VIOLATION OF EQUALITY OF OPPORTUNITY IN THE CREDIT MARKET

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Abstract

Credit market imperfections can prevent the poor from making profitable investments. Under asymmetric information observable features such as wealth and collateral play an important role in determining who gets credit. Collateral is important also because it influences the willingness of individuals to supply effort by itself and also through lower interest rates. We focus on the relation between equality of opportunity and credit market to establish if the possibility of getting credit is determined by collateral. Our conclusions are that equality of opportunity is violated in the credit market and that richer individuals may also exert less effort in equilibrium, in particular marginal investors do. This suggests that public credit policies could be targeted usefully at poorer classes of would be borrowers both for equity and efficiency reasons. Contrary to this, recent policies, particularly in Italy, ignore completely the wealth condition of the would-be investor.

Keywords: equality of opportunity, credit, moral hazard, cross-subsidization, collateral

JEL classification: D63, D8, H8

1 Introduction

Credit market imperfections can prevent the poor from making profitable investments. Asymmetric information is crucial to understand the role of individual wealth in relation to credit availability. Lack of collateral may obviously represent a barrier. Under full information each project is funded only upon the evaluation of the borrowers' effort. Under asymmetric information instead

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observable features such as wealth and collateral play an important role in determining who gets credit. Collateral is important also because it influences the willingness of individuals to supply effort by itself and also through lower interest rates. We focus on the relation between equality of opportunity and credit market to determine if under these circumstances the possibility of getting credit is determined by collateral.

The seminal contribution on the effect of asymmetric information on the credit market is due to Stiglitz and Weiss (1981) who demonstrate that the credit market may not clear due to the possible existence of an interest rate above which the default rate rises so much that the profitability of the banks starts to decrease. This happens because higher repayment rates imply a higher expected cost for all those with higher probability of success. Therefore, on one side, there's an incentive to adopt projects with higher risk in order to afford higher repayment rates. On the other side, safer borrowers will be the first to leave the market as rates increase due to a standard adverse selection effect. Competition implies break even constraints i.e. the extension of lending until the rate of return is not negative. If at this rate, there's no equilibrium between demand and supply of deposits, some projects are rationed out.

However based on an enriched model, Bester (1985) shows that credit rationing isn't general at all. Different amounts of collateral could be devised to determine separating equilibria among different classes of borrowers solving the asymmetric information problems. Moreover, Riley (1987) underlines that credit rationing will occur only for some classes of borrowers determined by their lowest wealth level. An increase in the number of social types progressively reduces the rationing phenomenon and only in the limit redlining may appear.

A different framework proposed by De Meza and Webb (1987) is characterized not only by the absence of rationing but also by excessive lending. They show that competitive equilibria can arise in which some borrowers realize projects whose social benefits don't compensate their social costs. A cross-subsidization among safe and risky borrowers occurs due to asymmetric information. An increase in the amount of collateral delivers a reduction in cross-subsidies.

On the same pespective, De Meza and Webb (1999) study how credit-market requirements may exclude low-wealth individuals. This happens in a context of heterogenous quality profiles of borrowers. In this case, the pooling interest rate is below the rate charged in the full information case bringing both to excessive lending and investments in low-return projects. No credit rationing is possible because as interest rates rise, it is the low quality borrowers that are pushed out of the market. Following such line of analysis proposed in DW (1999), we construct a model in which we analyze how a competitive equilibrium performs in terms of equality of opportunity. In particular we analyze a model of the credit market characterized by both hidden information about the intrinsic features of the investor, notably her aversion to effort, and standard moral hazard. Entrepreneurs differ also for observable wealth which they post entirely as collateral. As in De meza and Webb asymmetric information delivers overinvestment and

cross subsidization for investor in each wealth class. However richer individuals are more likely to get credit than poorer ones, given a certain aversion to effort. This is due to several reasons: on one side collateral mitigates the moral hazard problem and delivers more effort spent for the same level of effort aversion. Moreover richer individuals are charged lower interest rates which in turn has the same effect. Finally cross subsidization occurs to a larger extent in richer borrowers' classes. For all these reasons we find that the equality of opportuntity principle, defined in this context as the equal possibility of getting credit given one individual's personal features (e.g. her effort aversion) is violated. Poorer individuals have far less chance to participate in the credit market. Our next line of inquiry is to determine whether in the resulting equilibrium rich investors participating actually exert more or less effort. From what we know poorer individuals exert less effort, for any given effort aversion, due to collateral. However richer individuals participate also for lower level of effort aversion. We show that for the marginal individuals participating in the credit market in different classes of wealth, effort spent is inversely correlated with wealth (and collateral). This result suggests that a public policy that transfers resources and credit from rich to poor people at the margin increases output.

In the next section, after setting up our model we discuss the trade-off between collateral, repayment and effort in the benchmark case of self-financed project. In section 3 first, we consider the possibility to have overlending rather than credit rationing due to stochastic dominance structure chosen. Thereafter, focusing on the behaviour of the marginal borrower, we observe how cross subsidization takes place in borrowers' classes. The analysis goes on in section 4 demonstrating the violation of the equality of opportunity principle through the correlation between repayment and effort aversion. Section 5 is devoted to test the incentive effect evaluating the differential inefficiency of the marginal borrowers in different welath classes due to a wrong allocation of resources from the bank. Finally in section 6 some recent policies for targeting credit interventions in Italy are reviewed in the light of our results. Conclusions follow.

2 The model

2.1 The Projects

Consider a project with capital requirement K. It yields a gross return Y with probability $p(e)$ or zero revenue with probability $1-p(e)$, where e is the amount of effort. Returns to effort are positive and diminishing as usual, i.e. $p'(e) > 0$ and $p''(e) < 0$. In more general terms, we can express the distribution of returns $F(e)$ conditional on effort value such that greater effort reflects a continuous distribution of returns which stochastically dominates any distribution with lower effort. Each borrower must raise an outside finance.

