Università degli Studi di Napoli
Federico II

Tesi di Dottorato di Ricerca in
Scienze Economiche
XVIII Ciclo

Policy Interventions in Credit Markets with Imperfect Information

Reito Francesco

Coordinatore: prof. Alfredo Del Monte

Relatore: prof. Maurizio Caserta

Napoli, gennaio 2006

Introduction to the PhD Thesis:

"Policy Interventions in Credit Markets with Imperfect Information"

The Thesis consists of **4** chapters. Each of these corresponds to a distinct research paper in the two following main topics:
- asymmetric information in the credit market and
- rationale for the presence of trade unions.

The former topic is discussed in the first 3 papers while the latter in the additional paper.

The first chapter, **"Asymmetric Information in The Credit Market and Unemployment Benefit as a Screening Device"**, analyzes the *principal-agent* relationship in the case of asymmetric information in the credit market. It is based on the classic[1] *Stiglitz-Weiss* (1981) in the adverse selection setting. The two authors have plainly shown how the *rationing* can occur in markets (the credit one is a practical example) where the contracting parties have different information about the terms of the transactions. To avoid credit rationing, and a lower entrepreneurial activity and economic growth (especially in less developed countries), some economists have suggested several policy interventions.

[1]The cited literature refers to each paper bibliography.

Mankiw (1987), for example, suggests that public transfers, such as *investment subsidies*, may produce improvements on the market solution. *De Meza-Webb*, instead, show how an *investment tax* can alleviate the over-investment problem occurring in the particular scenario they imagine. Curiously, very few other papers investigate on other possible sovereign interventions. One of these is *Minelli-Modica* (2003) that point out the availability of collateral as the most efficient device for entrepreneurs to signal their project quality ("good" or "bad"). Hence, they propose the government should intervene, when potential entrepreneurs do not have enough collateral to start up a firm, directly providing the required sum. The two authors then compare the cost of their proposal with the ones generated by the two most widely used policy interventions in less developed countries, that is *interest rate subsidy* and *investment subsidy*. They conclude showing their policy, along with the interest rate subsidy, is the cheapest for the government to implement.
Unfortunately, the three policies cited by *Minelli-Modica* produce *pooling* equilibria with *all* types of firms ("good" and "bad") being financed. This is not an efficient solution, from a social viewpoint, if the bad projects have a negative expected net value (that is they produce less than the resources exploited).
To solve these inefficiencies, in this first paper, the government is assumed to intervene by offering an *unemployment benefit* to all potential entrepreneurs in order to encourage the bad ones not to ask for a loan. The main contribution of the paper is the analysis between the *inefficiencies* suffered in a given market (here, the credit one) and possible *solutions* generated by focusing

on other, apparently distant, markets. If we do not treat the credit market in isolation, we have the possibility to observe other interesting features: the unemployment benefit produces *separating* equilibria in the sense that only good firms get a loan. Moreover, this policy is in general cheaper than the other alternatives (although it is not essential for the analysis to compare policies that produce different results in terms of "types" financed).

The second paper, **"Redistribution as a Device for Total Screening in a Credit Market with Adverse Selection"**, is again based on *Stiglitz-Weiss* (1981). The model describes the effects a *redistribution* of initial assets can have on the given informational structure. It is assumed that some potential firms do not have the collateral required by banks to separate types. Through the redistribution, the government assures to each entrepreneur the same level of collateral and, at the same time, it allows the bank to screen "all" types of projects. If (and only if) the total initial wealth is not enough to guarantee the same amount to each prospective entrepreneurs, the authority is actually demanded to provide public money. Again we derive *separating* equilibria with only good firms financed. The bad ones do not ask for a loan just to preserve their "new" endowment.
The redistribution policy turns out to be, in general, cheaper than other possible alternatives. This gives an idea about the actual viability of this kind of interventions. Furthermore, when the total output, generated by "all and only" good firms, is high enough to repay those who initially had more than the new "egalitarian" income, we certainly avoid concerns about pareto-efficiency and production incentives.

The third paper, **"Moral Hazard in the Credit Market: the Case of Italy after the Law n. 142/2001"**, analyzes the economic results produced by partially modifying the law on firm bankruptcy. The model compares the moral hazard problems faced by a bank when, for limited funds, it has to finance either a labor-managed firm (LMF) or a profit maximizing one (PMF). Before the law n. 142/2001, a cooperator in a LMF could only be either an entrepreneur or a simple subordinate worker, but not both. Now the two position has been grouped and the LMF members can clearly benefit from the legislative worker protection in case of firm liquidation. In other words, we know that, in case of bankruptcy, moneylenders are entitled to be satisfied on all *movable properties* only after the subordinate labor credits (having a high priority). So, each cooperator, with respect to the twin PMF entrepreneur, is allowed to recover his labor income that can "unfairly" contain some *entrepreneurial profits*. As a result, labor-managed firms hardly get a loan because the lenders have a lower probability to be repaid. Besides, the law has clearly raised the moral hazard problem on the *effort* contribution of LMF members.

The main contribution of the paper refers to the relationship between legislative interventions and asymmetric information in the credit market. The model shows that with a simple *reform* on the bankruptcy law, LMF cooperators can alleviate the moral hazard problem and improve their reputation as "good" debtors.

The additional paper, **"How Trade Unions Promote Cooperation among Workers"**, studies one of the possible explanations for the presence

of trade unions in the labor market: the apparent wage rigidity may, in fact, be the outcome of a *non-cooperative game* between the members of a trade union. The model shows that a trade union produces a positive "insurance effect" simply by reducing the *variance* of each member expected income. To achieve this result, it is assumed the trade union asks a membership *fee* to each employed (reducing the monopolistic union wage), and provides a subsidy to the unemployed (raising the reservation wage). With respect to the solution provided by *Solow* (1990), the present paper tries to develop two important points:

- the actual possibility, thanks to the trade union, of a wage above the competitive level without assuming it as exogenously given (is it possible, from a general equilibrium standpoint, to assume a wage over the competitive level without a proper explanation?);
- the risky nature of each period expected income. The workers are considered *risk-averse* and not *risk-neutral*. It obviously is a more realistic assumption (do not workers realize they face a simple *lottery* every period between a monopolistic and a reservation wage?). Moreover, the risk aversion allows to explain the higher expected utility derived from a reduction on the *variance* of each worker expected income.

