, microsavings programs help unbanked workers directly through saving products and match money, and also help them indirectly through this wage effect. The results are similar to microsavings program empirical evaluations in developing countries that find increased access to loans and entrepreneurship.[6] In addition, my general equilibrium approach allows me to account for wage and welfare effects.

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[6]See Dupas and Robinson (2013a, 2013b); Ashraf et al (2010); Armendariz and Morduch (2010); Collins, Morduch, Rutherford and Ruthven (2009); Dowla and Barua (2006); Devaney (2006); Collins (2005); Rutherford (2002); and Ruthven et. al (2002).

Regarding the welfare analysis, poor individuals clearly benefit from microsavings because they receive interest on their deposits and match money. In addition, poor individuals with high ability have significant welfare gains due to access to the credit market and the opportunity to become entrepreneurs. My model can also account for the increases in pre-tax and post-tax wages. As a result of this positive general equilibrium wage effect, workers have a small welfare gain and entrepreneurs, besides those who were previously excluded due to low initial wealth, have a slight welfare loss. Overall, the aggregate welfare effect is positive.

The first counterfactual policy I analyze shows that changes to government subsidies, paid for by adjustments in the tax rate on worker and entrepreneur income, can have significant effects. Government subsidies provide banks with resources to cover the extra costs of managing small deposits and match money. However, a higher government subsidy also leads to a higher income tax, which transfers a small amount of capital from both workers and entrepreneurs to micro-savers or firm-owners who become entrepreneurs due to the microsavings programs. Overall, I find that adding a microsavings program to an economy with unbanked individuals can improve output, wages and the percentage of entrepreneurs relative to no program. Interestingly, decreasing the government subsidy to the baseline microsavings program increases output, after-tax wages and aggregate payments, but decreases the percentage of entrepreneurs slightly.

The second government policy shows that reducing financial transaction costs can lead to changes in the economy both with and without microsavings. Lowering this cost reduces the interest rate on loans. Highly productive firms are eager to expand their businesses by borrowing cheaper capital. This expansion causes a higher wage (pre and after-tax) due to a bigger demand for workers. As a result, marginal individuals have a higher incentive to become workers instead of entrepreneurs, reducing the percentage of entrepreneurs in an economy without microsavings. In an economy with microsavings, more individuals with low initial wealth but high ability run firms when borrowing costs fall, which leads to a higher percentage of entrepreneurs. When financial transaction costs fall in both economies with and without microsavings, the entrepreneur income Gini falls because there are fewer marginal low productivity firms. Overall, lowering the financial transaction cost leads to higher output per capita and higher wages.[7]

In the third policy experiment the transaction cost on small deposits decreases. I find that a lower transaction cost on small deposits reduces the outside donations that microsavings programs need to fund the program, but has little effect on the percentage of entrepreneurs, firm size, entrepreneur returns or wages. Microsavings programs pay match money and cover the extra transaction cost for managing small deposits, and the programs are funded by two sources of funds: government subsidies and outside donations. I take donations as given (from data) and do not model donors' decisions. Government subsidies are funded by income taxes on workers and

[7]This financial taxation experiment can be linked to the literature on entrepreneurs and taxation. For example, Cagetti and De Nardi (2009) show that the estate tax has little impact on savings and investment by small businesses, but has a significant impact on large firms.

entrepreneurs and financial taxes on banks (part of the financial transaction cost). This counterfactual experiment has no discernible effect on entrepreneurs' average profit, wages, percent of entrepreneurs or the match rate. However, it reduces that amount of private donations that microsavings programs must raise to maintain their government partnership.

This paper is directly related to the large body of literature on microfinance. There are two main strategies to study the impact of microfinance on the macroeconomy (Morduch 2012). Empirically, Demirguc-Kunt and Levine (2009) use cross-country data to show a positive correlation between financial expansion and the reduction of inequality. Hermes (2014) shows that higher levels of microfinance participation decrease income inequality using a macro level dataset for 70 developing countries. Banerjee at. al (2015) published six randomized evaluations that identify positive effects of microcredit on borrowers using data for six countries on four continents. On the other hand, Ahlin and Jiang (2008) extend Banerjee and Newman (1993)'s occupational choice model to include group lending. They conclude that microfinance helps people escape poverty by increasing income, which allows them to become self-employed. The model has no unbanked people and the saving decisions and interest rates are exogenous. Buera, Kaboski and Shin (2014b) theoretically and quantitatively focus on the effects of microfinance on the macroeconomy, where microfinance is introduced as fixed small-sized loans with the same interest rate as traditional banks' loans. All individuals can save in traditional banks, saving decisions are endogenous, and individual lending standards are applied. The main focus of my model is to assess the effects of bringing the unbanked people into the financial system in the U.S., given banks' minimum deposit requirements.

Microsavings programs in developing countries are described in detail as evidence for demand for savings by the poor (see Armendariz and Morduch (2010) on SafeSave in Bangladesh, Bank Rakyat Indonesia and BAAC in Tahiland; Collins, Morduch, Rutherford and Ruthven (2009) on RoSCAs in South Asia and ASCAs in SouthAfrica; Dowla and Barua (2006) on Grameen GPS in Bangladesh). The Financial Diaries (Collins, 2005; Rutherford, 2002; and Ruthven et al, 2002) are strong-empirical examples of such demand studies (Devaney 2006). However, most of the program evaluation studies focus on microcredit instead of microsavings. Limited field experiments in developing countries show evidence that individuals are more likely to increase consumption, income, and investment in health, as well as reduce vulnerability to illness and other negative shocks if they have access to savings accounts or informal savings (Dupas and Robinson (2013a, 2013b), Ashraf et. al (2010)). This paper theoretically and quantitatively studies the microsavings programs in developed financial systems and looks at the impacts of such programs on individuals' occupational choice, wage, investment, and inequality.

I also contribute to the literature that is looking for effective development tools to support low income people and microenterprises. De Mel et. al (2010) examine a random cash grant program in Sri Lanka and find that the direct cash aid is more important for retail sector enterprises than for manufacturing and service sector enterprises. Buera, Kaboski, and Shin (2014a) evaluate the effects of Asset Grant

Programs on occupational choice and wealth mobility in developing countries. The programs directly make grants that are financed by a one-time tax on the wealthiest individuals. They find a negative impact on aggregate capital because not all of the poor who receive grants become entrepreneurs. The microsavings programs that I evaluate have the feature of granting match money to micro-savers as well as the opportunity to save and borrow.

In addition, this paper is related to the literature on entrepreneurship, financial frictions, and misallocation (Buera, Kaboski, and Shin (2015); Antunes, Cavalcanti and Villamil (2008b, 2015); Midrigan and Xu (2014); Moll (2014); Buera and Shin (2011); Midrigan and Xu (2010); Hsieh and Klenow (2009); Lloyd-Ellis and Bernhardt (2000); Banerjee and Newman (1993); Lucas, (1978)). Following the literature, this paper has two capital market frictions: a financial tax on the banking sector and imperfect contract enforcement for borrowers.

The idea of evaluating the effect of microsavings programs on entrepreneurship also contributes to the literature on entrepreneurship and wealth. As noted, Cagetti and De Nardi (2006) use a life cycle model and find that more restrictive borrowing constraints result in less wealth inequality, smaller firm size, lower aggregate capital and a lower percentage of entrepreneurs. Quadrini (2000) examines the role of entrepreneurship and saving behavior on wealth inequality using a general equilibrium model with an infinitely lived household who can choose whether to be an entrepreneur each period. I use a one-period general equilibrium model to evaluate microsavings programs and find that the programs reduce the income inequality among entrepreneurs.

Finally, my paper extends the literature on IDAs impacts in the U.S. by studying the effects of IDAs on macroeconomic indicators. Rademacher et. al (2010) study the impact of IDAs on housing, and Schreiner and Sherraden (2007) study the association between IDA design and saving outcomes including the frequency of deposits and the occurrence of withdrawals. Both analyses use econometric approaches and therefore cannot capture general equilibrium effects, which I find are important.

In the remainder, section 2 summarizes stylized facts about microsavings. Section 3 contains the model with microsavings, the bank's problem, entrepreneur's problem, and the occupational choice decision. Section 4 calibrates the model using U.S. data and discusses model fit. Section 5 introduces the microsavings program. Section 6 analyzes the effects of microsavings and presents the quantitative policy experiments. Section 7 concludes.

2.2 Stylized facts about microsavings in the U.S.

The goal is to build a model that is consistent with several stylized facts from microsavings programs. This section summarizes facts about U.S. banks, microsavings and IDA programs. The Appendix provides additional information on microsavings and IDAs.

Fact 1: ***Banks impose minimum balance requirements on saving deposit accounts.***

Armendariz and Morduch (2010) document that banks pay a higher transaction cost per dollar for small deposits than for large deposits. Most banks charge maintenance fees or restrict individuals from opening an account unless they maintain a minimum deposit account balance. For instance, Citibank requires at least $1,500 in the prior calendar month of combined average balances in either Basic Checking or linked Savings Plus accounts. Bank of America requires an average daily balance of $1,500 or more. US Bank requires either a $300 daily balance or $1,000 average monthly balance to avoid fees. Banks require minimum amounts because they pay overhead costs to operate branches and employ workers to monitor accounts and provide customer service. Banks impose minimum size requirements to avoid high operation and monitoring costs on small accounts.

Fact 2: ***Inability to maintain a minimum balance and high account fees are the main reasons people are unbanked.***

Johnston and Morduch (2008) define the unbanked as people who do not have a bank account. More commonly, unbanked refers to those who do not have deposit accounts of any type; see Sherraden (2005), Chapter 8, Caskey. The FDIC (2011, 2012) indicates that "unbanked households are those that lack any kind of deposit account at an insured depository institution." Hamilton (2007) establishes that the majority of unbanked have low income and lack the minimum balance to open checking and savings accounts.

Fact 3: ***Microsavings programs partner with banks to avoid high regulatory costs.***

Christen, Lyman and Rosenberg (2003) show that banks face regulations such as rules governing operations, minimum capital requirements, consumer protection requirements, fraud prevention, credit information services, secured transactions, interest rate limits, foreign ownership limitations, taxes and accounting issues. Banks expend resources to comply with these legal, reporting and other regulatory requirements. According to Ledgerwood and White (2006), transformation from a credit-focused microfinance institution (MFI) to a regulated bank with savings programs costs between $\$700,000$ and $1.5 million. The costs differ depending on the country and most transformations require donor or government support. Due to these costly regulatory requirements, U.S. banks partner with non-profit MFI providers to develop microsavings programs jointly. MFIs are not subject the costly regulatory requirements that banks face, they recruit participants and provide financial education, and they give banks access to their micro deposits (CFED).

Fact 4: ***Programs offer a savings match rate, often 1:1, up to a limit.***

Individual Development Accounts (IDAs) are matched savings accounts that help people with lower income save with "match money." IDA programs often offer a 1:1 match rate, where for each dollar deposited in an IDA the account holder receives an additional dollar as match money to help achieve one of three goals: purchase a first house, pay for post-secondary education, or invest in a small business. Match rates vary depending on the program (CFED). Individuals may deposit as much as they wish, but deposits are matched only up to a specified limit.

Fact 5: ***The U.S. government partners with donors to cover the extra transaction costs on small deposits and provide match money.***

Transaction costs per dollar on small deposits are higher than for large deposits (fact 1). Many banks claim they cannot profit on deposit accounts smaller than $500; see Richardson (2003). Therefore, banks will manage small deposit accounts only if the extra transaction costs on these accounts can be offset. The U.S. government partners with non-profits to fund the extra transaction costs and provide match money for microsavings accounts through programs funded by government subsidies and private donations. The largest provider of match funds for IDAs is the U.S. government's Assets for Independence (AFI) program. AFI stipulates: (i) applicants must raise non-federal funds equal to or greater than their AFI project grant; (ii) grantees may use a maximum of 15% of the grant for operating costs, with the remainder of the government subsidy (at least 85%) used for match money; and (iii) IDA programs may receive funds from state governments, borrow from private investors, and raise private individual and business donations (donations are tax deductible (CFED)).

Fact 6: ***Low-income individuals benefit from microsavings programs.***

The unbanked receive no interest from savings and lack collateral for business loans. Microsavings offer lower income individuals a channel to hold assets safely, earn interest, receive match money on savings, and access business loans if needed.

Overall, the facts show that the U.S. government and non-profits partner to fund microsavings programs with government subsidies and private donations. The programs cover the extra cost of small savings accounts and provide match money for small savers. I construct a model that is consistent with these facts. I add a minimum deposit balance requirement on banks (facts 1 and 2) to Antunes, Cavalcanti, and Villamil's (2008b) general equilibrium occupational choice model, and this gives rise to "unbanked" households. I introduce a microsavings program consistent with facts 3, 4, and 5 and conduct counterfactual policy experiments in order to understand the implications of the program on occupational choice, firm size, and other key economic performance indicators.

2.3 Model

Consider an economy with a continuum of measure one individuals. Each individual lives for one period and reproduces another so population is constant. Time is discrete and infinite. A single good can be used for consumption or production, or left to the next generation as a bequest.

2.3.1 Preferences, endowments and technology

Individuals care about their own consumption, c_t, and a bequest to the next generation, z_{t+1}. The utility function for a representative individual in period t is

$$U = (c_t)^{\gamma}(z_{t+1})^{1-\gamma}, \quad \gamma \in (0,1) \tag{2.1}$$

Each individual is endowed with initial wealth b_t, a bequest from the previous generation, and managerial talent x drawn from a continuous cumulative probability distribution function $\Gamma(x)$ with $x \in [0,1]$.

Individuals choose their occupation, either a worker or an entrepreneur. Entrepreneurs can operate only one project. The production technology uses capital k and labor n to produce a single consumption good y, given by

$$y = xk^{\alpha}n^{\beta}, \quad \alpha, \beta > 0, \quad and \quad \alpha + \beta < 1 \tag{2.2}$$

Capital fully depreciates between periods. Entrepreneurs employ workers and capital.

2.3.2 The capital market and microsavings programs

A representative bank accepts deposits from savers if they meet a minimum deposit balance requirement $\underline{b}$ and lends to borrowers with collateral up to a limit. The size of an agent's initial wealth and the minimum deposit balance requirement determine whether an agent has access to bank deposits.

Case 1 (banked if $b \geq \underline{b}$): Agents have sufficient funds to have a deposit account at a bank. They can competitively rent capital to the bank and earn deposit interest rate i_D. They can use their capital to fund a business and may borrow additional capital from the bank at loan interest rate i_L.

Case 2 (unbanked if $b < \underline{b}$): Agents do not meet the requirement to have a deposit account.

- If no microsavings program exists, these low initial wealth agents are unbanked: The unbanked "keep their capital at home" and have only their own capital to fund a business. They are not eligible for loans due to a lack of collateral.
- If a microsavings program exists, these low wealth agents have access to financial services:

- They competitively rent capital to the bank, earn deposit interest rate i_D, and receive match money $s = \eta b$ at match rate η.
- They can use their capital to fund a business *and* they may invest their match money and borrow additional capital from the bank at interest rate i_L.

Bank: The bank issues loans to borrowers who have collateral (deposits), and sets a minimum balance requirement $\underline{b}$ for savings accounts. Let D_1 denote deposits from all savers with initial wealth above the minimum balance and D_2 denote deposits from all savers who do not meet the minimum and can save only through microsavings programs. Let $1_{ms} = 1$ indicate access to a microsavings program and $1_{ms} = 0$ indicate no access. The bank receives total deposits:

$$D = D_1 + 1_{ms} D_2 \tag{2.3}$$

Consistent with facts 4 and 5, the bank accepts private donations S^D and government subsidies S^G in order to pay the extra cost of offering a microsavings program, ecD_2, and it disburses match money to micro-savers in aggregate amount S.[8] Thus,

$$S^D + S^G = S + ecD_2 \tag{2.4}$$

Aggregate match money for all micro-savers with initial wealth below $\underline{b}$ is:

$$S = \eta D_2. \tag{2.5}$$

[8]Microsavings programs allow banks to avoid the regulatory costs of running their own savings program (fact 3). The extra transaction costs ec for small savings accounts are covered by donations and subsidies (fact 5). Overhead and intermediation costs on loans are equivalent to the costs on deposits since $D = L$ in equilibrium.

where $s = \eta b$. Deposits above $\underline{b}$ do not receive a match.

The representative bank's problem is the following:

$$\max_{i_L} \quad (1+i_L)L-(1+i_D)D-(ovc+\tau)D_1-1_{ms}(ovc+\tau+ec)D_2-1_{ms}S+1_{ms}(S^D+S^G)$$

$$\text{subject to:} \qquad L = D = D_1 + 1_{ms}D_2 = \int_{\underline{b}} b\Upsilon_t(db) + 1_{ms}\int_0^{\underline{b}} b\Upsilon_t(db)$$

$$1_{ms}[S^D + S^G = S + ecD_2]$$

$$1_{ms}[S = \eta D_2]$$

The objective indicates the bank maximizes profit.[9] The bank earns revenue from loan repayments $(1 + i_L)L$, must repay depositors $(1 + i_D)D$, pay overhead and transaction costs $ovc+\tau$ associated with "regular" deposits D_1 and microsavings deposits D_2 that include the extra transaction costs ec incurred by small deposits, pay aggregate match money S to micro-savers (if a microsavings program exists), and the bank receives funds from private donors and the government $S^D + S^G$ (if a program exists). The first constraint indicates the standard accounting condition that bank assets (L) must equal liabilities (D), where liabilities include standard bank deposits D_1 and deposits associated with the microsavings program $1_{ms}D_2$ (if the program exists). The right side of this constraint indicates that the bank raises D_1 from savers with bequests at least as great as minimum deposit size requirement $\underline{b}$ and D_2 from the low initial wealth depositors with $0 < b < \underline{b}$. The second constraint indicates that

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[9]Abstracting from the indicator function notation, the bank's problem when there is no microsavings program is: $\max_{i_L} \quad (1 + i_L)L - (1 + i_D)D_1 - (ovc + \tau)D_1$ subject to: $D = D_1 = \int_{\underline{b}} b\Upsilon_t(db)$. The problem with microsavings is:
$\max_{i_L} \quad (1 + i_L)L - (1 + i_D)D - (ovc + \tau)D_1 - (ovc + \tau + ec)D_2 - S + (S^D + S^G)$ subject to: $L = D = D_1 + D_2 = \int_{\underline{b}} b\Upsilon_t(db) + \int_0^{\underline{b}} b\Upsilon_t(db)$, $S^D + S^G = S + ecD_2$, and $S = \eta D2$.

if a microsavings program exists, the funds from donations and government subsidies must cover aggregate match money S and the extra cost of small deposits ecD_2. Similarly, the third constraint indicates that if a microsavings program exists the individual match payments to all program participants coincide with the aggregate match money S.

The zero profit condition implies that

$$i_L = i_D + \tau + ovc \tag{2.6}$$

Transaction cost τ reflects financial sector taxes (e.g. taxes on financial transactions, bank profits or inflation) and bank regulatory compliance costs. Bank overhead ovc is the cost to operate the institution such as labor and utility costs.

2.3.3 Optimal behavior and competitive equilibrium

2.3.3.1 Entrepreneurs

Individuals who decide to become entrepreneurs choose the level of capital and the number of employees to maximize profit subject to a technological constraint and a credit market incentive constraint. Given k and w, an entrepreneur solves the problem:

$$\pi(k, x; w) = \max_{n} xk^{\alpha}n^{\beta} - wn \tag{2.7}$$

Let a be the amount of self-financed capital (or, equivalently, the part of the loan that is fully collateralized by the agent's personal assets) and l be the amount borrowed from a bank (or, equivalently, the amount of the loan that is not collateralized). The unconstrained problem is similar to the problem in Antunes, Cavalcanti and Villamil (2008b).

Unconstrained problem: An entrepreneur who does not need credit ($b > a$ and $l = 0$) solves[10]

$$\max_{k \geq 0} \pi(k, x; w) - (1 + i_D)k \tag{2.8}$$

Deposit interest rate i_D is the opportunity cost of investing one's own funds in the firm.

Constrained problem: The problem of a high-income entrepreneur is different from the problem of a low-income individual. There are two cases:

If $\mathbf{b} \geq \underline{\mathbf{b}}$: The entrepreneur has an initial bequest above the minimum balance, and full access to the banking system. To borrow from the bank, the loan contract must be self-enforcing because the entrepreneur cannot commit to repay. This requires the amount that would be seized in default $\phi\pi(\cdot)$ to be at least as great as the loan repayment:

$$\phi\pi(a + l, x; w) \geq (1 + i_D + ovc + \tau)l(b, x; w, i_D)$$

The incentive constraint guarantees ex ante repayment and can be written as:

$$l(b, x; w, i_D) \leq \frac{\phi}{1 + i_L}\pi(k(b, x; w, i_D), x; w) \tag{2.9}$$

The maximum amount that an entrepreneur can borrow from a bank is increasing in the entrepreneur's bequest b and managerial ability x. Recall that $i_L = i_D + \tau + ovc$.

