Asymmetric Information and Credit Market Failures

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Introduction

The continuous success of every economy is dependent on its encouragement of new innovations and entrepreneurships and thus its assurance on constant economic growth. To achieve this, economies must have the capability of investing in and funding new ideas regularly. This ability is contingent on the existence of efficient credit markets. In efficient credit markets, all projects which are socially profitable and seek funding are financed appropriately based on their characteristics. In reality, credit markets are highly distorted and inefficient. These distortions are due, among other things, to the existence of asymmetric information between lenders and borrowers.

Entrepreneurs often have incentives to convey incomplete information about themselves or their projects' characteristics to banks or other financiers. Also, banks do not have the ability to observe or verify this information. As a result, information asymmetry exists. This information asymmetry leads banks to either under-invest in low risk, high return projects or over-invest in high risk, low return projects. Also, in the process of credit allocation, some entrepreneurs may be denied funding or given funding less than what they initially asked for, even when they are willing to borrow at a higher interest rate or put up larger collateral; thus credit may be rationed. As a result, there is either investment in excess or shortage of socially efficient level. The socially efficient level would generally be achieved under full information, when both sides of transaction (i.e. banks and entrepreneurs) have full information about each others' characteristics and actions as well as about each others' total benefits and total costs of the transaction.

This literature review focuses on the nature of asymmetric information in credit markets and different types of inefficiencies caused by information asymmetry, namely

underinvestment, overinvestment and credit rationing. Throughout, it considers different public policies that can potentially improve efficiency in particular circumstances. The potential role for government in the economy and the design of the prospective policies are affected by the different types of credit market inefficiencies. We will see that policy intervention may be welfare-improving, even though the government is subject to the same information asymmetries as financial institutions. It is not possible to determine unambiguously whether policy should encourage or discourage credit. In general, this depends on the particular context considered.

When the amount of capital required to start-up a project is larger than entrepreneurs' initial wealth, there is a need for external financing. There are different ways of financing the remaining amount of required capital, such as debt and equity financing. We will examine how the presence of different financing methods affects inefficiencies in the market.

In order to alleviate the extent of information asymmetries; banks use different screening criteria to distinguish between projects and provide different projects with the most suitable contracts. The various mechanisms that banks use will also be discussed, as well as some of the welfare implications of these mechanisms.

Venture capital has received considerable attention recently in the credit market literature. Venture capital is often seen as a private solution to problems of asymmetric information. In contrast to banks, venture capital firms typically have specialized knowledge and expertise that allows them to better evaluate, screen and monitor projects. The particular ways in which they can overcome information asymmetries, to some extent, will be discussed.

At the end of this literature review, the empirical evidence section illustrates the theory of asymmetric information and its effect on credit markets by using some country specific examples.

Asymmetric Information, Credit Market Failure, and Policy Implications

Asymmetric Information:

An optimal decision is always made by utilizing full information. Using incomplete information results in decisions with adverse consequences. In every market, these adverse consequences leads to inefficient markets and credit markets are no exceptions.

In credit markets, entrepreneurs with good projects tend to relay necessary information about themselves and their projects' characteristics to banks in order to qualify for the most appropriate terms of financing. However, entrepreneurs with bad projects tend to conceal the necessary information banks need to screen projects. They do that in order to manipulate banks' inabilities to identify and observe the actual quality of their projects and thus qualify for financing. As a result, incomplete or asymmetric information is apparent in credit markets.

Information asymmetry exists when financiers or banks are not able to observe all the relevant information about the risk level of entrepreneurs' projects as well as different characteristics of entrepreneurs such as their level of ability, effort and wealth. Since actions taken by entrepreneurs are not verifiable and observable by banks, they lead to information asymmetry as well.

Asymmetric information leads to two types of problems (Boadway and Sato, 1999). One type is associated with the characteristics of entrepreneurs, where incomplete information leads to adverse. That is, banks choose unsuitable projects to fund. The other type is associated with the actions taken by the entrepreneurs, which leads to the problem of moral hazard. This problem takes many forms. Entrepreneurs can choose to exert different amount of effort on their projects under various circumstances. Also, entrepreneurs tend to choose higher risk projects that yield higher returns if successful instead of choosing a risk level that has a higher probability of success. As well, entrepreneurs who are endowed with a large initial wealth might not use their wealth to self-finance their projects and they request more loans than they need.

Since banks incur a cost from financing unsuitable projects such as cost of forgone credits that are not paid back by the entrepreneurs who default, they need to adopt different screening criterions to be able to distinguish between projects. In reality, the credit market is a complex environment and banks may not be able to discover all relevant information on projects through different screening criteria, which tends to lower social efficiency. That is why the existence of asymmetric information induces government intervention. Even though the government is not at an advantage in terms of having more and better knowledge about the characteristics of entrepreneurs and their projects compared to banks, it can still come up with policies that are welfare improving (Gale, 1990b).

Banks may not choose to devote the socially optimal amount of resources for the purpose of acquiring information about the characteristics of entrepreneurs or about the industry-wide characteristics that are relevant to their financing decisions. That may be

the case if there are information spillovers between banks. This may occur if for example, banks' decisions to whether offer funding contracts to particular entrepreneurs or not, implicitly reveal information to the market about their characteristics. In that case, banks will have some incentives to free-ride on the information acquisition efforts of other banks. As a result, government can invest in the most straightforward policy option, public acquisition of information (Boadway and Sato, 1999). Here, governments can thrive to acquire information on aggregate risks of entrepreneurs and their projects. However, government may not have the necessary skills to investigate this issue. Thus, governments may alternatively act as "coordinating agencies" and bring together the banks in the investigation of the industries and project-based risks.