Asymmetric Information in the Credit Market and Unemployment Benefit as a Screening Device

Francesco Reito *

Abstract

We consider an economy where firms/entrepreneurs are different in terms of unobservable projects quality. Adverse selection in the credit market forces creditors to ask for collateral when potential debtors have sufficient wealth. We study the interaction between credit and labor market when entrepreneurs have no (even illiquid) wealth to offer as a collateral requirement. Both pooling and no contract at all are possible equilibrium outcomes depending on the proportion of good firms and the expected net value for banks on low quality projects.

To solve the inefficiencies, different policies are available for the government to implement. If we do not treat the credit market in isolation, it becomes also possible to focus on the labor market: We propose an unemployment benefit to low quality types to encourage them to offer their labor forces rather than asking for a loan. The policy cost is then compared to the often cited interest rate subsidy offered to banks to reach a minimum profitability from pooling contracts.

JEL classification: D81; D82; H53.

*University of Catania, DEMQ (Dipartimento di Economia e Metodi Quantitativi), Catania ITALY. Tel. 0039 3288242694. e-mail: f.reito@unict.it, mail address: Via Altavilla, 58, 95126, Catania, Italy

1 Introduction

From the seminal paper of Stiglitz-Weiss [17], the literature on credit market and asymmetric information, demonstrates, with a few exceptions, the possibility of credit rationing equilibria. It is not always appropriate, anyway, to consider the credit market in isolation. In particular, if we take into account the possibility for the potential entrepreneurs to offer their force in the labor market, we would possibly be able to separate types without the inefficiency of the rationing. In this paper a simple model of the credit market is proposed. The bank's actions and the policy interventions are influenced by what happens in the labor market. The workers expected income affects the individual's choice (whether to be a worker or an entrepreneur) and, consequently, the borrowers pool faced by the banks.

In the proposed model, the potential entrepreneurs differ in their expected final returns. We assume for simplicity that there are only two types of firms/entrepreneurs with two different projects. The bank faces an adverse selection problem for the firm type is private information.

In the available literature[1], collateral can be used as a screening device. Banks have the possibility to offer a contract for each type with different collateral and interest rate requirements. The good project firm, so, is able to put up a larger (even illiquid or not usable as a monetary investment) sum as a signal, asking, at the same time, for a lower interest rate payment. Anyway not all the potential firms/entrepreneurs have enough (even illiquid)

[1]See, for examples: Bester[5], De Meza and Webb[9] and Innes[12].

money to use. In underdeveloped regions, for example, a situation where the banks grant a few loans with higher interest rates in the absence of external wealth, is easily observable. In these cases, and, in particular, if one project has a negative expected value and if the proportion of good firms is not high enough, the optimal response from the credit institution is to stop financing and leaving even the good firms without the possibility to start up the project.

The only way to escape from the sub-optimal, stable equilibrium is the participation of a sovereign authority as to modify players payoffs. A common policy intervention is to offer an interest rate subsidy to banks to let all the firms operating, with a rent gained by low project types.

Another possible policy, the one exploited in this paper, could be that of presenting a gift to bad entrepreneurs (as an unemployment benefit) if they choose not to ask for a loan and remain in the labor market as workers. If the bad entrepreneurs find it convenient to be simple workers, the banks will end up by facing no adverse selection problems.

This time the borrowers pool would be formed only by high quality firms and we also gain a separating equilibrium contract without any losses[2].

The final (expected) cost of implementing this unemployment benefit policy is then compared to the interest rate subsidy one, showing a large parameters space range of policy cheapness. Finally, we take into account the expected income of workers as a category to prove it is better to work only for good firms.

[2]With the interest rate subsidies, we only reach pooling equilibria with both kinds of firms operating.

The aim of the paper is to show how the optimal response of the authority to credit market inefficiencies is not only the one of giving subsidies to the bank or firm sectors. With respect to the relevant literature, this paper tries to develop the idea of solving the failures of a given market, focusing on another one. In our case, to avoid credit rationing we study the labor market conditions of who is potentially entitled to start up a firm.

The outline of the paper is as follows. The basic model is presented in section 2. Section 3 computes the principal credit market equilibria under asymmetric information in the two cases of entrepreneurs' initial wealth sufficient to pose collateral and not. Section 4 concludes proposing the unemployment benefit policy as a screening device.

2 The Model

There are two types of entrepreneurs with two different projects, H and L; both require a monetary investment of I to begin operating;

Consider the same production function for each firm with two arguments, one entrepreneur and one employee[3], but with different final expected return:

$$Exp[y] = f(1 \text{ entrepreneur}, 1 \text{ worker}) = \begin{cases} p_h h & \text{for entrepreneur } H, \\ p_l l & \text{for entrepreneur } L. \end{cases}$$

[3]It is of course possible to extend the case to n workers for each firm. This may prove helpful in the welfare comparisons of Section 4.

In words, project H (high quality one) succeeds with probability p_h and yields a return of h, whereas with probability $1-p_h$ it fails and yields nothing. The other entrepreneur has a riskier project, L, that yields, in case of success, a return, l, greater than h, but with a probability, p_l, smaller than p_h. Project H, in any case, has an higher expected return $hp_h > lp_l$.

Assume project H has a strictly positive net value (from banks' viewpoint): $hp_h > I$, and project L to give even a negative expected value ($lp_l \geq I$ or $lp_l < I$).

The firms/entrepreneurs have insufficient wealth to start the projects and need an outside financing. Consider a bank with imperfect information about the entrepreneurs type. We examine very briefly the case where the entrepreneurs have sufficient wealth to use as a screening signal and then analyze the case of policy implementation when the firms cannot offer a collateral because their wealth is too low.

A contract between the bank and the entrepreneur specifies the amount advanced by the bank, that is I, and a couple (R, C) where R is the amount the firm has to repay if the return is positive and C is the collateral required in the case of bankruptcy.

Notice that with full information, the optimal contracts are $(h, 0)$ for type H and $(l, 0)$ for type L, and remember that if firm's profits were fully observable by the bank, the latter could offer a share finance contract and attain the first best in any case.

Take, for the remainder, the following list of the main assumptions used throughout the paper:

Meaning of risky: The riskier project L is a mean preserving spread of project H in the sense analyzed by Stiglitz and Weiss[17]. If we assumed a mean first order domination (see for this case De Meza and Webb[9] and Innes[12]), with only two possible outcomes and in particular with firms wealth equal to zero, any contract would be always accepted by both types. This is in a certain sense the version of the paper where the bad firms have a negative expected value for the banks.