[10]Use the optimal $\pi(n)$ to solve for k.

If an entrepreneur with sufficiently high initial wealth borrows from a bank, then the problem is to maximize net income subject to incentive and feasibility constraints:

$$\begin{aligned} V(b,x;w,i_D) = & \max_{a>0,\ l\geq 0} \pi(a+l,x;w)-(1+i_D)a-(1+i_L)l \\ \text{subject to:} \quad 0 \ \leq \ & l \leq \frac{\phi}{1+i_L}\pi(k(b,x;w,i_D),x;w) \qquad (2.10) \\ & a \leq b \quad \text{feasibility} \end{aligned}$$

In equilibrium, $1+i_L = 1+i_D+ovc+\tau$. Optimal policy functions $a(b,x;w,i_D)$ and $l(b,x;w,i_D)$ define the size of each firm: $k(b,x;w,i_D) = a(b,x;w,i_D)+l(b,x;w,i_D)$.

If b < $\underline{\mathbf{b}}$: The bank does not lend to individuals without deposits. Therefore, microsavings programs play an important role for low income borrowers. When such programs exist, low income entrepreneurs can self-finance using their initial wealth (or equivalently, the part of the loan that is fully collateralized by personal assets), receive match money s and invest it in their business, and borrow the remaining capital from a bank. Without microsavings, a constrained borrower cannot become an entrepreneur and becomes a worker due to insufficient capital. In other words, an individual becomes an entrepreneur only if $b \geq k^*$ when there is no microsavings program. Banks will not lend to these individuals because they lack collateral (deposits).[11]

An entrepreneur without sufficiently high initial wealth faces the following

[11]For $b < \underline{b}$, no microsavings gives $V = \max\ xa^{\alpha}n^{\beta} - wn$. With microsavings, the problem is: $\max\ \pi(a+l+s,x;w)-(1+i_D)b-s-(1+i_L)l$. For $b \geq \underline{b}$, the entrepreneur's problem has the same solution as Antunes, Cavalcanti and Villamil (2008a) ignoring taxes.

problem:

$$V^h(b,x;w,i_D,1_{ms}s) = \max_{a>0,\ l\geq 0} \pi(a{+}1_{ms}(l{+}s),x;w){-}(1{+}1_{ms}i_D)a{-}1_{ms}s{-}1_{ms}(1{+}i_L)l$$

$$\text{subject to:}\quad 0 \ \leq\ l\ \leq\ \tfrac{\phi}{1+i_L}\pi(k(b,x;w,i_D,1_{ms}s),x;w)$$

$$0 < a \leq b \quad \text{feasibility}$$

Optimal policy functions $a(b,x;w,i_D)$ and $l^h(b,x;w,i_D,1_{ms}s)$ define the size of each firm:

$$k(b,x;w,i_D,1_{ms}s) = a(b,x;w,i_D){+}l^h(b,x;w,i_D,1_{ms}s), \text{ where } h = ms \text{ or } nms.$$

Note that when $h = ms$, $1_{ms} = 1$ and when $h = nms$, $1_{ms} = 0$.

2.3.3.2 Occupational choice

The occupational choice for each individual is derived from maximizing the agent's life time wealth. Let τ^I denote a common income tax on entrepreneurs and workers. The return to entrepreneurship is $(1-\tau^I)V(\cdot)$ and to worker is $(1-\tau^I)w$. Define $\Omega = [0,\infty] \times [\underline{x},\overline{x}]$. For any $w, i_D > 0$, an individual described by the pair (b,x) will choose to be an entrepreneur if $(b,x) \in E(w,i_D)$,[12] where

[12] Occupational choice is often determined by the entrepreneur and worker value functions. This is because lifetime wealth has the common term $(1+i_D)b$ since everyone can save. In this paper, occupational choice is determined by lifetime wealth. Both methods lead to the same solution.

$$E(w,i_D) = \begin{cases} \{(b,x)\in\Omega : (1-\tau^I)V(b,x;w,i_D) + (1+i_D)b \\ \qquad\qquad \geq (1-\tau^I)w + (1+i_D)b\} & \text{if } b \geq \underline{b} \\ \{(b,x)\in\Omega : (1-\tau^I)V^h(b,x;w,i_D,1_{ms}s) + (1+1_{ms}i_D)b + 1_{ms}s \\ \qquad\qquad \geq (1-\tau^I)w + (1+1_{ms}i_D)b + 1_{ms}s\} & \text{if } b < \underline{b} \end{cases}$$

$$E(w, i_D) = \begin{cases} \{(b,x) \in \Omega : (1-\tau^I)V(b,x;w,i_D) \geq (1-\tau^I)w\} & \text{if } b \geq \underline{b} \\ \{(b,x) \in \Omega : (1-\tau^I)V^h(b,x;w,i_D,1_{ms}s) \geq (1-\tau^I)w\} & \text{if } b < \underline{b} \end{cases}$$

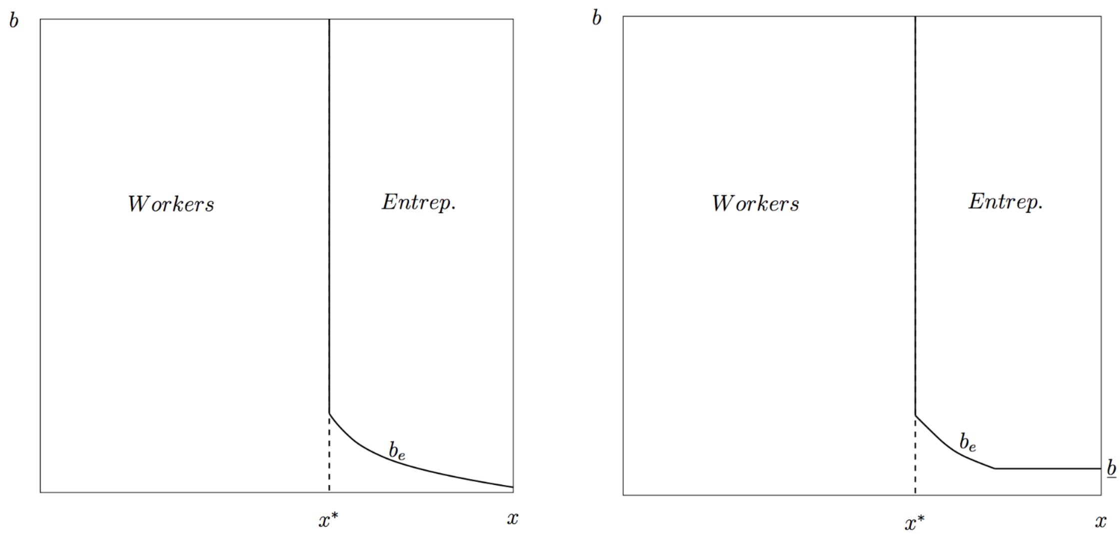
The complement of $E(w, i_D)$ in Ω is $E^c(w, i_D)$. If $(b, x) \in E^c(w, i_D)$, then individuals are workers.

Lemma 2.1. *Define $b_e(x; w, i_D)$ as the curve in Ω where $V(b, x; w, i_D) = w$ when $b \geq \underline{b}$ and $V^h(b, x; w, i_D, 1_{ms}s) = w$ when $b < \underline{b}$ where $h = ms$ or nms. Then there exists an $x^*(w, i_D)$ such that $\frac{\partial b_e(x;w,i_D)}{\partial x} < 0$ for $x > x^*(w, i_D)$ and $\frac{\partial b_e(x;w,i_D)}{\partial x} = -\infty$ for $x = x^*(w, i_D)$. When $b < \underline{b}$, and an economy has microsavings, $\frac{\partial b_e(x;w,i_D)}{\partial x} < 0$ for $x > x^*(w, i_D)$; when the economy has no microsavings, $\frac{\partial b_e(x;w,i_D)}{\partial x} = 0$ for $x > x^*(w, i_D)$. In addition, for all x:*

1. *If $b < b_e(x; w, i_D)$, then $(b, x) \in E^c(w, i_D)$ (the agent is a worker)*
2. *If $b \geq b_e(x; w, i_D)$, then $(b, x) \in E(w, i_D)$ (the agent is an entrepreneur)*

Proof. The proof is in the Appendix. □

Figure 2.1(a) indicates that agents are workers when their managerial ability is low, $x < x^*(w, i_D)$, or initial wealth b is low. If agents were not credit constrained the line would be vertical at critical ability level x^*. The negatively sloped b_e curve indicates that some high ability agents may be credit constrained and remain workers (see Antunes, Cavalcanti and Villamil (2008a)). Figure 2.1(b) introduces the unbanked caused by minimum deposit requirement $\underline{b}$. Individuals are again workers when ability or wealth are low. When x is sufficiently high and $b > \underline{b}$, agents can



(a) Fully banked

(b) With Unbanked

Figure 2.1: Occupational choice

become entrepreneurs, depending on whether or not they are credit constrained. If initial wealth is very low, agents now will be workers even if their managerial ability is high because they lack collateral to borrow.

2.3.4 Consumers

Individual lifetime wealth is defined as:

$$Y_t = \begin{cases} \max\{(1-\tau^I)w, (1-\tau^I)V(b_t, x_t; w_t, i_{tD})\} + (1+i_D)b_t & \text{if } b \geq \underline{b} \\ \max\{(1-\tau^I)w, (1-\tau^I)V^h(b_t, x_t; w_t, i_{tD}, 1_{ms}s_t)\} & \\ \quad +(1+1_{ms}i_{tD})b_t + 1_{ms}s_t & \text{if } b < \underline{b} \end{cases}$$

Given life time wealth, the individual solves the following problem:

$$\max_{c_t, z_{t+1}} U = (c_t)^{\gamma}(z_{t+1})^{1-\gamma}, \quad \gamma \in (0,1)$$

$$\text{subject to:} \qquad c_t + z_{t+1} = Y_t$$

The optimal policy functions for consumption and bequests are thus $c_t = c(Y_t)$ and $z_{t+1} = b(Y_t)$. The functional form of consumer preferences implies that individuals leave a proportion $1 - \gamma$ of their lifetime wealth as a bequest. Bequests are non-negative since every individual can be a worker.

2.3.5 Competitive equilibrium

Let Γ_t be the bequest distribution in period t, which is endogenously determined across periods. The initial bequest distribution Γ_0, government spending g and tax rate τ^I are exogenously given. In a competitive equilibrium agents optimize, markets clear and the law of motion is satisfied.

1. Free entry into the bank sector (zero profits in equilibrium) implies:

$$i_L - i_D = ovc + \tau$$

2. The market clearing conditions for labor and capital are:

$$\iint_{z \in E(w_t, i_{tD})} n(x; w_t, i_{tD}) \Upsilon_t(db)\Gamma(dx) = \iint_{z \in E^c(w_t, i_{tD})} \Upsilon_t(db)\Gamma(dx)$$

$$\iint\limits_{z\in E(w_t,i_{tD})} k(b,x;w_t,i_{tD})\Upsilon_t(db)\Gamma(dx) = \iint_{\underline{b}} b\Upsilon_t(db)\Gamma(dx)$$

$$+ (1-1_{ms})\iint_{z\in E(w_t,i_{tD})}^{\underline{b}} a(b,x;w_t,i_{tD})\Upsilon_t(db)\Gamma(dx)$$

$$+ 1_{ms}\iint_0^{\underline{b}} b\Upsilon_t(db)\Gamma(dx) + 1_{ms}\iint\limits_{z\in E(w_t,i_{tD})} s\Upsilon_t(db)\Gamma(dx)$$

3. The government budget constraint given wage w, intermediation cost τ, government subsidies to microsavings programs S^G, tax τ^I and government spending g is:

$$\iint\limits_{z\in E(w_t,i_{tD})} \tau^I(wn(x;w_t,i_{tD}) + V(b,x;w_t,i_{tD}))\Upsilon_t(db)\Gamma(dx) + \tau D = g + S^G \tag{2.11}$$

4. Law of motion: $\Upsilon_{t+1} = \int P_t(b,A)\Upsilon_t(db)$

The law of motion for the distribution of bequests is provided to fully characterize the competitive equilibrium since the bequest is the only connection between periods. Let $P_t(b_t, A) \equiv Pr\{z_{t+1} \in A|b_t\}$ be the non-stationary transition probability function that assigns a probability for a bequest in $t+1$ for the descendant of an agent that has bequest b_t.

The quantitative exercises evaluate policy experiments where the real wage, interest rate and income distribution do not change significantly over time.[13]

[13] Antunes et al. (2008a) show that there exists a unique stationary equilibrium with $w > 0, r - 1 < \infty$ and for any initial bequest distribution Υ_0, it converges to an invariant bequest distribution Υ.

2.4 Calibration

In order to study the quantitative effect of microsavings on entrepreneurship, wages and other variables, we must assign values for the model parameters. The model is calibrated to match key statistics in the United States, where financial markets are well developed and intermediation costs in banking are small. Individuals live for one period in the model, which is chosen to be 35 years, the typical working years from age 25 to 60. Assume that the cumulative distribution of managerial ability is given by $\Gamma(x) = x^{\frac{1}{\epsilon}}$ and $x \in [0, 1]$. When ϵ is one, entrepreneurial talent is uniformly distributed in the population. When ϵ exceeds one, the talent distribution is concentrated among low talent agents. The following parameters must be determined: technology (α, β), utility (γ), and ten institutional and policy parameters ($\underline{b}$, η, *ovc*, *ec*, ϕ, τ, S^G, S^D, g, τ^I).

Following Gollin (2002), we set α and β so that in the entrepreneurial sector 35% is paid to capital, 55% of income is paid to labor, and 10% are profits. As in Antunes et. al (2013), intermediation costs are the sum of intermediary taxes and regulatory compliance costs, as a percentage of total bank assets. In the U.S. τ is 0.5%.[14] Overhead costs are measured as financial institution total expenses over total assets. Beck and Demirguc-Kunt (2009) find that *ovc* is 2% in high income countries. Since a period is 35 years, the target overhead cost is $ovc = (1 + 0.02)^{35} - 1 = 1$ and $\tau = (1 + 0.005)^{35} - 1 = 0.1907$. The income tax $\tau^I = 0.25$ is set to match the average

[14] Since deposits equal credit in equilibrium, this also measures the analogous cost on deposits.

income tax rate in the U.S. that ranges from 10% to 39.6%; see US Tax Center (2015).

Microsavings programs partner with banks. Program sponsors screen clients and offer financial training courses. Banks provide small savings accounts and distribute match money. The benchmark model uses a 1:1 match rate, $\eta = 1$. Banks differ in the minimum deposit balance $\underline{b}$ they require (fact 1). The benchmark economy sets $\underline{b} = \$1,500$, which is a common balance in large banks. Consistent with fact 5, the largest provider of matching funds for IDA programs is the federal government's Assets for Independence (AFI) program. AFI applicants are required to raise non-federal funds in an amount equal to or greater than their AFI project grant. Therefore, $S^D \geq S^G$. Grantees may use 15% of the grant for operating costs. Almost 60% of IDA programs receive matching funds through AFI, and AFI provides an average annual appropriation of $25 million to fund IDA matches; see FDIC (2007). I use this number to compute government subsidies for the 35 year model period, normalized by $10 million, to get $S^G = 87.5$.[15] These parameters are varied in policy experiments.

The benchmark model has no microsavings program: government subsidy $S^G = 0$, deposit intermediation cost $\tau = 0.1907$,[16] and income tax $\tau^I = 0.25$. Government spending g is simulated to be 2098 to balance government budget (2.11). In policy experiments with a microsavings program, income tax τ^I is adjusted using $S^G = 87.5$, $g = 2098$ and $\tau = 0.1907$ from the benchmark model.

[15] $S^G = [\$25,000,000/10,000,000] * 35 = 87.5$

[16] Recall that $\tau = (1 + 0.005)^{35} - 1 = 0.1907$.

Costs per dollar are higher for collecting small than large deposits. Recall (2.4): $S^G + S^D = S + ecD_2$ and aggregate match money condition (2.5): $S = \eta D_2$. Match rate η is 1 in the benchmark economy. The simulated total amount of small savings $D_2 = \int_0^{\underline{b}} b\Upsilon_t(db) = 1.04$, and hence $\underline{b}$ determines D_2. I compute S^G from AFI data. The relationship between private donations S^D and government subsidies S^G is calculated using the EARN 2012 financial statement data, giving $S^D = 1.7S^G$.[17] Since data on donations is better than data on the extra cost of managing a small savings account, ec is calculated using (2.4), giving $ec = 0.1677$.[18]

Three parameters remain to be determined: the fraction of total income left to the next generation, $1-\gamma$; investor protection (strength of financial contract enforcement), ϕ; and the curvature of the entrepreneurial ability distribution, ϵ. These three parameters are chosen such that in the baseline model the percentage of unbanked is 6%;[19] the percent of entrepreneurs over the total employed population is 12%;[20] and

[17]EARN's 2012 financial statement reports that the unrestricted contributions by donors are \$833, 351 and government grants are \$486, 647. Thus, $\frac{S^D}{S^G} = \frac{833{,}351}{486{,}647} = 1.7$.

[18]For the 35 year period, $ec = (1 + 0.1677)^{35} - 1 = 226$.

[19]The Global Findex Database 2014 indicates the percentage of adults that have a bank account in the U.S. is 94% (Demirguc-Kunt, et. al (2015)), so the percentage of the unbanked is 6%. An alternative way to calculate the unbanked is the following: FDIC (2013) reports 7.7% of households are unbanked, which is approximately 9.6 million households and 16.7 million adults. The U.S. working-age population is 202.27 million (FRED 2013), which leads to 8.26% unbanked individuals in the economy. I use 6% and check sensitivity. The results are consistent.

[20]The OECD reports entrepreneurs as a percentage of the total employed population at 7% during $2000 - 2010$. Assah Meh (2002) reports 12%. Cagetti and De Nardi (2006) find that business owners or self-employed individuals as a percentage of total population is 16.7% and self-employed business owner as a percentage of total population is 7.6%. Quadrini (1999) has two definitions: (i) Families that own a business or have a financial interest in a business enterprise, giving 14.9% entrepreneurs. (ii) Families in which the head

the Gini index of entrepreneurial earning is 54%, Assah Meh (2002).

Table 2.1 shows the value of each parameter.

Table 2.1: Calibration, parameter values, baseline economy (no microsavings)

Parameters	Value	Comment/Observations
α	0.35	Capital share, Gollin (2002)
β	0.55	Labor share, Gollin (2002)
τ	0.005	Tax/regulation cost, Demirguc-Kunt and Levine (2000)
τ^I	0.25	Effective tax rate, US Tax Center (2015)
ovc	0.02	Bank overhead cost, Beck and Demirguc-Kunt(2009)
η	1	Match rate (CFED 2009)
$\underline{b}$	\$1,500	Minimum balance
γ	0.959	Calibrated: match % unbanked (FDIC and FRED 2013)
ϕ	0.225	Calibrated: match % entrepreneurs/total population
ϵ	3.2	Calibrated: match entrepreneurial income Gini index, Assah Meh (2002)

The calibrated value of $\gamma = 0.959$ indicates that agents leave about 4.1% of lifetime wealth to the next generation. The ratio of bequests to labor earnings in the model steady state is $(1-\gamma)/(1-(1-\gamma)(1+r)) = 0.0447$, which is in the interval estimated by Gokhale and Kotlikoff (2000), where bequests account for 4-8% of labor compensation. The value of ϕ in the baseline economy is 0.225. This value is lower than the value of 0.26 in Antunes, Cavalcanti and Villamil (2008b) and is

is self-employed in their main job, giving 17.9%. The Global Entrepreneurship Monitor 2014 reports the number is 14% among the U.S. working-age population. Measurements range from 7% to 17.9%; I choose the percentage of entrepreneurs target to be 12%.

consistent with the intuition that low bequest individuals use microsavings to borrow with collateral, which requires less enforcement. Recall that ϕ is equivalent to an additive utility punishment that reflects the strength of contract enforcement.