2.2 The Borrowers

We consider an economy with a finite number of individuals. We assume that the population has a mass normalized to 1. All heterogenous agents are risk-neutral and effort cost is given by μe, where μ represents the effort aversion parameter. At the same time, each agent belongs to a certain class of wealth that they put up entirely as collateral c. The borrower's aversion to effort and her actual effort choice are assumed to be private information and are indipendently distributed from c. Let $X = (1 + r)K$ be the total repayment where r is the interest rate required by the bank. The borrowers' expected utility when the project is funded is given by:

$$U = p(e)(Y - X) - (1 - p(e))c - \mu e \tag{1}$$

2.3 The lenders

As in de Meza and Webb (1987), the lenders don't know the effort characteristics of borrowers. They can only observe the population distribution of effort in terms of first order stochastic dominance and the investment opportunities which they are facing. We assume zero risk-free interest rate. For a single borrower, the representative bank's profit in a competitive market is:

$$\pi = p(e)X + (1 - p(e))c - K = 0 \tag{2}$$

2.4 Comparative statics

It can be interesting to note that if individual's investment is realized entirely as self-financed project, the effort level will be chosen with:

$$max_e \; p(e)Y - \mu e - K \tag{3}$$

Therefore, the optimum choice e^* follows from the FOC:

$$p'(e^*) = \frac{\mu}{Y} \tag{4}$$

This represents our first-best level of effort (benchmark case). Now we analyze the possibility to receive a loan from a bank in order to invest in the same project. In a context of hidden action, we assume that e isn't verifiable by the banks, hence it's not contractible. Moreover, there's limited liability, i.e. if projects returns are less than the repayment obbligations, the borrowers bear no responsibility to pay out of pocket. We allow for some collateral c where $c < K$. The effort choice of a borrower follows from:

$$max_e \; p(e)(Y - X) - (1 - p(e))c - \mu e \tag{5}$$

Therefore, the optimal choice $\tilde{e}(Y, X, c)$ is described by the following FOC:

$$p'(\tilde{e}) = \frac{\mu}{Y + c - X(c)} \tag{6}$$

From straightforward comparative statics it follows:

$$\frac{d\tilde{e}}{dY} > 0; \quad \frac{d\tilde{e}}{dc} > 0; \; \frac{d\tilde{e}}{dX} < 0 \tag{7}$$

Proof. See the appendix ■

We can see that $\tilde{e}(Y, X, c)$ is increasing in c and decreasing in X. Reasonably, if the borrower works harder, the probability of success increases and the risk of default decreases. A higher repayment negatively affects the borrower's return in case of success, but not in the case of failure, thus reducing incentives to apply more effort. On the other side, a higher amount of collateral reflects higher penalty in case of failure providing incentives to put more effort.

Looking at the representative bank's net profit, we observe that:

$$\pi = p(e)X + (1 - p(e))c - K = 0 \tag{8}$$

The banks maximize the borrower's utility subject to incentive compatibility curve (eq. 6). Given $p''(e) < 0$ and comparing (4) and (6), we point out that $\tilde{e} < e^*$. Equations (6) and (8) jointly determine the amount of effort and consequently the probability of success into the project. Moving along the incentive curve, the amount of repayment is decreasing. If the borrowers put higher effort in the project, the risk of default is reduced and the amount of repayment X must be lower to keep the net profits of banks at the competitive level. As a consequence, a decrease in X raises the incentive to work hard. Due to competitive market, the highest possible level of effort is generated even if this is less than the first-best case. This implies that the source of the inefficiency is due simply by the incentive distortion in limited responsibility i.e. no capital losses beyond the collateral posted.

3 Rationing or overlending?

In this section, we first examine the possibility to have credit rationing as in Stiglitz and Weiss (1981) or overlending as in De Meza and Webb (1987). A combination of hidden types and hidden action is showed by De Meza and Webb (2000) who demonstrate that credit rationing may coexist with excess lending. Here, we take into account the possibility of hidden types as demonstrated by De Meza and Webb (1999) assuming that heterogeneity regards the aversion to effort μ rather than the quality of the project.

Our attention is entirely focused on the behaviour of the marginal borrower. For any class of wealth, the marginal borrower is defined as the individual who is indifferent to exit or remain active in the credit market. Due to the stochastic dominance structure (different from Stiglitz and Weiss' mean preserving spreads between individuals' projects), we also know that the marginal borrower is the individual with the highest aversion to effort for any class of wealth. Under asymmetric information, this implies that her own repayment X will be below that of the full information case due to cross-subsidization. Therefore, for each class of borrowers overlending occurs. A link between the aversion to effort and the choice of effort is then proposed:

Remark 1 *For any level of the repayment X, the more averse to effort the borrower is, the lower the amount of effort chosen*

$$\frac{d\tilde{e}}{d\mu} = \frac{1}{(Y - X + c)p''(\tilde{e})} < 0 \tag{9}$$

while in terms of probability of success:

$$\frac{dp\left[\tilde{e}(X,\mu)\right]}{d\mu} = p'(\tilde{e})\frac{d\tilde{e}}{d\mu} < 0 \tag{10}$$

Remark 1 implies that individuals with a greater aversion to effort also display a higher probability of default. Since, given X, the marginal individuals capture the lowest share of project expected returns, their choice of effort is farthest from the socially efficient value showed above. However, in such framework, credit rationing is impossible given that individuals with the highest aversion to effort are the first to exit from the market as the interest rates rise. Further, a representative borrower will undertake a project if and only if:

$$\bar{U}(\tilde{e}, \mu, X) \geq 0 \tag{11}$$

Particularly, a borrower enters into the credit market applying for funds if and only if:

$$p(\tilde{e})(Y - X + c) \geq \mu\tilde{e} + c$$
$$p(\tilde{e}) \geq \frac{\mu\tilde{e} + c}{(Y - X + c)} \tag{12}$$

