Government Loan, Guarantee, and Grant Programs: An Evaluation

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Recently, there has been a trend toward loan guarantee programs over other programs that support the credit market. From 1970 to 1998, the real value of outstanding federal loan guarantees rose at an accelerated pace, while the real value of direct loans, the other major government loan program, has remained about the same (see Figure 1). In particular, the Small Business Administration (SBA), which has provided government loan guarantees to small businesses since 1953, has experienced an unprecedented increase in its loan volume over the past three years. In December 1997, with the growing popularity of SBA loans, Congress passed an SBA funding bill that set aside $39.5 billion and $11 billion, respectively, for the SBA's 7(a) and 504 business loan programs over the next three years. This more than tripled the current 7(a) level which was $10.3 billion in fiscal year 1997.[1]

The surge in loan guarantee programs prompts the question: Are loan guarantees the best way to provide benefits to targeted borrowers or to channel additional resources to targeted sectors? As the following paragraphs show, not in all cases. This article explains that conclusion by examining the economic consequences of three distinct methods of channeling resources to targeted borrowers: direct government lending, loan guarantees, and outright grants. While the logic applies to any credit market segment, the article particularly focuses on the small business sector. The analysis studies the changes in firm investment, bankruptcy cost, and business entry under each loan program in a

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[1] Bureau of National Affairs, Inc. (1997).

theoretical model economy designed to capture the essential features of small business borrowing.

One thing is sure. These credit policies cannot make the private economy any more efficient, the reason being that the government does not have information or technology advantage over private agents. Therefore, there will not be any efficiency gain associated with credit policies. (In other words, the absence of efficiency gains means that policies cannot make any agent better off without hurting other agents.) In this article, we take as given a political desire to assist a particular group of borrowers and look at how the different alternate credit programs redistribute resources.

Perhaps it is most appropriate to explore the effects of government credit programs within a model of financial frictions. It is natural to do so because many economists contend that such frictions have a greater effect on certain kinds of borrowers, such as small businesses and students, than on others. Accordingly, the environment studied here is one in which financial frictions are caused by private information: in particular, moral hazard.[2] Moral hazard occurs when the very act of insuring a borrower against risk induces him to take on additional risk. Such frictions drive a wedge between the cost of internal funds and that of external funds as in Townsend (1979) and Gale and Hellwig (1985). The central notion is that wealth affects people's decisions, creating liquidity constraints.

The relevance of such a model is supported by empirical evidence. Holtz-Eakin, Joulfaian, and Rosen (1994), Evans and Leighton (1989), Blanchflower and Oswald (1998), and Evans and Jovanovic (1989) among many others, find that a lack of wealth affects people's ability to become self-employed, even after accounting for the possible correlation between entrepreneurial ability and wealth. In a more recent study, Bond and Townsend (1996) reported on the results of a survey of financial activity in a low-income, primarily Mexican neighborhood in Chicago and found that borrowing is not an important source of finance for business start-ups. In their sample, only 11.5 percent of business owners financed their start-up with a bank loan, while 50 percent of the respondents financed their start-up entirely out of their own funds.

1. AN OVERVIEW OF GOVERNMENT CREDIT PROGRAMS

In the United States, the federal government regularly proposes and endorses programs that are designed to direct and encourage the flow of funds to

[2] Adverse selection—namely, situations in which borrowers have unverifiable hidden knowledge about their likelihood of repayment—is another form of private information that gives rise to financial frictions. See de Meza and Webb (1987), Gale (1991), Innes (1991), and Lacker (1994) for discussion.

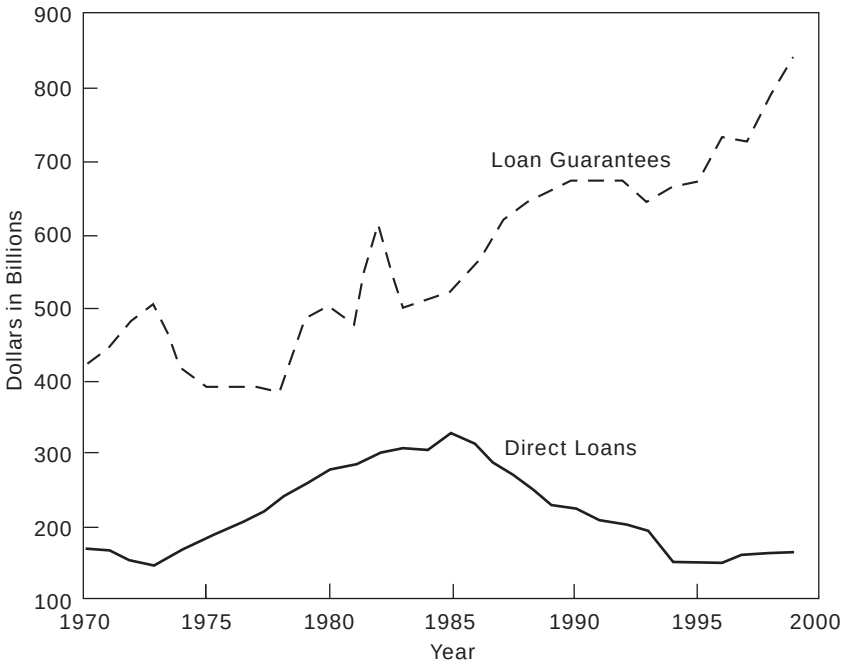
selected consumers and businesses. For instance, the Community Reinvestment Act (CRA) attempts to increase the flow of funds to disadvantaged communities or persons by requiring depository institutions to make a minimum effort to fund these groups. Similarly, the SBA's section 7(a) loan program and its Small Business Investment Company program encourage the flow of funds to small businesses through government guarantees of debt issued by the financial intermediaries providing the funds to the small business. Numerous other government-sponsored enterprises (GSEs) such as Fannie Mae, Sally Mae, Freddie Mac, etc., operate on secondary markets and provide credits for targeted groups in exchange for preferential treatment from the government.

Government intervention in the financial market has occurred mainly via direct loans, grants, and indirect loan guarantees. In the case of direct loans, a government agency acts as an intermediary in place of banks; it issues loans directly to the targeted group, obtaining funds from the capital markets by issuing Treasury securities and/or imposing taxes. Direct loans typically offer large subsidies, usually to the agricultural and rural sectors. Unlike direct loans, grants and loan guarantees do not involve any repayment from the recipients. Grants, provided by the government directly to the targeted recipients, are often received at the end of the period when they are added to business profits to help defray costs. Loan guarantees provide investors with assurance that the government will make up any difference between a given guaranteed loan payment and an agent's actual loan payment. A loan guarantee requires the participation of three parties: the government agency, the borrower, and the private lender. The government agency deals indirectly with the borrower through a private lender. Typically, the acquisition of an SBA loan proceeds as follows. The borrower first presents the appropriate financial data for the lender to review. Based on the lender's evaluation, three courses of action are possible: the lender (1) may decide to finance the loan without an SBA loan guarantee; (2) may provide financing conditional upon obtaining an SBA loan guarantee; or (3) may reject the loan. If the lender approves the loan based on the SBA's willingness to provide a guarantee, then the lender must help the borrower prepare the SBA loan application. Upon completion of the application, the SBA reviews the loan. Over 90 percent of all loan guarantee applications are approved by the SBA (Haynes 1996). Of course loan guarantee programs assist a wide range of borrowers besides small businesses, including homeowners, students, and exporters.[3]

Figure 1 depicts the recent trend in government direct loan and loan guarantee programs (GSEs included). As shown here, federal credit outstanding in

[3] In addition to direct loans and loan guarantees, GSEs aid borrowers in housing, agricultural, and student loan markets, primarily through the operation of secondary markets. The tax-exempt status of state and local governments allows them to borrow at reduced cost and to direct the interest savings to preferred borrowers.