The model fits the U.S. economy well in view of the fact that the U.S. economy has microsavings and the benchmark model does not. The capital to output ratio is not calibrated. Maddison (1995) finds that the U.S. capital to output ratio is about 2.5 and in the benchmark model, where low wealth unbanked individuals cannot save, it is 2.1. Similarly, World Bank Development Indicators data shows that average total private credit as a share of income in the U.S. is 2.03 from 1993 to 2013, and it is 1.31 in the model where low wealth individuals cannot borrow because they lack collateral (savings accounts). KPMG 2014 Survey of U.S. banks indicates that compliance costs are about $5-10\%$ of total bank operating costs, see Cyree (2015). In the benchmark model, the regulatory compliance costs are about 8.7% of banks' total operating costs, which falls within the KPMG Survey interval.[21] The unbanked working-age population in the data is 6% (The Global Findex Database 2014) and it is 4.9% in the benchmark model. I underestimate the unbanked population because, in practice, there are individuals who choose to be unbanked due to other reasons such as concerns about privacy or tax evasion, which are not modeled. The interest rate, percentage of entreprenuers, and entrepreneur income Gini match well.[22]

[21]For one year, $\frac{\tau}{i_D+ovc+\tau} = 0.005/(0.02+0.02+0.005) = 11\%$. For the 35 years in a period, $\frac{\tau}{i_D+ovc+\tau} = 0.1907/(1+1+0.1907) = 8.7\%$.

[22]The model predicts an income Gini of about 31%, which does not match 40-44% in the data. This standard problem occurs because workers in the model receive the same equilibrium wage, biasing the income Gini downward.

Table 2.2: Basic statistics, U.S. and baseline economy

	U.S. economy	Baseline model
Yearly real interest rate (%)	2.0	2.0
Regulation cost as a % of total bank operation costs (%)	$5-10$	8.7
% of entrepreneurs (%)	12	12
Entrepreneurs' income Gini (%)	54	57
Capital to output ratio	2.55	2.1
Private credit to output ratio	2.03	1.31
% of unbanked	6	4.9

2.5 Microsavings

The previous section calibrated the stationary equilibrium of the baseline model without microsavings. Individuals chose their occupation based on their initial bequest and ability. I now introduce a microsavings program into the benchmark economy. The baseline microsavings program offers a match of $\eta = 1$ and the minimum deposit size requirement is $\underline{b} = \$1,500$. I consider the case where microsavings programs are funded by income taxes and a transaction cost that includes a tax on the bank. In practice, entrepreneurs that borrow from a bank bear the transaction cost because equation (2.6) follows from the zero profit condition on the bank: $i_L = i_D + \tau + ovc$. Entrepreneurs and workers pay a common income tax rate τ^I to balance budget equation (2.11), given that the government subsidy to partially fund the microsavings program increases from baseline level $S^G = 0$ to $S^G = 87.5$, exogenous government non-microsavings spending is fixed at $g = 2098$, and $\tau = 0.1907$.

Compared to an economy without microsavings, introducing the program has the following effects. First, the percentage of entrepreneurs increases slightly. This is

Table 2.3: Baseline economy versus economy with microsavings

	Baseline model	Model with microsavings
% of entrepreneurs	12	12.15
Entrepreneurs' income Gini (%)	57	52.8
Wage	100	120.7
After tax wage	100	118.9
Income tax rate	0.25	0.263
Government subsidy	$S^G = 0$	$S^G = 87.5$
Output	100	106.3

not surprising because one goal of microsavings programs is to help poorer individuals save and borrow, and nascent micro-entrepreneurs to start micro businesses. Second, the pre-tax and after tax wages are higher. The microsavings program increases the number entrepreneurs. The demand for workers increases while the supply of workers decreases, increasing the pre-tax market wage. The income tax also rises to fund government subsidy S^G to the microsavings program. Overall, the market wage effect is bigger than the income tax effect, which results in a higher after tax wage. Third, the entrepreneur income Gini coefficient falls. The microsavings program leads to more entrepreneurs, but they run small microenterprises and earn low income. However, the income of the highly-productive entrepreneurs that run larger more productive firms drops because wages increase. This leads to a reduction in the entrepreneur Gini index from 57 to 52.8, indicating less inequality. Fourth, output rises. The microsavings program provides more working capital due to exogenous external donations S^D and government directed credit S^G (paid for by taxes).

Table 2.3 summarizes the effect of the microsavings program. The program affects occupational choice, output and income inequality. Micro-savers are individuals whose initial wealth is below the bank's minimum balance and their economic activities are at a very small scale. However, if they run microenterprises due to help from the microsavings program, they create jobs.

2.5.1 Welfare analysis

Analysis of the welfare effects of microsavings shows that microsavings has strong distributional implications for a small (target) group of individuals. The welfare change is measured as the fraction of consumption and bequest that is left for the next generation that an individual of a given ability is willing to pay in order to switch from the baseline economy without microsavings to the economy with the microsavings program. This conditional welfare change is calculated in the following way: Denote by $\bar{\omega}(x, b)$ how much an agent is willing to pay to avoid the change, where

$$u([1 + \bar{\omega}(x, b)]c_t^*, [1 + \bar{\omega}(x, b)]z_{t+1}^*) = u(\hat{c}_t, \hat{z}_{t+1})$$

For utility $u(c_t, z_{t+1}) = (c_t)^\gamma (z_{t+1})^{1-\gamma}$, I use homogeneity of the utility function and simplify the equation to $[1 + \bar{\omega}(x, b)](c_t^*)^\gamma (z_{t+1}^*)^{1-\gamma} = (\hat{c}_t)^\gamma (\hat{z}_{t+1})^{1-\gamma}$. This yields

$$\bar{\omega}(x, b) = \frac{(\hat{c}_t)^\gamma (\hat{z}_{t+1})^{1-\gamma}}{(c_t^*)^\gamma (z_{t+1}^*)^{1-\gamma}} - 1$$

Figure 2.2 shows the welfare impact of microsavings across the low bequest individuals in equilibrium. If the economy switches to a world with a microsavings program, the target group is better off. The low initial wealth target groups benefits from the program because they now have interest bearing deposits, match money, and

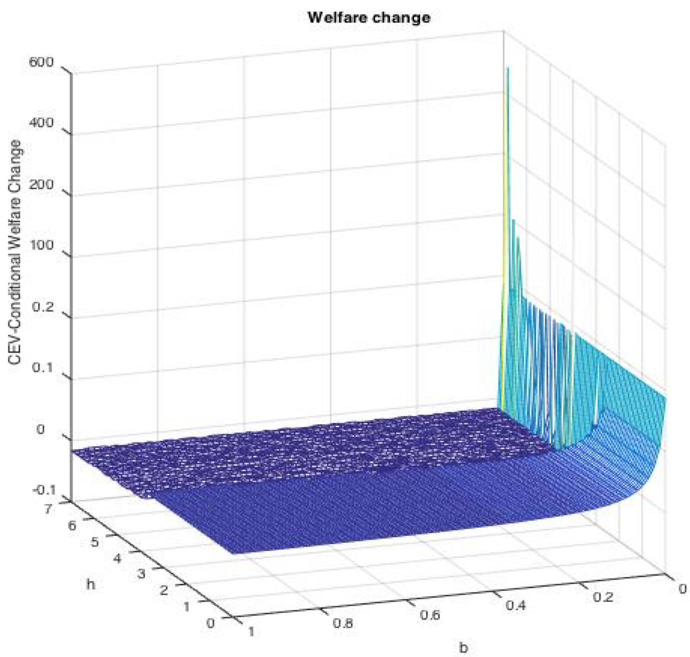


Figure 2.2: Welfare gain with microsavings

a positive wage effect. In addition, individuals with low initial wealth and high ability have a significant welfare gain because their new access to the credit market allows them to become entrepreneurs. As a result of the positive wage effect, workers have a small welfare gain and entrepreneurs, outside those that were previously excluded or constrained due to their low initial wealth, have a slight welfare loss. Overall, the aggregate welfare impact across all agents is positive.

2.6 Policy experiments

In this section I conduct three policy experiments to better understand how altering key features of the microsavings program affects outcomes. Recall program funding equation (2.4): $S^D + S^G = S + ecD_2$. The first experiment alters the level of the government subsidy S^G used to fund the microsavings program when increased spending is financed by an increase in the common tax on worker and entrepreneur income τ^I. The second experiment examines intermediation costs τ. The third experiment examines an improvement that lowers the extra costs on small deposits ec.

2.6.1 Policy experiment: Change the government subsidy S^G

This experiment alters the government subsidy for microsavings, S^G. The government raises funds for the program by increasing a common tax τ^I on worker and entrepreneur income. I fix τ and g, and τ^I adjusts to satisfy government budget equation (2.11). I also fix private donations, S^D, and the extra cost of managing small deposits, ec. Program match rate η adjusts to balance funding equation $S^D + S^G = \eta D_2 + ecD_2$.[23] I compute an aggregate payoff, which is the weighted average of payoffs to all workers and entrepreneurs.[24]

The goal of the experiment is to determine the effect of changing government funding for the program on output, the percentage of entrepreneurs, wages (pre and after-tax), and weighted payoffs. Table 2.4 shows the results of the experiment. The first panel reproduces the results for the baseline economy with no microsavings $S^G_{nms} = 0$ and for the economy with baseline microsavings S^G_{ms} calibrated to the U.S. economy. The match rates η are 0 and 1, respectively, and the income tax increases to support the program. The baseline microsavings program increases output, wages,

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[23]Recall (2.5), where $S = \eta D_2$. S^D is fixed at the same level as in the baseline economy with microsavings and the program policy that private donations must exceed the government subsidy is neglected (fact 5(i)).

[24]Aggregate payoff = %entrepreneurs $*$ average business income + %workers $*$ after-tax income.

entrepreneurs and the weighted payoff.

Table 2.4: Experiment 1: Vary government subsidy S^G

	Output per Capita %	wage w % (after tax)	% Ent	Ent income Gini	Aggregate Payoff
$S^G_{nms} = 0$ $\tau^I = 25\%$, $\eta = 0$	100	100 (100)	12	57	100
$S^G_{ms} = 87.5$ $\tau^I = 26\%$, $\eta = 1$	106.3	120 (119)	12.15	52.8	110
$S^G = 2 * S^G_{ms}$ $\tau^I = 27.58\%$, $\eta = 1.37$	105.8	121.36 (117)	12.21	52.6	109.3
$S^G = 4 * S^G_{ms}$ $\tau^I = 30.15\%$, $\eta = 2.11$	104.6	122.6 (114)	12.43	52.4	106.5
$S^G = 0.5 * S^G_{ms}$ $\tau^I = 25.64\%$, $\eta = 0.81$	108	112.2 (121)	12.05	52.3	112.3

In the second panel the government subsidy is doubled and quadrupled. This raises small savers' match money, with η increasing from the baseline of 1 to 1.37 and 2.11, respectively. The income tax τ^I required to pay for the program increases from the baseline of 26% to 27.58% and 30.15%. The program transfers capital from all taxpayers to micro-savers. Quadrupling S^G, while extreme, is instructive. Match rate η more than doubles, but the income tax rises to fund the government subsidy. With more match money, low wealth individuals can become entrepreneurs by using savings and bank loans to invest in their businesses. The higher income tax leads marginal entrepreneurs to become workers. A decrease in the number of low profit marginal enterprises and an increase in the number of low bequest but high ability firms causes the entrepreneur Gini coefficient to decrease. More firms means the demand for workers increases and the supply of workers drops, which increases the wage. The income tax is higher and workers receive a lower after-tax wage (114) than in the baseline economy with microsavings (119). Output per capita is also lower (104.6) relative to the microsavings baseline (106.3) because firms pay both a higher tax on profits and higher labor costs.

The last panel reduces the government subsidy to microsavings. The percentage of entrepreneurs falls because there is less match money and small and less efficient firms exit. However, funding a smaller microsavings program permits the tax rate to decrease and the after-tax wage rises. Interestingly, output and the aggregate payoff increase. The reason is that the economy has fewer firms with low productivity and workers have higher after-tax income.

Overall, this experiment shows that changing the level of the government subsidy, ceteris paribus, has important distributional effects. This is a targeted program by design: increasing government subsidies transfers resources from all taxpayers to micro-savers. The economy with microsavings yields higher output (106.3) and after-tax wages (119) than an economy without microsavings, (100) and (100), since the program is also partially funded by exogenous donations. Scaling the program back suggests gains in output, after-tax wages, and aggregate payoffs when donations remain fixed.

2.6.2 Policy experiment: Transaction cost τ

This experiment lowers the transaction cost that financial institutions face from the 0.05% level in the U.S. to counterfactual levels of 0.0375% and 0.025%.[25] The microsavings program does not affect transaction cost τ.[26] I fix government spending g and income tax τ^I adjusts to balance government budget constraint (2.11). Because transaction cost τ is small compared to income tax τ^I, when τ decreases from 0.05% to the counterfactual levels, τ^I barely changes.

Table 2.5 reports the results. The first panel is the case with no microsavings program where the income tax is $\tau^I = 0.25$. In this economy the decreases in τ leads borrowing interest rate i_L to decrease from 100 to 97.59 and 95.46. Highly productive firms are eager to expand by borrowing cheaper capital from the bank and output increases. The demand for labor increases, which causes the wage to increase. The higher after-tax wage induces marginal individuals to become workers instead of entrepreneurs. As a result, the percentage of entrepreneurs declines, as well as the entrepreneur income Gini coefficient.[27] Output per capita is higher due to the expansion of highly productive firms and the aggregate payoff is slightly higher

[25] Recall from the calibration that $\tau = (1+0.005)^{35}-1 = 0.1907$ due to the 35 year model period.

[26] τ includes the cost of complying with regulations such as rules that govern operations, reserve requirements, deposit insurance, consumer protection, fraud prevention, credit information services, secured transactions, interest rate limits, foreign ownership limitations, tax and accounting issues; see Christen, Lyman and Rosenberg (2003).

[27] The entrepreneur income Gini coefficient declines because fewer small firms are operated by marginal individuals and high productivity firms do not increase dramatically. In an economy without microsavings there are no entrepreneurs with low initial wealth below threshold $\underline{b}$.

Table 2.5: Experiment 2: Lower financial transaction costs τ

	Output per Capita %	Wage % After tax	% of Ent	Ent Income Gini	Aggregate Payoff
Given income tax $\tau^I = 0.25$.					
$\tau_{nms} = 0.005$ $i_L = 100$	100	100 (100)	12	57	100
$\tau = 0.75 * \tau_{nms}$ $i_L = 97.59$	106.8	105 (105.2)	11.3	52	101.5
$\tau = 0.5 * \tau_{nms}$ $i_L = 95.46$	106.9	104.7 (104.66)	10.9	51.8	100.9
Given income tax $\tau^I = 0.263$.					
$\tau_{ms} = 0.005$ $i_L = 100$	106.3	120.7 (118.9)	12.15	52.8	110
$\tau = 0.75 * \tau_{ms}$ $i_L = 97.59$	107.8	124 (122)	12.8	51	115
$\tau = 0.5 * \tau_{ms}$ $i_L = 95.46$	112	127 (125)	12.6	44.3	117

due to a higher wage.

The second panel is the case with a microsavings program with income tax $\tau^I = 0.263$. The cost of borrowing falls by exactly the same amount as in the economy with no microsavings program since $i_L = i_D + \tau + ovc$. In this economy firms borrow more to invest and require more labor. The after-tax wage is higher and individuals with low managerial ability choose to be workers. More low bequest and high ability individuals become entrepreneurs when the cost of borrowing falls, i_L, and run firms at a higher scale. As a result, the percentage of entrepreneurs and output increase.

Overall, a policy that lowers intermediation costs leads to higher loans, output per capita and wages. In an economy without microsavings, the policy decreases the number of entrepreneurs. On the other hand, in an economy with microsavings the same τ cut leads to more entrepreneurs, and even higher output, wages and aggregate payoffs. The reason is that microsavings allow high productivity but low initial wealth entrepreneurs, who were previously unbanked, to enter entrepreneurship and run their firms at a larger scale. Cyree (2015) studies the cost of bank compliance and shows that when the regulatory compliance component of transaction costs increases, banks tend to issue fewer loans. My results and consistent with this, showing that when transaction costs decrease banks charge a lower interest rate, which encourages borrowing.

This experiment explores the implications of lowering transaction costs in the traditional banking system, which are often caused by regulations. However, many regulations support social goals that I do not model. For example, required deposit insurance contributes to the stability of the banking system. Therefore, reducing such transaction costs on banks to zero would not be desirable even if it were feasible. An important topic for future research is to better understand the role of the regulations inherent in financial transaction cost τ.

2.6.3 Experiment: Lower the extra cost on small deposits ec

This experiment lowers the extra cost that banks incur on managing small deposits. The federal government's Assets for Independence (AFI) program requires microsavings programs to raise non-federal funds in an amount equal to or greater than their AFI project grant. Fact 5(ii) indicates that grantees may use up to 15% of the grant to cover operating costs and the remainder (at least 85%) of the government subsidy must be used for match money. I assume that the entire government subsidy is used to provide match money and that private donations cover the extra cost of small deposits. In the calibration I found that the baseline extra cost is 16.77%, which is calculated using equation $S^G + S^D = \eta D_2 + ecD_2$. In addition, $S^D = 1.7S^G$.[28]

The purpose of this experiment is to assess the impact of reducing the costs of managing small deposits, ec.[29] Experiment 3 has two parts. First, I fix government subsidy S^G and private donations S^D, and then transfer the surplus from the ec reduction to micro-savers through a higher match rate η. Second, I fix S^G and η, and determine how much pressure can be released on private fund raising S^D due to the lower ec. Minimum balance requirement $\underline{b}$ determines D_2, and this is also fixed.

The center column of table 2.6 shows experiment 3a, where the extra cost of managing small deposits is cut by 50% or 75%. In this case match rate η increases slightly. By design the government subsidy and private donations are constant. The experiment has no discernible effect on entrepreneur's average profit, wages or the percentage of entrepreneurs. In experiment 3b the government subsidy and match rate stay the same. The decrease in ec now reduces the amount of private donations

[28] The relationship between private donations S^D and government subsidies S^G is calculated using the EARN 2012 financial statement data, $\frac{S^D}{S^G} = \frac{\$833{,}351}{\$486{,}647} = 1.7$, where $\$833,351$ is the unrestricted contributions by donors and $\$486,647$ is the government grants.

[29] Startups such as Branch and InVenture are testing smartphone screening methodologies that reduce the cost of lending. The programs target individuals who do not have credit scores, but use a smartphone app that can evaluate client behavioral patterns that correlate with repayment or default; see Dwoskin, WSJ. I assume that cost reductions on microsavings are similar.

Table 2.6: Experiment 3: Lower the extra cost on small deposits ec

	Match rate	Average profits %	Wage %	% of ent	Donation needed
	3a: Fix $S^D = 1.7S^G$				3b: Fix $\eta = 1.$
$ec_{base} = 0.1677$	$\eta = 1$	100.2	120.7	12.15	$S^D = 1.7\ S^G$
$ec_{base} = 0.5 * ec_{base}$	$\eta = 1.0004$	100.2	120.7	12.15	$S^D = 1.506\ S^G$
$ec_{base} = 0.25 * ec_{base}$	$\eta = 1.0006$	100.2	120.7	12.15	$S^D = 1.409\ S^G$

S^D that the AFI requires for the microsavings program. When ec falls by half, the private donations the microsavings program must raise decrease by 11.4%. If ec is only a quarter of the baseline, then the donation required to keep the same program scale declines by 17%.[30] Overall, a reduction in ec has little impact on entrepreneurs and workers, but reduces the pressure to raise private funds somewhat. In practice, lower ec would benefit savers by decreasing maintenance fees on small accounts, which I did not model in this paper.

2.7 Conclusion

This paper focuses on U.S. microsavings programs, especially for individuals who save to invest in a small business. I use aggregate data on Individual Development Accounts (IDAs) to explore the benefits of having microsavings in the U.S. I introduce a minimum balance requirement imposed by banks, which causes some individuals to be "unbanked." The model is an otherwise standard occupational choice model with individuals that are heterogeneous in managerial ability and initial wealth. I study a

[30]The calculations are: $\frac{(1.506-1.7)*87.5}{1.7*87.5}$ and $\frac{(1.409-1.7)*87.5}{1.7*87.5}$

microsavings program that resembles an IDA, designed to assist individuals with low initial wealth. Because banks are subject to higher regulatory costs than non-banks, non-profits partner with traditional banks to offer microsavings programs that serve unbanked individuals.

The results show that microsavings programs in the U.S. can increase the percentage of entrepreneurs, output, wages, and the credit to output ratio. This occurs because previously unbanked individuals who use microsavings now have deposits and collateral, which makes them eligible for business loans. By design the program increases the number and scale of small firms, and these firms tend to be less productive relative to larger firms. The previously unbanked are helped directly by savings accounts and match money, and workers benefit indirectly when the wage effect is positive. Some low wealth individuals have the opportunity to become entrepreneurs.