Credit Market Failures:

As was mentioned earlier, existence of asymmetric information causes credit market failures and inefficiencies. These inefficiencies lead to different outcomes. One outcome is underinvestment in good or low risk projects and the other is overinvestment in poor or high risk projects in comparison to the socially optimal level. Another outcome is credit rationing, which takes place throughout the process of credit allocation. The types of inefficiencies are of an importance to policy makers, since they affect the potential policies that can be used in order to achieve social efficiency.

Credit rationing occurs when from a pool of entrepreneurs with the same characteristics, some receive financing and some are denied, even though they are willing to borrow at higher interest rates or put up more collateral than is required. Also, credit rationing can occur when banks supply a smaller loan size than is demanded by entrepreneurs at a given interest rate (Jaffee ad Russell, 1976).

The different outcomes of inefficiencies are contingent on different factors. Credit rationing outcome is dependent on the equilibrium interest rate. In addition to the equilibrium level of interest rate, underinvestment and overinvestment are conditional on the different characteristics or parameters of projects as well.

When the equilibrium interest rate is below the market clearing rate, where demand for credit equals supply of credit, there is credit rationing. This interest rate is considered the equilibrium interest rate, because any loans at an interest rate higher than the equilibrium rate are considered risky by banks. Banks draw this conclusion, since they have access to asymmetric information on each project (Stigltiz and Weiss, 1981).

If a risk neutral entrepreneur is indifferent between two projects at higher interest rates, an increase in interest rate induces the entrepreneur to choose the project with lower probability of success and higher payoffs when successful and this leads to an adverse selection problem. Since these actions are not in the interest of banks, they have more reasons to ration credit. As a result, banks end up rejecting the loan request of some entrepreneurs with worthy projects; otherwise, there is a decline in banks' profits due to higher probability of defaults (Stiglitz and Weiss, 1981).

The increase in interest rate attracts riskier projects into the pool of projects that require financing and this is not beneficial. Therefore, this sets an upper limit for the interest rate below the market interest rate. As a result, in presence of excess demand, banks do not increase the interest rate beyond that limit and this causes credit rationing in the equilibrium (De Meza and Webb, 1999).

Thus, we can conclude that the problem with credit rationing is the level of equilibrium interest rate and all policies have to aim at correcting this interest rate level in

order to increase efficiency. One way is to subsidize lending and the interest rate paid on deposits (De Meza and Webb, 2000). Subsidizing increases the volume of lending which alleviates the level of credit rationed. However, this policy is not the most effective one, because it does not improve the composition of the pool of entrepreneurs who request credit.

As we mentioned earlier, whether the credit market equilibrium entails underinvestment and overinvestment or not, depends on the characteristics of the pool of funded projects as well as the interest rate charged by banks. Generally speaking, in the social optimum, all projects for which the expected social return is at least as large as the expected social costs are funded and undertaken. Private markets achieve this outcome if all participants have perfect information. Banks will choose their interest rates conditional on the characteristics of entrepreneurs in order to maximize profits, and competition between banks will drive banks' profits to zero. In equilibrium, the projects of marginal entrepreneurs, the ones who are indifferent between investing in a safe asset or in the project itself, will be such that social marginal benefits equal social marginal costs.

However, under asymmetric information, banks cannot make the funding contracts conditional on the characteristics of entrepreneurs, and are forced to offer a single interest rate for all projects. Competition between banks will insure that banks' profits are driven to zero and that will determine the pooling equilibrium interest rate. In turn, the equilibrium interest rate will determine which entrepreneurs will choose to apply for a loan. Inefficiency arises because, in general, the pool of entrepreneurs that apply for funding will be different from the pool of entrepreneurs that are funded in the social

optimum. The marginal project in the pooling equilibrium under asymmetric information will be such that the expected private marginal benefit equals the expected private marginal costs, both of which differ from the social ones, since the banks capture part of the expected benefits and support part of the expected costs.

More specifically, the equilibrium interest rate, r*, is the optimal rate at which banks maximize their expected return (Stiglitz and Weiss, 1981). At the pooling equilibrium, competition between banks insures that the interest rate, r*, is set between the interest rate at which the low risk entrepreneurs are willing to borrow (r_L) and the interest rate at which the high risk entrepreneurs are willing to borrow (r_H); that is: $r_L < r^* < r_H$. There would be excess demand for loans at r_L, because all low risk and high risk entrepreneurs are interested to borrow at this rate. Also, there would be excess supply of funds at r_H, because only high risk entrepreneurs are willing to borrow at this level.

To see how we might get underinvestment in equilibrium, consider an environment where all potential projects have the same expected return but have different probabilities of success. Since the banks support part of the cost in the case of bankruptcy, the expected return of entrepreneurs, net of expected interest payments will be higher for high risk projects. As a result, at the competitive pooling equilibrium interest rate, r*, we can get underinvestment because the relatively low risk entrepreneurs may opt out of the market even if the expected social return on their project is positive. The reason is that at this pooling interest rate low risk entrepreneurs cannot afford to borrow, because the expected cost of borrowing is higher for them since they are more likely to make full repayments to the banks. Thus, they drop out of the pool faster, because of their lower expected return. To prevent this type of entrepreneur from

dropping out of the pool, government can offer easier terms of contract through public credit programs (Gale, 1990a). These terms typically consist of interest rates, collateral requirements, longer maturity dates and grace periods than what banks offer. As a result, the entrepreneurs end up making lower payments relative to what they would have paid to banks and thus they can remain in the pool.