Fixed loan size: The firms demand an identical loan of I. This situation could be adequate to analyze credit loans to a pool of firms with similar project size. If the firms can ask different loan size contracts (as in Innes[12]), this information could be used to screen types. In these cases it is difficult, anyway, to reach the full separation[4].

Monopolistic bank: The bank is considered to be monopolistic; most of the literature on credit rationing considers the credit market to be competitive. For underdeveloped regions, anyway, a monopolistic bank could be a better assumption to describe the prevalent credit behavior and the higher interest rate contracts with respect to richer regions[5]. Considering the credit sector as competitive gives also the difficulty of the non existence of an unequivocal notion of competitive equilibrium in models with adverse selection.

Risk neutrality: All the agents are considered risk neutral. This simplifying assumption assures the possibility of using the collateral to screen

[4]It is a good approximation of the case of Southern Italy where around 75 percent of firms who ask for loans are very small. See [13].

[5]The high spread between Italian regions (See [14]) is a plain evidence.

types under asymmetric information. Stiglitz and Weiss [17] and [18] have shown that this property may disappear in a model of adverse selection where agents have different degrees of risk aversion. More risk averse entrepreneurs will be more collateral averse even though they have high quality projects. Collateral in these cases could not be used as a sorting device anymore.
On the interpretative side, risk neutrality can be considered a realistic assumption when we study the entrepreneurial risky activity in very poor environments[6].

3 Market Equilibrium

We will study the two cases, wealth, W, bigger than zero and wealth equal to zero, separately. Since bankruptcy is more frequent for type L, the bank can use a collateral requirement to separate types. Nonetheless, if the entrepreneurs' wealth is equal to zero, separation is considered impossible since a contract can specify only the repayment R. In the case a bank offered two different contracts with two different repayments, all the firms would choose the lower.

[6]This quality may allow us to distinguish entrepreneurs from simple workers that usually are considered more risk averse.

3.1 Case $W > 0$

If the entrepreneurs have sufficient wealth, $W > 0$, the bank can separate types by asking more collateral to good types only. In this case, assume also $W \geq C_h$, where C_h is the amount of collateral the bank requires to separate types. Firm H's and L's profit, with a contract of the type (R, C), are given respectively by

$$u_H(R, C) = W + p_h(h - R) - (1 - p_h)C, \quad \text{and}$$
$$u_L(R, C) = W + p_l(l - R) - (1 - p_l)C.$$

The bank can propose a pair of contracts trying to separate types[7]. Consider the pair (R_h, C_h) and $(l, 0)$ with R_h and C_h chosen so that the individual rationality constraint on H types and the incentive compatibility constraint on L types are satisfied with equality (consider for the remainder an outside option equal to zero as to approximate the case of a very low self-employment wage[8]) , so:

$$p_h(h - R_h) - (1 - p_h)C_h = 0, \qquad p_l(l - R_h) - (1 - p_l)C_h = 0.$$

The solution is

$$R_h = \frac{\theta h - l}{\theta - 1}, \qquad C_h = \frac{p_h p_l (l - h)}{p_h - p_l},$$

[7]This Section equilibria are based on Minelli and Modica[15] assumptions.

[8]This could be the case of a two sector model, traditional and industrial, where in the former there is a poor developed labor market with a very large supply and a wage that can be normalized to 0, and in the latter firms can develop only with the help of lending institutions.

where $\theta = p_h(1-p_l)/p_l(1-p_h)$.

With this contracts, the bank can easily separate the entrepreneurs. Its profits on type H and type L are, respectively

$$v(R_h, C_h; H) = p_h R_h + (1-p_h)C_h - I = hp_h - I \quad \text{and}$$
$$v(b, 0; L) = lp_l - I,$$

that are the full information or first best profits (that is project expected value minus investment costs). If the expected value for the bank on type L is negative, $lp_l < I$, it can be proposed just one contract, (R_h, C_h), and only the good firms will apply for a loan. The bank can again extract all the rent from trade as in a full information setting.

Therefore if W is high enough, it could be used as a sorting device and the equilibrium is efficient. Thanks to risk neutrality, the bank is able to separate types without leaving information rents[9].

3.2 Case $W = 0$

Consider now the case $W = 0$[10]. This time there is no possibility for the bank to use the collateral as a sorting device. What is interesting is that in the formulation of the model, there is not an observable parameter that could be used to screen types.

[9] In brief, (R_h, C_h) lies on the individual rationality line of each type.

[10] In these cases (very poor environments), the public institution is often asked to intervene. $W = 0$ is a polar assumption useful to describe environments where entrepreneurs initial endowments are not sufficient to put up as a collateral and the parameters do not allow for a separation.

Here a contract specifies only a repayment sum, R. Firm H's profit and firm L's profit are respectively

$$u_H(R) = p_h(h - R) \quad \text{and} \quad u_L(R) = p_l(l - R).$$

By incentive compatibility, the bank will propose a single contract and the entrepreneur will accept iff the expected payoff is at least equal to the outside option. Bank profits from contract R are (take λ as the proportion of good firms in the borrowers pool):

$$v(R) = \lambda p_h R + (1 - \lambda) p_l R - I \qquad \text{if } R \leq h \qquad \text{pooling contract , and}$$
$$v(R) = (1 - \lambda)(p_l R - I) \qquad \text{if } h < R \leq l \qquad \text{separating contract.}$$

The monopolistic bank will set $R = h$ or l in any contract to extract all the rent. It will set $R = h$ if pooling is more profitable, that is if

$$\lambda \geq \frac{p_l(l - h)}{(p_h - p_l)h + lp_l - I}$$

and $R = l$ otherwise. So if the above expression is not satisfied, the market equilibrium would operate with bad types only (but only, of course, if their expected net value for the bank is not negative, that is $lp_l \geq I$).

If the bank makes losses on bad types, it will set $R = h$ iff $h(\lambda p_h + (1 - \lambda)p_l) - I \geq 0$, that is we would observe a pooling equilibrium iff

$$\lambda \geq \frac{I - hp_l}{h(p_h - p_l)}.$$

Anyway we could have only a constrained efficient equilibrium since a contract accepted by good types will also be accepted by the bad ones.