These programs can be expensive to operate depending on the scale. I find that a higher government subsidy leads to a higher income tax, which transfers some capital from all agents to micro-savers or firm-owners who become entrepreneurs due to the microsavings programs. The positive effect of microsavings on the wage and after-tax wage is due to the smaller supply of workers. Overall, an income tax financed increase in the government subsidy to microsavings programs has positive effects on the percentage of entrepreneurs (by design) and on wages, but has negative effects on the after-tax wage and a small effect on output per capita.

I take as given that the goal of microsavings programs is to help the unbanked, who tend to have low income. The objective of this paper was not to study the motivation for microsavings programs that help disadvantaged groups. I take as given the fact that fast-growing microsavings and IDAs exist, and evaluate the impact of the programs on wages, income inequality, welfare, and other macroeconomics indicators. Overall the paper characterizes the tradeoffs that policy-makers face when they design programs that target the unbanked or entrepreneurs.

APPENDIX A
APPENDIX TO CHAPTER 1

A.1 Kuhn-Tucker conditions

The Lagrangian associated with an entrepreneur who borrows from a bank is:

$$\begin{aligned} LG^B &= \pi(a + l^B, x; w) - (1 + i_D)a - (1 + i_L^B)l^B \\ &- \lambda_1[(1 + i_L^B)l^B - \phi\pi(a + l^B, x; w)] - \lambda_2(\underline{l} - l^B) - \chi_1(a - b) \end{aligned} \tag{A.1}$$

The Kuhn-Tucker conditions are:

$$\begin{aligned} \frac{\partial LG^B}{\partial l^B} =& \frac{\partial \pi(a + l^B, x; w)}{\partial l^B} - (1 + i_L^B) \\ &- \lambda_1(1 + i_L^B) + \lambda_1\phi\frac{\partial \pi(a + l^B, x; w)}{\partial l^B} + \lambda_2 \leq 0 \end{aligned} \tag{A.2}$$

$$\frac{\partial LG^B}{\partial a} = \frac{\partial \pi(a + l^B, x; w)}{\partial a} - (1 + i_D) + \lambda_1\phi\frac{\partial \pi(a + l^B, x; w)}{\partial a} - \chi_1 \leq 0 \tag{A.3}$$

$$\lambda_1[\phi\pi(a + l^B, x; w) - (1 + i_L^B)l^B] = 0 \tag{A.4}$$

$$\lambda_2(l^B - \underline{l}) = 0 \tag{A.5}$$

$$\chi_1(b - a) = 0 \tag{A.6}$$

$$a \geq 0, \quad \frac{\partial LG^B}{\partial a}a = 0, \quad \lambda_1 \geq 0, \quad \lambda_2 \geq 0, \quad \chi_1 \geq 0$$

The Lagrangian associated with an entrepreneur who borrows from a microfinance institution is:

$$\begin{aligned} LG^M &= \pi(a + l^M, x; w) - (1 + i_D)a - (1 + i_L^M)l^M - \lambda_3[(1 + i_L^M)l^M \\ &- \phi\pi(a + l^M, x; w)] - \chi_2(a - b) \end{aligned} \tag{A.7}$$

The Kuhn-Tucker conditions are:

$$\frac{\partial LG^M}{\partial l^M} = \frac{\partial \pi(a+l^M, x; w)}{\partial l^M} - (1+i_L^M) - \lambda_3(1+i_L^M) + \lambda_3\phi\frac{\partial \pi(a+l^M, x; w)}{\partial l^M} \le 0 \tag{A.8}$$

$$\frac{\partial LG^M}{\partial a} = \frac{\partial \pi(a+l^M, x; w)}{\partial a} - (1+i_D) + \lambda_3\phi\frac{\partial \pi(a+l^M, x; w)}{\partial a} - \chi_2 \le 0 \tag{A.9}$$

$$\lambda_3[\phi\pi(a+l^M) - (1+i_L^M)l^M] = 0 \tag{A.10}$$

$$\chi_2(b-a) = 0 \tag{A.11}$$

$$l \ge 0, \quad \frac{\partial LG^M}{\partial l^M}l^M = 0, \quad a \ge 0, \quad \frac{\partial LG^M}{\partial a}a = 0, \quad \lambda_3 \ge 0, \quad \chi_2 \ge 0$$

Constrained entrepreneurs are those for which $l > 0$ holds. It is optimal for entrepreneurs to put their entire wealth in their project. To see this, assume that constrained entrepreneurs do not put their entire wealth in the project; that is $0 \le a < b$. Then for entrepreneurs who borrow from a microfinance institution, equation (A.11) gives us $\chi_2 = 0$, and from (A.8) at equality and (A.9) it follows that $i_L^M(1+\lambda_3) + \lambda_3 - i_D \le 0$, which is a contradiction since $i_L^M > i_D$. For entrepreneurs who borrow from a bank ($l \ge \underline{l}$), equation (A.6) and (A.5) give us $\chi_1 = 0$ and $\lambda_2 = 0$. (A.8) at equality and (A.9) show that $(1+\lambda_1)(ovc^B + \tau) + \lambda_1(1+i_D) \le 0$ since $1 + i_L^B = 1 + i_D + ovc^B + \tau$, which is also a contradiction. Therefore, if entrepreneurs are credit constrained, $a = b$.

Regarding the entrepreneur's problem, we shall consider eight different cases: Case 1-4 are for entrepreneurs who get a microfinance loan and Case 5-8 are for those who get a bigger loan from a bank.

1. $0 < a < b$ and $l^M = 0$ which means that neither constraint binds. From (A.10) and (A.11) we have $\lambda_3 = \chi_2 = 0$ and

$$a = k^*(x; w, i_D) = (x(\frac{\beta}{w})^{\beta}(\frac{\alpha}{1+i_D})^{1-\beta})^{\frac{1}{1-\alpha-\beta}} \tag{A.12}$$

2. $0 < a = b$ and $l^M = 0$, but $\phi\pi(a + l^M, x; w) - (1 + i_L^M)l^M > 0$. This case arises because financial intermediation implies a discrete jump in costs. We have $\lambda_3 = 0$ and χ_2 (which is non-negative) given by equation (A.9) at equality:

$$\chi_2 = \frac{\partial\pi(a + l^M, x; w)}{\partial a} - (1 + i_D) \tag{A.13}$$

   The intuition is the following: the entrepreneur would invest more if she had a higher bequest. The entrepreneur's marginal profit exceeds $1+i_D$ but is smaller than $1 + i_L$.

3. $0 < a = b$ and $0 < l^M$ and $\phi\pi(a+l^M, x; w)-(1+i_L^M)l^M > 0$, then from equation (A.10), $\lambda_3 = 0$. (A.8) and (A.9) at equality shows $\chi_2 = \frac{\partial\pi(a+l^M,x;w)}{\partial a} - (1 + i_D)$. Therefore,

$$l^M + b = k^*(x; i_L^M, w) \tag{A.14}$$

$$l^{M*} = (\frac{\alpha x^{\frac{2-\beta}{1-\beta}}(\frac{\beta}{w})^{\frac{1}{1-\beta}}}{1 + i_L^M})^{\frac{1-\beta}{1-\alpha-\beta}} - b \tag{A.15}$$

4. $0 < a = b$ and $0 < l^M$ and $\phi\pi(a + l^M, x; w) - (1 + i_L^M)l^M = 0$. This is the credit-constrained case. Equation (A.9) solves $\chi_2 = \frac{\partial\pi(a+l^M,x;w)}{\partial a} - (1 + i_D) + \lambda_3\phi\frac{\partial\pi(a+l^M,x;w)}{\partial a}$; Equation (A.8) gives

$$\lambda_3 = \frac{\frac{\partial\pi(a+l^M,x;w)}{\partial l^M} - (1 + i_L^M)}{(1 + i_L^M) - \phi\frac{\partial\pi(a+l^M,x;w)}{\partial l^M}}$$

5. $0 < a = b$, $l^B = \underline{l}$, and $\phi\pi(a+l^B, x; w) - (1+i_L^B)l^B > 0$. The agent borrows the minimum amount from a bank. Then (A.4) leads to $\lambda_1 = 0$. Equation (A.3) solves $\chi_1 = \frac{\partial\pi(a+l^B,x;w)}{\partial a} - (1+i_D)$; (A.2) gives $\lambda_2 = (1+i_L^B) - \frac{\partial\pi(a+l^B,x;w)}{\partial l^B}$.

6. $0 < a = b$, $l^B > \underline{l}$, and $\phi\pi(a+l^B, x; w) - (1+i_L^B)l^B > 0$. The agent borrows more than the threshold amount, but is not credit-constrained. Then $\lambda_1 = \lambda_2 = 0$, and $\chi_1 = \frac{\partial\pi(a+l^B,x;w)}{\partial a} - (1+i_D)$.

$$l^B + b = k^*(x; i_L^B, w) \tag{A.16}$$

$$l^{B*} = \left(\frac{\alpha x^{\frac{2-\beta}{1-\beta}} \left(\frac{\beta}{w}\right)^{\frac{1}{1-\beta}}}{1+i_L^B}\right)^{\frac{1-\beta}{1-\alpha-\beta}} - b \tag{A.17}$$

7. $0 < a = b$, $l^B > \underline{l}$, and $\phi\pi(a+l^B, x; w) - (1+i_L^B)l^B = 0$. This is the credit-constrained case. $\lambda_2 = 0$ from (A.5). Equation (A.2) and (A.3) solve λ_1 and χ_1

$$\lambda_1 = \frac{\frac{\partial\pi(a+l^B,x;w)}{\partial l^B} - (1+i_L^B)}{(1+i_L^B) - \phi\frac{\partial\pi(a+l^B,x;w)}{\partial l^B}} \tag{A.18}$$

$$\chi_1 = \frac{\partial\pi(a+l^B,x;w)}{\partial a} - (1+i_D) + \lambda_1\phi\frac{\partial\pi(a+l^B,x;w)}{\partial a} \tag{A.19}$$

8. This is a special case where the constrained loan amount is equal to the threshold loan amount $\underline{l}$. In other words $0 < a = b$, $l^B = \underline{l}$ and $\phi\pi(a+l^B, x; w) - (1+i_L^B)l^B = 0$. It is possible that the maximum she could borrow is exactly equal to the threshold $\underline{l}$ for some borrowers with (b, x).

A.2 Occupational choice proofs

Define $\Omega = [0, \infty] \times [\underline{x}, \overline{x}]$. For any $w, i_D > 0$, an individual described by the pair (b, x) will choose to be an entrepreneur if $(b, x) \in E(w, i_D)$, where

$$E(w, i_D) = \{(b, x) \in \Omega : \max\{V^B(b, x; w, i_D), V^M(b, x; w, i_D)\} \geq (1 - \tau^w)w\} \quad \text{(A.20)}$$

The complement of $E(w, i_D)$ in Ω is $E^c(w, i_D)$. If $(b, x) \in E^c(w, i_D)$, then individuals are workers. In addition, entrepreneurs (b, x) get microloans if $(b, x) \in E^M(w, i_D) \subseteq E(w, i_D)$, where

$$E^M(w, i_D) = \{(b, x) \in E(w, i_D) : V^M(b, x; w, i_D) \geq V^B(b, x; w, i_D)\} \quad \text{(A.21)}$$

Individuals will take a bank loan if $(b, x) \in E^B(w, i_D) \subseteq E(w, i_D)$, where

$$E^B(w, i_D) = \{(b, x) \in E(w, i_D) : V^B(b, x; w, i_D) \geq V^M(b, x; w, i_D)\} \quad \text{(A.22)}$$

Lemma A.1. *Define $b_e(x; w, i_D)$ as the curve in Ω where $\max\{V^M(b, x; w, i_D), V^B(b, x; w, i_D)\} = (1 - \tau^w)w$. Then there exists an $x^*(w, i_D)$ and $x^{**}(w, i_D)$ such that $\frac{\partial b_e(x;w,i_D)}{\partial x} < 0$ for $x > x^*(w, i_D)$. and $\frac{\partial b_e(x;w,i_D)}{\partial x} = -\infty$ for $x = x^*(w, i_D)$. In addition:*

1. *If $x < x^*$, then $(b, x) \in E^c(w, i_D)$ (the agent is a worker)*
2. *If $b < b_e(x; w, i_D)$, then $(b, x) \in E^c(w, i_D)$ $\forall x^*(w, i_D) < x < x^{**}(w, i_D)$ (the agent is a worker)*
3. *If $b \geq b_e(x; w, i_D)$, then $(b, x) \in E(w, i_D)$ $\forall x > x^*(w, i_D)$ (the agent is an enterpreneur)*
4. *For all $x > x^{**}$, $(b, x) \in E(w, i_D)$ $\forall b$ (the agent is an enterpreneur).*

Proof. Continuity of $V^M(b,x;w,i_D)$ and $V^B(b,x;w,i_D)$ follows from the Maximum Theorem and differentiability, cf., Theorem 4.11 of Stokey and Lucas. From the Lagrangian and the Envelope Theorem, provided $x>0$,

$$\begin{aligned}
\frac{\partial V^M}{\partial b} &= V_1^M = \chi_2\\
\frac{\partial V^M}{\partial x} &= V_2^M = \pi_2^M(b+l^M,x;w)(1+\lambda_3\phi) > 0\\
\frac{\partial V^M}{\partial w} &= V_3^M = \pi_3^M(b+l^M,x;w)(1+\lambda_3\phi) < 0\\
\frac{\partial V^M}{\partial i_D} &= V_4^M = -a - l^M\theta(1+\lambda_3) < 0\\
\frac{\partial V^B}{\partial b} &= V_1^B = \chi_1\\
\frac{\partial V^B}{\partial x} &= V_2^B = \pi_2^B(b+l^B,x;w)(1+\lambda_1\phi) > 0\\
\frac{\partial V^B}{\partial w} &= V_3^B = \pi_3^B(b+l^B,x;w)(1+\lambda_1\phi) < 0\\
\frac{\partial V^B}{\partial i_D} &= V_4^B = -a - l^B(1+\lambda_1) < 0
\end{aligned} \tag{A.23}$$

Let $V^j(b,x;w,i_D) = \max\{V^M(b,x;w,i_D), V^B(b,x;w,i_D)\}$. Let k^{j*} be the optimal level of capital that corresponds to $j \in \{M,B\}$. By the implicit function theorem we have that:

$$V^j(b,x;w,i_D) = (1-\tau^w)w$$

$$\frac{\partial b_e}{\partial x}(x;w,i_D) = -\frac{\frac{\partial V^j(b_e,x;w,i_D)}{\partial x}}{\frac{\partial V^j(b_e,x;w,i_D)}{\partial b_e}} = -\frac{V_2^j(b_e,x;w,i_D)}{V_1^j(b_e,x;w,i_D)}$$

and $V_2^j(b_e,x;w,i_D) > 0 \ \forall x > 0$ from equation A.23.

The derivative of the value function with respect to bequest is: $V_1^j(b,x;w,i_D) = \chi_j$.

If $b < k^{j*}$, then $a^j = b$. For $l^M > 0$ or $l^B \geq \underline{l}$, $\pi_1^j(b+l^j,x,w) \geq 1+i_D$ since $\lambda^j = 0$, e.g. $\pi_1^M(b+l^M,x,w) = 1+i_L^M$ from (A.8) at equality and $\pi_1^B(b+l^B,x,w) =$

$1+i_L^B$ when credit is not constrained ($\phi\pi(a+l^j,x;w)-(1+i_L^j)l^j > 0$); and $\lambda^j > 0$, e.g. $(1+\lambda_3\phi)\pi_1^M(b+l^M,x,w) = (1+\lambda_3)(1+i_L^M)$ from (A.8) at equality and $(1+\lambda_1\phi)\pi_1^B(b+l^B,x,w) = (1+\lambda_1)(1+i_L^B)$ when credit is constrained ($\phi\pi(a+l^j,x;w)-(1+i_L^j)l^j = 0$). Then,

$$V_1^j(b,x;w,i_D) = \chi_j = \pi_1^j(b+l^j,x,w) - (1+i_D) > 0 \quad \text{or}$$

$$V_1^j(b,x;w,i_D) = \chi_j = (1+\lambda_j\phi)\pi_1^j(b+l^j,x,w) - (1+i_D) > 0 \ .$$

If $b \geq k^{j*}$, no one borrows. Then $V^j(b,x;w,i_D)$ cannot increase with b since the optimal level of capital is raised before the bequest is exhausted when $b > k^{j*}$. When $b = k^{j*} = a$, $V^M(b,x;w,i_D)$ and $V^B(b,x;w,i_D)$ increase at the same rate as b increases, and so

$$V_1^j(b,x;w,i_D) = 0 \quad when \quad b > k^{j*}$$

$$V_1^M(b,x;w,i_D) = V_1^B(b,x;w,i_D) \quad when \quad b = k^{j*} \ .$$

Therefore, if $b < k^{j*}$,

$$\frac{\partial b_e}{\partial x}(x;w,i_D) < 0 \ ;$$

if $b \geq k^{j*}$,

$$\frac{\partial b_e}{\partial x}(x;w,i_D) = -\infty \ .$$

When $b > k^{j*}$, $V^j(b,0;w,i_D) = 0 < (1-\tau^w)w$. Therefore, by continuity and monotocity with respect to x, $V_2^j > 0$ and $V_{22}^j = \pi_{22}(1+\lambda_j\phi) > 0$, where $\pi_2 = k^{j\alpha}n^{j\beta}$, there exist $x^*(w,i_D)$ such that $V^j(b,x^*;w,i_D) = (1-\tau^w)w$. That is, for $x \leq x^*(w,i_D)$, b is irrelevant and agent always becomes a worker. However, for $x > x^*$, agent becomes an entrepreneur if $b \geq b_e(x, w, i_D)$. Point $x^*(w, i_D)$ is independent of b. To see this, solve the equation:

$$(1-\tau^w)w = \pi^j(k^{*j}, x^*, w) - (1+i_D)k^{*j}$$

and we get

$$x^* = \{A[(\beta^\beta - 1)[\frac{\beta}{(1-\tau^w)w}]^{\frac{1}{1-\beta}}] - \frac{(1+i_D)}{(1-\tau^w)w}\}^{-(1-\alpha-\beta)}$$

where $A \equiv [(\frac{\beta}{(1-\tau^w)w})^\beta(\frac{\alpha}{1+i_D})^{1-\beta}]^{\frac{\alpha}{(1-\beta)(1-\alpha-\beta)}}$.

Since $V^j(b, x; w, i_D)$ is continous and strictly increasing in x, $V^j_{22} > 0$, and $V^j(0, 0; w, i_D) = 0 < (1-\tau^w)w$ there exist a point $x^{**}(w, i_D)$ such that $V^j(0, x^{**}; w, i_D) = (1-\tau^w)w$. Then for $x > x^{**}(w, i_D)$, the agent becomes an entrepreneur for any bequest level.

□

Lemma A.2. *Define $b_B(x; w, i_D)$ as the curve in Ω where $V^M(b, x; w, i_D) = V^B(b, x; w, i_D)$ with $\frac{\partial b_B(x;w,i_D)}{\partial x} \geq 0$. For all $x > x^*$:*

1. *If $b_e(x; w, i_D) \leq b \leq b_B(x; w, i_D)$, then $(b, x) \in E^M(w, i_D)$*
2. *If $b \geq b_B(x; w, i_D)$, then $(b, x) \in E^B(w, i_D)$*

Proof. By the implicit function theorem we have that:

$$V^M(b_B, x, w, i_D) = V^B(b_B.x, w, i_D)$$

$$\Rightarrow \quad \frac{\partial b_B}{\partial x} = -\frac{V^M_2 - V^B_2}{V^M_1 - V^B_1}$$

1. If an agent does not borrow when we let b take on a high value such that $k^{j*} \leq b$, then $k^{*M} = k^{*B} = a < b$. We showed in the proof of Lemma A.1 that $V_1^j(b, x; w, i_D) = 0$ when $b > k^{j*}$ and $V_1^M(b, x; w, i_D) = V_1^B(b, x; w, i_D)$ when $b = k^{j*}$,

$$\frac{\partial b_B}{\partial x}(x; w, i_D) = -\infty \ .$$

Same as the proof of Lemma A.1, we have a point $x_0(w, i_D) = x^*(w, i_D)$ (since $V^j(b, x; w, i_D) = \max\{V^M(b, x; w, i_D), V^B(b, x; w, i_D)\} = V^M(b, x; w, i_D) = V^B(b, x; w, i_D)$) such that $\frac{\partial b_B}{\partial x}(x; w, i_D) = -\infty$ for $x = x^*$. The intuition is that when the agent does not borrow, then whether borrow from a bank or from a MFI has nothing to do with this agent.

2. Once agents borrow ($k^* > b$), $k^{*M} < k^{*B}$ because $l^{*M} < l^{*B}$ and $a^j = b$. That is because if the microloan size is bigger than bank's loan size, then people will instead borrow from the bank for a lower interest rate on loans.