However, since the pooling interest rate is generally lower than the r_H at which high risk entrepreneurs can afford to borrow, banks attract high risk individuals to request funding. As a result, banks end up underinvesting in low risk projects and overinvesting in high risk projects. In other words, when expected returns of the projects are observable but their riskiness is not, banks tend to underinvest in low risk and/or high return projects. Due to underinvestment, too few projects of a given return are funded (Stiglitz and Weiss, 1981). Also, when expected returns of the projects if successful are known but their probability of success is unknown, banks tend to overinvest in high risk and/or low return projects (De Meza and Webb, 1987). The existence of asymmetric information makes good projects draw in bad ones into the market. Therefore, too many of these projects are funded which leads to overinvestment.

If the pooling equilibrium interest rate is below r_L, banks do not maximize profits. Therefore, they do not set the interest rate at this level. If the pooling equilibrium interest rate is above r_H, all entrepreneurs including low and high risk opt out of the pool. At this level of interest rate, banks end up with excess supply of credit and they cannot attract any borrowers (Stiglitz and Weiss, 1981).

Thus, in order to eliminate underinvestment in low risk and/or high return projects and overinvestment in high risk and/or low return projects, banks need to offer separating

equilibrium interest rate where they offer different interest rates to entrepreneurs with various characteristics and projects. That is, banks need to offer a menu of contracts to entrepreneurs with different terms. Then entrepreneurs can choose the contract that suits them and their projects the most. However, in order to do this, banks need to be able to observe at least some characteristics of entrepreneurs and their projects. We discuss this matter in the third section under "What Banks Can Do?"

The pooling equilibrium interest rate, r*, is adequate for the average risk projects and thus there is cross-subsidization, where at equilibrium the low risk projects implicitly subsidize the high risk projects. Hence, there is a need for a subsidy on loans in order to reduce the additional costs resulting from the informational asymmetry and as a result decrease the underinvestment problem (Neyer, 2004). However, subsidizing the projects with higher than average probability of success is hard to implement since the probability of success is not observable (Boadway and Keen, 2005).

Another policy option to partly correct informational externality is loan guarantees (Boadway and Sato, 1999). Through loan guarantees, government compensates banks for the losses they incur from entrepreneurs who default. This policy addresses the underinvestment problem, where banks are hesitant to invest in good projects due to their probabilities of default. However, loan guarantees can give incentives to banks to take chances on certain projects. In order to implement this policy, government must be able to verify the success or failure of each of these entrepreneurs. This is to prevent banks from cheating and giving false reports to the government. Thus, this policy has moral hazard problems engraved in it. Loan guarantees induce the interest

rate for the bad projects to fall below the optimal level and thus it is not an optimal policy.

With investment subsidies, government subsidizes entrepreneurs' investments rather than giving loan guarantees to the banks in case of a default by an entrepreneur (Boadway and Sato, 1999). However, it is not clear whether this policy is more efficient than loan guarantees or not. At any given interest rate, the investment subsidy increases the demand of entrepreneurs for capital.

As was mentioned earlier, overinvestment occurs when the proportion of entrepreneurs, who ask for credit and have high risk and/or low return projects, is very high (De Meza and Webb, 2000). Therefore, banks over lend to low return projects (De Meza and Webb, 1999). Thus, there is a need for tax on loans or interest income in order to maintain social efficiency. Like the underinvestment results of Stiglitz and Weiss (1981) model, in this model, better projects implicitly subsidize the poor ones in equilibrium. However, taxing the projects with lower than average probability of success is difficult to execute, because the probability of success is not observable (Boadway and Keen, 2005).

Generally speaking, policies must ensure more low risk and/or high return entrepreneurs and less high risk and/or low return entrepreneurs apply for credit. In order to discourage the low return projects or high risk entrepreneurs from requesting financing, government can raise the return to alternative activities (De Meza and Webb, 2000). Government can make the alternatives to borrowing more attractive than subsidizing lending by eliminating tax advantages to self employment over some ranges. This policy entails problems of administration and monitoring.

Another alternative is that government can subsidize the non entrepreneurs (De Meza, 2002). This disencourages the low return projects or low ability entrepreneurs from seeking financing. However, this is not the best policy. Thus, it is better to increase bankruptcy penalties to discourage the high risk entrepreneurs from undertaking their projects. Governments can also influence the pool of entrepreneurs by regulating the entry to loan markets through chartering laws as well (Jaffee and Russell, 1976).

Financing Methods: Debt vs. Equity

Entrepreneurs are endowed with some amount of initial wealth (W). If the initial capital (K) necessary for starting up the projects is larger than the initial wealth (i.e. $W<K$), then there is a need for outside financing. The value of outside financing is equal to the gap between the initial wealth and the required capital (i.e. $F=K-W$). The way that this gap is financed is of crucial importance. In the literature two types of financing have been mentioned: debt financing and equity financing (Boadway and Keen, 2003). Each financing method pertains to the level of riskiness of each project. If the method of financing is chosen based on the characteristics of the entrepreneurs and their projects, then the inefficiencies in the market diminish.