As we are interested in solving problems, from now on, we will consider only inefficient conditions with the impossibility of using the collateral to signal the firm type. Starting with this sort of equilibrium, the only way to avoid a world without credit is an intervention from the sovereign authority. The individual's occupational choice, together with the agents payoff, may be influenced by a definite political manoeuvre while comparing the consequent costs and benefits.

4 Policy

Begin with the case of the last (constrained) efficient equilibrium and consider the case where no collateral is available ($W = 0$) and the proportion of good types, λ, is not so high to allow a pooling equilibrium.

If $\lambda < \frac{I - hp_l}{h(p_h - p_l)}$ no firms are operating.

4.1 The Interest Rate Subsidy

It is interesting and at the same time essential to consider the total (gross) cost of different policy interventions before making comparisons. For example, the interest rate subsidy is often cited and considered by governments. In this policy the bank is asked to lower the interest rate but, thanks to the subsidy, its revenue will be at least equal to that in the absence of policies

(no credit position and zero profit):

$$\lambda p_h(1+\beta)h + (1-\lambda)p_l(1+\beta)h - I = 0,$$

where β is the additional interest rate paid by the government to induce the bank financing all the firms (the interest rate to refer is the previous h since the outside option as workers is not modified in this policy[11]). The (per firm) cost of this policy is simply $(\lambda p_h + (1-\lambda)p_l)\beta h = I - (\lambda p_h + (1-\lambda)p_l)h$ and we will take it into account in the comparison with the cost of our next policy proposal. Whit this kind of intervention, all the projects (also the bad ones) are financed. The equilibrium is again unconstrained efficient and the size of the government spending depends on the absolute value of the loss generated by inefficient firms (those who have negative expected value or $p_l l - I < 0$).

4.2 The Unemployment Benefit Policy

Again refer to the non-credit scenario. Before analyzing the unemployment benefit screening policy, assume there are, for simplicity, n external workers and n potential firms (note that for limited loans availability, only a part of the population has the opportunity to be entrepreneurs). At the inefficient equilibrium (no firms in), everyone works in the traditional sector where the wage is given and normalized to 0.

[11] Minelli and Modica[15] have shown this is the most efficient policy (cheaper for the government) in this kind of asymmetric information setting. Another possible, but more expensive, policy is, for example, the investment subsidy where the authority co-finances a share of the project.

The proposed government intervention is as follows: it should impose a lower interest rate offered by the bank (R_{new}) with the promise of giving an unemployment benefit to bad entrepreneurs to discourage them asking for a loan. Again, R_{new}, should be chosen in order to keep bank's revenue at least equal to its pre-policy profits, that is:

$$v(R) = \lambda(p_h R_{new} - I) \geq 0,$$

where only good firms are considered.

It is useful to derive the employment rate after the policy intervention:

$$e = \frac{n\lambda}{2n - n\lambda} = \frac{\lambda}{2 - \lambda},$$

where e is the employment rate and $n\lambda$ is at the same time the number of good firms in the market and the consequent employees (firms have to assure them a wage at least equal to the outside option)[12].

The unemployment benefit will be calculated taking into account the potential rent gained by the bad types on the contract with a lower interest rate, $p_l(l - R_{new})$, or in other words, it must satisfy the bad types individual rationality constraint:

$$(1 - e)S \geq p_l(l - R_{new}),$$

[12]In the definition of e all agents, the n simple workers and the n potential entrepreneurs are considered. This is appropriate both in the case examined here where the unemployment benefit is granted only to potential entrepreneurs and in the case, that will be discussed in the footnote 14, where the benefit is conceded to everyone unemployed. This last case happens when the potential entrepreneurs do not have a label to distinguish themselves from simple workers. Thanks to Jean Hindriks (UCL University - CORE) for comments on this.

where the left hand side is the worker expected payoff having normalized the reservation wage to 0 and S indicates the benefit offered by the government for unemployed entrepreneurs.

The policy must also satisfy the incentive compatibility constraint for the good types to avoid the possibility of announcing themselves as bad types:

$$(1-e)S \leq p_h(h - R_{new}).$$

The per capita insurance sum is then:

$$S = \frac{1}{1-e} p_h p_l \frac{l-h}{p_h - p_l}$$

and the repayment to the bank:

$$R_{new} = \frac{hp_h - lp_l}{p_h - p_l}.$$

The repayment needs to satisfy $p_h R_{new} \geq I$ otherwise the bank would find it optimal to propose no contract[13]. Stiglitz and Weiss [17] tacitly maintain this type of assumption in a different setting though. In the second section of their paper, when they analyze the choice of a single firm between two projects (a moral hazard problem), the bank, implicitly, finds it convenient the lower repayment designed in order to let the firm choose the safer project. Without the assumption, we remain stuck in a no-contract equilibrium for

[13]Another way to implement the policy is as follows: the government could impose a repayment level as to satisfy the bank zero profit condition with equality on the contract with H types, $R_{new} = \frac{I}{p_h}$. Then the two constraints (IC of L and IR of H) should be satisfied giving an upper bound for the interest rate repayment on the contract for good firms. It happens to be the same as before, $R_{new} \leq \frac{hp_h - lp_l}{p_h - p_l}$.

$0 < p_l l - p_h R_{new} < I - p_h R_{new}$. This assumption is clearly not essential if the government could also subsidy the bank if $p_h R_{new} < I$ in order to reach a zero profit situation and then consider this additional cost when comparing different policy outcomes. To ease the exposition and avoid several subcases, we exclude that possibility.

The final (per firm) cost of this policy is $(1-\lambda)(1-e)S$, where only bad and unemployed entrepreneurs are taken into account. The new equilibrium is efficient for only good projects are financed.

4.3 Comparison between Policies

It is cheaper to use the unemployment subsidy when:

$$(\lambda p_h + (1-\lambda)p_l)\beta h \geq (1-\lambda)(1-e)S$$

that always holds when (letting $\gamma = \frac{l-h}{p_h - p_l}$) :

$$\lambda < \frac{I - p_l(h - \gamma p_h)}{p_h(h - \gamma p_l)},$$

giving a wide parameters range to policy intervention comparing the last sum to the initial inefficient condition[14].