Case $k^{*M} < b < k^{*B}$ does not exist since $b > k^{*M}$ leads to self-finance with no borrowing.

Recall,

$$\frac{\partial b_B}{\partial x} = -\frac{V_2^M - V_2^B}{V_1^M - V_1^B} = -\frac{\pi_2^M(b + l^M, x; w)(1 + \lambda_3 \phi) - \pi_2^B(b + l^B, x; w)(1 + \lambda_1 \phi)}{\chi_2 - \chi_1} \ .$$

Case $b < k^{*M} < k^{*B}$, we consider four subcases:

(a) $\lambda_1 = 0$ and $\lambda_3 = 0$ ($0 < l^{*M} < \frac{\phi}{1+i_L^M}\pi(k(b, x; w, i_D), x; w)$[1] and $\underline{l} < l^{*B} <$

[1]Condition $(1 + i_L^M)l^{*M} - \phi\pi(k(b, x; w, i_D), x; w) < 0$ leads to $l^{*M} < \frac{\phi}{1+i_L^M}\pi(k(b, x; w, i_D), x; w)$.

$\frac{\phi}{1+i_L^B}\pi(k(b,x;w,i_D),x;w)$ or $0 < l^{*M} < \frac{\phi}{1+i_L^M}\pi(k(b,x;w,i_D),x;w)$ and $\underline{l} = l^{*B}$).

From optimization problem, $\pi(k^*,x;w) = (1-\beta)(\frac{\beta}{w})^{\frac{\beta}{1-\beta}}(xk^{*\alpha})^{\frac{1}{1-\beta}}$, then $\pi_2^M(b+l^{*M},x;w) = V_2^M < V_2^B = \pi_2^B(b+l^{*B},x;w)$ since $k^{*M} < k^{*B}$ and $\pi_{21}^j > 0$. We also know that $\chi_j = \pi_1^j(k^*,x;w) - (1+i_D)$ and so $V_1^M - V_1^B = \pi_1^M(b+l^{*M},x;w) - \pi_1^B(b+l^{*B},x;w) > 0$ since $k^{*M} < k^{*B}$ and $\pi_{11}^j < 0$. $\pi_1^M(b+l^{*M},x;w) > \pi_1^B(b+l^{*B},x;w)$ due to the concave function π with decreasing return to scale. Overall,

$$\frac{\partial b_B}{\partial x} > 0$$

(b) $\lambda_1 = 0$ and $\lambda_3 > 0$ ($l^{*M} = \frac{\phi}{1+i_L^M}\pi(k(b,x;w,i_D),x;w)$ and $\underline{l} < l^{*B} < \frac{\phi}{1+i_L^B}\pi(k(b,x;w,i_D),x;w)$ or $l^{*M} = \frac{\phi}{1+i_L^M}\pi(k(b,x;w,i_D),x;w)$ and $\underline{l} = l^{*B}$).

The agent is constrained by the upper limit when he/she goes to MFI, then the optimal loan size will be the upper bound and $\phi\pi(b+l^M,x;w) = (1+i_L^M)l^M$. If we do partial derivative on x for both sides of this equation, we get $\pi_2^M = \frac{\partial\pi(b+l^M,x;w)}{\partial x} = 0$ locally. Therefore, $V_2^M - V_2^B = \pi_2^M(1+\lambda_3\phi) - \pi_2^B < 0$ due to $\pi_2^B = (\frac{\beta}{w})^{\frac{\beta}{1-\beta}}x^{\frac{\beta}{1-\beta}}(k^{*B})^{\frac{\alpha}{1-\beta}} > 0$. In addition, $\lambda_3 > 0$, $\lambda_1 = 0$ and $\chi_j = \pi_1^j(k^*,x;w)(1+\lambda_j\phi) - (1+i_D)$. $V_1^M - V_1^B = \pi_1^M(b+l^{*M},x;w)(1+\lambda_3\phi) - \pi_1^B(b+l^{*B},x;w) > 0$ since $k^{*M} < k^{*B}$ and $\pi_{11}^j < 0$. Therefore,

$$\frac{\partial b_B}{\partial x} > 0$$

(c) $\lambda_1 > 0$ and $\lambda_3 = 0$ ($0 < l^{*M} < \frac{\phi}{1+i_L^M}\pi(k(b,x;w,i_D),x;w)$ and $l^{*B} = \frac{\phi}{1+i_L^B}\pi(k(b,x;w,i_D),x;w)$).

The prove is symmatric to subcase (b) and

$$\frac{\partial b_B}{\partial x} > 0$$

For a given level of bequest, the choice depends on the parameters ovc^j, θ, τ and i_D as the equality shows: $V^B = V^M$, which implies that

$$\pi^M(b+l^{*M}, x; w, i_D)-(1-i_D)b-(1+i_L^M)l^{*M} = \pi^B(b+l^{*B}, x; w, i_D)-(1-i_D)b-(1+i_L^B)l^{*B}$$

where $i_L^M = \theta(ovc^M + \tau + i_{dc}^G)$ and $i_L^B = i_D + ovc^B + \tau$. Therefore, parameters i_D, ovc^j, θ and τ determines whether $V^B > V^M$ or vice versa for a given b.

(d) $\lambda_1 > 0$ and $\lambda_3 > 0$ ($l^{*M} = \frac{\phi}{1+i_L^M}\pi(k(b, x; w, i_D), x; w)$ and $l^{*B} = \frac{\phi}{1+i_L^B}\pi(k(b, x; w, i_D), x; w)$).

The agent is constrained by the upper limit no matter where he/she goes to borrow, then the optimal loan size will be the upper bound and $\phi\pi(b + l^j, x; w) = (1 + i_L^j)l^j$. If we do partial derivative on x for both sides of this equation, we get $\pi_2^j = \frac{\partial\pi(b+l^j,x;w)}{\partial x} = 0$ locally. Therefore, $V_2^M - V_2^B = \pi_2^M(1 + \lambda_3\phi) - \pi_2^B(1 + \lambda_1\phi) = 0$.

Also, $\lambda^j = \frac{\pi_1^j-(1+i_L^j)}{(1+i_L^j)-\phi\pi_L^j}$ and $\frac{\partial\lambda^j}{\partial\pi_1^j} = \frac{(1-\phi)(1+i_L^j)}{[(1+i_L^j)-\phi\pi_L^j]^2} > 0$. We know that $\pi_1^M(b + l^{*M}, x; w) > \pi_1^B(b + l^{*B}, x; w)$ due to $k^{*M} < k^{*B}$ and $\pi_{11}^j < 0$. Therefore, $\lambda_3 > \lambda_1$. $\pi_1^M(b + l^{*M}, x; w)(1 + \lambda_3\phi) - \pi_1^B(b + l^{*B}, x; w) > 0 \Rightarrow V_1^M - V_1^B > 0$. Overall,

$$\frac{\partial b_B}{\partial x} = 0$$

It suggests that when one agent is constrained at the upper limit both at banks and MFIs, the decision on where to borrow is independent of ability x and only depends on bequest b. When $b > b_B$, the agent chooses banks and when $b < b_B$, going to MFIs is better for the agent.

Finally, there does not exist a point $x^R(w, i_D)$ such that $V^M(0, x^R; w, i_D) =$

$V^B(0, x^R; w, i_D)$ and for $x > x^R$, agent borrows from a bank regardless of the bequest level.

It is because for $x > x^{**}$ and $b = 0 < b_B$ (if $x^* < x < x^{**}$ and $b = 0$, then the agent becomes a worker), we have

$$V^M(0, x; w, i_D) < V^B(0, x; w, i_D)$$

due to $l^M < l^B$ (The agent must borrow to be an entrepreneur, otherwise, there is no capital to produce.). However, $V_2^M < V_2^B$, where $V_2^j = \pi_2^j(1 + \lambda^j \phi)$ and $V_{22}^M < V_{22}^B$. Therefore, as x increasing, V^B increases faster than V^M and so V^B will always bigger than V^M.

□

A.3 Intermediation costs τ and investor protection ϕ

The results of the credit markets financial frictions policy experiments in our model with microfinance programs are consistent with the results in Antunes, Cavalcanti and Villamil (2008) on occupational choice, firm size, income inequality and economic development.

Table A.1 describes when intermediation cost τ is lower than the baseline model, it becomes cheaper to borrow in both banks and MFIs. Therefore, the credit to output ratio is higher than before. However, the percentage of entrepreneurs is lower since the wage is higher for being a worker. Quantitatively, when the intermediation cost is four times of the baseline for given interest rate, the percentage of entrepreneurs increases to 7.16%, output per capita decreases to 90.18% of the baseline value, and

Table A.1: Policy experiments: Intermediation cost on loans

	Output per Capita %	Wage %	% of entrepreneurs	Credit to output ratio	Entrep income Gini
Baseline	100	100	6.99	2.03	45.07
Exogenous interest rate i_D. Enforcement parameter $\phi = 0.34$					
$\tau = \frac{1}{2} * \tau_{base}$	102	101.4	6.91	2.08	45.38
$\tau = 2 * \tau_{base}$	96.33	97.25	7.01	1.88	44.93
$\tau = 4 * \tau_{base}$	90.18	92.52	7.16	1.67	44.53

the credit to output ratio falls from 2.03 to 1.67. Therefore, there are less highly productive entrepreneurs due to expensive capital, which lead to a decrease in income inequality among entrepreneurs.

Table A.2: Policy experiments: Enforcement

	Output per Capita %	Wage %	% of entrepreneurs	Credit to output ratio
Baseline	100	100	6.99	2.03
Exogenous interest rate i_D. Intermediation cost parameter $\tau_{base} = 0.005$				
$\phi = 1$	180	144	5.16	6.67
$\phi = \frac{1}{2} * \phi_{base}$	72.49	73.04	8.31	0.89
$\phi = \frac{1}{4} * \phi_{base}$	51.24	53.46	9.23	0.34
$\phi = \frac{1}{5} * \phi_{base}$	44	47.96	10.3	0.26

Table A.2 shows that as the level of enforcement decreases, output per capita and credit to output ratio decrease. Again, more individuals become entrepreneurs, but they are less productive. The intuition is that the demand for loans will fall when contract enforcement is weaker. Then the entrepreneurs decrease working capital and firm size. Since there are less workers being hired, the extra labor will start a small and less productive firm.

APPENDIX B
APPENDIX TO CHAPTER 2

B.1 The relationship between microsavings and IDAs

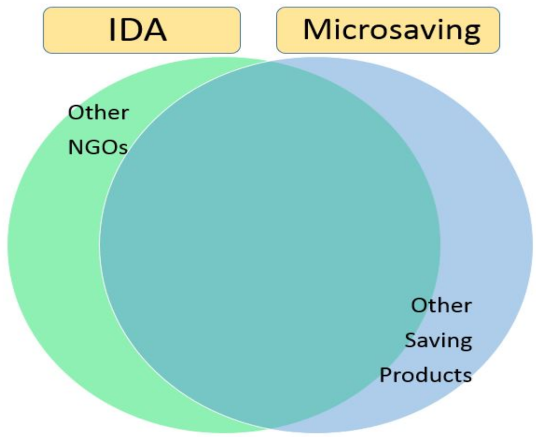

Figure B.1: Microsavings and IDAs

Figure B.1 shows the relationship between microsavings and individual deposit accounts (IDAs). They are two distinct programs, that provide small savings accounts to similar groups of people. The main difference is that IDAs are partnerships between banks and NGOs, where NGOs include microsavings institutions and other non-profit agencies. Microsavings institutions form direct partnerships with banks to offer IDAs and other microsavings accounts. Microsavings and IDAs overlap in most respects, hence I model them together in the paper.

I use data from EARN (2012) to calibrate the model. EARN is a non-profit organization that was founded in California in 2001 by individuals and organizations including a State Senator, government officers, and a foundation. They partner with banks to provide microsavings products, including IDAs, to low income and unbanked households. Once clients reach the savings goal of $2000 in a certain period, they receive $4000 in match money, a 1:2 match rate with an upper limit of $2000. On average, EARN's clients have a household income below $21,000, 71% are women, and 91% identify as a person of color. EARN's total deposits are $6.8 million, and they launched 775 microenterprises.

B.2 Kuhn-Tucker conditions

The Lagrangian associated with an entrepreneur who borrows from a bank when $b \geq \underline{b}$ is :

$$\begin{aligned} LG^{b \geq \underline{b}} =& \pi(a+l,x;w) - (1+i_D)a - (1+i_L)l \\ & - \lambda_1[(1+i_L)l - \phi\pi(a+l,x;w)] - \chi_1(a-b) \end{aligned} \tag{B.1}$$

The Kuhn-Tucker conditions are:

$$\frac{\partial LG^{b \geq \underline{b}}}{\partial l} = \frac{\partial \pi(a+l,x;w)}{\partial l} - (1+i_L) - \lambda_1(1+i_L) + \lambda_1 \phi \frac{\partial \pi(a+l,x;w)}{\partial l} \leq 0 \tag{B.2}$$

$$\frac{\partial LG^{b \geq \underline{b}}}{\partial a} = \frac{\partial \pi(a+l,x;w)}{\partial a} - (1+i_D) + \lambda_1 \phi \frac{\partial \pi(a+l,x;w)}{\partial a} - \chi_1 \leq 0 \tag{B.3}$$

$$\lambda_1[\phi\pi(a+l,x;w) - (1+i_L)l] = 0 \tag{B.4}$$

$$\chi_1(b-a) = 0 \tag{B.5}$$

$$a \geq 0, \qquad \frac{\partial LG^{b \geq \underline{b}}}{\partial a} a = 0, \quad \lambda_1 \geq 0, \quad \chi_1 \geq 0$$

The Lagrangian associated with an entrepreneur who borrows from a bank with microsavings when $b < \underline{b}$ is:

$$\begin{aligned} LG^{ms} =&\pi(a+s+l^{ms},x;w) - (1+i_D)a - s - (1+i_L)l^{ms} \\ &- \lambda_2[(1+i_L)l^{ms} - \phi\pi(a+s+l^{ms},x;w)] - \chi_2(a-b) - \chi_3(b-\underline{b}) \end{aligned} \tag{B.6}$$

The Kuhn-Tucker conditions are:

$$\begin{aligned} \frac{\partial LG^{ms}}{\partial l^{ms}} =&\frac{\partial \pi(a+s+l^{ms},x;w)}{\partial l^{ms}} - (1+i_L) - \lambda_2(1+i_L) \\ &+ \lambda_2\phi\frac{\partial \pi(a+s+l^{ms},x;w)}{\partial l^{ms}} \leq 0 \end{aligned} \tag{B.7}$$

$$\frac{\partial LG^{ms}}{\partial a} = \frac{\partial \pi(a+s+l^{ms},x;w)}{\partial a} - (1+i_D) + \lambda_2\phi\frac{\partial \pi(a+s+l^{ms},x;w)}{\partial a} - \chi_2 \leq 0 \tag{B.8}$$

$$\lambda_2[\phi\pi(a+s+l^{ms},x;w) - (1+i_L)l^{ms}] = 0 \tag{B.9}$$

$$\chi_2(b-a) = 0 \tag{B.10}$$

$$\chi_3(\underline{b}-b) = 0 \tag{B.11}$$

$$l^{ms} \geq 0, \quad \frac{\partial LG^{ms}}{\partial l^{ms}}l^{ms} = 0, \quad a \geq 0, \quad \frac{\partial LG^{ms}}{\partial a}a = 0, \quad \lambda_2 \geq 0, \quad \chi_2 \geq 0, \quad \chi_3 \geq 0$$

The Lagrangian associated with an entrepreneur's problem without microsavings when $b < \underline{b}$ is:

$$LG^{nms} =\pi(a,x;w) - a - \chi_4(a-b) - \chi_5(b-\underline{b}) \tag{B.12}$$

The Kuhn-Tucker conditions are:

$$\frac{\partial LG^{nms}}{\partial a} = \frac{\partial \pi(a,x;w)}{\partial a} - 1 - \chi_4 \leq 0 \tag{B.13}$$

$$\chi_4(b-a) = 0 \tag{B.14}$$

$$\chi_5(\underline{b}-b) = 0 \tag{B.15}$$

$$a \geq 0, \qquad \frac{\partial LG^{nms}}{\partial a}a = 0, \quad \chi_4 \geq 0, \quad \chi_5 \geq 0$$

Constrained entrepreneurs are those for which $l > 0$ holds. It is optimal for entrepreneurs to put their entire wealth in their project. To see this, assume that constrained entrepreneurs do not put their entire wealth in the project; that is $0 \leq a < b$. Then for entrepreneurs who borrow from a bank, equation (B.10) gives us $\chi_2 = 0$, and from (B.7) at equality and (B.8) it follows that $(1+\lambda_2)(ovc+\tau)+\lambda_2(1+i_D) \leq 0$, which is a contradiction. For entrepreneurs who have $b > \underline{b}$, the same proof follows. Therefore, if entrepreneurs are credit constrained, $a = b$.

Regarding the entrepreneur's problem, we shall consider ten different cases: Case 1-4 are for entrepreneurs who have a bequest above the threshold $\underline{b}$ and borrow from a bank. Case 5-8 are for those who have a bequest below the threshold $\underline{b}$, but microsavings programs exist and so they can borrow from a bank. In addition, Case 9-10 are for low bequest entrepreneurs when the economy has no microsavings, and so they cannot borrow.

1. $0 < a < b$ and $l = 0$ which means that neither constraint binds. From (B.4) and (B.5) we have $\lambda_1 = \chi_1 = 0$ and

$$a = k^*(x; w, i_D) = (x(\frac{\beta}{w})^{\beta}(\frac{\alpha}{1+i_D})^{1-\beta})^{\frac{1}{1-\alpha-\beta}} \tag{B.16}$$

2. $0 < a = b$ and $l = 0$, but $\phi\pi(a+l, x; w) - (1+i_L)l > 0$. This case arises because financial intermediation implies a discrete jump in costs. We have $\lambda_1 = 0$ and χ_1 (which is non-negative) given by equation (B.3) at equality:

$$\chi_1 = \frac{\partial\pi(a + l^M, x; w)}{\partial a} - (1 + i_D) \tag{B.17}$$

The intuition is the following: the entrepreneur would invest more if she had a higher bequest. The entrepreneur's marginal profit exceeds $1+i_D$ but is smaller than $1 + i_L$.

3. $0 < a = b$ and $0 < l$ and $\phi\pi(a + l, x; w) - (1 + i_L)l > 0$, then from equation (B.4), $\lambda_1 = 0$. (B.2) and (B.3) at equality shows $\chi_1 = \frac{\partial\pi(a+l,x;w)}{\partial a} - (1 + i_D)$. Therefore,

$$b + l = k^*(x; w, i_D) \tag{B.18}$$

$$l^* = (\frac{\alpha x^{\frac{2-\beta}{1-\beta}}(\frac{\beta}{w})^{\frac{1}{1-\beta}}}{1 + i_L})^{\frac{1-\beta}{1-\alpha-\beta}} - b \tag{B.19}$$

4. $0 < a = b$ and $0 < l$ and $\phi\pi(a + l, x; w) - (1 + i_L)l = 0$. This is the credit-constrained case. Equation (B.3) solves $\chi_1 = \frac{\partial\pi(a+l,x;w)}{\partial a} - (1+i_D) + \lambda_1\phi\frac{\partial\pi(a+l,x;w)}{\partial a}$; Equation (B.2) gives

$$\lambda_1 = \frac{\frac{\partial\pi(a+l,x;w)}{\partial l} - (1 + i_L)}{(1 + i_L) - \phi\frac{\partial\pi(a+l,x;w)}{\partial l}} \quad .$$

$b < \underline{b}$, an economy with Microsavings:

$\lambda_3 = 0$ from Equation (B.11) for Case 5-8.

5. $0 < a < b$, $l^{ms} = 0$. From (B.9) and (B.10) we have $\lambda_2 = \chi_2 = 0$, and $a + s = k^*(x; w, i_D)$. Note that an agent first uses all of the match money and then uses their bequest to self-invest because the match money does not earnt interest, but bequest does.