Figure 1 Real Value of Federal Credit and Guarantees Outstanding (1992 dollars)



the form of loan guarantees has experienced an explosive growth relative to that of direct loans.[4]

Tables 1 and 2 present the various direct loan and guaranteed loan programs that existed in the 1996 fiscal year. As the tables show, virtually every sector of the economy is covered by some type of program, and assistance to some sectors takes the form of both direct loans and guaranteed loans. In this article, we focus on the kinds of programs associated with investment behavior. Examples of such programs include those targeted to the entrepreneurial community and students.

2. THE THEORETICAL MODEL

A sensible model for our purpose must have two key features. First, the model should display asymmetric information that gives rise to financial frictions so

[4] Grants are not used as much as direct loans and loan guarantees. We do not have time-series data on the spending of government grants in the United States.

Table 1 Direct Loan Transactions of the Federal Government: 1996 Fiscal Year (Millions of Dollars)

	Net Outlays	Outstandings
National defense		1,384
Internal affairs	1,674	38,983
Energy	1,036	34,125
Natural resources and environment	34	294
Agriculture	6,183	15,580
Commerce and housing credit	1,570	40,897
Transportation	47	314
Community and regional development	1,963	17,739
Education, training, employment and social services	9,120	12,431
Health	25	834
Income security	93	2,303
Veteran benefits and services	1,442	1,188
General government direct loans	379	462
Total	23,566	166,534

Source: The Budget of the United States Government, 1996.

that agents' wealth affects their investment demand. Second, the model should also demonstrate that the amount of desired investment (not simply whether to invest) varies with the cost of borrowing.

Here we describe an economic environment that contains the above features. It is a simple environment with borrowing and lending occurring under the condition of moral hazard. The main characteristic of this environment is that some information regarding the return to investment projects is concealed and is observable to project owners but not to lenders. Because lenders do not have full information, they cannot determine the state of the projects so they have to spend real resources to verify borrowers' reports. The economy studied here also includes another important characteristic: agents decide whether to start a new business or remain an employee. Since imperfect information limits risk-sharing, this self-selection turns out to be correlated with the amount of assets that agents hold, as well as the quality of their business projects. Therefore, both margins of business activity are captured in the model, namely, the intensive margin of business investment and the extensive margin of entry.

To introduce some notation, we refer to a two-period economy with a continuum of agents of measure one. Consumption takes place in both periods, and we denote them by c_i, $i = 1, 2$. The utility function is assumed to take the form $U(c_1) + c_2$. In the first period, each agent receives some wealth w and a project that can be operated in the second period. Wealth w has a cumulative distribution function $G(w)$ on the interval $[\underline{w}, \overline{w}]$, where $0 < \underline{w} < \overline{w}$. The

Table 2 Guaranteed Loan Transactions of the Federal Government: 1996 Fiscal Year (Millions of Dollars)

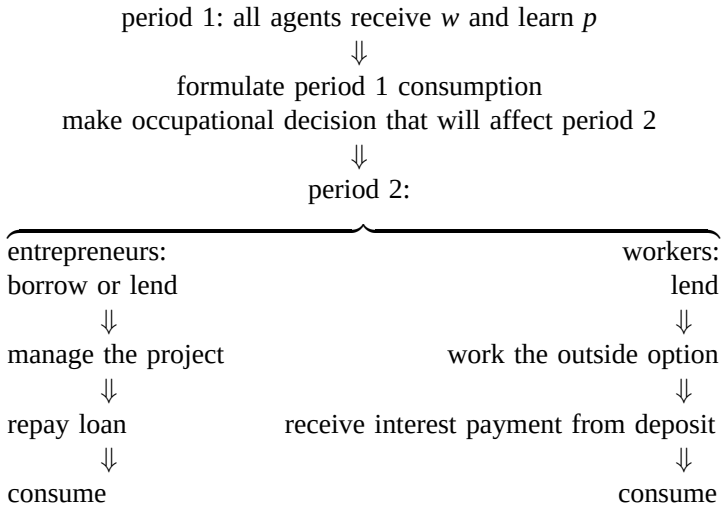
	Net Outlays	Outstandings
National defense	276	441
Internal affairs	8,418	34,341
Energy		691
Natural resources and environment		
Agriculture	5,082	12,309
Commerce and housing credit	181,277	987,420
Transportation	826	2,154
Community and regional development	839	2,565
Education, training, employment and social services	19,816	101,874
Health	210	3,113
Income security	5	3,867
Veteran benefits and services	28,676	154,762
General government direct loans	379	462
Subtotal	245,425	1,303,537
less secondary guaranteed loans	−101,540	−497,433
Total	143,885	806,104

Source: The Budget of the United States Government, 1996.

project is indexed by its probability of success p: if a project succeeds, it produces output $f(k)$, where k is total investment; if it fails, no output will be produced. Function $f(k)$ is assumed to be increasing in k and concave, i.e., $f'(.) > 0$ and $f''(.) < 0$. The project success probability p is characterized by a cumulative distribution function denoted by $\Gamma(p)$ with support $[\underline{p}, \overline{p}]$. The probability of success p is a measure of business quality.

In the first period, after receiving his endowment of assets and a project, an agent determines his consumption for this period and his saving for the second period. He also decides whether he wants to carry out his project. In period 2, the agent, if he is an entrepreneur, decides how much to invest. If the total amount of investment exceeds his saving, then he needs to borrow. If the agent is a worker, he draws his income from lending and a fixed income q from working an outside option in period 2.[5] The following timeline describes the sequence of actions.

[5] We could assume that production takes both capital and labor as inputs and that q corresponds to the wage that is endogenously determined. This assumption would further complicate the analysis here without much gain.



The information structure of the economy is as follows. Everything in the first period is public information: the level of assets, the quality of the project, and the decision about whether or not to be an entrepreneur. In period 2, however, when production takes place, only those carrying out the project observe the outcome of the project. An outsider can learn the outcome only after bearing a verification (auditing) cost. Given that financing a project may require loans from more than one lender, the optimal financial structure is one where all lending is transacted by a large financial intermediary who lends to a large number of borrowers and borrows from a large number of depositors. Because it has a comparative advantage in doing so, the financial intermediary monitors the borrowers to economize on verification costs; if there were direct lending, each of the lenders who lent to an entrepreneur would have to verify the investment project's return in the event of default.

Those wishing to borrow attempt to do so by announcing loan contract terms: the amount of loans borrowed, repayment after production conditional on borrowers' report, and when monitoring occurs. If the financial intermediary accepts the terms, it then takes deposits, makes loans, and monitors project returns as required by the contracts it accepts. We assume perfect competition in the financial sector. Then, in equilibrium, the financial intermediary will be perfectly diversified, will earn zero profits, and will have a nonstochastic return on its portfolio. Therefore, the intermediary need not be monitored by the depositors.

The two-outcome distribution of returns is a special case of the more general distributions discussed in Townsend (1979) and Gale and Hellwig (1985). We rule out randomized verification strategies, that is, the financial intermediary cannot verify the return of an agent's project with some probability. The optimal contract in this setting is a debt contract where entrepreneurs pay a fixed amount

if the project succeeds and default if the project fails, in which case verification takes place. We can interpret the act of verification as implying bankruptcy for two reasons. First, in the more general setup, the optimal contract turns out to be the standard debt contract under which the return is observed if and only if the firm is insolvent. Second, real-world bankruptcy does appear to involve a transfer of information. The cost of bankruptcy can be substantial and is likely to be a function of the level of the firms' debt. For simplicity, we assume that bankruptcy cost takes the form of $\beta + \gamma b$, where β corresponds to the fixed cost, and γ is the per-unit variable cost. The amount of borrowing is denoted by b. Firms' total investment k is then the sum of its own internal fund or savings from first period s and loan borrowing b.