[14]If the unemployment benefit is offered to all unemployed (it is the case when entrepreneurs do not have a label to distinguish themselves from simple workers), we should consider $(\lambda p_h + (1-\lambda)p_l)\beta h \geq (2-\lambda)(1-e)$, where $(2-\lambda)$ represents all the agents except the good firms. This option, *ceteris paribus*, enhances policy costs but the theoretical result remains unchanged. See footnotes 3 and 6 that give an idea of how the analysis should then be implemented if the policy cost becomes too high. We could, for example,

Note that in the derived benefit sum we are not considering any sort of (not-modeled in this paper) 'non effort' utility from staying at home. This parameter is obviously not important for the final intuition of this model but it could be relevant for two reasons: first, it would enhance the numerical conclusions for the policy cost would be reduced and second, a large disutility from working gives the possibility of a benefit lower than a strictly positive reservation wage. Note also that, with the unemployment benefit policy, only good firms ask for a loan while the remaining bad entrepreneurs prefer to stay in the labor market. This should be taken into account when deciding upon the desirability of each intervention.

With the unemployment benefit, all the bad entrepreneurs prefers to offer their labor force rather than run a firm. In the new equilibrium, the (and only the) good projects are financed, the bank is at leat weakly better off with respect to the no-credit equilibrium and we observe no inefficient (net) losses.

Finally, we can compute the per capita expected income of a worker after each policy to show the net gain of the employees as a category. The expected payoff is higher under our proposal when:

$$0 \leq \frac{(1-\lambda)[(1-e)S]}{2-\lambda},$$

where the left hand side term is the expected payoff per worker in a pooling equilibrium and the right one is the expected in the proposed separating

take into account risk averse simple workers and a utility function considering both income and leisure to decrease the unemployment benefit level.

equilibrium with good firms only. At first sight, it could seem unusual to find an unemployment revenue bigger than the reservation wage. This happens for a precise utility function over income and leisure was not modeled. This singularity, then, could be avoided simply considering a cost from working high enough so the benefit is lower than a strictly positive reservation wage.

In the new equilibrium, reached with the unemployment benefit policy intervention, only the good types are financed. The bank extracts all the possible rent from them and do not care about the low quality entrepreneurs. In a certain parameters space range, the policy becomes less expensive than the often proposed interest rate subsidy and the workers as a category are not worse-off.

This is only to argue that in the presence of credit market failures due to asymmetric information, the possible solution can be attained also focusing in an apparently distant market. The strategy, often used, of subsidizing the credit sector may be less efficient than a simple intervention in the labor market as to avoid the behavior of bad entrepreneurs. The latter may ask for a loan just because they do not have a minimum outside option as workers.

5 Conclusion

In this paper it has been analyzed a simple model of asymmetric information in the credit market when it interacts with the labor market. In the absence of any policy interventions, we often observe a situation where the banks are

not willing to grant loans for the presence, in the borrowers pool, of high risk firms with negative expected value projects. Different policies could be implemented, such as the interest rate subsidy leading to a pooling equilibrium where all the firms are operating and the banks makes no profit.

It is argued that even an intervention in the labor market can change the stable equilibrium with an interesting difference: only the good entrepreneurs will ask for a loan whereas the bad ones prefer to offer their labor force when they receive a sufficient unemployment benefit. That is, the way to reach an efficient equilibrium is not only the one of giving money to the banks but to assure a better outside option to workers.

With respect to the available literature, this paper considers the idea of focusing in a certain market to solve the inefficiencies we observe in other apparent distant markets. In the case studied above, labor and credit markets are in some ways so linked as to allow policy makers to avoid credit rationing just caring of workers' welfare.

References

[1] Banerjee, A.V. and A. Newman (1993): Occupational Choice and the Process of Development, Journal of Political Economy 101, 274-298.

[2] Banca d'Italia (2002): Bollettino Statistico, IV.

[3] Benabou, R. (1996): Inequality and Growth, NBER Macroeconomic Annual.

[4] Besanko, D. and A. Thakor (1987): Collateral and Rationing: Sorting Equilibria in Monopolistic and Competitive Credit Markets, International Economic Review, 28(3), 671-689.

[5] Bester, Helmut (1985): Screening versus Rationing in Credit Markets with Imperfect Information, American Economic Review 75, 850-855.

[6] Bester, Helmut (1987): The Role of Collateral in Credit Markets with Imperfect Information, European Economic Review 31, 887-899.

[7] Choe C. (1998): A Mechanism Design Approach to an Optimal contract Under Ex Ante and Ex Post Private Information, Review of Economic Design 3, 237-255.

[8] Commission of the European Community (2003): Communication from the commission on the implementation of the 2002 Broad Economic Policy Guidelines.

[9] De Meza, David and Webb, D.C. (1987): Too Much Investment: A Problem of Asymmetric Information, Quarterly Journal of Economics 102, 281-292.

[10] De Meza, D. and D. Webb (2000), Does Credit Rationing Imply Insufficient Lending? Journal of Public Economics 78, 215-234.

[11] Ghosh, Parikshit, Dilip Mookherjee and Debraj Ray (2000): Credit Rationing in Developing Countries: an Overview of the Theory, in A Reader in Development Economics, edited by D. Mookherjee and D. Ray, Blacwell.

[12] Innes, Robert (1991): Investment and Government Intervention in Credit Markets when There is Asymmetric Information, Journal of Public Economics 46, 347-381.

[13] Italian Ministry of Industry (2003): Indagine sulla Legge 488/92.

[14] Italian Treasury (2003): Fifth report on territorial Development.

[15] Minelli, Enrico and Modica Salvatore (2003): Credit Market Failures and Policy,Core Discussion Paper UCL.

[16] Piketty, T. (1997): The Dynamics of Wealth Distribution and the Interest Rate with Credit Rationing, Review of Economic Studies 64, 173-189.

[17] Stiglitz, Joseph E. and Andrew Weiss (1981): Credit Rationing in Markets with Imperfect Information, American Economic Review 71, 393-410.

[18] Stiglitz, Joseph E. and Andrew Weiss (1992): Asymmetric information in Credit Markets and its Implications for Macro-Economics, Oxford Economic Papers 44, 694-724.

[19] Townsend, Robert (1979): Optimal Contracts in competitive markets with Costly State verification, Journal of Economic theory 21, 265-293.

Redistribution as a Device for Total Screening in a Credit Market with Adverse Selection

Francesco Reito *

Abstract

A simple model based on Stiglitz-Weiss (1981) is analyzed. Agents are heterogeneous in terms of observable, albeit not liquid, endowment. The presence of adverse selection forces borrowers to pose some collateral to secure their loans. When the individual wealth is not sufficient to reach the threshold of collateral needed by creditors to separate types, credit rationing may occur.