Looking at the marginal case, from (12), there's a cut off probability of success. Loans aren't asked under this threshold. We can define this value with equality as $p_M(\tilde{e})$. While the average probability of success into the project is defined as $\bar{p}(\tilde{e})$ where $\bar{p}(\tilde{e}) > p_M(\tilde{e})$. This implies that $\bar{p}(\tilde{e})X > p_M(\tilde{e})X$ where $\bar{p}(\tilde{e})X$ can be defined as the representative bank's average payment on each demand of K. Given that the utility from the project of the marginal borrower is zero, if she asks for a loan, the expected profit of the bank on the same loan $[\bar{p}(\tilde{e}) - p_M(\tilde{e})]\,X$ must be negative. Following this procedure, we can state that:

Remark 2 *The expected value of the marginal borrower's project is negative in equilibrium*

In a model with perfect information, repayments can be assigned to each borrower based on her own aversion to effort. In the asymmetric context, a competitive equilibrium induces excessive lending even if the expected profit of a bank on the marginal borrower's project is negative. On one side, the representative lender makes positive expected profits only on loans with positive expected net return for the borrowers. On the other side, as in De Meza and Webb (1987), profits are practically lost in equilibrium due to cross-subsidization to borrowers with a higher aversion to effort. Due to competitive market and given the repayment $X = (1 + r)K$, the bank's break-even constraint is given by:

$$p(\tilde{e})X = K - (1 - p(\tilde{e}))c \tag{13}$$

Differentiating (13) with respect to collateral c and repayment X, it follows that:

$$\frac{dX}{dc} = \frac{-\left[(1 - p(\tilde{e})) - p'(\tilde{e})\frac{d\tilde{e}}{dc}c\right]}{\left[p(\tilde{e}) + p'(\tilde{e})\frac{d\tilde{e}}{dX}X\right]} < 0 \tag{14}$$

Proof. See the Appendix ■

For a given aversion to effort, higher collateral reduces the repayment X. Further, even if indipendently distributed, a relation between the amount of collateral and the aversion to effort can be proposed. Taking into account the

utility function of the marginal borrower ($U_i = 0$) and further differentiating with respect to collateral and aversion to effort, it follows that:

$$\frac{d\mu}{dc} = \frac{p'(\tilde{e})\left(\frac{c+\mu\tilde{e}}{\mu}\right)(1-\frac{dX}{dc})}{\frac{c}{\mu^2}p'(\tilde{e})(Y-X+c)+\tilde{e}} > 0 \tag{15}$$

Proof. See the Appendix ■

We define the marginal set as the set of the marginal individuals, one for each class of wealth, whose utilities are zero. Hence, formula (15) shows that along the marginal set, a higher wealth is accompanied by higher aversion to effort i.e. richer marginal individuals seem to be more averse to effort in the project. The intuition for the result is that in a context of hidden action, individuals are evaluated just on the basis of their collateral indipendently by the aversion to effort they have. This implies that for a richer class of borrowers, cross-subsidization is wider than in other classes, the moral hazard problem increases while the repayment rate is reduced to mantain break-even for the bank.

4 Inequality of opportunity

In the previous section, we have showed that as in Bester (1985), an increase in the amount of wealth has only positive effects for both borrower's utility and lender's profit function. Further, De Meza and Webb (1987, 2002) show that an increase in the amount of wealth implies a reduction in the need to borrow. No other effect is taken into account.

However, Stiglitz and Weiss (1992) show that an increase in the amount of collateral may have quite different impacts with respect to Bester (1985)'s environment. Under certain conditions, notably decreasing risk aversion, richer borrowers are those who are more willing to undertake riskier projects [1]. As a consequence the representative bank may be forced to increase the interest rate in response to an increase in wealth. It follows that an ex-post moral hazard question must be analyzed. Higher interest rates affects individuals in two ways. On one side, there's a reduction in the share of low-risk borrowers (negative selection effect), while, on the other side, borrowers are motivated to use riskier techniques (positive incentive effects).

Relative to Stiglitz and Weiss (1992) our setting is complicated by the independent role of the aversion to effort parameter. From the borrower's point of view, an increase in the repayment X brings forth a reduction in terms of utility:

[1] They study the case where individuals have the same opportunity sets with decreasing absolute risk aversion. Instead, Wette (1983) show that in the dynamic of incentive effects no assumption of risk aversion is required if opportunity sets differ accross borrowers.

$$\frac{\partial U_i}{\partial X} = -p'(\tilde{e})\left(\frac{c+\mu\tilde{e}}{\mu}\right) < 0 \tag{16}$$

Proof. See the Appendix ■

From (15), we know that an increase in the amount of collateral is positively correlated to the aversion to effort in the marginal set. Moreover, given that for each class of wealth, the marginal borrower has the highest aversion to effort, the higher the class of wealth, the higher the aversion to effort accompanied to it. Now, additional information about the link between the aversion to effort μ and the amount of repayment X can be developed.

Remark 3 *In the marginal set, other things being equal, the lower the amount of repayment X assigned, the more averse to effort the borrower is*

$$\frac{d\mu}{dX} = \frac{-p'(\tilde{e})\left(\frac{c+\mu\tilde{e}}{\mu}\right)}{\frac{c}{\mu^2}p'(\tilde{e})(Y-X+c)+\tilde{e}} < 0 \tag{17}$$

Proof. See the Appendix ■

Expression (17) implies that, as expected, the individuals with the highest aversion to effort in the marginal set (i.e. the richest) are those who pay the lowest interest rate.