Let x denote the payment by the entrepreneur to the financial intermediary, and let r be the interest rate the financial intermediary pays to investors. It follows that the financial intermediary is willing to accept loan contract offers yielding an expected rate of return of at least r. Borrowers differ in the amount s of their initial wealth that they save, and their project's probability of success p. A loan contract with a borrower (s, p) must satisfy the following constraint,

$$px = rb + (1 - p)(\beta + \gamma b), \tag{1}$$

if the intermediary is willing to accept it. Investment k is the total of saving s and loan borrowed b. The loan contract also has to be feasible for the borrower

$$x \leq f(k). \tag{2}$$

This expression says that the borrower has enough to repay the loan in the good state.

Borrowers will then maximize their own expected utility by setting investment level k, subject to the constraints just described. Therefore, announced loan contracts will be selected so that they solve

$$\pi(s, p) = \max_b \{pf(b + s) - px\} = \max_b \{pf(b + s) - rb - (1 - p)(\beta + \gamma b)\}, \tag{3}$$

where $b = k - s$, subject to conditions (1) and (2). The function $\pi(s, p)$ is the expected second-period consumption of a borrower with saving s and business project p.

The return v to a representative worker (s, p) is equal to

$$v(s) = q + rs, \tag{4}$$

consisting of the income q plus the gross return rs on savings. In period 1, an agent chooses his period 1 consumption c_1, saving s, period 2 consumption c_2, and occupational decision δ to solve the following problem:[6]

$$\max U(c_1) + Ec_2, \tag{5}$$

subject to

$$Ec_2 = \delta\pi(s,p) + (1-\delta)v(s), \tag{6}$$

$$s = w - c_1, \tag{7}$$

$$\delta \in \{0,1\}. \tag{8}$$

Condition (6) says the second-period consumption depends on the agent's occupation, $\pi(s,p)$ for an entrepreneur and $v(s)$ for a worker. Condition (7) indicates that saving is the difference between an agent's asset endowment and his first-period consumption. Condition (8) restricts δ to be a binary variable that takes a value 1 when the agent chooses to be an entrepreneur in the second period and 0 when he chooses to be a worker.

Saving in period 1 is a solution to the following first-order condition:

$$U'(w-s) = \begin{cases} \pi_1(s,p) & \text{if } \pi(s,p) > v(s), \\ r & \text{otherwise.} \end{cases} \tag{9}$$

Figures 2 and 3 describe the determination of occupational choice for a given project and a given endowment of asset. The asset level is measured on the horizontal axis in Figure 2, the project success probability is measured

[6] Another way of writing an agent's problem is as follows:

$$\max_{\delta}\{U^w, U^e\},$$

where U^w is the utility of being a worker in the second period, and U^e is the utility of being an entrepreneur in the second period. The occupational decision is denoted by δ; it takes a value of 1 when $U^w < U^e$ and 0 otherwise. Moreover,

$$U^w = \max_{c_1,s,c_2} U(c_1) + E(c_2),$$

subject to

$$Ec_2 = v(s),$$

$$s = w - c_1.$$

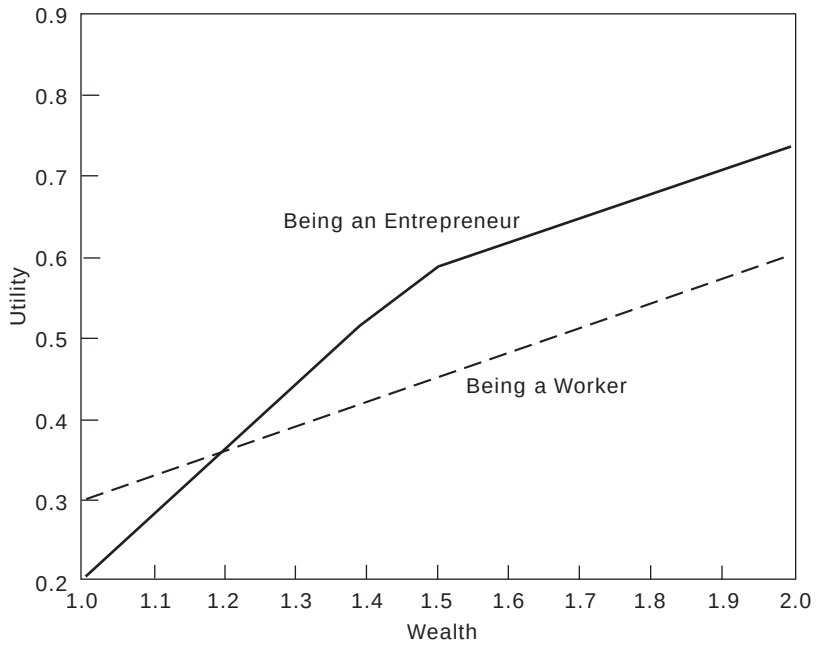
$$U^e = \max_{c_1,s,c_2} U(c_1) + E(c_2),$$

subject to

$$Ec_2 = \pi(s,p),$$

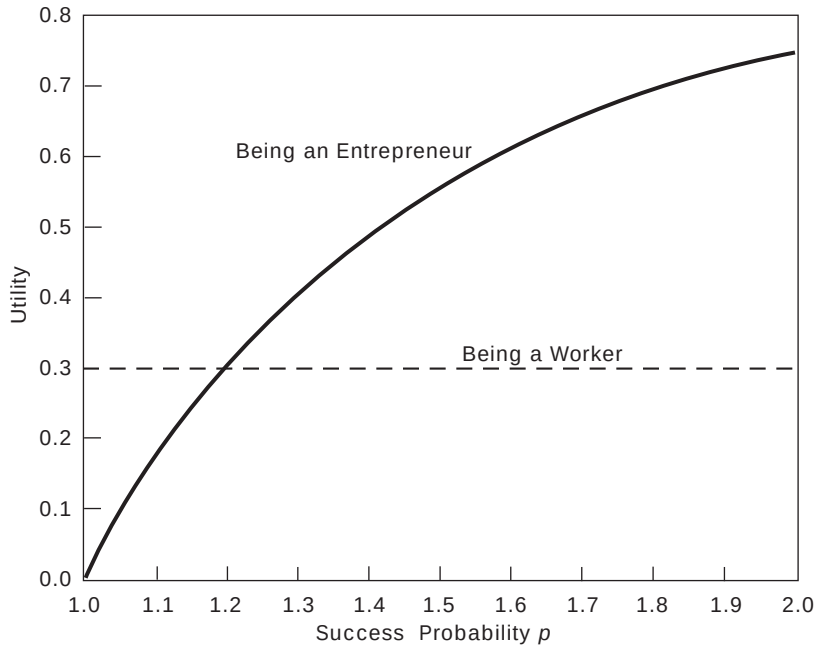
$$s = w - c_1.$$

Figure 2 Determination of Occupational Choice - I



on the horizontal axis in Figure 3. The utility of being either an entrepreneur or a worker is measured in the vertical axis of both figures. Note first that all entrepreneurs equate the marginal product of investment to the marginal cost of funds, which includes the monitoring cost associated with lending, i.e., $pf'(k) = r + (1 - p)\gamma$. Workers save additional wealth, so utility rises with wealth at rate r for workers. Entrepreneurs also save any additional wealth, and additional saving for this group reduces future borrowing needs, saving $r + (1 - p)\gamma$. This holds as long as saving is less than desired capital stock. If saving is greater than that, investment is self-financing, and extra wealth will first increase utility at rate $pf'(s)$ (which is less than $r + (1 - p)\gamma$), then r. Thus, there is a cutoff level of wealth, as shown in Figure 2, such that agents with wealth higher than the cutoff level will become entrepreneurs. It is clear from the profit function that entrepreneurs' utility increases with the quality of their business, while the utility of workers does not vary with their endowed project. Hence, as shown in Figure 3, there exists a cutoff level of business quality for each wealth level so that agents with projects above the cutoff level will become entrepreneurs. Results 1 and 2 summarize the analysis.