To solve the inefficiencies, different policies are available for the government to implement. This paper policy proposal, namely an overall redistribution of initial wealth, in general proves to be:

a) unconstrained efficient in the sense it produces a total screening and not a pooling equilibrium,

b) cheaper than other alternatives and

c) pareto improving.

JEL classification: D81; D82; H53.

Keywords: monopolistic screening, policy intervention, credit rationing

*University of Catania, DEMQ (Dipartimento di Economia e Metodi Quantitativi), Catania, ITALY. Tel. 0039 3288242694. e-mail: f.reito@unict.it, mail address: Via Altavilla, 58, 95126, Catania, Italy.

1 Introduction

From the seminal paper of Stiglitz-Weiss (1981), an extensive literature on credit market imperfections have shown how asymmetric information can be the source of several inefficiencies on market equilibria[1]. The common remedy, exploited by creditors to solve moral hazard or adverse selection problems, is a collateral requirements chosen in order to separate types. It is widely recognized that this instrument of screening, along with a type dependent interest rate repayment, is sufficient to reach the first best solution. Of course, this kind of screening is possible only if potential firms have enough collateral to pose. This is not the case of the very poor environments in less developed countries where, who has a feasible project usually has neither the monetary sum to start up a firm nor the collateral to secure a debt.

In such environments, the sovereign institutions are often asked to intervene to improve efficiency when possible. Recently, some research has been devoted to pointing out some forms of legal interventions and, as a very brief review, I will suggest to take into account the following three papers on that topic. The first one is de Meza-Webb (1987) that suggests an investment tax when credit market are characterized by over-investment. This is in net contrast to the Stiglitz-Weiss (1981) scenario. The second is Mankiw (1986) that argued how investment subsidies can be beneficial for firms to relieve their liability burden. The third work I refer is Minelli-Modica (2003). When

[1] See as a refresh, Bester (1985) and (1987), de Meza-Webb (1987) and (2000) and Innes (1991).

firms are too poor to operate they suggest the government should intervene directly providing the necessary collateral to all potential firms. The creditors, as a consequence, find it profitable to offer pooling contract and firms receive the monetary gift only if their projects succeed. The authors then compare this (constrained) efficient pooling equilibrium with the ones generated by the two most widely used policy instrument in developing countries, namely *interest rate* and *investment* subsidies[2]: all three policies produce pooling equilibria, but the money in a saving account and the interest rate subsidy policies are the most efficient in the sense they have the highest difference between benefits and costs. They have the same expected cost for the policy-maker but the interest rate subsidy has also the additional drawback of distorting the equilibrium price in the capital market.

In the model examined here, I propose a different government intervention: a complete redistribution of initial wealth in order to accomplish a total screening in the population of firms. Through the redistribution the authority should assure to all potential firms the level of collateral needed by banks to separate types. As a result, the bank can screen all potential firms and only good types ask for a loan. When the total wealth is not enough, the government should pose its additional money and that is the cost I will compare to the ones of other policy alternatives. For pareto efficiency, the surplus generated running all the good firms will also serve to pay back those

[2]The interest rate policy subsidizes the bank by augmenting the loan interest rate when it is not sufficient to guarantee a pooling equilibrium. With the investment subsidy intervention, the government directly co-finances a share of the loan needed by borrowers.

who contributed more to the public fund.

Every economist knows the pros and cons of redistribution policies. In an adverse selection setting, redistribution can have the following unambiguous efficient property. Instead of dealing with pooling equilibria, where the losses generated by bad types have to be taken into account, this paper proposal let only good firms operate. Nonetheless, if the surplus of all good firms is so high as to compensate the entrepreneurs who initially had more than the pre-policy endowment, we also avoid the consideration about adverse impact on production incentives. In addition, it is shown the redistributive operation is cheaper than other policy options in a very wide parameters interval.

Total redistribution is, clearly, a polar case used to point out how beneficial this kind of intervention can be. In less developed countries, good entrepreneurial ideas are usually not exploited for initial wealth is inefficiently distributed. If poor firms projects are divided into two types, good and bad, policies that generate pooling equilibria can actually have negative effects for a simple reason: entrepreneurs, who are at the same time *poor* and *bad*, become, in a sense, justified to pursue their risky projects for their outside option is very low. After a redistribution, instead, they turn out to be responsible for the loss of their own *new* property in case of bankruptcy. As a result, via the screening collateral requirement, bad-poor entrepreneurs become aware on the nature of their activity and only *good* entrepreneurs will have the incentive to run a firm.

The outline of the paper is as follows. The basic model is presented in section 2. Section 3 computes credit market equilibria under asymmetric

information both when entrepreneurs' initial wealth is sufficient to pose collateral and not. Section 4 compares two possible policies: the interest rate subsidy and the proposed redistribution as a total screening device. Section 5 concludes with a numerical example.

2 The Model

A 1 period economy is considered. There is a traditional sector with a very large number of identical agents and a potential industrial sector with a continuum of prospective entrepreneurs of total mass 1, identified with the interval $[0, 1]$ representing each agent initial endowment, e. The distribution of people over e is described by the cumulative function $F(e)$.
The initial endowment is considered observable but not liquid forcing any potential firm to ask for an outside loan to start-up a project. We consider a monopolistic and, jointly, monopsonistic bank offering financing contracts. Thanks to observability, every contract can be conditioned on the wealth level.

There are two types of entrepreneurs with two different projects, A and B; both require a monetary investment of I to begin operating;

Consider the same production function for each firm with two arguments, 1 entrepreneur and $n \geq 1$ employees. The two projects differ in the final

expected return, $Exp[y]$:

$$Exp[y] = f(1 \text{ entrepreneur}, n \text{ workers}) = \begin{cases} ap_a & \text{for entrepreneur } A, \\ bp_b & \text{for entrepreneur } B. \end{cases}$$

In words, project A the *high quality* one succeeds with probability p_a and yields a return of a, whereas with probability $1 - p_a$ it fails and produces nothing. The other entrepreneur has a *riskier* project, B, that yields, in case of success, a return, $b > a$, but with a probability, $p_b < p_a$. Project A, in any case, has an higher expected product $ap_a > bp_b$.