As it was mentioned earlier, the problem of inefficient credit markets arises from the existent of asymmetric information on characteristics of the pool of entrepreneurs who ask for financing. Usually, this pool consists of many high risk entrepreneurs and low return projects and a few low risk entrepreneurs and high return projects. As a result, underinvestment and overinvestment in unsuitable projects take place. In order to alleviate the extent of inefficient results, it is better to let entrepreneurs endogenously choose the method of financing themselves rather than banks assigning it to them. The

reason is that they have full information on their own characteristics as well as the attributes of their own projects and thus they can make a more informed choice than banks can do for them. The choice of financing method by entrepreneurs may in fact convey some information to financial institutions about the characteristics of entrepreneurs. The structure of information affects the financing method that entrepreneurs choose. Entrepreneurs with good projects try to choose the financing method that signals their characteristics to the banks (De Meza and Webb, 1987).

Debt financing entails banks to provide credit to entrepreneurs in the hope that they pay them back the full amount. Thus, moral hazard and default risks are the drawbacks of debt financing. Debt contracts are often used when expected returns of the projects if successful are known but their probability of success is unknown. That is banks tend to use debt contracts when there is overinvestment in high risk and/or low return projects. Specifically, debt contracts favour high risk projects (De Meza, 2002), because of large debt payments that high risk entrepreneurs have to make to the banks. As a result, this gets rid of some of the high risk entrepreneurs and eliminates the problem of overinvestment in high risk and/or low return projects.

Debt contracts are the optimal method of financing if projects with the same return can be grouped together. With debt contracts, low risk entrepreneurs contribute the most to the banks' profits (De Meza, 2002). Since entrepreneurs who choose debt contracts do not accrue any cost if they go bankrupt, as a result, they choose riskier projects than socially optimal levels at the expense of higher expected returns and this leads to problem of moral hazard (Boadway and Tremblay, 2003).

In case of a debt contract, an entrepreneur is usually monitored only if he declares bankruptcy or if he pays back the loan partially. They are typically not monitored ex ante, because monitoring is costly (Boadway and Tremblay, 2003).

Equity financing involves banks providing loans to entrepreneurs in exchange for receiving a share of the projects' return. When expected returns of the projects are observable but their riskiness is not, equity financing is a better mode of financing than debt financing because equity financing does not discriminate against low risk entrepreneurs (De Meza, 2002). Banks favour low risk entrepreneurs under equity financing, because they have higher probability of success. Equity contracts attract low risk types on profitable terms and as a result a fully efficient equilibrium appears and thus underinvestment is eliminated (De Meza, 2002).

Also, since the expected net profit of an entrepreneur is increasing in the expected return, then the ones with higher expected returns adopt this method of financing. Thus, we can make the equity contract conditional on expected return. In order to adopt equity contracts as a method of financing, it must be possible to observe returns ex post (Boadway and Keen, 2003). The distribution of probability of success determines which projects are financed by equity contracts (Boadway and Keen, 2005).

The choice between debt and equity financing can be made endogenous if the returns are observable ex post (Boadway and Tremblay, 2003). Competition among banks can determine how projects are financed. Intuitively, projects with high return and low probability of success are debt financed. The reason behind this is that all the benefits of the projects accrue to entrepreneurs; that is entrepreneurs can default on the loan at banks' expense. Also, the ones with low return and high probability of success

are equity financed. This is due to the fact that under these circumstances, entrepreneurs have a low probability of default and thus they can pay a share of their low expected return to the banks. As a result, mostly entrepreneurs benefit from choosing equity financing, since they do not have to pay a large amount to the banks (Boadway and Keen, 2003). As a result, there is overinvestment in both types of projects. In this situation, government can impose a progressive tax system on the ex post return. That is, as expected return increases the amount of tax increases. This policy improves efficiency but it is hard to implement (Boadway and Keen, 2003).

What Can Banks Do?

Banks incur costs because of asymmetric information. This is due to the fact that asymmetric information leads banks to finance unsuitable projects and/or refuse to finance suitable ones. Some of these projects end up going bankrupt and banks have to incur the losses of their forgone supplied credit.

It is natural that entrepreneurs with good projects try to convey as much information as possible to banks in order to get the most suitable way of financing. Conversely, entrepreneurs with bad projects try to hide as much information as possible from banks, in order to take advantage of banks' inability to determine the actual quality of their projects and qualify for financing. The onus is, therefore, on banks to adopt various screening criteria that induce entrepreneurs to reveal as much information as possible about the quality of their projects and their own characteristics (Stiglitz and Weiss, 1981).

Banks should set the terms of contracts in a way that entrepreneurs can select the contract that is most suitable for them and as a result take actions in the interest of both

parties and give less incentive to the entrepreneurs with bad projects to request loans. Under these contracts, asymmetric information is revealed in equilibrium (Hellmann and Stiglitz, 2000).

Also, in order to eliminate underinvestment in low risk and/or high return projects and overinvestment in high risk and/or low return projects, banks need to offer separating equilibrium interest rates where they offer different rates to entrepreneurs with various characteristics and projects.

Normally, each bank specializes in one sort of financing method (Hellmann and Stiglitz, 2000). In practice banks use certain financial agreements in order to deal with the problem of asymmetric information. For instance, some commercial banks use favourable terms for large amounts of deposits in order to screen the low profit projects (Ueda, 2000). Banks can add other non-price terms such as down payment requirements to the contracts to deal with information asymmetry (Jaffee and Russell, 1976).