Figure 3 Determination of Occupational Choice - II



Result 1. Given a project, there is a threshold asset level such that agents with assets higher than the threshold will choose to undertake their projects.

Result 2. Given the asset endowment, there is a threshold probability of success such that agents whose projects have a higher probability of success become entrepreneurs.

The competitive equilibrium of this economy is defined as a resource allocation for workers and entrepreneurs together with an interest rate for which two conditions hold. First, agents maximize expected utility by choosing several decision variables, including their consumption in both periods, their saving in period 1, their occupational decisions and, in the case of entrepreneurs, their investment and loan size in period 2. Second, the market for capital clears, i.e.,

$$\int_p \int_w b(w,p)\delta(w,p)dG(w)d\Gamma(p) = \int_p \int_w \max\{s(w,p)-k,0\}\delta(w,p)dG(w)d\Gamma(p) + \int_p \int_w s(w,p)[1-\delta(w,p)]dG(w)d\Gamma(p), \quad (10)$$

where δ denotes the occupational choice. The left-hand side of (10) is demand for loans by entrepreneurs; the first term on the right-hand side is saving by entrepreneurs, and the second term is saving by workers. Agents' saving s, investment k, and occupational decision δ are all functions of their assets w and their project quality p.

The Case of the First Best without Information Asymmetry

We now briefly analyze the economy without information asymmetry in order to draw comparisons. Starting with period 2, in the absence of information asymmetry, the interest rate charged by intermediaries is equal to their cost of funds. Hence direct lending performs equally as well as financial intermediation, and there will also be no need for financial intermediaries. Agents face the same interest rate regardless of their asset holdings. The entrepreneurial decision will be determined solely by the quality of the business project. To see this, note that the profit function for an entrepreneur with saving s and success probability p is

$$\begin{aligned}\pi(s,p) &= \max_b \{pf(s+b) - rb\} \\ &= pf(k^*) - r(k^* - s), \end{aligned} \tag{11}$$

where k^* is the solution to the following first-order condition

$$pf'(k^*) = r.$$

The income for a worker with saving s and project p is

$$v(s) = rs + q.$$

It is clear that the difference between $\pi(s,p)$ and $v(s)$ is independent of s. Additional saving has the benefit of reducing required borrowing for the entrepreneur, which is worth r per unit in period 2. Rate r is the same as the rate of return that workers obtain on their savings. Therefore, greater initial wealth does not make entrepreneurship any more attractive than working.

The key difference between the economy with imperfect information and the economy examined here is that wealth enters into the decision rules of agents in the information-constrained economy. Private information reduces aggregate output in two ways. First, as Result 2 demonstrates, it is not always true that the most efficient projects are chosen. Some inefficient projects are carried out simply because the owners have higher internal funds, and some efficient projects are not activated because the owners have insufficient funds. Second, there is a social cost associated with monitoring. This cost does not accrue to any member of the economy and hence is viewed as a deadweight loss. The discussion of government policies in the credit market in the next section will be centered around these two dimensions. The first relates to the

extent of business activity in the economy, while the second is a measure of the transaction costs associated with financial intermediation.

3. GOVERNMENT CREDIT PROGRAMS

The government finances loans by borrowing from lenders at a competitive, risk-free interest rate. Correspondingly, it finances subsidies through imposition of an income tax, which we assume is a lump-sum levy.[7] The government has access to the same information and verification technology as the private financial intermediary, therefore, as shown earlier, government subsidies cannot be Pareto-improving. However, government subsidies and taxation do have distributive effects. We will focus on the use of government credit programs for redistributive purposes and will ask which programs are most efficient in channeling resources to the desired groups.

Direct Loans

Suppose the government institutes a direct loan program that is available to a subset of the population, identified by race or location. The targeted group otherwise has the same characteristics as the population as a whole and is a fraction μ of the general population. We assume that direct government loans will bear a below-market interest rate, and we denote the difference between this interest rate and that of the market rate by ε.[8] A lump-sum income tax τ is levied on all agents in order to finance the subsidy.

We examine the subsidized entrepreneurs first. It is convenient to consider the situation where the private financial intermediary administers all the loans and is compensated by the government for the amount of the loan subsidy. Using the same notation as before, in period 2 the break-even condition for the financial intermediary becomes

$$px = (r - \varepsilon)b + (1 - p)(\beta + \gamma b), \tag{12}$$

[7] There is another potential avenue for the government to finance its loans that is not captured by the model: the government can issue securities and require private financial intermediaries and households to hold a certain proportion of these securities. An increase in the number of government subsidies will then increase the amount of government securities that must be held by banks or by households. This increase in private agents' holding of government securities can in turn affect the behavior of households and private intermediaries. For example, the U.S. Farm Credit System has at least the implicit support of the U.S. government, permitting it to issue bonds at an interest rate only very slightly above Treasury security yields. Effectively, this support lowers the opportunity cost of funds to the lender. Interested readers can find related discussion in Fried (1983).

[8] In our setup, it does not matter whether entrepreneurs receive all their loans from the government at a below-market interest rate or only receive a fraction of their loans at a below-market interest rate. That is, the two cases are the same as long as the net subsidy is the same in both cases.

where εb is the direct loan subsidy. The profit function for a subsidized entrepreneur (s, p) is

$$\pi^s(s,p) = \max_b \{pf(b+s) - px\} \tag{13}$$

$$= \max_b \{pf(b+s) - (r-\varepsilon)b - (1-p)(\beta + \gamma b)\}. \tag{14}$$

An entrepreneur decides loan borrowing b according to

$$pf'(b+s) = r - \varepsilon + (1-p)\gamma. \tag{15}$$

Consider first the partial equilibrium effects of the direct loan program where the effect of the change of interest rate is not taken into account. Agents now borrow more and have a lower marginal productivity of capital.[9] Given our monitoring technology, this increases social cost in the sense that additional resources will be allocated to monitoring. The decrease in marginal productivity of capital is independent of the success probability of the project p.

Since profits are strictly increasing in the loan subsidy rate $\varepsilon\left(\frac{\partial \pi^s}{\partial \varepsilon} = b > 0\right)$, subsidized entrepreneurs will benefit. Moreover, it is the cash-poor entrepreneurs with good projects who benefit the most. The intuition is clear. The direct loan subsidy studied here is proportional to the amount of loans borrowed, and it is precisely those who are either poor or have a good business who need to borrow the most.

An unsubsidized entrepreneur's profit function remains the same as equation (3). We denote it by $\pi^u(s,p)$, where the superscript u stands for unsubsidized. A worker's income also remains the same as equation (4).

The agent's problem is now

$$\max U(c_1) + Ec_2, \tag{16}$$

subject to

$$Ec_2 = \delta[\xi\pi^s(s,p) + (1-\xi)\pi^u(s,p)] + (1-\delta)v(s), \tag{17}$$

$$s = w - c_1 - \tau, \tag{18}$$

$$\delta \in \{0,1\}, \tag{19}$$

where ξ is 1 if the agent belongs to the targeted group and 0 if not.