In a context of perfect information, individuals with a higher aversion to effort don't receive credit, indipendently by the class of wealth they belong. Instead, with asymmetric information, in equilibrium, there are pooling interest rates such that richer individuals with high aversion to effort may stay in the market. Since interest rates are higher for poorer individuals, selection among poorer individuals is more severe due to a lower cross-subsidization. Some of the poorest class of individuals with just insufficient collateral may even be rationed out by the bank. This implies that a redlining phenomenon may occurr even in an overlending environment as in De Meza and Webb (2002).

Notwithstanding individuals with the highest aversion to effort would surely not be funded, such pooling equilibria perfectly characterize a violation of the equality of opportunity principle. Aversion to effort being equal, richer individuals with higher wealth receive a loan while poorer individuals with a lower amount of wealth may get out or even be redlined. This occurs due to two reasons. One one side, the richier individuals post more collateral, are charged lower interest rates and for both reasons exert more effort other things equal. On the other side, more cross subsidization occurs in the richer class (because of the reason above) and therefore more negative-surplus projects are realized in this class than in the others. For both these reasons, the aversion to effort of the marginal borrower in a rich class is bound to be larger than in lower wealth classes.

However, that's not all. We can go further in our analysis. In the case in which the incentive effect prevails, an increase in the level of wealth of richier types induces more cross subsidization and entry of even more effort averse rich types.

Proposition 4 *In the marginal set, due to incentive effect, an increase in the wealth of borrowers leads to the entry of individuals with higher aversion to effort*

Proof. Bester (1985) and De Meza and Webb (1987) show that an increase in the wealth of a borrower brings to a reduction in the amount of repayment required. Cross-subsidization is reduced pushing worse entrepreneurs out of the market. Here, instead, due to the presence of incentive effects (SW, 1992), an increase in collateral implies more effort into the project from participating borrowers and a reduction of the repayment such that some marginal borrowers can enter. In this case, the variation of the bank's expected return (R) can be positive:

$$\frac{dR}{dc} = \left[p(\tilde{e}) \frac{dX}{dc} + p'(\tilde{e}) \frac{d\tilde{e}}{dc} (X - c) + (1 - p(\tilde{e})) \right] > 0 \tag{18}$$

Then, given (15), if the incentive effect is higher than the selection one, the competitive market will induce banks to further reduce the amount of repayment X. For any class of wealth, this encourages other borrowers with a higher aversion to effort to participate into the market. ■

To sum up, there exists a discrimination between classes of wealth. Low-wealth classes may be excluded from the market without considering the aversion to effort which they are endowed of. An increase in inequality in the form of a higher wealth for rich classes implies a lower repayment that in turn causes more rich individuals with higher aversion to effort to enter into the market further discriminating low-wealth individuals with a lower aversion to effort. In both cases, an evident violation of the equality of opportunity principle is produced.

5 Inefficiency due to incentive effect

The analysis of the marginal borrower focuses on the individuals' choice to enter or not in the credit market. It's useful in our context because it allows the analysis of the conditions under which the marginal poorer's effort level is higher than the marginal richer's ones. The combination of personal wealth and individual aversion to effort assumes a crucial role in determining who becomes a borrower. As demonstrated above, due to more collateral, lower interest rates and more cross subsidization, richer individuals characterized by high aversion to effort may decide to enter into the credit market affecting the

composition of the bank's lending portfolio. An efficiency question must then be faced. Competition will force the banks to offer pooled-contracts dependent on collateral yielding zero expected profit. We can express the profit function in terms of probability distributions as follows:

$$\text{Bank's profit} \qquad \pi = \int_{p_M(\tilde{e})}^{1} [p(\tilde{e})X + (1 - p(\tilde{e}))c - K]\, dp(\tilde{e}) = 0 \tag{19}$$

where $p_M(\tilde{e})$ is defined as the probability of success into the project of the marginal borrower for any class of wealth c. As explained, given the choice about participation in the credit market, the marginal borrower's utility must be zero:

$$\text{Marginal borrower utility} \qquad U_i = p(\tilde{e})(Y - X + c) - c - \mu\tilde{e} = 0 \tag{20}$$

Combining conditions (19)-(20) and the standard optimal choice of effort (6), a study about the possible behaviour of the marginal borrower for any wealth level c in the marginal set can be developed. Therefore, starting by the bank's net return function (19), we can derive the probability of success of the marginal borrower $p_M(\tilde{e})$ in terms of monetary measures as:

$$p_M(\tilde{e}) = \frac{2K - c - X}{X - c} \tag{21}$$

Proof. See the Appendix ■

Formula (21) provides a clear link between the choice to remain active in the market and the amount of collateral owned by each individual. It's a function of the capital K required for the realization of the project and the class of wealth c which the individuals belong to. Substituting (21) into the utility function of a borrower (20), we can write that:

$$U_i = \left(\frac{2K - c - X}{X - c}\right)(Y - X + c) - c - \mu\tilde{e} = 0 \tag{22}$$

In particular, from effort choice (6):

$$U_i = \left(\frac{2K - c - X}{X - c}\right)(Y - X + c) - c - p'(\tilde{e})(Y - X + c)\tilde{e} = 0 \tag{23}$$

Further, if the incentive effect prevails, a negative correlation between collateral and effort can be derived. It follows that:

Proposition 5 *Due to incentive effects, the richer the marginal borrower, the lower her own effort level into the project*

$$\frac{d\tilde{e}}{dc} = \frac{\frac{1}{p'(\tilde{e})}\left[\frac{2Y(K-X)}{(X-c)^2}\right] - \tilde{e}}{\frac{p''(\tilde{e})}{p'(\tilde{e})^2}\left[\frac{-(2K-X)(Y+X-c)-Yc}{(X-c)}\right] + (Y-X+c)} < 0 \tag{24}$$