Assume project a has a weakly positive net value (from creditors' viewpoint), $ap_a \geq I$, and project B a negative one, $bp_b < I$.

As for the *information structure*, each firm knows its own quality. The bank, instead, only knows there are two types of projects, *good* and *bad*, for each wealth level. It also knows the distribution function over e and the proportion of good types, λ. This creates a typical adverse selection problem and the bank has to design contracts in order to avoid B types for they have a negative net value (the bank makes losses with this kind of borrowers).

2.1 Main Assumptions

Take, for the remainder, the following list of the main assumptions used throughout the paper:

Meaning of risky: the riskier project B is a mean reducing spread of project A in the sense analyzed by Stiglitz-Weiss (1981). If we assumed a

mean first order domination (see for this case De Meza-Webb (1987) and Innes (1991)), with only two possible outcomes and in particular with firms wealth equal to zero, any contract would be always accepted by both types. This is in a certain sense the version of the paper where the bad firms have a negative expected value for the banks.

Fixed loan size: the firms demand an identical loan of I. This situation could be adequate to analyze credit loans to a pool of firms with similar project size[3]. If the firms can ask different loan size contracts (as in Innes (1991)), this information could be used to screen types. In these cases it is difficult, anyway, to reach the full separation.

Monopolistic-Monopsonistic bank: the bank is considered to be monopolistic; most of the literature on credit rationing considers the credit market to be competitive. For underdeveloped regions, anyway, the assumption of monopoly turns out to be a good assumption to describe the prevalent credit behavior compared to richer regions[4]. Considering the credit sector as competitive gives also the difficulty of the non existence of an unequivocal notion of competitive equilibrium in models with adverse selection. The monopsony on the side of deposits collection, allows us to normalize at 0 the interest rate paid on banking deposits. That fits the evidence in Italy too (see again Bank of Italy report of 2002).

[3]It is a good approximation of the case of Southern Italy where around 75% of firms asking for loans are very small. See Italian treasury report of 2003.

[4]The high spread between Italian regions is a plain evidence. See Bank of Italy report of 2002.

Risk neutrality: all the agents are considered risk neutral. This simplifying assumption assures the possibility of using the collateral to screen types under asymmetric information. Stiglitz-Weiss (1981) and (1992) have shown that this property may disappear in a model of adverse selection where agents have different degrees of risk aversion. More risk averse entrepreneurs will be more collateral averse even though they have high quality projects. Collateral in these cases could not be used as a sorting device anymore.
On the interpretative side, risk neutrality can be considered a realistic hypothesis when studying any sort of entrepreneurial activity. This feature, in fact, consent to distinguish entrepreneurs from simple workers that usually are considered more risk averse.

3 Market Equilibrium

A contract between the bank and the entrepreneur specifies the amount advanced by the bank, I, and a couple (R, C) where R is the sum the firm has to repay if the return is positive and C is the collateral required in case of bankruptcy.

Had we full information, the optimal contracts would be $(a, 0)$ for type A and no-contract for type B since $bp_b < I$. By offering $R = a$ and $C = 0$ to A, the monopolistic bank is able to attain its first best profits, $ap_a - I$, that is project expected value minus investment costs. Note that if firm's profits were fully observable, the bank could offer a share finance contract and reach

the first best again.

We will study the two following possible cases:

- individual wealth, $e \geq C^{FB}$ where C^{FB} is, as defined later, the equilibrium collateral the bank requires in order to separate types. We will see it is considered a first-best level of collateral for the bank through C^{FB} is able to reach its first-best profits.

- individual wealth, $e < C^{FB}$.

Since bankruptcy is more frequent for type B, the bank can use the collateral requirement to separate types. Nonetheless, if the entrepreneurs' wealth is below C^{FB}, we will see separation is rarely possible (it is for singular parameters values) and the collateral loses its property of screening device. In this case a contract can only specify the repayment level R. Anyway this is not feasible for, if two different contracts with two different repayment levels were offered, all the firms would choose the lower.

3.1 Case $e \geq C^{FB}$

If the entrepreneurs have sufficient wealth, the bank can separate types by asking a determinate collateral level, C^{FB}. The contract assumes the form of a pair (R^{FB}, C^{FB}) where the over-script FB announces that with this pair the bank achieves its first-best profits.

Take, for notational use, $(R^{FB}, C^{FB}) = (R, C)$.

To obtain R and C, we first have to derive firms and bank expected utilities. For an endowment level of $e \in [0, 1]$, firm A's and B's profit, with

a contract of type (R, C), are respectively given by

$$u_A(R, C) = e + p_a(a - R) - (1 - p_a)C \quad \text{and}$$
$$u_B(R, C) = e + p_b(b - R) - (1 - p_b)C.$$

We imagine every firm has initially deposited the endowment in a banking saving account and, by the assumption of monopsony, receives the lowest possible deposit rate (normalizable to 0). Since it is assumed there is an initial traditional economy with a very large number of agents, we can also normalize the reservation wage to 0. The participation constraint, thus, is simply equal to the initial level of individual endowment of each potential entrepreneur, that is

$$u_A(R, C) \geq e \qquad (\text{PC}_\text{A}) \qquad \text{and}$$
$$u_B(R, C) \geq e \qquad (\text{PC}_\text{B}).$$

Since the expected net value of B projects is negative from banks viewpoint, $bp_b < I$, the latter will try not to have bad firms in the borrowers pool. The bank will propose the pair (R, C) chosen so that the individual rationality constraint on A types and the incentive compatibility constraint on B types are satisfied with equality:

$$\begin{cases} e + p_a(a - R) - (1 - p_a)C = e & (\text{IC}_\text{A}) \qquad \text{and} \\ e + p_b(b - R) - (1 - p_b)C = e. & (\text{PC}_\text{B}) \end{cases} \tag{1}$$

The solution is

$$R = \frac{\theta a - l}{\theta - 1}, \qquad C = \frac{p_a p_b (b - a)}{p_a - p_b},$$

where $\theta = p_a(1-p_b)/p_b(b-p_a)$.

With this contract, the bank can easily separate the entrepreneurs. Moreover, the contract can be modified so that incentives are strict and only A firms will apply (Bs are out).