[9] We limit our attention to cases where $(1-p)\gamma \geq \varepsilon$. If the inequality is not satisfied, external funds will be more attractive than internal funds, and entrepreneurs will choose to deposit all their savings with the financial intermediary—an unrealistic situation.

The corresponding first-order condition that solves for saving is as follows:

$$U'(w-s-\tau)=\begin{cases}\frac{\partial \pi^{s}(s,p)}{\partial s}, & \text{subsidized entrepreneurs;}\\ \frac{\partial \pi^{u}(s,p)}{\partial s}, & \text{unsubsidized entrepreneurs;}\\ r, & \text{worker.}\end{cases} \tag{20}$$

The imposition of a lump-sum tax reduces the incentive to save for all agents in the economy, while the reduction in the marginal productivity of saving (and therefore of capital) further discourages subsidized entrepreneurs from saving. Taxation and public provision of the subsidy thus crowd out private saving. This reduction in private saving would further increase the demand for external funding and hence increase the monitoring cost associated with external finance in the event of failure. Moreover, loan subsidies give the targeted group an advantage over the nontargeted group: holding everything else the same, an agent belonging to the targeted group is more likely to become an entrepreneur. Therefore, some agents in the nontargeted group will be crowded out of entrepreneurship.

To summarize, the partial equilibrium analysis above indicates that on one hand a direct loan encourages cash-poor agents with good projects to carry out their projects. On the other hand, it creates an incentive for subsidized entrepreneurs to overinvest beyond the desired investment level; a disincentive for all agents, particularly entrepreneurs, to save; and a disincentive for unsubsidized agents to become entrepreneurs.

The competitive general equilibrium of this economy with government subsidy rate ε is easily defined. It is a resource allocation of workers, entrepreneurs, an interest rate, and a lump-sum tax rate τ that satisfies three conditions. First, agents choose their consumption in both period 1 and period 2; their savings in period 1; their occupational decisions and, in the case of entrepreneurs, their borrowing in period 2 to maximize the expected discounted utility from consumption. Second, the market for capital clears. Third, government balances its budget, i.e.,

$$\int_{p}\int_{w}\mu\varepsilon b(s,p)\delta(s,p)dG(w)d\Gamma(p)=\int_{p}\int_{w}\tau dG(w)d\Gamma(p), \tag{21}$$

the left-hand side represents government expenditure on direct loan subsidies, and the right-hand side represents government revenue from lump-sum tax.

The general equilibrium effect of direct loans from the government is more involved. The increase in loan demand and the decrease in private saving will drive the interest rate up, the increase in interest rate will have offsetting effects on savings and the demand for loans. Therefore, in equilibrium, the above partial equilibrium results will be lessened. Moreover, fewer unsubsidized entrepreneurs will choose to become entrepreneurs, and those that do will invest less in response to the increased interest rate, i.e., the government subsidy will

crowd out unsubsidized entrepreneurs and their investment. We summarize these findings in Result 3 and plot them in Figure 4. This figure shows how the population is divided into workers and entrepreneurs for the benchmark case and for the case of direct subsidies. In the benchmark model, the cutoff line for being an entrepreneur is downward sloping. Any agents above the cutoff line will become entrepreneurs, any below will be workers. Under direct loans, the cutoff line for the targeted group shifts downward and becomes steeper, reflecting that cash-poor entrepreneurs with good business prospects benefit the most from direct loans. For the nontargeted group, the cutoff line shifts upward, reflecting the crowding effect caused by the advantage that subsidized entrepreneurs have over the unsubsidized, along with the effect of taxation.

Result 3. Under direct loans from the government, subsidized entrepreneurs will for a given interest rate invest more in their projects, reducing their marginal return on capital. Entrepreneurs in the targeted group with few assets and good projects (low w and high p) benefit most from a direct loan subsidy. Savings for all agents decline, but savings for subsidized entrepreneurs decline even more. Unsubsidized entrepreneurs have less incentive to carry out their projects, hence some of them will be crowded out of entrepreneurship. These results are likely to be weakened in general equilibrium because the interest rate is higher.

Loan Guarantees

Now consider a government loan guarantee program. Motivated by SBA practices, we assume that the government guarantees a proportion η of each private loan made by targeted entrepreneurs. In other words, the private lender, in case of default, is guaranteed η percent of the loan payment. Again to facilitate comparison, we assume that only a fraction μ of the population are members of the targeted group.

We consider first the entrepreneurs who receive loan guarantees. Let x denote loan payment in the event of success. Then the break-even condition for the financial intermediary is

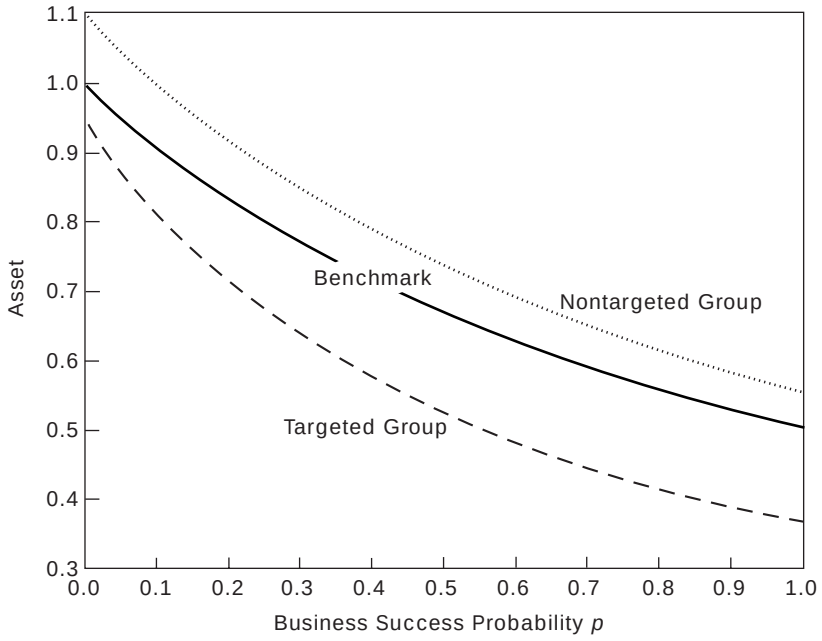
$$px + (1-p)\eta x = rb + (1-p)(\beta + \gamma b). \tag{22}$$

The corresponding profit function for a subsidized entrepreneur becomes

$$\begin{aligned}\pi^s(s,p) &= \max_b \{pf(b+s) - px\} \\ &= \max_b \{pf(b+s) - p[rb + (1-p)(\beta+\gamma b)]/[p + (1-p)\eta]\},\end{aligned} \tag{23}$$

where $x = \frac{rb+(1-p)(\beta+\gamma b)}{p+(1-p)\eta}$ by equation (22).

Figure 4 Determination of Occupational Choices under Direct Loans



Loan borrowing b is determined by the following equation, which requires the marginal productivity of capital to be equal to the marginal cost

$$pf'(b+s) = r + (1-p)\gamma - (1-p)\eta\frac{r+(1-p)\gamma}{p+(1-p)\eta}$$
$$= \frac{p[r+(1-p)\gamma]}{p+(1-p)\eta}. \tag{24}$$

Again, we will only study the case where agents weakly prefer internal funds to external funds even under loan guarantees. As in the case of direct loan programs, the marginal productivity of capital is smaller than the benchmark case. However, unlike direct loan programs, the difference $(1-p)\eta\frac{r+(1-p)\gamma}{p+(1-p)\eta}$ is a function of both the loan guarantee percentage and the success probability of the project. In fact, the difference decreases with p, implying that the investment behavior of agents with riskier projects is more distorted; that is, there is more overinvestment, compared with the benchmark economy.