Proof. See the Appendix ■

The fact that, in the marginal set, effort is negatively correlated with collateral has far reaching consequences. Indeed, it means that marginal richer individuals not only are more averse to effort, causing a violation of equality of opportunity, but also actually exert less effort than marginal poorer individuals. The traditional literature about the credit market suggests that an increase in the amount of collateral c brings forth an increase in the amount of effort $\tilde{e}$ for all classes of borrowers. Here, instead, we show that in the marginal set, the effort levels of richer individuals are lower than those of the poorer ones. An inefficiency question due to the wrong allocation of credit arises. Although more wealth motivates better individual participating in the credit market before and after the increase in wealth, entry of some new types occurs as well. The entrants are certainly characterized by higher aversion to effort. However our last result suggests also that in equilibrium they actually exert a lower effort. Hence while for the infra marginal individuals more wealth can only imply more effort, the entry of new marginal partecipant worsens the pool and may decrease average effort spent in each class.

Some interesting consequences follow. On one side, due to asymmetric information, the amount of collateral is the only observable tool for the banks. If the selection effect prevails, we observe that the credit market is inequitable because it funds individuals with a certain level of collateral excluding the poorer. That's referred to as a violation of the equality of opportunity principle.

Moreover, credit allocation isn't only unequal but also inefficient. Particularly, in our model, two sources of inefficiency are now revealed. The first traditional inefficiency belongs to the overlending phenomenon class due to cross-subsidization as in De Meza and Webb (1987). More interestingly the second source of inefficiency is derived from a wrong credit allocation among classes of wealth i.e. individuals who receive funds from the bank may also be those who put less effort into the realization of the project. In the second sense, inequality and inefficiency are clearly intertwined. The two problems can be addressed jointly through a government action aimed at changing the composition of loans rather than the overall amount of credit. Since richer individuals exert less effort (in the margin) a redistributive policy to poorer ones might increase the surplus in the system.

6 Public policy implications

We know that the representative lender is unable to observe the borrowers' aversion to effort. Therefore, an opportunistic behaviour by the marginal individual is possible particularly if she belongs to a higher class of wealth due to a wider cross-subsidization. Such condition leads the bank to an inefficient credit allocation's choice. From a public policy perspective, several attempts may be taken in order to align the borrowers' incentives with those of the banks even if that is particularly difficult, especially for young and small firms that typically lack sufficient collateral and equity capital and have a short track record.

Asymmetric information and asset inequalities are common causes of discrimination into the credit market. The traditional literature points out how equity considerations must be evaluated separately from efficiency analysis. On one side, equity objectives are always considered costly i.e. redistribution reduces economic performance. For example, Okun (1975) described redistribution famously to be like carrying money from the rich to the poor in a "leaky bucket". On the other side, Welfare Economics underlines how a competitive equilibrium without government intervention is Pareto-efficient. Such condition refers to as a benchmark supposing that each public intervention automatically implies a trade-off between equity and efficiency objectives. However, if market failures exacerbate the initial inequality, better working credit markets and more equal asset distribution might be efficiency and equity-enhancing (see Stiglitz, 1998). This possibility is clearly suggested by our model too.

There has been a considerable debate over the role of the government in economic development, derived in response to the literature on endogenous growth (Lucas, 1988), but also as a result of the experience of high growth rates in East and Southeast Asian countries characterized by high participation of governments in the investment process. It's not well established what policy maker should do in order to design valid programs. A problem for government intervention in credit markets is that they are not likely to be any better informed than private lending institutions. They may not be better able to pool risks and to overcome rent-seeking. In other words, the mere fact of market failure does not imply a need for government intervention. The economic impact of direct loans, credit guarantees, and debt subsidies have been examined in a variety of different theoretical frameworks. From the efficiency's point of view, Hoff and Lyon (1995) suggest that direct transfers for particular classes of wealth may be superior to simple credit policy i.e. targeted transfers. They go beyond equity considerations having efficiency and growth perspectives. In general, it's true that redistributing assets provides the opportunity to cope with market failures of all sorts and increases the efficiency with which they can use whatever asset they have. Different possible designs were developed in order to focus on particular social groups (see Ravallion, 2002). Some alternative mechanisms can be thought of (minimum wage policy, employment programs...) but also human capital programs would also potentially be useful. To justify government intervention, it must be demonstrated that market decision-making leads to inefficient decisions. Thus, to ascertain whether implementing a public pol-

icy on a loan market is beneficial, it must be determined if the positive impact of intervention is higher than the negative incentives due to credit guarantee. No general public subsidy is sufficient to improve both equity and efficiency in the credit market, see De Meza and Webb (2000). If in principle the idea to intervene in favour of the poor is well founded, empirical evidence suggests that the results aren't so positive as expected. Credit plans were often characterised by inefficiencies and involvement by less poor groups. Serious informational and enforcement problems but also administrative and bureaucratic costs may wipe out efficiency gains from relieving credit constraints (Besley, 1994).

Looking at different public policies in western societies, different types of intervention in credit markets have been widespread for decades. However, they particularly focused on efficiency grounds and they didn't help so much to develop credit opportunities for poorer borrowers.