The criteria that banks use to gather as much information as possible about entrepreneurs and their projects as well as to offer separating contracts are as follows: maximum self-finance requirement, entrepreneur's choice of financing, size of entrepreneurs' personal wealth and social group they belong to, user charges, stage financing, size of loan requested by entrepreneurs, the interest rate they are willing to pay on the loan, collateral requirements as well as capital structure. There are other criteria that can be used as risk screens such as income and age. These criteria let banks to identify and affect the default behaviour of the distinguishable group (Jaffee and Russell, 1976). Also, if the menu of contracts is chosen appropriately, banks can identify the characteristics of the entrepreneurs.

The discussion below describes each of these criterions as well as their impact on credit market failures.

Maximum Self-Finance Requirement:

Ideally, banks prefer to base the terms of contracts on probability of success of entrepreneurs and/or projects, which is not observable. In practice, banks are able to observe the wealth level of entrepreneurs to some extent. Therefore, they can use the wealth level as the basis of the contracts. This leads us to one screening criterion called maximum self-finance requirement, which banks can use as part of their contracts (Stiglitz and Weiss, 1981). That is, entrepreneurs with higher than average success probability must finance as much of the project as possible themselves by investing their initial endowment of wealth and raise outside funds if necessary. This is due to the fact that they can finance themselves on better terms than banks and avoid the cost of borrowing (De Meza and Webb, 1987). Usually, the deposit rate earned if they invest their initial wealth is lower than the interest rate they have to pay if they borrow. Thus the opportunity cost of using their own initial wealth is lower than borrowing from banks.

If entrepreneurs fail to put up their initial wealth as part of financing, this would signal to the banks that their projects are worse than average and thus can be disqualified from receiving loans. Maximum self-finance decreases the amount of debt repayment and as a result decreases the deadweight cost of excessive risk taking (De Meza and Webb, 1999).

Since this method discloses some information about the capability of entrepreneurs and the way they perceive their own projects, it helps banks to choose more

suitable projects to fund. This has a positive impact on credit markets by reducing the extent of inefficiencies.

Entrepreneurs' Choice of Financing:

Another way of screening projects is through a self-selection process such as entrepreneurs' choice of financing (Hellmann and Stiglitz, 2000). For a given expected return, banks perceive the projects choosing equity financing as the ones with lower success probability and the ones choosing debt financing as the ones with higher than average success probability. Again, this method helps banks finance the suitable projects and as a result improves credit market efficiency.

Size of Personal Wealth and Social Group:

Banks can determine the type of entrepreneurs by evaluating the size of their personal wealth and the social group they belong to (De Meza, 2002). Usually, poor individuals and the ones who belong to a lower social class are denied access to capital markets. This is because their default rate is high and denying access to capital markets to these individuals increases the efficiency of credit markets. Thus, determining the size of personal wealth and the social group of entrepreneurs reduces the amount of informational externalities.

User Charges:

One way to complicate the form of contracts is user charges (Boadway and Sato, 1999). These charges are fixed amounts that banks acquire from entrepreneurs up front to recover part of the evaluation costs. Evaluation costs pertain to the costs of assessing entrepreneurs and their projects. When entrepreneurs refuse to accept user charges as part of the contracts, this indicates that their probability of default is high. User charges

increase efficiency in credit markets, because banks are able to recover some costs of financing in case some entrepreneurs default on their loans. Also, user charges influence the selection process, where entrepreneurs choose the type of user charge that suits their project the most and this signals to banks their characteristics and the nature of their projects. As a result, informational externalities diminish.

Stage Financing:

Another method of screening projects is to stage financing (Ueda, 2000). That is, banks can initially give a portion of total funding at a lower interest rate and give the remaining portion at a higher interest rate at a later date. The entrepreneurs with projects that are high in expected returns are confident in the outcome of their projects. These entrepreneurs do not mind the increase in interest rate later on and they continue borrowing. However, the ones with projects that have low expected returns do not want to borrow at a higher rate at a later date, because they are aware of their projects' poor outcome. As a result, they avoid this type of borrowing. This criterion has an unclear effect on efficiency, since banks are not covered if the entrepreneurs who choose stage financing go bankrupt. This criterion helps reduce the adverse selection problem to a certain extent.

Size of the Loan:

Banks can use the amount of loan requested as another screening criterion (Stiglitz and Weiss, 1981). When the expected returns of projects are known but the riskiness of them is not, the amount of loan is positively proportional to the probability of default of entrepreneurs. More loans taken by entrepreneurs signal their inability of repayments. The reason is that risky entrepreneurs do not have anything to lose if they

go bankrupt; thus, they are not afraid of taking on large loan sizes. Using this mechanism to separate contracts may result in an efficient number of projects funded; however, inefficiency exists in the size of projects. This inefficiency can be mitigated by imposing a tax on loans, because the tax is an additional cost of borrowing for the entrepreneurs (Boadway and Keen, 2003). As a result, entrepreneurs only request the amount of loan that is necessary for their projects. One disadvantage associated with using this separating mechanism is that it distorts the optimal use of capital for some entrepreneurs. However, size of loan can be used along side with interest rate banks charge in order to separate contracts.

Interest Rate Charged:

The interest rate that entrepreneurs are willing to pay affects their behaviour and thus can be used as a screening device (Stiglitz and Weiss, 1981). Entrepreneurs who have projects with higher risks and probability of failure are the ones willing to pay higher interest rates, even more than the bank's rate, in order to receive loans. The reason is that they have a high probability of default. These high risk projects with high probability of default lower banks' profits. Thus, banks must ensure that they do not lend money to these types.