To find out how loan guarantees affect entrepreneurs, we can examine the profit function of a typical subsidized entrepreneur $\pi^s(s,p)$,

$$\frac{\partial \pi^s}{\partial \eta} = (1-p)\frac{rb+(1-p)(\beta+\gamma b)}{p+(1-p)\eta} - (1-p)^2\eta\frac{rb+(1-p)(\beta+\gamma b)}{[p+(1-p)\eta]^2}$$

$$= (1-p)\frac{rb+(1-p)(\beta+\gamma b)}{[p+(1-p)\eta]^2}p > 0. \tag{25}$$

The derivative of expected utility with respect to the subsidy rate η is positive, indicating that all subsidized entrepreneurs benefit from the loan guarantee. To see which subsidized entrepreneurs benefit most, we can examine how the effect of the subsidy rate varies with saving and project quality.

$$\frac{\partial\left(\frac{\partial \pi^s}{\partial \eta}\right)}{\partial s} = \frac{\partial\left(\frac{\partial \pi^s}{\partial \eta}\right)}{\partial b}\frac{\partial b}{\partial s}$$

$$= -(1-p)\frac{r+(1-p)\gamma}{[p+(1-p)\eta]^2}\ p < 0, \tag{26}$$

$$\frac{\partial\left(\frac{\partial \pi^s}{\partial \eta}\right)}{\partial p} = -\{b[r+(1-p)\gamma]+(1-p)\beta\}\frac{p}{[p+(1-p)\eta]^2}$$

$$-(1-p)(b\gamma+\beta)\frac{p}{[p+(1-p)\eta]^2}$$

$$+(1-p)\{b[r+(1-p)\gamma]+(1-p)\beta\}\frac{\eta-p(1-\eta)}{[p+(1-p)\eta]^3}. \tag{27}$$

Intuitively, given that a fixed proportion of a loan is guaranteed in the event of failure, those who borrow more and/or have a higher probability of failure will benefit more from loan guarantees. This explains why those with low savings enjoy relatively more benefits. The effect of loan guarantees on an agent with a good project is determined by two forces. On the one hand, having a good project means borrowing more and hence being able to enjoy the benefits of large loan guarantees in the event of failure; on the other hand, a good project means a lower probability of failure and therefore less need for a loan guarantee. The first two terms on the right-hand side of equation (27) are negative, while the sign of the third one is ambiguous. Since $\frac{\partial\left(\frac{\partial \pi^s}{\partial \eta}\right)}{\partial p}|_{p=0} > 0$ in the neighborhood of $p = 0$, agents will benefit more if they have a higher probability of success. Conversely, $\frac{\partial\left(\frac{\partial \pi^s}{\partial \eta}\right)}{\partial p}|_{p=1} < 0$ indicates that, in the neighborhood of $p = 1$, agents with a lower probability of success will benefit more. These results suggest that a middle range of entrepreneurs benefits the most from the loan guarantees.

An unsubsidized entrepreneur has the same profit function and investment behavior as in the benchmark economy. We denote an unsubsidized entrepreneur's profit function by $\pi^u(s,p)$. The income of workers remains the same.

An agent's problem in period 1 is defined as follows:

$$\max U(c_1) + Ec_2, \tag{28}$$

subject to

$$Ec_2 = \delta[\xi\pi^s(s,p) + (1-\xi)\pi^u(s,p)] + (1-\delta)v(s), \tag{29}$$

$$s = w - c_1 - \tau, \tag{30}$$

$$\delta \in \{0,1\}, \tag{31}$$

where ξ takes a value of 1 if the agent belongs to the targeted group and 0 otherwise.

Agents in period 1 will determine their saving for period 2 so that the marginal gains from saving in the latter period equal the marginal cost of reduced consumption in the former one. Under loan guarantees, the marginal gains from saving are lower than in the benchmark economy, thus inducing subsidized entrepreneurs to reduce their savings. For unsubsidized entrepreneurs and workers, the lump-sum income tax acts to increase their marginal benefits of consumption in period 1; accordingly, under loan guarantees, unsubsidized entrepreneurs and workers will increase their consumption and reduce their savings. Moreover, unsubsidized entrepreneurs will receive less from their projects than their subsidized counterparts and as a result are likely to be crowded out of entrepreneurship.

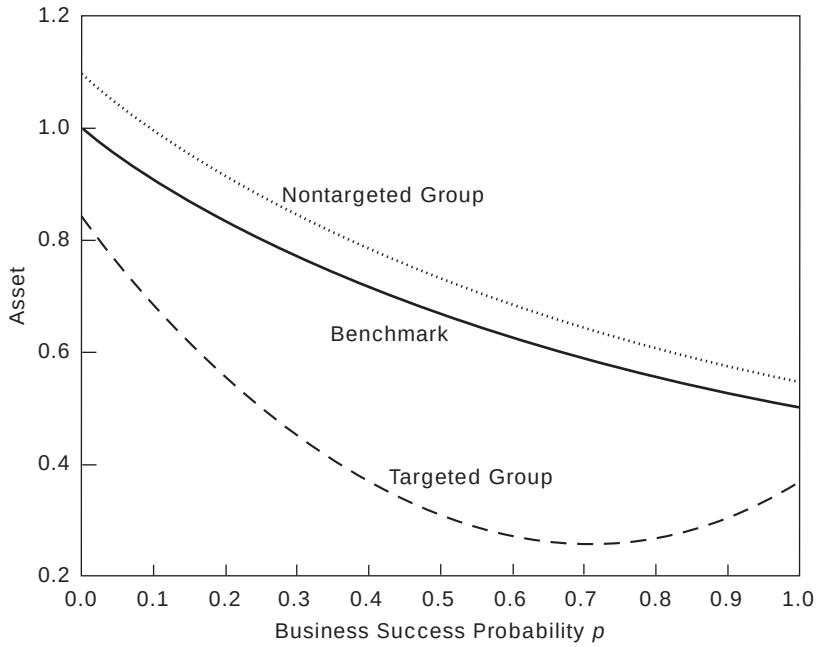
The competitive equilibrium can be defined similarly to that of an economy with direct loans with the government budget constraint being

$$\int_p \int_w \mu(1-p)\eta x(s,p)\delta(s,p)dG(w)d\Gamma(p) = \int_p \int_w \tau dG(w)d\Gamma(p), \tag{32}$$

where $\delta(s,p)$ is the indicator for occupational decision; it has a value of 1 for entrepreneurs and 0 for workers. The left-hand side is the government's expense to guarantee a fraction μ of entrepreneurs a portion η of their loans in the event of default, and the right-hand side is government revenue from the lump-sum tax.

In general equilibrium, the increased loan demand and decreased loan supply raise the equilibrium interest rate, in which case borrowing is more expensive for entrepreneurs and saving is more attractive for all agents. Consequently, the partial equilibrium results will be lessened. Moreover, unsubsidized entrepreneurs will reduce their investment in response to the higher interest rate. We summarize these findings in Result 4. Figure 5 describes the determination of occupational choices under loan guarantees. Agents above the cutoff lines

Figure 5 Determination of Occupational Choices under Loan Guarantees



become entrepreneurs, and those below become workers. Under loan guarantees, the cutoff line for targeted entrepreneurs shifts downward and becomes more convex, indicating that entrepreneurs with businesses of mediocre quality benefit the most from the loan guarantees; the cutoff line for nontargeted entrepreneurs shifts upward, reflecting the crowding out of unsubsidized entrepreneurs.