Particularly, in Italy, there exist some programs which use contingent transfers, where transfers are specifically linked to boost R&D investments (FIT-Fondo per l'Innovazione Tecnologica, law 46/82) or investments in Human capital accumulation (law 388/2000). They usually involve pure transfers of resources to borrowers without requiring repayment. An applicant could be rejected for a guaranteed loan only under certain conditions: significantly negative net worth, tax delinquency, default, or window dressing of balance sheets. In most cases, the credit risk of a borrower was no longer a concern for loan approval, which meant that there was practically no incentive for a risky firm to hide their personal characteristics. Moreover, given that banks bear no default risk, the scheme significantly reduces the institution's incentive to examine and monitor the borrower. In order to facilitate the flow of funds, the use of direct loans by government-backed financial institutions and loan guarantees has also been implemented. One of the biggest available tool is represented by the law 488/1992 which helps borrowers to increase their investment opportunities providing funds assigned to managerial, technical, and businesses development particularly in manufacturing industry, trade business or tourist services. However, collateral or guarantees are often required for such sizable loan contracts losing the redistributive aim in favour of poor people which firstly justify public interventions.

Moreover, different programs to small- and medium-sized enterprises (SMEs) were proposed as special Credit Guarantee Programs, e.g. Fondo di garanzia per le piccole e medie imprese, law 23/12/1996, n. 662 or law 7/8/1997, n. 266 or D.M 31/5/99, n. 248. Some suggest these programs aren't so useful for helping small businesses or improving economic performance in the areas that receive these loans. Others insist the programs are needed to provide support to small businesses, which often face difficulties finding sufficient borrowing opportunities. However, very little serious empirical evidence exists on whether the net economic impact of such guaranteed lending programs is positive or negative. A few recent studies provide some insight for considering such question (Rapporti ISAE, nov. 2007) with consistent evidence that even if these lending programs produce a small positive impact on economic performance, they leave unaffacted the chances of poor people to become entrepreneurs.

Alternative European union programs involve transfers using "self-targeted programmes"' through POR (Piani operativi regionali) particularly focusing on disadvantaged regions (Obiettivo 1). They constitute workfare programmes in order to enrich poor districts in the south of Italy with different investment opportunity sets. They could be important tools to provide protection and insurance to poor households, to avoid or fight poverty traps but also to guarantee to all individuals the right to participate in the growth of economy. However, they mostly work as safety nets i.e. ex-post mechanisms as the only devices available to the policy maker without really helping the poorest. Therefore, it seems that there's no public policies which is really helpful to develop concrete opportunities for poor but rather they completely focus on efficiency grounds possibly increasing inequality into the system, but without reaching their stated objectives.

However, in recent years, a micro-credit policy has been developed in the attempt to fight poverty around the world. The Grameen Bank in Bangladesh or Banco-sul in Central America produce microfinance schemes, with clever mechanisms overcoming asymmetric information using group-based lending, joint liability and continuous monitoring stage to repay by offering loans once repayment of the smaller current loans has occurred. Morduch (1999) has shown that despite their costly operations, microcredit institutions have obtained a relative success in developing countries, reaching some of the poorest classes of wealth. Further, there's a increasing size of the microfinance local products which more often involve the intervention of the governments and NGOs' participation helping to break out of a poverty situation. Even if there's no empirical literature about the causal link between access to micro-credit and more efficient use of assets due to missing data sets, we may suppose that it represents a potentially powerful redistributive device.

On the whole our opinion is that the evidence points to a limited impact of policy measures aimed at increasing credit opportunities without targeting accurately the beneficiaries. While credit policies (not only public) aimed at poor people, notably microcredit seem to have scored well. This is coherent with our result suggesting that a mix of redistributive policies and credit policies with a clear target on poorer individuals may increase output.

7 Conclusion

We have explored the relationship between equality of opportunity and efficiency in the credit market. Building on leading models of asymmetric information (both ex-ante and ex-post) in the credit market, our model allows for heterogeneity of would-be entrepreneurs both in wealth and preferences over effort aversion. Equality of opportunity is evaluated relative to effort aversion, which is obvioulsy also the unbservable variable. The wealth of different individuals, on the contrary, is observable and entirely posted as collateral.

In this context we find two important results. On one side we demonstrate

that, due to effects linked to collateral both direct and indirect (notably greater effort and cross subsidization), richer individuals participate more in the credit market even when relatively averse to effort. This is characterized as a violation of the equality of opportunity principle. An important caveat in this result is that more participation for the richer results also from more effort due to the own participation in the project and the consequent lower interest rates, which by themselves mitigate the moral hazard problem.

However we also find that marginal richer borrowers exert less effort than poorer ones in equilibrium, notwithstanding these conterbalancing effects. This result has far reaching consequences for public policies. In particular it strongly suggests that the allocation of credit can be made more efficient by transferring resources form richer to poorer borrowers. More in general it suggests that public programmes are more likely to produce results if targeted at lower wealth individuals. This clashes with some evidence about the way existing public policies are devised and implemented particularly in Italy. On the contrary it is coherent with the growing interest for programmes of micro-credit in poor countries.