6. $0 < a = b$, $l^{ms} = 0$. Then $\lambda_2 = 0$ from (B.9), and $\chi_2 = \frac{\partial \pi(a+s+l^{ms},x;w)}{\partial a} - (1 + i_D)$ from (B.8).

$$b + s = k^*(x; w, i_D) \tag{B.20}$$

7. $0 < a = b$, $l^{ms} > 0$, and $\phi\pi(a + s + l^{ms}, x; w) - (1 + i_L)l^{ms} > 0$. This is the borrowing but not credit-constrained case. $\lambda_2 = 0$ from (B.9). Use equation (B.8) to solve for χ_2

$$\chi_2 = \frac{\partial \pi(a + s + l^{ms}, x; w)}{\partial a} - (1 + i_D) \tag{B.21}$$

8. $0 < a = b$, $l^{ms} > 0$, and $\phi\pi(a + s + l^{ms}, x; w) - (1 + i_L)l^{ms} = 0$. This is the credit-constrained case. Equations (B.7) and (B.8) give λ_2 and χ_2

$$\lambda_2 = \frac{\frac{\partial \pi(a+s+l^{ms},x;w)}{\partial l^{ms}} - (1 + i_L)}{(1 + i_L) - \phi \frac{\partial \pi(a+s+l^{ms},x;w)}{\partial l^{ms}}} \tag{B.22}$$

$$\chi_2 = \frac{\partial \pi(a + s + l^{ms}, x; w)}{\partial a} - (1 + i_D) + \lambda_2 \phi \frac{\partial \pi(a + s + l^{ms}, x; w)}{\partial a} \tag{B.23}$$

Now consider $b < \underline{b}$, an economy without microsavings:

9. $0 < a < b$, $\chi_4 = \chi_5 = 0$ from equations (B.14) and (B.15), and $a = k^*(x; w, i_D)$.

10. $0 < a = b$, $\chi_5 = 0$ from equation (B.15), and $\chi_4 = \frac{\partial \pi(a,x;w)}{\partial a} - 1$ from (B.13). Therefore, $b = k^*(x; w, i_D)$. For agents with $b < k^*(x; w, i_D)$, there is no channel for them to borrow.

B.3 Proof of Lemma

Define $\Omega = [0, \infty] \times [\underline{x}, \overline{x}]$. For any $w, i_D > 0$, an individual described by the pair (b, x) will choose to be an entrepreneur if $(b, x) \in E(w, i_D)$, where

$$E(w, i_D) = \begin{cases} \{(b,x) \in \Omega : (1-\tau^I)V(b, x; w, i_D) \geq (1-\tau^I)w\} & \text{if } b \geq \underline{b} \\ \{(b,x) \in \Omega : (1-\tau^I)V^h(b, x; w, i_D, 1_{ms}s) \geq (1-\tau^I)w\} & \text{if } b < \underline{b} \end{cases} \tag{B.24}$$

where $h = ms$ or nms. The complement of $E(w, i_D)$ in Ω is $E^c(w, i_D)$. If $(b, x) \in E^c(w, i_D)$, then individuals are workers.

Lemma B.1. *Define $b_e(x; w, i_D)$ as the curve in Ω where $V(b, x; w, i_D) = w$ when $b \geq \underline{b}$ and $V^h(b, x; w, i_D, 1_{ms}s) = w$ when $b < \underline{b}$ where $h = ms$ or nms. Then there exists an $x^*(w, i_D)$ such that $\frac{\partial b_e(x;w,i_D)}{\partial x} < 0$ for $x > x^*(w, i_D)$ and $\frac{\partial b_e(x;w,i_D)}{\partial x} = -\infty$ for $x = x^*(w, i_D)$. When $b < \underline{b}$, and an economy has microsavings, $\frac{\partial b_e(x;w,i_D)}{\partial x} < 0$ for $x > x^*(w, i_D)$; when the economy has no microsavings, $\frac{\partial b_e(x;w,i_D)}{\partial x} = 0$ for $x > x^*(w, i_D)$. In addition, for all x:*

1. *If $b < b_e(x; w, i_D)$, then $(b, x) \in E^c(w, i_D)$ (the agent is a worker)*

2. *If $b \geq b_e(x; w, i_D)$, then $(b, x) \in E(w, i_D)$ (the agent is an enterpreneur)*

Proof. Continuity of $V(b, x; w, i_D)$ follows from the Maximum Theorem and differentiability, cf., Theorem 4.11 of Stokey and Lucas. Recall, $i_L = i_D + ovc + \tau$. From the Lagrangian and the Envelope Theorem, provided $x > 0$:

If $b \geq \underline{b}$:

$$\begin{aligned}
\frac{\partial V}{\partial b} &= V_1 = \chi_1 \\
\frac{\partial V}{\partial x} &= V_2 = \pi_2(b + l, x; w)(1 + \lambda_1 \phi) > 0 \\
\frac{\partial V}{\partial w} &= V_3 = \pi_3(b + l, x; w)(1 + \lambda_1 \phi) < 0 \\
\frac{\partial V}{\partial i_D} &= V_4 = -a - l(1 + \lambda_1) < 0
\end{aligned} \tag{B.25}$$

If $b < \underline{b}$:

$$\begin{aligned}
\frac{\partial V^{ms}}{\partial b} &= V_1^{ms} = \chi_2 \\
\frac{\partial V^{ms}}{\partial x} &= V_2^{ms} = \pi_2(b + s + l^{ms}, x; w)(1 + \lambda_2 \phi) > 0 \\
\frac{\partial V^{ms}}{\partial w} &= V_3^{ms} = \pi_3(b + s + l^{ms}, x; w)(1 + \lambda_2 \phi) < 0 \\
\frac{\partial V^{ms}}{\partial i_D} &= V_4^{ms} = -a - l^{ms}(1 + \lambda_2) < 0
\end{aligned} \tag{B.26}$$

Let $k^*(x; w, i_D)$ be the optimal level of capital for each entrepreneur. By the implicit function theorem we have that:

$$V(b, x; w, i_D) = w \quad \text{if } b \geq \underline{b} \tag{B.27}$$

$$V^h(b, x; w, i_D, 1_{ms}s) = w \quad \text{if } b < \underline{b} \tag{B.28}$$

$$\frac{\partial b_e}{\partial x}(x; w, i_D) = -\frac{\frac{\partial V(b_e, x; w, i_D)}{\partial x}}{\frac{\partial V(b_e, x; w, i_D)}{\partial b_e}} = -\frac{V_2(b_e, x; w, i_D)}{V_1(b_e, x; w, i_D)} \quad \text{if } b \geq \underline{b} \tag{B.29}$$

$$\frac{\partial b_e}{\partial x}(x; w, i_D, 1_{ms}s) = -\frac{V_2^h(b_e, x; w, i_D, 1_{ms}s)}{V_1^h(b_e, x; w, i_D, 1_{ms}s)} \quad \text{if } b < \underline{b} \tag{B.30}$$

and $V_2(b_e, x; w, i_D) > 0$ and $V_2^{ms}(b_e, x; w, i_D, s) > 0 \; \forall x > 0$ from Equation (B.25) and (B.26).

For $b \geq \underline{b}$,

If $b \leq k^*(x; w, i_D)$, then $a = b$ and $l \geq 0$. Therefore, $\lambda_1 = 0$ when the agent is not credit constrained (Case 3). From Equation (B.2) and (B.3), $\pi_1(b + l, x, w) \geq 1 + i_D$ since $\pi_1(b + l, x, w) = 1 + i_L$ and $i_L > i_D$. Then, $V_1(b, x; w, i_D) = \chi_1 = \pi_1(b+l, x, w) - (1+i_D) > 0$. When the agent is credit constrained (Case 4), $\lambda_1 > 0$. From Equation (B.2), $\pi_1(b + l, x, w)(1 + \lambda_1\phi) = (1 + \lambda_1)(1 + i_L)$. From Equation (B.3), $\chi_1 = \pi_1(b+l, x, w)(1 + \lambda_1\phi) - (1 + i_D) > 0$ since $(1 + \lambda_1)(1 + i_L) > (1 + i_D)$. Overall,

$$V_1(b, x; w, i_D) = \chi_1 > 0 \ .$$

If $b > k^*(x; w, i_D)$, no one borrows. Then $V(b, x; w, i_D)$ cannot increase with b since the optimal level of capital is raised before the bequest is exhausted, and so

$$V_1(b, x; w, i_D) = 0 \ .$$

Therefore,

$$\begin{aligned} &\text{if } b \leq k^*(x; w, i_D), \qquad \frac{\partial b_e}{\partial x}(x; w, i_D) < 0 \\ &\text{if } b > k^*(x; w, i_D), \qquad \frac{\partial b_e}{\partial x}(x; w, i_D) = -\infty \ . \end{aligned}$$

When $b > k^*(x; w, i_D)$, $V(b, 0; w, i_D) = 0 < w$. Therefore, by continuity and monotonocity with respect to x, $V_2 > 0$ and $V_{22} = \pi_{22}(1 + \lambda_1\phi) > 0$, where

$\pi_2 = k^\alpha n^\beta$, there exists an $x^*(w,i_D)$ such that $V(b,x^*;w,i_D) = w$. That is, for $x \leq x^*(w,i_D)$, $V(b,x;w,i_D) < w \; \forall b$ and the agent always becomes a worker. However, for $x > x^*(w,i_D)$, the agent becomes an entrepreneur if $b \geq b_e(x,w,i_D)$.

For $b < \underline{b}$,

There is no agent who has $b < \underline{b}$ and $x > x^*(w,i_D)$ such that $b \geq k^*(x;w,i_D)$, because the value function is increasing in both b and x. An agent with $b = \underline{b}$ and $x > x^*(w,i_D)$ is credit constrained if he chooses to become an entrepreneur. Therefore, an agent with $b < \underline{b}$ and $x > x^*(w,i_D)$ must be credit constrained as well.

With microsavings,

For $b < k^*(x;w,i_D)$, then $a = b$ and $l^{ms} > 0$. Therefore, $\lambda_2 = 0$ when the agent is not credit constrained (Case 7). From equations (B.7) and (B.8), $\pi_1(b + s + l^{ms}, x, w) \geq 1 + i_D$ since $\pi_1(b + s + l^{ms}, x, w) = 1 + i_L$ and $i_L > i_D$. Then, $V_1^{ms}(b,x;w,i_D,s) = \chi_2 = \pi_1(b+s+l^{ms},x,w) - (1+i_D) > 0$. When the agent is credit constrained (Case 8), $\lambda_2 > 0$. From equation (B.7), $\pi_1(b + s + l^{ms}, x, w)(1 + \lambda_2\phi) = (1+\lambda_2)(1+i_L)$. From equation (B.8), $\chi_2 = \pi_1(b+s+l^{ms},x,w)(1+\lambda_2\phi) - (1+i_D) > 0$ since $(1 + \lambda_2)(1 + i_L) > (1 + i_D)$. Overall,

$$V_1^{ms}(b,x;w,i_D,s) = \chi_2 > 0 \; .$$

$$\frac{\partial b_e}{\partial x}(x;w,i_D) < 0 \; .$$

In addition, $V^{ms}(b,x;w,i_D,s)$ is continuous and strictly increasing in x, and $V_{22}^{ms} > 0$. Since $V^{ms}(0,0;w,i_D,s) = 0 < w$, and $V^{ms}(0,x;w,i_D,s) = 0 < w$ since people cannot save or borrow ($k = 0$) if $a = b = 0$. As a result, there does not exist a point $x^{**}(w, i_D)$ such that $V^{ms}(b, x^{**}; w, i_D) = w$, where an agent becomes an entrepreneur if $x > x^{**}(w, i_D)$ $\forall b$.

Without microsavings, agents cannot save or borrow.

For $b < k^*(x; w, i_D)$, agents become workers for all x since they cannot reach the optimal capital level. Therefore, $a = l = 0$, $V_2^{nms}(b_e, x; w, i_D) = 0$, and so

$$\frac{\partial b_e}{\partial x}(x; w, i_D) = 0 \ .$$

An agent becomes a worker if $b < b_e(x; w, i_D)$ $\forall x$.

□

B.4 Data

This paper uses aggregate level data on the unbanked population and macroeconomic indicators such as the percentage of the unbanked population, tax rates, the percentage of entrepreneurs, government subsidies, match rate and other indicators. The following information includes the motivation of this paper and also resources for the future projects.

Federal Deposit Insurance Corporation (FDIC) partnered with the U.S. Census Bureau, collecting data on the unbanked and underbanked households[1]. They aim to understand the diverse population and expand safe, secure and affordable banking services in the economy. As shown in table B.1, 7.7% of households were unbanked

[1]Underbanked households have a bank account and also use alternative financial services like payday loans or pawning.

in 2013, 20% were underbanked. Only 67% of households were fully banked[2] in this highly developed financial system.

Table B.1: FDIC national survey of unbanked and underbanked households

	2009	2011	2013	2015
Unbanked (%)	7.6	8.2	7.7	7.0
Unbanked households (million)	9.0	10	9.6	9.0
Underbanked (%)	18.2	20.1*	20	19.9
Underbanked households (million)	21	24	24.8	24.5
Fully banked (%)	70.3	68.8*	67	68
Unknown	4.1	2.9*	5.3	5.0

Figure B.2 exhibits the reasons people report being unbanked. The most common are, “Do not have enough money” or “Account fees are high or unpredictable”. This is mainly due to the minimum balances that banks require. I do not consider in this paper the people who are unbanked for reasons like privacy, history problems and inconvenient services.

Figure B.3 displays the geographic locations of unbanked households in the U.S. The unbanked household rate is higher in the Southern states (10.21% - 15.10%) than in the Northern states (1.89% - 7.73%). The East Coast states tend to have a higher rate than the Midwest states.

[2]Fully banked households are those who had a bank account and did not use alternative financial services in the past 12 months.

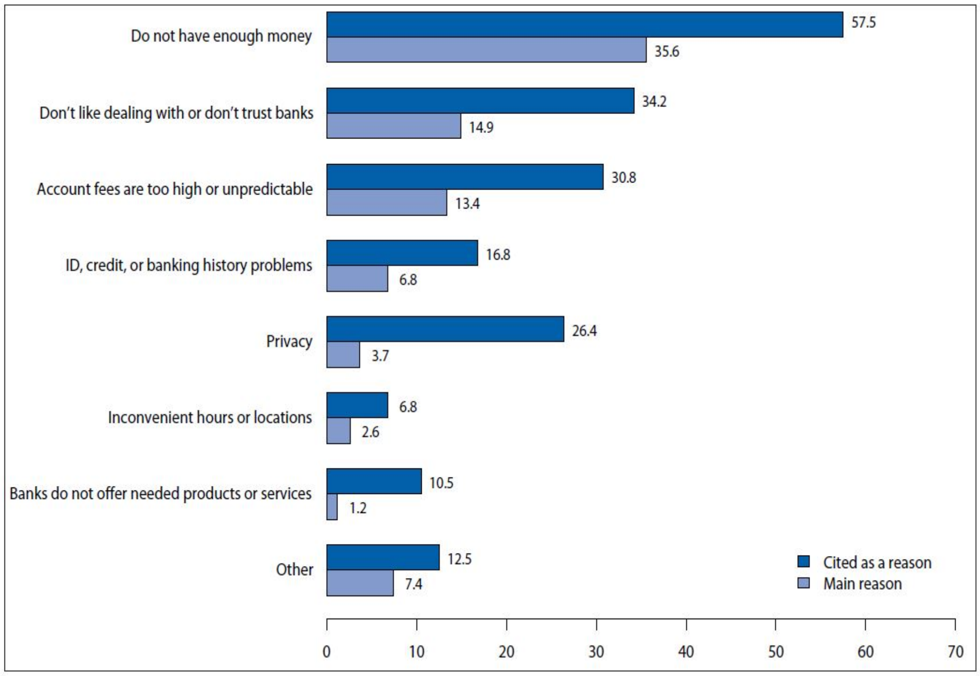

Figure B.2: Reasons for being unbanked (2013 survey)

To look at the age group, table B.2 shows that relatively young adults (15 to 44 years) are more likely to be unbanked. For example, 12.5% of people who were age 25 to 34 were unbanked in 2013, but only 3.5% of people who were age 65 years or more were in the same situation. This fact further motivates the action of bringing the unbanked back into the mainstream financial system. It is because the financial status of the working-age population is crucial to the economic development of an economy.

Regarding the business cycle, by looking at the percentage of the unbanked from 2009 to 2015 in table B.1, we find that the percentage of the unbanked is higher when the economy is under recession, and the percentage of the unbanked declines

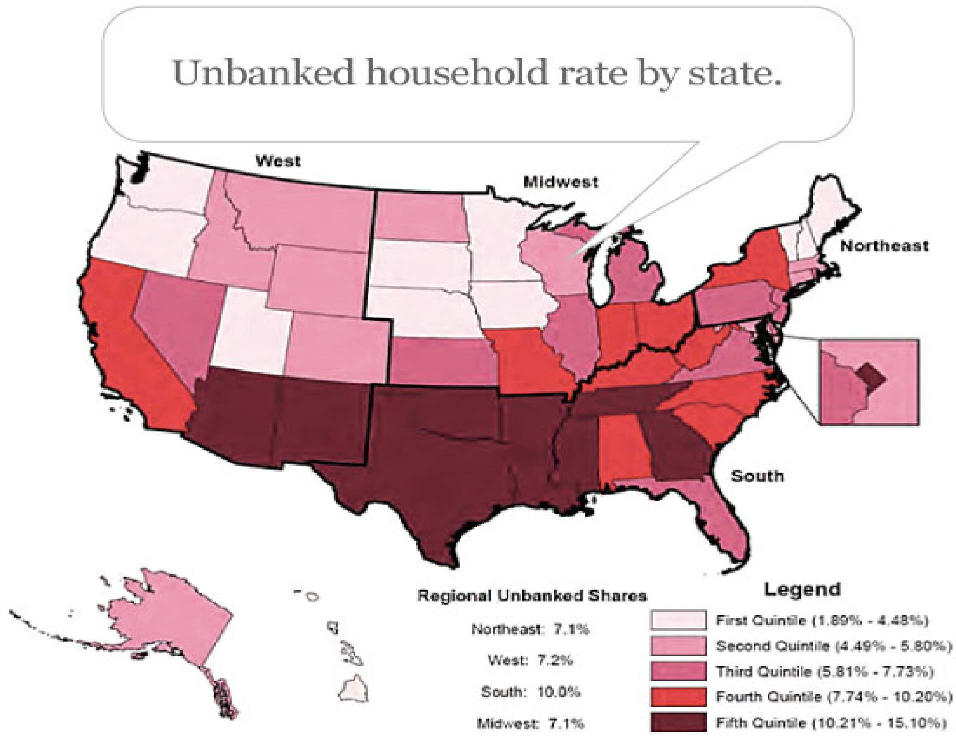

Figure B.3: Where are the unbanked (FDIC, The Financial Brand)

Table B.2: FDIC survey on unbanked households - age groups

Age group	2011	2013	2015
15 to 24 years (%)	17.4	15.7	13.1
25 to 34 years (%)	12.7	12.5	10.6
35 to 44 years (%)	9.3	9.0	8.9
45 to 54 years (%)	8.1	7.5	6.7
55 to 64 years (%)	5.5	5.6	5.8
65 years or more (%)	3.9	3.5	3.1

when the economy is recovering well. The business cycle might play a role here. However, in order to test this hypothesis, more data is required. In some cases, the survey instrument changes lead to non-comparable results across years. For instance, the 2009 survey is the very first survey on the unbanked and underbanked households. The 2009 and 2011 surveys are not directly comparable to 2013 and 2015 surveys because the 2009 and 2011 definitions do not incorporate use of auto title loans in estimating the underbanked, fully banked, and status unknown rates. Nevertheless, in the near future, the relationship between the business cycle and the unbanked can be an interesting topic to explore.

B.5 Model timeline

For each agents, the model timeline looks like the following: each agents lives for one period. At the beginning of the period, they realize their initial endowments: bequest b and managerial ability x; equilibrium market prices: wage w and interest rate i_D. They can observe whether there are microsavings programs in the economy and then make their occupational choice on becoming either an entrepreneur or a worker. If the agent optimally chooses to be an entrepreneur, he or she also needs to determine whether to borrow and how much to borrow. At the end of the period, regardless each agent's occupational choice, they receive income and make optimal choices on consumption and the amount of bequest that leave for the next generation.

B.6 Computational methodology

1. Generate a large number of individuals, N = 10000

2. Discretization of state space: For each agent i assign (b^i, x^i), where $x^i \sim \Gamma(x) = x^{\frac{1}{\epsilon}}$.

3. Guess (w^0, r^0) solve optimal behavior and check

   Labor market clears: $LS^0 = LS - LD$

   Capital market clears: $KS^0 = KS - KD$

4. If $(LS^0$ and $KS^0) < 0.5\%$, stop (move to step 5).

   Otherwise, update prices (redo step 3):

$$\begin{bmatrix} w^1 \\ i_D^1 \end{bmatrix} = \sigma \begin{bmatrix} w^0 \\ i_D^0 \end{bmatrix} + (1-\sigma) \begin{bmatrix} a_{11} & 0 \\ 0 & a_{22} \end{bmatrix} \begin{bmatrix} LS^0 \\ KS^0 \end{bmatrix}$$

5. Given the new bequest distribution, compute the equilibrium for the next generation (steps 2-4). Stop when $(w_{t+1}, r_{t+1}) \approx (w_t, r_t)$.