Result 4. With government loan guarantees, investment by subsidized entrepreneurs for a given interest rate is higher, and marginal returns to capital are lower, than in the benchmark economy by an amount that decreases with p. Poor entrepreneurs with mediocre projects (low w and medium p) benefit more than others from the loan guarantees. Private savings are lower, especially for entrepreneurs. The increase in the equilibrium interest rate in general equilibrium will lessen these results.

Grants

Instead of lending directly to entrepreneurs or providing investors with a guarantee on entrepreneurial loans, the government can offer targeted entrepreneurs

a grant of ϕ, payable at the end of the period and financed by lump-sum income tax τ. Added to firm profits, the grant would be available for investors. Again, we assume that the targeted group is a fraction μ of the population and that they share the same wealth and business quality characteristics as the general population.

For subsidized entrepreneurs in period 2, using the same notation as before, the loan payment x for an entrepreneur with saving s, project success probability p, and borrowing b satisfies the break-even condition

$$px = rb + (1-p)(\beta + \gamma b). \tag{33}$$

A subsidized entrepreneur (s,p) chooses b to maximize his profit function in the second period,

$$\begin{aligned}\pi^s(s,p) &= \max_b\{pf(s+b) + \phi - px\} \\ &= \max_b\{pf(s+b) + \phi - rb - (1-p)(\beta+\gamma b)\}.\end{aligned} \tag{34}$$

It is easy to see that the first-order condition that determines firms' investment is unchanged so that a grant does not alter an entrepreneur's investment choices. Additionally, from the first-order condition (9), a grant does not change an entrepreneur's saving decision in period 1 either.[10] However, it does increase an agent's incentive to become an entrepreneur since carrying out a risky activity is associated with a higher payoff now. Obviously, since $\frac{\partial \pi(s,p)}{\partial \phi} = 1$, the benefit is fixed for all entrepreneurs regardless of their assets and business projects.

The problem of an unsubsidized entrepreneur remains the same as in the benchmark economy. An agent's problem at period 1 is now

$$\max U(c_1) + Ec_2, \tag{35}$$

subject to

$$Ec_2 = \delta(\xi\pi^s(s,p) + (1-\xi)\pi^u(s,p)) + (1-\delta)v(s), \tag{36}$$

$$s = w - c_1 - \tau, \tag{37}$$

$$\delta \in \{0,1\}, \tag{38}$$

where δ is 1 if the agent chooses to be an entrepreneur in period 2 and 0 otherwise; ξ takes a value of 1 if the agent belongs to the targeted group and 0 otherwise.

The marginal gain from saving is unaffected by the grant. However, the marginal cost of saving at period 1 is increased by the imposition of a lump-sum

[10] As with direct loans and loan guarantees, the associated lump-sum income tax has a distortionary effect on agents' saving in period 1.

tax. Therefore, all agents will reduce their saving. The incentive to consume more in period 1 is smaller for grants than for those of direct loans and loan guarantees.

The definition of general equilibrium under grants is similar to the cases of direct loans and loan guarantees except for the government's budget constraint

$$\int_p \int_w \mu\phi\delta(w,p)dG(w)d\Gamma(p) = \int_p \int_w \tau dG(w)d\Gamma(p). \tag{39}$$

Here the left-hand side is the government's expense from giving out a fixed grant ϕ to targeted entrepreneurs, and the right-hand side is lump-sum tax revenue.

As with direct loans and loan guarantees, in general equilibrium increased loan demand and decreased loan supply drive up the interest rate, loan borrowing becomes more expensive and saving more attractive. The partial equilibrium results discussed will be lessened. These findings are summarized in Result 5. Figure 6, which depicts how grants affect agents' occupational choices, shows the asset-project success probability cutoff line shifting downward for the targeted group and upward for the nontargeted group.

Result 5. With grants, the investment behavior of subsidized entrepreneurs for a given interest rate is unaffected. All entrepreneurs benefit equally from the subsidies regardless of their asset holdings and project quality. Agents in period 1 will reduce their saving in response to the imposition of the lump-sum tax. These effects are reduced in general equilibrium due to the increase in the equilibrium interest rate.

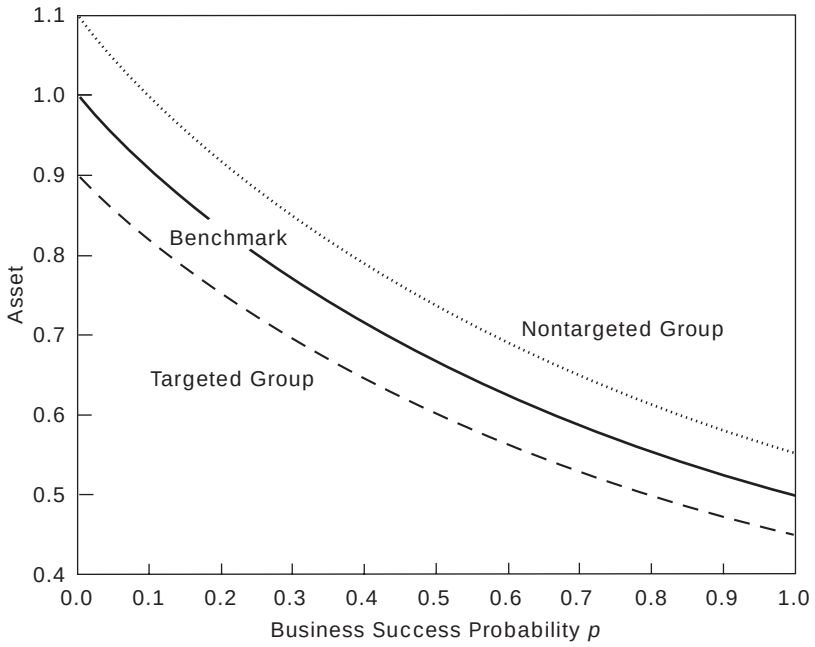
Our analysis, despite its partial equilibrium nature, provides some evidence on the direction and magnitude of the many channels through which agents are affected under different loan programs. First, along the investment margin, both direct loans and loan guarantees create incentives for entrepreneurs to overinvest (compared with the benchmark economy). The incentive is stronger for owners of poor projects under loan guarantees. Grants, on the contrary, do not alter investment behavior.

Second, with respect to risk-shifting, owners of good projects who are less wealthy benefit the most from direct loans. While poor agents do benefit more from loan guarantees, those with medium-quality projects benefit the most. Grants are nondiscriminatory; a fixed amount is assigned to all entrepreneurs.

Third, government subsidies in the form of direct loans and loan guarantees crowd out the saving of all agents in the economy, especially those of the entrepreneurs. Lump-sum income taxation reduces consumption in period 1 and hence increases the marginal utility of consumption in period 1. Moreover, it reduces savings for all agents under all loan programs.

To summarize, grants have the least distortionary effect, direct loans are capable of targeting efficient projects, and loan guarantees are more likely to

Figure 6 Determination of Occupational Choices under Grants



attract relatively riskier entrepreneurs. Since direct comparison of the general equilibrium impact of different government credit programs is not as transparent as that of partial equilibrium analysis, we now turn to numerical analysis for some insights.

4. A NUMERICAL EXAMPLE

This section reiterates the lessons of the previous analysis in general equilibrium by incorporating the effect of loan programs on the interest rate. These lessons are conducted by applying a hypothetical numerical example.

Before we launch our numerical analysis, note that all these forms of government subsidies shift loan demand outward, while lump-sum taxation shifts private loan supply inward so that in the new equilibrium, the interest rate will go up. This rise in the equilibrium interest rate offsets some of the benefits created by government subsidies for entrepreneurs, since loans are more expensive now. In contrast, the rise in the interest rate benefits workers who are disadvantaged by taxation.