A The Appendix

A.1 Comparative statics

$$max_{\tilde{e}} p(\tilde{e})(Y - X) - (1 - p(\tilde{e}))c - \mu\tilde{e}$$

Case 6 *:*

$$\frac{d\tilde{e}}{dY} =?$$

$$p'(\tilde{e}) = \frac{\mu}{Y + c - X}$$

$$p''(\tilde{e})d\tilde{e} = -\frac{\mu dY}{(Y + c - X)^2}$$

$$\frac{d\tilde{e}}{dY} = -\frac{\mu}{p''(\tilde{e})(Y + c - X)^2}$$

$$\frac{d\tilde{e}}{dY} = -\frac{p'(\tilde{e})}{p''(\tilde{e})(Y + c - X)} > 0$$

Case 7

$$\frac{d\tilde{e}}{dc} =?$$

$$p'(\tilde{e}) = \frac{\mu}{Y + c - X}$$

$$p''(\tilde{e})d\tilde{e} = -\frac{\mu dc}{(Y+c-X)^2}$$

$$\frac{d\tilde{e}}{dc} = -\frac{\mu}{p''(\tilde{e})(Y+c-X)^2}$$

$$\frac{d\tilde{e}}{dc} = -\frac{p'(\tilde{e})}{p''(\tilde{e})(Y+c-X)} > 0$$

Case 8

$$\frac{d\tilde{e}}{dc} = ?$$

$$p'(\tilde{e}) = \frac{\mu}{Y+c-X(c)}$$

$$p''(\tilde{e})d\tilde{e} = -\frac{\mu dc}{(Y+c-\frac{dX}{dc})^2}$$

$$\frac{d\tilde{e}}{dc} = -\frac{\mu}{p''(\tilde{e})\left[Y+c-\left(\frac{-\left[(1-p(\tilde{e}))-p'(\tilde{e})\frac{d\tilde{e}}{dc}c\right]}{\left[p(\tilde{e})+p'(\tilde{e})\frac{d\tilde{e}}{dX}X\right]}\right)\right]^2} > 0$$

Case 9 *:*

$$\frac{d\tilde{e}}{dX} = ?$$

$$p'(\tilde{e}) = \frac{\mu}{Y+c-X}$$

$$p''(\tilde{e})d\tilde{e} = \frac{\mu dX}{(Y+c-X)^2}$$

$$\frac{d\tilde{e}}{dX} = \frac{\mu}{p''(\tilde{e})(Y+c-X)^2}$$

$$\frac{d\tilde{e}}{dX} = \frac{p'(\tilde{e})}{p''(\tilde{e})(Y+c-X)} < 0$$

A.2 Rationing or overlending?

A) Proof of eq. (14)

Differentiating (13) with respect to collateral c and repayment X, we obtain that:

$$\left[p(\tilde{e}) + p'(\tilde{e})\frac{d\tilde{e}}{dX}X\right]dX = -\left[(1-p(\tilde{e})) - p'(\tilde{e})\frac{d\tilde{e}}{dc}c\right]dc$$

Therefore, it follows that:

$$\frac{dX}{dc} = \frac{-\left[(1-p(\tilde{e})) - p'(\tilde{e})\frac{d\tilde{e}}{dc}c\right]}{\left[p(\tilde{e}) + p'(\tilde{e})\frac{d\tilde{e}}{dX}X\right]} < 0$$

B) Proof of eq. (15)

We start by the utility function for the marginal borrower i (1) and by the FOC in (6) which are respectively given by:

$$U_i = p(\tilde{e})(Y - X + c) - c - \mu\tilde{e} = 0$$

$$p'(\tilde{e}) = \frac{\mu}{Y - X + c}$$

From (1) , the condition of the marginal borrower implies that:

$$(Y - X + c) = \frac{c + \mu\tilde{e}}{p(\tilde{e})} \tag{25}$$

Substituting (25) into (6), it follows that:

$$p(\tilde{e}) = \frac{c + \mu\tilde{e}}{\mu}p'(\tilde{e}) \tag{26}$$

which refers to the probability of success of the marginal borrower. Therefore, the utility function of the marginal borrower at any level of wealth can be expressed as:

$$U_i = \frac{c + \mu\tilde{e}}{\mu}p'(\tilde{e})(Y - X + c) - c - \mu\tilde{e} \tag{27}$$

Looking at (27), we can differentiate the utility function with respect to c, μ, X. Hence, we can establish by envelope theorem that in computing the first-order effects respectively of changes in c,μ,X on the maximum value.of the utility function U_i the only effect of any consequences is the direct effect. Therefore, given (5), the terms in each of the three equations respectively $d\tilde{e}/dc$, $d\tilde{e}/d\mu$ and $d\tilde{e}/dX$ all vanish by envelope theorem:

1) Proof of $\frac{\partial U_i}{\partial c}$:

$$\frac{\partial U_i}{\partial c} = \left\{ \begin{array}{c} \left[\frac{p'(\tilde{e})(Y-X+c)}{\mu} + p'(\tilde{e})\left(\frac{c+\mu\tilde{e}}{\mu}\right) - 1\right] + \\ + \frac{d\tilde{e}}{dc}\left[p'(\tilde{e})(Y-X+c) + \left(\frac{c+\mu\tilde{e}}{\mu}\right)p''(\tilde{e})(Y-X+c) - \mu\right] + \\ - \left[\frac{dX}{dc}p'(\tilde{e})\frac{c+\mu\tilde{e}}{\mu}\right] \end{array} \right\} \quad (28)$$

By envelope theorem:

$$\frac{d\tilde{e}}{dc}\left[p'(\tilde{e})(Y-X+c) + \left(\frac{c+\mu\tilde{e}}{\mu}\right)p''(\tilde{e})(Y-X+c) - \mu\right] = 0$$

Therefore eq. (28) can be rewritten as:

$$\frac{\partial U_i}{\partial c} = \left[\frac{p'(\tilde{e})(Y-X+c)}{\mu} + p'(\tilde{e})\left(\frac{c+\mu\tilde{e}}{\mu}\right) - \frac{\mu}{\mu} - \left(\frac{dX}{dc}p'(\tilde{e})\frac{c+\mu\tilde{e}}{\mu}\right)\right] =$$

$$= \left[p'(\tilde{e})\left(\frac{c+\mu\tilde{e}}{\mu}\right) - \left(\frac{dX}{dc}p'(\tilde{e})\frac{c+\mu\tilde{e}}{\mu}\right)\right] > 0 \quad (29)$$

given that $\left[\frac{p'(\tilde{e})(Y-X+c)}{\mu} - \frac{\mu}{\mu}\right] = 0$ by (6). The same analysis can be developed for $\frac{\partial U_i}{\partial \mu}$ and (16).