B.7 Bank's balance sheet

The bank's problem in the model is based on the bank's balance sheet. When there is no microsavings program in the economy, a representative bank takes deposits from savers who meet the minimum balance requirement. Since the bank needs to return deposits to savers with interests, the regular deposits are bank's liabilities. On the other side of the bank's balance sheet, the bank uses deposits as loan funds to lend out. Borrowers pay back loans with interests, which creates the assets for the bank. This model assumes there is no bank's equity.

Table B.3: Bank's balance sheet without microsavings

Assets	Liabilities
Loans	Regular Deposits
Equity = Assets − Liabilities = 0	

Table B.4: Bank's balance sheet with microsavings

Assets	Liabilities
Loans + Donations + Government Subsidies	Regular Deposits + Small Deposits + Match Money
Equity = Assets − Liabilities = 0	

Once the microsavings programs are introduced to the economy, the bank partner with microsavings programs to offer these services. The main reason that the bank require a minimum balance is because managing a large number of small deposit accounts are costly. Therefore, microsavings programs are able to be launched only if the government supports and donations can cover bank's costs for taking small deposits and distributing match money. The bank owns regular savers' deposits and micro-savers' small deposits and match money. At the same time, bank's assets become loans, donations and government subsidies.

B.8 Substitute modeling methodology

An alternative way to build the model environment is to have an economy with overlapping generations of individuals who live for J periods. In each period, there is a mass one of each generation. The population is constant which requires each individual to reproduce another in the last period of life. Time is discrete and infinite (t = 0, 1, 2, ...).

The consumer's problem now becomes:

$$U_t = \sum_{j=1}^{J-1} \beta^{j-1} \frac{(c^j_{t+j-1})^{1-\sigma} - 1}{1-\sigma} + \beta^{J-1} \frac{[(c^J_{t+J-1})^{1-\gamma}(b_{t+J})^{\gamma}]^{1-\sigma} - 1}{1-\sigma}$$

$$s.t. \qquad c^j + a^{j'} \leq Y(x, a^j; w, i_D) + (1 + i_D)a^j \tag{B.31}$$

$$Y(x, a^j; w, i_D) = max\{(1-\tau^I)w_t, (1-\tau^I)V(b_t, x_t; w_t, i_{tD})\} \tag{B.32}$$

$$c^j, a^j, b^{J+1} \geq 0, j = 1, ...J, \text{and } a^{J'} = b^{J+1}, a^1 = b. \tag{B.33}$$

where $\beta \in (0, 1)$ is the discount factor and $\sigma > 0$ is the inverse of the elasticity of intertemporal substitution. Equation (B.31) is the consumer's budget constraint, with income Y. Equation (B.32) implies that individuals choose their optimal occupation to maximize income after tax. Equation (B.33) shows choice variable constraints and initial conditions.

There are debates on having more periods increasing the possibility of internal finance. People can save assets at the earlier periods to support their consumptions or businesses at later periods. For example, Banerjee and Moll (2010) have households lived infinitely (when $J \to \infty$) in their occupational choice model. They show that households can self-finance capital and do not have to borrow to fund projects. As a result, financial frictions have a long-run effect on output only when either entrepreneurial ability x must change over time (as in Buera and Shin 2013) or agents are finitely lived (e.g., Antunes et al. 2008).

In Antunes et. al (2015) agents live for $J = 9$ periods. They did sensitivity analysis with respect to J and find the results are similar with one period lived households ($J = 1$).

In addition, the problem this paper focuses on is a more fundamental issue than smoothing consumption through internal finance. In this paper, there is a group of people who are not able to save. The main goal here is to bring the unbanked back into the financial system.

Therefore, I follow Banerjee and Newman (1993), Galor and Zeira (1993), and Antunes et. al (2008b) with households lived for $J = 1$ period.

B.9 The model with microsavings programs funded by wage taxes

The model in the main section assumes that microsavings programs are funded by flat income taxes. Workers pay income tax on wage income and entrepreneurs pay the same tax rate on income from firm profits. In practice, governments can choose different tax strategies to fund programs. For instance, Antunes et. al (2015) studies the effect of credit subsidies on development in Brazil. The credit program subsidizes the interest rate on loans and the subsidies are funded by a payroll tax, consistent with policy in Brazil. They find that this program is largely a transfer from households to some entrepreneurs, without a significant effect on output. In this section, I answer the following question: what are the impacts of microsavings programs if the government subsidies are funded by taxes on workers' wages (only) and financial taxes? Specifically, this section shows the effects when the income tax on workers and entrepreneurs is replaced by a wage tax on workers only and everything else is held the same. Both economies have a financial consistent with U.S. policy. Although this is a counterfactual policy for the U.S. economy, I re-calibrate the model to match key facts in the U.S. economy using the same targets as previously.

B.9.1 Occupational choice

The occupational choice for each individual is derived from maximizing the agent's life time income. Define $\Omega = [0, \infty] \times [\underline{x}, \overline{x}]$. For any $w, i_D > 0$, an individual described by the pair (b, x) will choose to be an entrepreneur if $(b, x) \in E(w, i_D)$,[3]

[3]Occupational choice is often determined by the entrepreneur and worker value functions. This is because lifetime wealth has the common term $(1 + i_D)b$ since everyone can save. In this paper, occupational choice is determined by lifetime wealth. Both methods lead to the same solution.

$$E(w, i_D) = \begin{cases} \{(b, x) \in \Omega : V(b, x; w, i_D) + (1 + i_D)b \geq (1 - \tau^w)w + (1 + i_D)b\} & \text{if } b \geq \underline{b} \\ \{(b, x) \in \Omega : V(b, x; w, i_D, 1_{ms}s) + (1 + 1_{ms}i_D)b + 1_{ms}s \geq \\ \qquad (1 - \tau^w)w + (1 + 1_{ms}i_D)b + 1_{ms}s\} & \text{if } b < \underline{b} \end{cases}$$

where

$$E(w, i_D) = \begin{cases} \{(b,x) \in \Omega : V(b,x;w,i_D) \geq (1-\tau^w)w\} & \text{if } b \geq \underline{b} \\ \\ \{(b,x) \in \Omega : V^h(b,x;w,i_D,1_{ms}s) \geq (1-\tau^w)w\} & \text{if } b < \underline{b} \end{cases} \tag{B.34}$$

and $h = ms$ or nms. The complement of $E(w, i_D)$ in Ω is $E^c(w, i_D)$. If $(b, x) \in E^c(w, i_D)$, then individuals are workers.

B.9.2 Consumers

Individual's life time income is defined as:

$$Y_t = \begin{cases} \max\{(1-\tau^w)w, V(b_t,x_t;w_t,i_{tD})\} + (1+i_D)b_t & \text{if } b \geq \underline{b} \\ \\ \max\{(1-\tau^w)w, V(b_t,x_t;w_t,i_{tD},1_{ms}s_t)\} + (1+1_{ms}i_{tD})b_t + 1_{ms}s_t & \text{if } b < \underline{b} \end{cases}$$

B.9.3 Competitive equilibrium

The government budget constraint given wage, tax τ^w, intermediary tax or regulation cost τ, government subsidies to microsavings programs S^G and government spending g:

$$\iint \tau^w wn(x;w_t,i_{tD})\Upsilon_t(db)\Gamma(dx) + \tau D = g + S^G \tag{B.35}$$

B.9.4 Calibration

In order to study the quantitative effect of microsavings on entrepreneurship, wages, and other variables, values must be assigned for the model parameters. I calibrate to match key statistics in the United States, where financial markets are well developed and intermediation costs in banking are small. The following parameters must be determined: two for technology (α, β), utility (γ), and ten institutional and policy parameters ($\underline{b}$, η, ovc, ec, ϕ, τ^w, τ, S^G, g, S^D). The payroll tax $\tau^w = 0.33$ is set to match the average tax rate on labor income in the U.S.; see Jones, Manuelli, and Rossi (1993).

In the benchmark model, there is no microsavings program. Given the government subsidy $S^G = 0$, intermediation cost on deposits $\tau = 0.1907$,[4] and wage tax τ^w, government spending g is simulated to be 158.5 to balance government budget (B.35). In policy experiments with a microsavings program, wage tax τ^w is adjusted by using $S^G = 87.5$, $g = 158.5$ and $\tau = 0.1907$ from the benchmark model.

Three parameters remain to be determined: the fraction of total income left to the next generation, $1-\gamma$, investor protection (strength of financial contract enforcement), ϕ, and the curvature of the entrepreneurial ability distribution, ϵ. These three parameters are chosen such that in the baseline model the percentage of unbanked is 6%; the percent of entrepreneurs over the total employed population is 12%, and the Gini index of entrepreneurial earning is 54%.

Table B.5 shows the value of each parameter.

The calibrated value of $\gamma = 0.958$ matches the percentage of the unbanked population in the U.S., which indicates that agents in general leave about 4.2% of lifetime wealth to the next generation. The ratio of bequests to labor earnings in the model steady state is $(1-\gamma)/(1-(1-\gamma)(1+r)) = 0.0459$, which is in the interval estimated by Gokhale and Kotlikoff (2000), where bequests account for 4-8% of labor compensation. The value of ϕ in the baseline economy is 0.228. Recall that

[4] Recall that $\tau = (1+0.005)^{35} - 1 = 0.1907$.

Table B.5: Calibration, parameter values, baseline economy (wage tax)

Parameters	Value	Comment/Observations
α	0.35	Capital share, Gollin (2002)
β	0.55	Labor share, Gollin (2002)
τ	0.005	Tax/regulation cost, Demirguc-Kunt and Levine (2000)
τ^w	0.33	Payroll tax rate, Jones, Manuelli, and Rossi (1993)
ovc	0.02	Bank overhead cost, Beck and Demirguc-Kunt(2009)
η	1	Match rate (CFED 2009)
$\underline{b}$	$1,500	Minimum balance
γ	0.958	Calibrated: match % unbanked (FDIC and FRED 2013)
ϕ	0.228	Calibrated: match % entrepreneurs/total population
ϵ	4.3	Calibrated: match entrepreneurial income Gini index

ϕ is equivalent to an additive utility punishment that reflects the strength of contract enforcement.

From the calibration results we can see that both consumption as a share of lifetime wealth and the contract enforcement parameter are similar under the wage tax model and the income tax model, 0.958% vs. 0.959% and 0.228 vs. 0.225. Relatively more low ability individuals become entrepreneurs in the wage tax model than in the income tax model, which leads to slightly higher contract enforcement in the former model. The main difference is in the talent distribution parameter, which I will discuss in the quantitative analysis section.

The model fits the U.S. economy well on some dimensions, but not others.

Table B.6: Basic statistics, U.S. and baseline economy with wage tax

	U.S. economy	Baseline model
Yearly real interest rate (%)	2.0	2.0
Regulation cost as a % of total bank operation costs (%)	5 – 10	8.7
% of entrepreneurs (%)	12.0	12.37
Entrepreneurs' income Gini (%)	54	58.8
Capital to output ratio	2.55	2.9
Private credit to output ratio	2.03	1.64

This is expected because this tax policy does not correspond to the U.S. economy, and the exercise is done solely to better understand the model. The capital to output ratio, which is not calibrated, exceeds the U.S. level. Maddison (1995) finds that the U.S. capital to output ratio is about 2.55 and it is 2.9 in the model. Similarly, World Bank Development Indicators data shows that average total private credit as a share of income in the U.S. is 2.03 from 1993 to 2013, and it is 1.64 in the model. This occurs because the benchmark economy restricts low wealth people from borrowing.

B.9.5 Counterfactual policy experiment: Wage taxes

Quantitative experiments are designed to explore how the equilibrium properties of the model change when microsavings programs are introduced in the economy.

The previous section calibrated the stationary equilibrium of the baseline model without microsavings. Individuals chose their occupation based on their initial ability and bequest. I now introduce a microsavings program into the benchmark economy. The baseline microsavings program offer a match of $\eta = 1$ and the minimum deposit size requirement is $\underline{b} = \$1,500$. I consider the case where workers pay the wage tax τ^w required to balance budget equation (B.35), given that the government subsidy increases from the baseline level of $S^G = 0$ to $S^G = 87.5$, exogenous other government non-microsavings spending is fixed at $g = 158.5$, and $\tau = 0.1907$.

Table B.7: Baseline economy versus economy with microsavings (wage tax)

	Baseline model	Model with microsavings
% of entrepreneurs	12.37	12.46
Entrepreneurs' income Gini (%)	58.8	62.7
Wage	100	133
After tax wage	100	114
Payroll tax rate	0.33	0.425
Government subsidy	$S^G = 0$	$S^G = 87.5$
Output	100	160
Capital to output ratio	2.9	2.58
Private credit to output ratio	1.64	1.9

Compared to an economy without microsavings, introducing the program into an economy that counterfactually funds the program with taxes only on workers' wages (and not on entrepreneurs) has the following effects. First, the percentage of entrepreneurs increases which is consistent with one of the goals of microsavings programs.

Second, the pre-tax and after-tax wages are higher. At first glance this may seem surprising. However, the microsavings program increases the number of entrepreneurs. As a consequence, the demand for workers increases while the supply of workers decreases, increasing the pre-tax market wage. The wage tax also rises in order to fund government subsidy S^G to the microsavings program. Overall, the market wage effect is bigger than the wage tax effect, which results in a higher after-tax wage.

Third, the entrepreneur income Gini coefficient increases. This result is different from the result in the income tax model. The reason is mainly due to the fact that entrepreneurs no longer pay taxes and they have more funds to invest in their business and a higher incentive to borrow. Although firm income drops due to the wage increase, the effect from reducing the tax rate on entrepreneurs to zero dominates the effect from a higher wage. Another reason is that the talent distribution changes in the new calibration. In the wage tax model, the calibration result for the talent distribution curvature parameter is $\epsilon = 4.3$, which is larger than the estimate in the income tax model (3.2). This implies that the ability distribution is highly concentrated on agents with low managerial talent in the wage tax model. In other words, more relatively low ability individuals run microenterprises and receive lower incomes compared to the microenterprises in the income tax model. Overall, more productive managers run larger firms and are richer because they do not pay income taxes, and more low productivity (and hence low income) micro firms enter entrepreneurship through microsavings programs. This leads to an increase in the entrepreneur Gini index from 58.8 to 62.7, indicating more inequality.

Fourth, the credit to output ratio rises. Microsavings programs provide more working capital due to external donations S^D and government directed credit S^G. The microsavings program with a match provides the low-wealth individuals with collateral that they can use to obtain loans. The effect on credit is positive.

Fifth, the capital to output ratio declines. This occurs because there is a large increase in the output, relative to the increase in capital. Again, in the wage tax model, all the government spending and microsavings funds are raised through taxes on workers and there are no taxes on entrepreneurs. Highly productive entrepreneurs increase the scale of their firms and some individuals switch their occupation from worker to entrepreneur. This counterfactual wage tax policy would lead to an (implausibly) large increase in output and firms demand more credit, especially by highly productive firms. The increase in the demand for labor by firms leads to a higher wage.

Table B.7 summarizes the effect of the microsavings program under the counterfactual wage tax framework. The program affects occupational choice, income inequality and the credit to output ratio. Compared to the economy with income taxes on both workers and entrepreneurs, microsavings in the wage income tax only economy has a larger impact on the wage and output for the reasons explained above. Clearly if the entire burden of funding the microsavings program falls on workers, in general this may not be desirable. This counterfactual policy was conducted solely to better understand the model.

REFERENCES

Accion Chicago Finanical Statement, (2013), Web. July 6th, 2014, http://accionchicago.org/wp-content/uploads/2015/03/2013-Annual-Report-Accion-Chicago.pdf

Accion East and Online, "Who We Are - Our History", Web. July 6th, 2014, http://www.accioneast.org/home/support-accion/about-accion/who-we-are.aspx

Accion East and Online Financial Statement, (2012), Web. July 6th, 2014, http://www.accioneast.org/Uploads/FileManager/Accion%20East%202012%20audited%20FS.pdf

Accion East and Online Learn, "Microloans in the United States", Web. April 4th, 2016, http://www.accioneast.org/home/support-accion/learn/microlending-in-the-united-states.aspx

Accion New Mexico-Arizona-Colorado Financial Statement, (2012), Web. July 6th, 2014, http://accionnews.org/newmexico/wp-content/uploads/2015/06/2012-Annual-Report-new.pdf

Accion San Diego Financial Statement, (2012), Web. July 6th, 2014, http://www.accionsandiego.org/documents/ACCION_AR_SANDIEGO_FINAL.pdf

Accion Taxes Financial Statement, (2013), Web. July 6th, 2014, https://www.liftfund.com/wp-content/uploads/2014/06/AccionTexas-2013ARFINAL.pdf

Accion US network, "About Accion - Membership", Web. July 6th, 2014. usnetwork.accion.org/about-accion

Aghion, P., Bolton, P., (1997), "A theory of trickle-down growth and development", *Review of Economic Studies 64 (2), 151172.*

Ahlin, C., and Jiang, N., (2008), "Can micro-credit bring development?", *Journal of Development Economics*, 86, 1-21.

AFI, "CFED: Frequently Asked Questions about Individual Development Accounts (IDAs)", October 14th, 2015, http://cfed.org/programs/idas/ida_faq_article/

American Banker Association, "Increased Business Lending The Wrong Road for Credit Unions", *American Bankers Association.*

Andreoni, J., (1990). "Impure Altruism and Donations to Public Goods: A Theory of Warm-Glow Giving", *Economic Journal 100 (401): 464-477. JSTOR 2234133.*

Antunes, A., Cavalcanti, T., (2007), "Start up costs, limited enforcement, and the hidden economy", *European Economic Review 51 (2007) 203-224.*

Antunes, A., Cavalcanti, T., and Villamil, A., (2008a), "Computing General Equilibrium Models with Occupational Choice and Financial Frictions", *Journal of Mathematical Economics*, 44, 553-568.

Antunes, A., Cavalcanti, T., and Villamil, A., (2008b), "The Effect of Financial Repression and Enforcement on Entrepreneurship and Economic Development", *Journal of Monetary Economics*, 55, 278-297.

Antunes, A., Cavalcanti, T., and Villamil, A., (2013), "Costly Intermediation and Consumption Smoothing", *Economic Inquiry*, 51(1), 459-472.

Antunes, A., Cavalcanti, T., and Villamil, A., (2015), "The Effects of Credit Subsidies on Development", *Economic Theory*, 58(1), 1-30.

Armendariz, B. and Morduch, J., (2010), "The Economics of Microfinance", *The MIT Press*: Cambridge, MA. Chapter 6, 8, and 9.

Assah Meh, C (2002), "Entrepreneurship, Inequality, and Taxation", *Bank of Canada*, working paper.

Ashraf, N., Karlan, D. S., Yin, W., and Shotland, M., (2010), "Evaluating Microsavings Programs: Green Bank of the Philippines (A)", *Harvard Business School* NOM Unit Case No. 909-062. Available at SSRN: http://ssrn.com/abstract=2025111.

Attanasio, O., Augsburg, B., Haas, R., Fitzsimons, E., and Harmgart, H., (2011), "Group lending or individual lending? Evidence from a randomised field experiment in Mongolia", *European Bank for Reconstruction and Development, Working Paper No. 136, December 2011.*

Banerjee, A., Duflo, E., Glennerster, R., and Kinnan, C.,(2009),"The miracle of microfinance? Evidence from a randomized evaluation", *NBER Working Paper No. 18950, Issued in May 2013.*

Banerjee, A., and Newman, A., (1993), "Occupational choice and the process of development", *Journal of Political Economy 101 (2), 274-298.*

Banerjee, A., Karlan, Dean., and Zinman, J., (2015), "Six Randomized Evaluations of Microcredit: Intorduction and Further Steps", *American Economic Journal: Applied Economics 2015, 7(1): 1-21 http://dx.doi.org/10.1257/app.201402*

Bank of America, "Personal Checking Account from Bank of America", Iowa, Web. October 16th, 2015, `https://www.bankofamerica.com/deposits/checking/personal-checking-account.go`

Bank of America, "Business Advantage", Web. March 21st, 2015, `https://www.bankofamerica.com/smallbusiness/business-financing/working-capital/business-loans.go`

Barr, M, (2005), "Microfinance and financial development", *Michigan Journal of International Law, 26, 271-96.*

Bartholdy, J., Boyle, G., and Stover, R., (1997), "Deposit Insurance, Bank Regulation, and Interest Rates: Some International Evidence", *University of Otago*, New Zealand. Processed.

Bates, T., Lofstrom, M., and Servon, L., (2011), "Why Have Lending Programs Targeting Disadvantaged Small Business Borrowers Achieved So Little Success in the United States?", *Economic Development Quarterly*, 25(3), 255-266.