Lower interest rates, on the other hand, attract more entrepreneurs and banks can make larger expected profits from each loan. As such, it may not be profitable to raise the interest rate or collateral requirements when there is excess demand for credit (Stiglitz and Weiss, 1981). An increase in interest rate above the rate that low risk people are willing to pay induces them to withdraw. Banks can induce entrepreneurs to undertake

safer projects by lending at lower interest rates (Stiglitz and Weiss, 1981). Thus, this criterion helps reduce the moral hazard problem.

Government could also attempt to assist certain groups by passing usury laws, which limit the amount of interest that can be charged on loans as well as by setting portfolio restrictions or other policies (see Ordover and Weiss, 1981 and Penner and Silber, 1973). These laws and restrictions may help improve efficiency.

There is another policy used by government which helps in controlling the interest rate (Boadway and Sato, 1999). Lending rate controls increase efficiency, since they directly control the maximum lending rate. Here government subsidizes banks for the losses they incur from interest rate being lower than the market equilibrium level even if the lower interest rate is welfare improving.

In addition to size of loan, banks can bundle up the interest rate they charge with collateral requirement in order to offer separating contracts.

Collateral requirement:

Banks can use collateral requirements as an incentive mechanism since the higher the collateral requirements, the less risky projects entrepreneurs choose (Bester, 1984a). Increasing the collateral requirement decreases banks' returns, because it either reduces the average degree of risk of the pool of entrepreneurs who normally take on projects with moderate expected returns or induces individual investors to undertake riskier projects in a multi-period model which have high default rates (Stiglitz and Weiss, 1981). Collateral requirement is positively related to riskiness of loans (Bester, 1985). When collateral requirements are very high, the wealthy individuals refuse to borrow and they use their own wealth endowments (Stiglitz and Weiss, 1981). In equilibrium high risks

choose a contract with a relatively high interest rate and a zero collateral requirement. Low risks signal their type by choosing to pay high collateral in exchange for a lower interest rate and this reduces the adverse selection problem. As long as low risks have sufficient wealth to post as collateral the equilibrium involves no rationing (Gale, 1990a).

Collateral can be both uniform and differential depending on if banks want to separate the entrepreneurs with good and bad projects (Boadway and Sato, 1999). However, the downfall of collateral requirements is that banks relax the evaluation of the entrepreneurs' efforts, since they know they can cover some of their losses in case of a default (Boadway and Sato, 1999). Since collateral requirement creates a moral hazard problem associated with banks then there is a potential role for government (Gale, 1990a). However, collateral requirement can decrease the adverse selection and moral hazard problems associated with entrepreneurs (Jappelli and Pagano, 2000).

Capital Structure:

Capital structure of a firm is another screening tool (Hellmann and Stiglitz, 2000). An important part of capital structure is retained earnings of the firm (Moore, 1993). Retained earnings help entrepreneurs to receive more favourable terms of contracts. This is due to the fact that they cover some portion of financing needed by the entrepreneurs and thus entrepreneurs ask for less amount of credit. This reduces the failure risk of entrepreneurs and its associated costs. As a result existences of retained earnings protect banks from risks of failure and the default costs accrued to banks (i.e., costs of forgone credit). Existence of retained earnings or sound capital structure of a firm benefit the entrepreneurs themselves in form of better terms of contracts.

When there is an adverse shock, the level of retained earnings is reduced; entrepreneurs end up with contracts that have higher interest rate and lower probability of success in the future. Also, some entrepreneurs are denied financing altogether, which leads to higher levels of credit rationing.

Venture Capital Financing vs. Bank Financing

Venture capital financing is often viewed as a private solution to the problem of asymmetric information in credit markets. Venture capitalists typically finance projects of entrepreneurs who suffer from lack of reputation with banks and do not have any experience in the industry, thus it is difficult for them to receive financing from banks (Ueda, 2000). Besides financing their projects, venture capitalists help them with strategic analysis and management recruiting, continuous monitoring as well as assist them to go public (Gorman and Sahlman, 1989).

Venture capitalists have the skills and technological expertise which allow them to gauge the quality and profitability of the projects better than banks (Ueda, 2000). Venture capitalists have more skills, because they have a better understanding of the business and the industry. In case of bank financing, entrepreneurs incur the cost of signalling the quality of their projects to banks. This cost is due to the fact that banks do not have the required skills to assess the projects properly. When entrepreneurs disclose their ideas to banks, banks gauge the quality of their project imperfectly. Naturally, venture capital firms tend to finance particularly innovative projects, those for which the asymmetry of information between entrepreneurs and banks are usually more important. Thus, venture capital finance is typically associated with highly risky, but usually very innovative projects with high expected return if successful.

Venture capitalists have three main tasks which address the problem of asymmetric information (Kaplan and Stromberg, 2001). The first task of venture capitalists is to screen the nature of the projects and the characteristics of the entrepreneurs before making the final decision on investing in them or not. By doing so, they can eliminate the unprofitable projects and unsuitable entrepreneurs. In this phase, venture capitalists prepare a detailed analysis of the investments. In this analysis they consider several aspects of the projects such as market size, strategy to be used, the technology adopted, the nature of the targeted customers, the existing or potential competitors, the nature of the management team, the terms of contract and potential risks associated with each project. Management risk is the most common type of uncertainty that venture capitalists must put up with. Normally management team is not experienced and knowledgeable. Venture capitalists deal with this problem by hiring more competent executives externally (Kaplan and Stromberg, 2001).