2)Proof of $\frac{\partial U_i}{\partial \mu}$:

$$\frac{\partial U_i}{\partial \mu} = \left[\frac{\mu\tilde{e} - c - \mu\tilde{e}}{\mu^2}p'(\tilde{e})(Y-X+c) - \tilde{e}\right] + \left[\frac{d\tilde{e}}{d\mu}p''(\tilde{e})\left(\frac{c+\mu\tilde{e}}{\mu}\right)(Y-X+c)\right] =$$

$$= -\frac{c}{\mu^2}p'(\tilde{e})(Y-X+c) - \tilde{e} < 0 \quad (30)$$

3) Finally, we obtain that eq. (15) is given by:

$$\frac{d\mu}{dc} = \frac{p'(\tilde{e})\left(\frac{c+\mu\tilde{e}}{\mu}\right)(1-\frac{dX}{dc})}{\frac{c}{\mu^2}p'(\tilde{e})(Y-X+c) + \tilde{e}} > 0$$

A.3 Inequality of opportunity

A) Proof of eq. (16)

$$\begin{aligned}\frac{\partial U_i}{\partial X} &= -p'(\tilde{e})\left(\frac{c+\mu\tilde{e}}{\mu}\right)+\frac{d\tilde{e}}{dX}\left[\mu p'(\tilde{e})(Y-X+c)-\left(\frac{c+\mu\tilde{e}}{\mu}\right)p''(\tilde{e})(Y-X+c)\right]= \\ &= -p'(\tilde{e})\left(\frac{c+\mu\tilde{e}}{\mu}\right)<0\end{aligned}$$

B) Proof of eq. (17)

$$\frac{d\mu}{dX}=\frac{-p'(\tilde{e})\left(\frac{c+\mu\tilde{e}}{\mu}\right)}{\frac{c}{\mu^2}p'(\tilde{e})(Y-X+c)+\tilde{e}}<0$$

A.4 Inefficiency due to incentive effect

A) Proof of eq. (21)

Starting by (19), we can compute that:

$$\pi=\int_{p_M(\tilde{e})}^{1}\left[(X-c)\,p(\tilde{e})+(c-K)\right]dp(\tilde{e})=$$

$$=\left[(X-c)\,\frac{p^2(\tilde{e})}{2}+(c-K)\,p(\tilde{e})\right]_{p_M(\tilde{e})}^{1}=$$

$$=\frac{(X-c)}{2}+(c-K)-\frac{(X-c)}{2}p_M^2(\tilde{e})-(c-K)\,p_M(\tilde{e})=$$

$$=\frac{(X-c)}{2}(1-p_M^2(\tilde{e}))+(c-K)\,(1-p_M(\tilde{e}))=0$$

$$=\frac{(X-c)}{2}(1+p_M(\tilde{e}))(1-p_M(\tilde{e}))+(c-K)\,(1-p_M(\tilde{e}))=0$$

Therefore, it follows that the probability of success of the marginal borrower in terms of monetary measures is equal to:

$$p_M(\tilde{e})=\frac{2K-c-X}{X-c}$$

B) Proof of eq. (24)

we can rewrite (23) as:

$$U_i = \frac{1}{p'(\tilde{e})}\left[(Y - X + c)\left(\frac{2K - c - X}{X - c}\right) - c\right] - (Y - X + c)\tilde{e} = 0$$

given that the marginal borrower's utility is equal to zero. It follows that:

$$U_i = \frac{1}{p'(\tilde{e})}\left[\frac{2KY - 2KX + 2Kc - XY + X^2 - Xc - cY}{X - c}\right] - (Y - X + c)\tilde{e} = 0$$

The effect of varying the level of collaterall with respect to the utility function is equal to:

$$\frac{\partial U_i}{\partial c} = \frac{1}{p'(\tilde{e})}\left[\frac{(2 - X - Y)(X - c) + (2KY - 2KX + 2Kc - XY + X^2 - Xc - cY)}{(X - c)^2}\right] - \tilde{e} =$$

$$= \frac{1}{p'(\tilde{e})}\left[\frac{2KX - 2Kc - X^2 + Xc - YX + Yc + 2KY - 2KX + 2Kc - YX + X^2 - Xc - cY}{(X - c)^2}\right] - \tilde{e} =$$

$$= \frac{1}{p'(\tilde{e})}\left[\frac{2Y(K - X)}{(X - c)^2}\right] - \tilde{e} < 0$$

which is definitively negative given that $X = (1 + r)K$. As regards, instead, the marginal borrower i's choice of effort satisfies:

$$\frac{\partial U_i}{\partial \tilde{e}} = -\frac{p''(\tilde{e})}{p'(\tilde{e})^2}\left[\frac{2KY - 2KX + 2Kc - XY + X^2 - Xc - cY}{(X - c)}\right] - (Y - X + c) =$$

$$= -\frac{p''(\tilde{e})}{p'(\tilde{e})^2}\left[\frac{-(2K - X)(X - c) + Y(X - K) - Y(K + c)}{(X - c)}\right] - (Y - X + c) =$$

$$= -\frac{p''(\tilde{e})}{p'(\tilde{e})^2}\left[\frac{-(2K - X)(Y + X - c) - cY}{(X - c)}\right] - (Y - X + c) < 0$$

Summing up the first derivatives of the utility function with respect to collateral and effort, a link between collateral and effort can be proposed as:

$$\frac{d\tilde{e}}{dc} = \frac{\frac{1}{p'(\tilde{e})}\left[\frac{2Y(K-X)}{(X-c)^2}\right] - \tilde{e}}{\frac{p''(\tilde{e})}{p'(\tilde{e})^2}\left[\frac{-(2K-X)(Y+X-c)-cY}{(X-c)}\right] + (Y-X+c)} < 0$$

which is definitively negative.

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