Beck, T., Levine, R., and Levkov, A., (2007), "Big Bad Banks? The Impact of U.S. Branch Deregulation on Income Distribution", *NBER Working Paper* No. 13299.

Beck, T., and Demirguc-Kunt, A., (2009), "Financial Institutions and Markets across Countries and over Time - Data and Analysis", *Policy Research Working Papers*, June 2009, World Bank.

Black, S., and Strahan, P., (2002), "Entrepreneurship and Bank Credit Availability", *Journal of Finance*, 57(6), 2807-33.

Blanchflower, D., Levine, P., and Zimmerman, D. (2003). "Discrimination in the Small Business Credit Market", *Review of Economics and Statistics*, 85, 930-943.

Bruhn, M., and Love, I., (2009), "The Economic Impact of Banking the Unbanked: Evidence from Mexico", *Policy Research Working Paper 4981*, World Bank, Washington, D.C.

Bond, P., and Townsend, R. (1996), "Formal and Informal Financing in a Chicago Ethnic Neighborhood", *Economic Perspectives*, 20(4), 3-27.

Bounouala, R., and Rihane, C., (2014), "Commercial Banks in Microfinance: Entry Strategies and Keys of Success", *Investment Management and Financial Innovations,* Volume 11(1).

Buera, F., Kaboski, J., and Shin,Y., (2015),"Entrepreneurship and Financial Frictions: A Macro-Development Perspective", *Annual Review of Economics*, 7(1), 409-436.

Buera, F., Kaboski,J., and Shin,Y., (2014b),"The Macroeconomics of Microfinance", *NBER Working Paper* No. 17905, March.

Buera, F. and Shin, Y., (2011)"Productivity Growth and Capital Flows: The Dynamics of Reforms", *American Economic Association-download preview.*

Buera, F. and Y. Shin (2011), "Self-insurance vs. Self-financing: A Welfare Analysis of the Persistence of Shocks", *Journal of Economic Theory*, 146, 845-862.

Bundrick, H., (2014), " Credit Unions vs. Banks: Understanding What Works for you", *The Simple Dollar*, Web. April 5th, 2016, `http://www.thesimpledollar.com/credit-union-vs-banks/`

Cagetti, M., and De Nardi, M., (2009), "Estate Taxation, Entrepreneurship and Wealth", *American Economic Review*, 99(1), 85-111.

Cagetti, M., and De Nardi, M., (2006), "Entrepreneurship, Frictions and Wealth", *Journal of Political Economy*, 114(5), 835-870.

Cavalcanti, T., and Villamil, A., (2003), "The Optimal Inflation Tax and Structural Reform", *Macroeconomic Dynamics, 2003, vol. 7, issue 03, pages 333-362.*

Cavalluzzo, K., and Wolken, J. (2005). "Small Business Loan Turn-downs, Personal Wealth and Discrimination", *Journal of Business*, 78, 153-178.

Center for Social Development (2010), "CSD Michael Sherraden named to TIME Magazine TIME 100", *Center for Social Development*, 2010-04-29. Retrieved 11 April 2013.

Cetorelli, N., and Strahan, P., (2006), "Finance as a Barrier to Entry: Bank Competition and Industry Structure in Local U.S. Markets", *The Journal of Finance*, 61, 437-461.

CFED, (2009),"Frequently Asked Questions about Individual Development Accounts (IDAs)", `http://cfed.org/programs/idas/ida_faq_article/`

CFA, "How Payday Loans Work", *PayDay Loan Consumer Information, Consumer Federation of America, Facts*, http://www.paydayloaninfo.org/facts

CGAP (Consultative Group to Assist the Poor), 2010. "Financial Access 2010: The State of Financial Inclusion through the Crisis", September.

CGAP, "Financial Inclusion", Web. June 20th, 2014. http://www.cgap.org/topics/financial-inclusion.

Chase, "Checking Accounts with Online Banking & Mobile Banking", October 27, 2015, https://www.chase.com/checking

China Construction Bank Corporation, (2016), July 1, 2016, http://ccb.com/cn/personal/deposit/rmbdeposits.html

Christen, P. R., Lyman, T., and Rosenberg, R., (2003), "Microfinance Consensus Guidelines: Guiding Principles on Regulation and Supervision of Microfinance", *Washington, DC: CGAP/World Bank.*

Citibank, "Checking: Basic Checking Accounts", Iowa, October 16th, 2015, https://online.citi.com/US/JRS/pands/detail.do?ID=ChkBasicChecking

CNNMoney, (2011), "10 Top Microfinance Companies - Women's Initiative for Self Employment", http://money.cnn.com/galleries/2011/smallbusiness/1107/gallery.top_ microfinance_companies/9.html

Collins, D., Morduch, J., Rutherford, S., and Ruthven, O., (2009), "Portfolios of the Poor: How the World's Poor Live on $2 a Day", *Princeton: Princeton University Press.*

Collins, D., (2005), "Stocks and Flows: Quantifying the Savings Power of the Poor", *Financial Diaries*, Cape Town, South Africa.

Community Affairs Department, (2005), "Individual Development Accounts: An Asset Building Product for Lower-Income Consumers", *Community Affairs Department: Comptroller of the Currency Administrator of National Banks.* February 2005. Retrieved 11 April 2013.

Credticards.com, (2015), Web. Dec. 29, 2015, http://www.creditcards.com/business.php

Crepon, B., Devoto, F., Duflo, E., and Pariente, W., (2015), "Estimating the Impact of Microcredit on Those Who Take It Up: Evidence from a Randomized Experiment in Morocco", *American Economic Journal: Applied Economics 2015, 7(1): 123-150.*

Cull, R., Demirguc-Kunt, A., and Morduch, J., (2013),"Banking the World: Empirical Foundations of Financial Inclusion - Chapter 2 Half the World is Unbanked, Chaia, A., Dalal, A., Goland, T., Gonzalez, M.J., Morduch, J., and Schiff, R.", *MIT Press.*

Cull, R., Demirguc-Kunt, A., and Morduch, J., (2009), "Microfinance Meets the Market", *Journal of Economic Perspectives*, 23(1), 167-92.

Cunningham, S., (2015), " Peer to Peer Lending Sites: An Exhaustive Review - The entire US p2p ecosystem in a single list", *LendingMemo, May 8, 2015*, Web. April 5th, 2016, http://www.lendingmemo.com/p2p-lending-sites/

Cyree, K., (2015), "The Direct Costs of Bank Compliance Around Crisis-Based Regulation for Small and Community Banks", https://www.communitybanking.org/documents/Session3_Paper3_Cyree.pdf

De Mel, S., McKenzie, D., and Woodruff, C., (2011), "Enterprise Recovery Following Natural Disasters", *The Economic Journal, 20 October 2011, Doi: 10.1111/j.1468-0297.2011.02475.x.*

Demirguc-Kunt, A., and Klapper, L., (2012), "Measuring Financial Inclusion: The Global Findex Database", *Policy Research Working Paper* 6025, World Bank.

Demirguc-Kunt, A., and Levine, R., (2009), "Finance and Inequality: Theory and Evidence", *Annual Review of Financial Economics 1.*

Demirguc-Kunt, A., and Huizinga, H., (1999), "Determinants of Commercial Bank Interest Margins and Profitability: Some International Evidence", *The World Bank Economic Review*, 13(2), 379-408.

Demirguc-Kunt, A., Klapper, L., Singer, D., and Van Oudheusden, P., (2015),"The Global Findex Database 2014: Measuring Financial Inclusion Around the World", *Policy Research Working Paper* No. 7255. World Bank, Washington, DC.

Devaney, P., (2006), "Microsavings Programs: Assessing Demand and Impact, A Critical Review of the Literature", *The IRIS Center.*

Dowla, A., and Barua, D., (2006), "The Poor Always Pay Back: The Grameen II Story", *Bloomfield, CT: Kumarian Press.*

Dupas, P., and Robinson, J., (2013a), "Savings Constraints and Microenterprise Development: Evidence from a Field Experiment in Kenya", *American Economic Journal: Applied Economics*, 5(1): 163-92.

Dupas, P., and Robinson, J., (2013b), "Why Don't the Poor Save More? Evidence from Health Savings Experiments", *American Economic Review* 103(4): 1138-71.

Duflo, E., and Klapper, L., (2015), "New Accounts in China Drive Global Financial Inclusion Figures", *CGAP, 22 May 2015*, https://www.cgap.org/blog/new-accounts-china-drive-global-financial-inclusion-figures

Dwoskin, E., (2015), "Lending Startups Look at Borrowers Phone Usage to Assess Creditworthiness", *The Wall Street Journal, TECH, Nov. 30, 2015.*

EARN, "Our Programs", *Oct. 22, 2015*, https://www.earn.org/savings-programs

Eiger, Z., and Mandell, J., (2015), "P2P Lending Basics: How it Works, Current Regulations and Considerations", *Morrison & Foerster, January 29, 2015.*

Fairlie, R., and Robb, A. (2007), "Why are Black-owned Businesses Less Successful than White-owned Businesses: The Role of Families, Inheritances, and Business Human Capital", *Journal of Labor Economic*, 25, 289-324.

FDIC, The Financial Brand, https://thefinancialbrand.com/25140/fdic-research-study-unbanked-underbanked/

FDIC (2014), "2013 FDIC National Survey of Unbanked and Underbanked Households", *Federal Deposit Insurance Corporation (FDIC), October 2014.*

FDIC (2012), "2011 FDIC National Survey of Unbanked and Underbanked Households", *Federal Deposit Insurance Corporation (FDIC), September 2012.*

FDIC (2011), "Tapping the Unbanked Market" Symposium", *Federal Deposit Insurance Corporation.*

FDIC (2007), "FDIC Quarterly Individual Development Accounts and Banks: A Solid 'Match"', https://www.fdic.gov/bank/analytical/quarterly/2007_vol1/IDAsbanks.html

Federal Deposit Insurance Corporation (FDIC) Householdsurvey (2013), "2013 Household Survey Results", *EconomicInclusion.Gov.*

Forbes, (2013), "Banking The Unbanked: A How-To", *Forbes, June 14th, 2013.*, http://www.forbes.com/sites/ashoka/2013/06/14/banking-the-unbanked-a-how-to/

FRED (2013), monthly data on working age population, https://research.stlouisfed.org/fred2

Global Entrepreneurship Monitor (GEM) (2014), "2014 United States Report", *Babson College Founding and Sponsoring Institution and Baruch College Sponsoring Partner Institution.*

Gollin, D., (2002), "Getting Income Shares Right", *Journal of Political Economy*, 110(2), 458-474.

Gokhale, J. and Kotlikoff, L., (2000), "The Baby Boomers' Mega-inheritance - Myth or Reality?", *Economic Commentary, Federal Reserve Bank of Cleveland.*

Hamilton, A., (2007), "Profiting from the Unbanked", *TIME Magazine*, August 16, 2007.

Hermes, N., (2014), "Does Microfinance Affect Income Inequality?", *Applied Economics*, 46(9), 1021-1034.

Heish, C., and Klenow, P., (2009), "Misallocation and Manufacturing TFP in China and India", *The Quarterly Journal of Economics, Vol. CXXIV, Novermber 2009, Issue 4.*

Honohan, P., (2008), "Cross-country Variation in Household Access to Financial Services", *Journal of Banking* & *Finance*, 32, 2493-2500.

Hsieh, C.-T. and Klenow, P., (2009), "Misallocation and Manufacturing TFP in China and India", *Quarterly Journal of Economics*, 124, 1403-1448.

ICBC, Industrial and Commercial Bank of China Ltd., (2016), July 1, 2016, `http://www.icbc.com.cn/ICBC`

Jayaratne, J., and Strahan, P., (1996), "The Finance-Growth Nexus: Evidence from Bank Branch Deregulation", *Quarterly Journal of Economics*, 111(3), 639-70.

Johnston and Morduch, J., (2008),"The Unbanked: Evidence from Indonesia", *The World Bank Economic Review*, 22(3), 517-537.

Jones, L., Manuelli, R., and Rossi, P., (1993), "Optimal Taxation in Models of Endogenous Growth", *Journal of Political Economy*, 101(3), 485-517.

Kaboski, J., and Townsend, R., (2011), "A Structural Evaluation of a Large-Scale Quasi-Experimental Microfinance Initiative", *Econometrica 79(5), September 2011: 1357-1406.*

Kaboski, J., and Townsend, R., (2012), "The Impact of Credit on Village Economies", *American Economic Journal: Applied Economics 4(2), April 2012: 98-133.*

Karlan, D., and Zinman, J., (2010), "Expanding Microenterprise Credit Access: Using Randomized Supply Decisions to Estimate the Impacts in Manila", http://www.dartmouth.edu/~jzinman/Papers/expandingaccess_manila_jul09.pdf

Ledgerwood, J., and White, V., (2006), "Transforming Microfinance Institutions: Providing Full Financial Services to the Poor", *Washington, D.C.: International Bank for Reconstruction and Development/World Bank.*

Light, I., and Bonacich, E. (1988). "Immigrant Entrepreneurs: Koreans in Los Angeles 1965-1982", *Berkeley: University of California Press.*

Liu, F. and Villamil, A., (2015), "Microfinance in the U.S.," *Working paper, The University of Iowa.*

Lloyd-Ellis, H. and D. Bernhardt (2000), "Enterprise, Inequality and Economic Development", *Review of Economic Studies*, 67, 147-168.

Lucas, Jr., R. E. (1978), "On the Size Distribution of Business Firms", *Bell Journal of Economics*, 9, 508-523.

Maddison, A., (1995), "Monitoring the World Economy", *Organization for Economic Cooperation and Development, Paris.*

Mendoza, M., (2013), "Microloans surging in Silicon Valley", Web. Oct. 20th, 2015, http://www.bigstory.ap.org/article/microloans-surging-silicon-valley

MicroCapital, (2007), "Microfinance Funds Universe", http://www.microcapital.org/microfinance-funds-universe/

MicroTracker, (2012), "U.S. Microenterprise Census Highlights, FY2012", *MicroTracker.*

Midrigan, V. and D. Y. Xu (2014), "Finance and Misallocation: Evidence from Plant-Level Data", *American Economic Review*, 104, 422-58.

MIX, (2009), "MFI Benchmark Analysis - Operating Efficiency: Victim to the Crisis?", *MicroBanking Bulletin, Issue 19, December 2009.*

MIX, Microfinance Information Exchange, (2010), "Trend Lines 2006-2008 MFI Benchmark Tables", *MicroBanking Bulletin*, Issue No. 20.

Moll, B. (2014), "Productivity Losses from Financial Frictions: Can Self-financing Undo Capital Misallocation?", *American Economic Review*, 104, 363-391.

Morduch, J. (1999), “The microfinance promise”, *Journal of Economic Literature 37, 1569-1614.*

Morduch, J., (2012), “Ten Research Questions”, *Financial Access Initiative Research Framing Note*, January.

National Association of Social Workers (1996),“Personal Responsibility And Work Opportunity Reconciliation Act of 1996: Summary of Provisions”, *National Association of Social Workers*, August. Retrieved 11 April 2013.

OECD (2010), “Entrepreneurs as a Percentage of the Total Employed Population by Gender 2000-10”, `http://skills.oecd.org/useskills/documents/34aentrepreneursasapercentage ofthetotalemployedpopulationbygender.html`

Payday Loans, Melzer, B., (2011), “THE REAL COSTS OF CREDIT ACCESS: EVIDENCE FROMTHE PAYDAY LENDINGMARKET”, *The Quarterly Journal of Economics (2011) 126, 517555. doi:10.1093/qje/qjq009.*

Public Service Credit Union, “The Difference Between Credit Unions and Banks”, Web. April 5th, 2016, `https://www.pscu.org/membership/credit-union-difference/`

Pollinger, J., Outbwaite, J., and Cordero-Guzman, H., (2007), “The Question of Sustainability for Microfinance Institutions”, *Journal of Small Business Management 2007 45(1), pp.23-41.*

Quadrini, V. (1999), “The Importance of Entrepreneurship for Wealth Concentration and Mobility”, *Review of Income and Wealth*, 45.

Quadrini, V. (2000), “Entrepreneurship, saving, and social mobility”, *Review of Economic Dynamics,3, 1-40*

Rademacher, I., Wiedrich, K., McKernan, S. and Gallagher, M, (2010) “Weathering the Storm: Have IDAs Helped Low-Income Homebuyers Avoid Foreclosure?”, *CFED and The Urban Institute*, April 2010.

Rafiq, R., Chowdhury, J., and Cheshier, P., (2009), “Microcredit, Financial Improvement and Poverty Alleviation of the Poor in Developing Countries: Evidence from Bangladesh”, *Journal of Emerging Markets 14 (2009): 24-37.*

Richardson, D., (2003), “Going to the Barricades with Microsavings Mobilization: A View of the Real Costs from the Trenches”, *MicroBanking Bulletin*, 9, 9-13.

Robinson, M., (2001), "The Microfinance Revolution: Sustainable Banking for the Poor", *Washington, DC: The World Bank.*

Rosenberg, R., Gonzalez, A., and Narain, S., (2009), "The New Moneylenders: Are the Poor Being Exploited by High Microcredit Interest Rates?", *CGAP, Occasional Paper, No. 15, Februray 2009*

Rutherford, S., (2006), "Uses and Users of MFI Loans in Bangladesh", *MicroSave-Briefing Notes on Grameen II*, Number 7. [www.microsave.org.]

Rutherford, S., (2002), "Money Talks: Conversations with Poor Households in Bangladesh about Managing Money", *Finance and Development Research Programme Working Paper Series. Manchester, UK*

Ruthven, O., and Kumar, S., (2002), "Fine-Grain Finance: Financial Choice & Strategy Among the Poor in Rural North India", *Finance & Development Working Paper 57, IDPM, University of Manchester, UK.*

Rhine, S. L. W., and Greene, W. H., 2006, "The Determinants of Being Unbanked for U.S. Immigrants", *Journal of Consumer Affairs*, 40, 21-40.

SBA, "The Code of Federal Regulation 13 CFR 119.2", Cornell University Law School Legal Information Institute, Web. Oct. 7th, 2014.

SBA, U.S. Small Business Administration, Office of Advocacy, (2004), "Private Firms, Establishments, Employment, Annual Payroll, and Receipts by Firm Size, 1988-2001", (qtd. in McKernan, S. and Chen, H.,(2005), "Small Business and Microenterprise as an Opportunity and Asset-Building Strategy",*Opportunity and Ownership Project, The Urban Institute, N0.3, June 2005.*)

SBA, "Microloan Program", Web. Oct. 7th, 2014. `https://www.sba.gov/content/microloan-program`

Schreiner, M., and Sherraden, M., (2007), "Can the Poor Save?: Saving and Asset Building in Individual Development Accounts", *Transaction Publishers*, New Brunswick and London.

Schreiner, M., and Woller, G., (2003), "Microenterprise Development Programs in the United States and in the Developing World", *World Development*, 31(9), 1567-1580.

Sherraden (2005) Chapter 8 Caskey, *Inclusion in the American Dream: Assets, Poverty, and Public Policy*, Oxford University Press, Inc.

Simon, R., (2015), “Big Banks Cut Back on Loans to Small Business”, *The Wall Street Journal, BUSINESS, Nov. 26, 2015*, http://www.wsj.com/articles/big-banks-cut-back-on-small-business-1448586637

The Power of Microfinance, “1. What is Microfinance? The Challenge”, Micro-Enterprise Management Group, LLC, Web. Oct. 3rd, 2014.

Townsend, M., and Yaron, J., (2001), “The Credit Risk Contingency System of an Asian Development Bank”, *Economic Perspectives 25(3), 2001: 31-48.*

U.S. Bank, “Personal Savings Account-Standard Savings Account”, Web. October 27th, 2015, https://www.usbank.com/savings/standard.html

U.S. Bank, “Business Loans from U.S. Bank”, Web. March 21st, 2015, https://www.usbank.com/small-business/credit-financing/business-loans.html

US Tax Center (2015), “2015 Federal Tax Rates, Personal Exemptions, and Standard Deductions - IRS Tax Brackets and Deduction Amounts for Tax Year 2015”, Sept. 12, 2016, https://www.irs.com/articles/2015-federal-tax-rates-personal-exemptions-and- standard-deductions

Weber, S., (2014), “International microlender brings small business lending to U.S. merchants”, *PBS Newshour, Topics, Economy, June 22, 2014*, Web April 4, 2016, http://www.pbs.org/newshour/updates/microlender-accion-helps-provide-loans-entrepreneurs/

Yunus, M., (1999), “Banker to the Poor: Micro-Lending and the Battle Against World Poverty?”, *New York: PublicAffairs. ISBN 978-1-58648-198-8.*

Zhang, M., (2013), ”Breaking China’s Investment Addiction”, *Project Syndicate, Feb. 14th, 2013,* Web. Sept. 6th, 2014.