The second task is to structure the financial contracts between themselves and the entrepreneurs, which include sophisticated financial instruments and contractual agreements that reduce the problem of asymmetric information (Keuschnigg and Nielsen, 2003). In this phase, venture capitalists allocate rights in such a way that they would be able to assist in monitoring and minimizing the impact of certain risks. Structuring of financial contracts involves allocating cash flow and control rights between entrepreneurs and venture capitalists in order to give incentives to entrepreneurs to perform at their optimal level. Here, venture capitalists allocate cash flow rights, voting rights, board rights, liquidation rights and other control rights. Cash flow rights, voting rights, control rights and future financings are usually based on each party's overall performances.

Voting rights, board rights and liquidation rights are based on entrepreneurs' performances; that is if they perform poorly venture capitalists take full control. As the entrepreneurs' performances improve they retain more control. If entrepreneurs have excellent performances, the venture capitalists give up the control and liquidation rights. Nonetheless, they keep the cash flow rights.

When there is explicit management risks, venture capitalists make sure that they have more control than entrepreneurs in terms of votes and board seats and have control over further financing if performance goals are not met. The reason is that the projects that succeed the most and the fastest are the ones with a stronger management team and more structured procedures.

Also, by giving equity shares to venture capitalists, they have stronger incentives to put more effort in costly activities that raise the potential value and not just minimize the potential losses. However, entrepreneurs must be given enough shares of equity, so that they have enough incentives to exert more effort. It is important to take into account the incentives of both parties when constructing the financial contracts (Keuschnigg and Nielsen, 2003).

The third task is continuous monitoring of the projects' performances after they invest in them and giving entrepreneurs constant advice on all aspects of the projects. In this stage, venture capitalists constantly monitor the performance of the project in order to find the areas of the projects that they can add value to or improve.

There are conflicts of interests between entrepreneurs and venture capitalists and they can be alleviated if venture capitalists provide their main tasks (Kaplan and Stromberg, 2001). These conflicts of interest arise because of the externalities involved

with the projects that choose venture capital financing. These projects are normally new and innovative.

There are two types of externalities; failure risk and moral hazard. Usually, innovative projects choose venture financing. There is failure risk associated with projects involving innovation of new ideas. One of the problems with the venture financing is to decide when stop supplying funds. However, it is essential to continue supplying funds to the project in order to learn more about all the outcomes of the new innovation. On the other hand if the outlook is not good, venture capitalists stop funding the project further (Bergemann and Hege, 1998). The probability of success of projects depends on how much venture capitalists invest in them. The higher is the investment level the faster venture capitalists learn about the projects. However, if the projects do not succeed after an initial high level of investment then both parties re-evaluate the possibility of success of the project.

Another downfall of venture capital financing is the problem of double moral hazard, where the effort level of both the entrepreneurs and the venture capitalists are not observable by the other parties (Keuschnigg and Nielsen, 2003). Besides the effort level, moral hazard is associated with the entrepreneurs' control in allocation of funds given to them by venture capitalists and amount of constant monitoring and advice provided by venture capitalists. If entrepreneurs have full information about the project they can use their powers adversely. This also gives the entrepreneurs the control over the flow of information to the venture capitalists, thus it may aggravate the problem of asymmetric information in this context (Bergemann and Hege, 1998).

The choice between bank and venture capital financing is dependent on the extent of asymmetric information between the entrepreneur and the bank (Ueda, 2000). Low collateral, high growth and high return projects aggravate the problem of asymmetric information and tend to induce the entrepreneur to choose venture capital financing. The entrepreneurs' final choice of financing between bank financing and venture capital financing depends on the entrepreneurs' collateral, size and profitability of the project.

When entrepreneurs have low collateral, they tend to use venture capital financing. Due to the existence of asymmetric information, banks charge them higher interest rate as a screening device. The entrepreneurs with low collateral may therefore get better terms of financing with a venture capital firm. Also, projects that are large in size and are potentially profitable can grow faster with venture capital financing.

Public Development Banks and Directed Credit

In addition to tax and subsidy instruments, the government can more directly affect the allocation of credit in the economy through public development banks and directed credit policies (Boadway and Sato, 1999). More specifically, the government can allocate capital directly to targeted industries by establishing development banks or public banks to substitute private banking. The development banks evaluate entrepreneurs on their own. When public banks give a loan to entrepreneurs, this sends a signal to private banks about the quality of entrepreneurs and thus private banks can lend to them as well. One advantage of this policy has loan guarantees and investment subsidies is that government should not worry about private banks' incentives (i.e., their effort level and the interest rate they choose). The downfall of this policy is the inability of governments and/or public banks to obtain information about industrial sectors and

entrepreneurs as efficiently as private banks can do. Thus, since it requires a lot of discretion it might lead to corruption between industry-based special interest groups and government officials. It is hard to implement this policy, since the public bank is not a profit-maximizer. As a result, this is not a very credible policy.

Another role for government can be the direct intervention in allocating financing through private banks (Boadway and Sato, 1999). The decision on government intervention depends on cost benefit analysis of private market failures. Some evidence from Asia suggests that direct involvement of government in credit allocation can lead to unstable credit markets. However, there is evidence that sole involvement of private sector causes inefficiencies in credit markets. As a result, government intervention where it sends correct market signals through various methods is very needed and practical to reduce informational externalities.