Table 3 A Numerical Example

	Benchmark	Direct Loan	Guarantee	Grant
Entrepreneurs				
total	0.2204	0.2205	0.2207	0.2227[1]
targeted	0.0441	0.0463	0.0467	0.047[2]
nontargeted	0.1763	0.1742	0.1740	0.1753
Monitoring cost	0.02066	0.02073[3]	0.02081	0.02073[3]
Total output	0.64543	0.64611[4]	0.64542	0.64548
Cutoff w level				
targeted	1.2574	1.2433	1.2344	1.2336
nontargeted	1.2574	1.2610	1.2613	1.2592
Cutoff p level				
targeted	0.6379	0.6341	0.6316	0.6307
nontargeted	0.6379	0.6392	0.6392	0.6385
Average w for entrepreneurs	0.9715	0.9663[5]	0.9664	0.9668
Average p for entrepreneurs	0.7895	0.7898[6]	0.7896	0.7876

[1] most overall entrepreneurial activity
[2] most entrepreneurial activity within targeted group
[3] least monitoring cost
[4] most total output
[5] least average wealth for entrepreneurs
[6] highest average business quality for entrepreneurs

In our numerical example, the utility function is chosen to be of *log* form in the first period, and linear in the second period, i.e., $U(w,p) = \frac{c_1^{1-2.5}}{1-2.5} + 3c_2$. The wealth variable w is a random draw from a uniform distribution over the interval $[0.2, 1.6]$, in which the richest person with wealth 1.6 is 8 times richer than the poorest person having wealth 0.2. The success probability p of an agent's endowed project follows a uniform distribution over the domain $[0.3, 0.85]$. The production function takes the form $1.7k^{0.67}$. The fixed monitoring cost β is set to be 0.1, and the unit cost γ is 0.4. The wage that workers get from the outside option q is 0.4.

We fix the lump-sum tax to be 0.001 per person; the fraction of agents who are eligible for subsidies μ is 0.2. Then we study the different loan programs whose rates—ε for direct loans, η for loan guarantees, and ϕ for grants—are chosen so that the government balances its budget in equilibrium. Table 3 reports the results.

The results are consistent with our analysis in the previous section. One thing common with all three loan programs is that agents in the targeted group are helped at the cost of the agents in the nontargeted group. Though

entrepreneurial activity increases under all loan programs in the targeted group, it declines in the nontargeted group. The threshold levels of both wealth and project quality increase for the nontargeted agents.

When comparing direct loans and loan guarantee programs, we find that loan guarantees are better at promoting entrepreneurship at the cost of lower average business quality and higher bankruptcy cost. The reason is straightforward. As shown in Section 3, direct loan programs benefit poor agents with good projects the most. So these agents tend to borrow more and therefore require most of the subsidies. Under loan guarantees, however, entrepreneurs with few assets and mediocre projects benefit the most. The resulting benefits are somewhat more evenly distributed. For the same reason, under direct loans the average wealth of entrepreneurs is lower and the average quality of their projects is higher than under loan guarantees. Since entrepreneurs with low quality projects are more likely to bankrupt, the bankruptcy cost is higher under loan guarantees. These results survive different parameter specifications in our experiments.

Another interesting result is that grants seem to outperform loan guarantees in promoting entrepreneurship at lower monitoring cost. However, grants induce the lowest average business quality among all the programs and do not seem to help the poor. This has to do with the nondiscriminatory nature of grants.

5. CONCLUSION

Are loan guarantees the best way to channel assistance to targeted classes of borrowers? Our analysis of a credit market with asymmetric information indicates that grants are most effective at promoting entrepreneurship. Loan guarantees attract relatively riskier businesses with few assets. Direct loans do best at targeting cash-poor borrowers with good projects. Subsidized entrepreneurs overinvest under direct loans and loan guarantees.

All of the programs, especially direct loan and loan guarantee programs, discourage private saving. So why are loan guarantees so popular? Although there is no clear answer, it may be that differences in government budgetary accounting allow guarantees to be passed easily since loan guarantees often do not appear in the budget until a payment is made. Webb (1991) provides an excellent review and an estimate of the unfunded liabilities of the U.S. government budget. Another possibility, as suggested by the model, is that the benefits of guarantees spread more evenly over a broad set of agents than do the benefits of direct loan subsidization. This more equitable distribution of benefits perhaps appeals to the public's conception of fairness and therefore can help generate more political support for guarantees.

REFERENCES

Blanchflower, David G., and Andrew J. Oswald. "What Makes an Entrepreneur?" *Journal of Labor Economics,* vol. 16 (January 1998), pp. 26–60.

Bond, Philip, and Robert Townsend. "Formal and Informal Financing in a Chicago Ethnic Neighborhood," Federal Reserve Bank of Chicago *Economic Perspectives,* vol. 20 (July–August 1996), pp. 3–27.

Bureau of National Affairs, Inc. "Senate Small Business Panel Approves Hikes in Popular Small Business 7(a) Loan Program," *BNA's Banking Report,* vol. 69 (July 7, 1997), p. 17.

de Meza, David, and David C. Webb. "Too Much Investment: A Problem of Asymmetric Information," *Quarterly Journal of Economics,* vol. 102 (May 1987), pp. 281–92.

Evans, David S., and Boyan Jovanovic. "An Estimated Model of Entrepreneurial Choice under Liquidity Constraints," *Journal of Political Economy,* vol. 97 (August 1989), pp. 808–27.

Evans, David S., and Linda S. Leighton. "Some Empirical Aspects of Entrepreneurship," *American Economic Review,* vol. 79 (June 1989), pp. 519–35.

Fried, Joel. "Government Loan and Guarantee Programs," Federal Reserve Bank of St. Louis *Review,* vol. 65 (December 1983), pp. 22–30.

Gale, Douglas, and Martin Hellwig. "Incentive-Compatible Debt Contracts: The One-Period Problem," *The Review of Economic Studies,* vol. 52 (October 1985), pp. 647–64.

Gale, William G. "Economic Effects of Federal Credit Programs," *American Economic Review,* vol. 81 (March 1991), pp. 133–52.

Haynes, George W. "Credit Access for High-Risk Borrowers in Financially Concentrated Markets: Do SBA Loan Guarantees Help?" *Small Business Economics,* vol. 8 (December 1996), pp. 449–61.

Holtz-Eakin, David, Douglas Joulfaian, and Harvey S. Rosen. "Entrepreneurial Decisions and Liquidity Constraints," *Rand Journal of Economics,* vol. 25 (Summer 1994), pp. 334– 47.

Innes, Robert. "Investment and Governmental Intervention in Credit Markets When There Is Asymmetric Information," *Journal of Public Economics,* vol. 46 (December 1991), pp. 347–81.

Lacker, Jeffrey M. "Does Adverse Selection Justify Government Intervention in Loan Markets?" Federal Reserve Bank of Richmond *Economic Quarterly,* vol. 80 (Winter 1994), pp. 61–95.

Office of Management and Budget. "Analytical Perspectives," *Budget of The United States Government, Fiscal Year 1996*. Washington: Government Printing Office, 1996.

Townsend, Robert M. "Optimal Contracts and Competitive Markets with Costly State Verification," *Journal of Economic Theory*, vol. 21 (October 1979), pp. 265–93.

Webb, Roy H. "The Stealth Budget: Unfunded Liabilities of the Federal Government," Federal Reserve Bank of Richmond *Economic Review*, vol. 77 (May/June 1991), pp. 23–33.