Empirical Evidence

There is some empirical evidence regarding credit market inefficiencies that are caused by asymmetric information. A set of data from National Westminster Bank of Great Britain contains information on 2838 loans granted to small and medium sized enterprises (i.e., SMEs) between April 1987 and December 1990 (Cressy and Toivanen, 2001). A defaulted data is defined when the entrepreneur fail to pay either the interest or the principal on the loan on the due date. About 62% of the SME loans are collateralized compared to the 79.5% in Germany (Edwards and Fischer, 1994). A little over 8% of the loans defaulted where 58.292% of these defaulted loans were collateralized, whereas, 63.045% of the successful loans were collateralized. As it was mentioned before, these empirics support the fact that probability of success is positively proportional to the

collateral that is put up as part of the contract. Also, the empirics suggest that mostly low risk and/or high return entrepreneurs put up collateral.

From the data collected on Estonian and Romanian baking system, we can draw the following remarks. The less market power banks have, more loans are mortgaged than are collateralized. As a result, banks can not make as much profits due to possibility of default (Hainz, 2003).

There is an understanding that geographical distance between banks and entrepreneurs can have an impact on credit allocation. There is a belief that the degree of information asymmetry reduces as this distance decreases. Naturally, if this is the case banks need to take the distance into account and as a result apply "geographical credit rationing". On the other hand, if distance does not affect credit allocation, taking it into account causes inefficiency (Carling and Lundberg, 2005). In an empirical analysis, Carling and Lundberg used quarterly data on 53, 383 Swedish limited companies with outstanding loan at a major Swedish bank during second quarter of 1994 and the first quarter of 2000. There were 575,768 observations or loan status reports. Most of the firms were small or medium sized. During mentioned time period, number of offices reduced by 66. However, the results show that the distance variable is not statistically significant and thus it does not impact credit allocation. Their finding confirms that there is no geographical credit rationing.

Conclusion

The existence of asymmetric information causes inefficiencies in credit markets. There are three diverse types of inefficiencies; namely, credit rationing, underinvestment in low risk and/or high return projects and overinvestment in high risk and/or low return

projects. Credit rationing arises from an equilibrium interest rate that is below the market clearing rate where demand of credit equals supply of credit. Underinvestment and overinvestment arise because the pooling equilibrium interest rate is set for average risk entrepreneurs. This rate is set between the reservation rate (the rate at which entrepreneurs can afford to borrow) of low risk entrepreneurs and high risk entrepreneurs. Therefore, in equilibrium, the composition of the pool of entrepreneurs who request financing is generally different from the pool of entrepreneurs that should be funded in the social optimum.

Entrepreneurs require financing from banks if the required capital to start their projects is larger than their initial wealth endowment. Banks finance through two different types of contracts; equity contracts and debt contracts. It is better to allow entrepreneurs to choose the method of financing for their own projects. The reason is that entrepreneurs have full information about themselves and their projects' characteristics, thus they can choose the type of contract appropriately and at the same time reveal some information to banks about their characteristics. Equity contracts may partly correct for underinvestment problems, because banks under equity contracts favour low risk entrepreneurs since they have higher probability of success. Thus, they attract more low risk entrepreneurs on profitable terms. Debt contracts partly correct for overinvestment problem, because banks favour high risk entrepreneurs. Thus, high risk entrepreneurs have to make large debt payments often. This induces them to opt out of the market.

Since entrepreneurs provide imperfect information about themselves and their projects, banks need to use different criteria to screen and separate projects. Also, banks

need to use these criteria to offer separating contracts. These criteria are as follows; maximum self-finance requirement, entrepreneur's choice of financing, size of entrepreneurs' personal wealth and the social group they belong to, user charges, stage financing, size of loan requested by entrepreneurs, the interest rate they are willing to pay on the loan, collateral requirements as well as capital structure.

Venture capital firms often have higher abilities to overcome problems resulting from asymmetric information. Venture capitalists have an advantage over banks, because they have the essential skills and technological expertise to better evaluate, screen and monitor projects. When entrepreneurs cannot receive financing from banks due to lack of reputation or experience in the industry, they may get financing from venture capitalists. Venture capitalists not only finance their project, but they provide strategic analysis, management recruiting, continuous monitoring and help them to go public. Like banks, venture capitalists have to overcome the problem of asymmetric information. To address this issue, venture capitalists perform three main tasks: screening the nature of projects, constructing the financial contracts between them and the entrepreneurs and continuous monitoring of the performance of entrepreneurs and outcomes of projects.

Even though governments are not better informed than banks about characteristics of entrepreneurs and their projects, they can still come up with policies that alleviate inefficiencies in credit markets. Governments can reduce informational externalities through information acquisition methods, loan guarantees, directed credit and direct government intervention in allocating credit. As was mentioned, the composition of the pool of entrepreneurs is one cause of underinvestment and overinvestment in unsuitable projects. As a result, other policies can be used to attract more of low risk entrepreneurs

and less of high risk entrepreneurs. These policies are as follows: federal credit programs with easier terms of contracts, encouraging alternative activities to borrowing, subsidizing non-entrepreneurs or increasing the cost of borrowing. Also, we mentioned the level of interest rate as another cause for all three types of inefficiencies. To alleviate this, government can subsidize investment or the interest rate paid on deposits. Also, usury laws will set limits for interest rate. The choice of appropriate policy will generally depend on the circumstances at hand.

Some of our theory was confirmed in the empirical evidence portion of this literature review based on country specific examples. The empirical works confirm that probability of success of projects is positively proportional to the collateral that entrepreneurs put up as part of their contract. Consequently, they suggest that mostly low risk and/or high return entrepreneurs put up collateral. In addition, the empirics show that the less market power banks have, more loans are mortgaged than are collateralized. As well, the empirics illustrate that there is no geographical credit rationing.

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