Bank profits on type A are

$$v(R, C; A) = p_a R + (1 - p_a)C - I. \tag{2}$$

Since from (1)

$$p_a R + (1 - p_a)C - I = p_a R + p_a(a - R) - I = ap_a - I,$$

it follows that the solution in (2) represents exactly the full information or first best profits. The bank can extract all the rent from trade as in a full information setting.

Therefore, if e is high enough, collateral can be used as a sorting device and the equilibrium is efficient. Thanks to risk neutrality, the bank is able to separate types without leaving information rents[5].

Considering the continuum of entrepreneurs, total profits for the bank are

$$v(R, C; e \geq C) = \lambda \int_C^1 (ap_a - I)dF(e), \tag{3}$$

where all good (λ) firms with wealth above C are financed.

[5]In brief, (R, C) lies on the individual rationality line of each type.

3.2 Case $e < C^{FB}$

Consider now the case where $e < C^{FB}$. This time there is only a rare possibility for the bank to use the collateral as a sorting device. It only happens for a singular combination of parameters but it is in general not possible. Assume it is not, so that the collateral is not a signalling device for all $e < C^{FB}$.

To avoid credit rationing for all poor firms, the bank could ask *No Collateral* and a very large repayment level trying again to extract all firm surplus. Theoretically, this operation is feasible for a monopolistic bank is not interested in an insufficient collateralizing wealth. In this case a contract will only specify the repayment sum, R. As a result, firm A's profit and firm B's profit are respectively

$$u_A(R) = p_a(a - R) \qquad \text{and A will accept the contract if } R \leq a$$

and

$$u_B(R) = p_b(b - R) \qquad \text{and B will accept the contract if } R \leq b.$$

The bank will set $R = a$ or $R = b$ in any contract to extract all the rent. Since $a < b$, if $R = b$ only bad firms would apply. This will never be profitable for the bank since $bp_b < I$.
If on the other hand, $R = a$, all the firms are attracted and the bank will have to concede a pooling equilibrium contract. The parameter λ, showing the proportion of good types, now becomes of interest in the analysis[6].

[6]It is possible to consider the parameter λ as dependent on wealth level in a way such

By incentive compatibility, the bank will propose a single contract and any entrepreneur will accept iff his expected payoff is at least equal to the outside option. Bank profits from a pooling contract R are:

$$v(R) = \lambda p_a R + (1-\lambda) p_b R - I \qquad \text{if } R \leq a. \tag{4}$$

As a consequence *all* types will apply.

Clearly, the bank chooses the highest repayment level, $R = a$, but only if pooling is profitable, that is if

$$a(\lambda p_a + (1-\lambda) p_b) - I \geq 0$$

or

$$\lambda \geq \frac{I - a p_b}{a(p_a - p_b)}. \tag{5}$$

Unfortunately the equilibrium is only constrained efficient since a contract is accepted by all types.

When (5) holds, we observe that *rich* and *good* firms along with *all* poor ones have the possibility of being financed. This hypothetical equilibrium needs a assumption implicitly considered in the literature on credit rationing, that is

$$\int_0^1 e dF(e) \geq \int_0^C I dF(e) + \int_C^1 \lambda I dF(e). \qquad \textit{(H1)}$$

---

that $\lambda'(e) > 0$. The intuition behind could be the incentive for poor firms to undertake risky projects if they only lose a small endowment after bankruptcy. A λ increasing in wealth would explain the lower probability of getting a loan the poorer is the initial asset. See next expression (5). It shows the lower is λ, the more difficult is to obtain a pooling equilibrium.

The assumption *H1* (a sort of condition for the equilibrium in the capital market) says the total wealth, deposited in the bank, should be at least equal to the money required to finance all possible equilibrium projects in the best case. Namely, the first integral should be greater than the investments needed by all poor firms (pooling equilibrium) plus the investments needed by screened rich and good firms.

If the expression (5) is not satisfied, there would be a no-contract equilibrium. All firms with $e < C$ and, evidently, all poor A types having a positive expected value are not financed.

As we are interested in solving problems, from now on, we will consider only inefficient equilibria with the impossibility of using the collateral to signal the firm type. In these cases (very poor environments), the public institution is often asked to intervene. Starting with this sort of equilibrium, the only way to avoid a world without credit is an intervention from the sovereign authority. The individual's occupational choice, together with the agents payoff, may be influenced by a definite political manoeuvre while comparing the consequent costs and benefits.

4 Policy

Begin with the case of the last inefficient equilibrium and consider all the potential entrepreneurs with $e < C$. Take the proportion of good types, λ, not so high as to allow a pooling equilibrium.

In other words, if

$$a(\lambda p_a + (1-\lambda)p_b) - I < 0 \tag{6}$$

or $\lambda < \frac{I - hp_l}{h(p_h - p_l)}$ no poor firms are operating for the bank finds that unprofitable. This represents an inefficient equilibrium from a social standpoint if the following assumption holds:

$$\lambda a p_a + (1-\lambda) b p_b - I \geq 0, \qquad \textit{(H2)}$$

that is if, on average, poor firms produce more than the resources exploited. When this assumption holds, it proves better to have all types of poor firms financed rather than none.

In the next subsections some possible government policies are compared to find the most efficient in this asymmetric information setting.

4.1 The Interest Rate Subsidy Policy

With this policy the bank is asked to offer the *unprofitable* pooling interest rate, a, to all firms with $e < C$. Thanks to the subsidy, its (per firm) revenue will be maintained at least equal to that in the absence of policies (no credit to poor firms and zero profit):

$$\lambda p_a (1+\beta) a + (1-\lambda) p_b (1+\beta) a - I = 0,$$

where β is the additional interest rate paid by the government to induce the bank financing poor firms.

The total cost of this policy is simply the sum of all the differences between the investment required and the average firm repayment:

$$\int_0^C [I - (\lambda p_a + (1-\lambda)p_b)a]dF(e), \tag{7}$$

and we will take it into account in the comparison with the cost of our next policy proposal. Whit this kind of intervention, all poor projects (also the bad ones) are financed[7]. The equilibrium is again unconstrained efficient and the size of the government spending depends on the absolute value of the loss generated by inefficient firms.

4.2 The Redistribution Policy

Again refer to the no-credit scenario.

The proposed government intervention is as follows: the government should redistribute all initial wealth before any contract is made. Namely, it should take all the endowments

$$\int_0^1 edF(e)$$

and give every potential entrepreneur $C = C^{FB}$. But things are not always so simple and we have to consider the next two sub-cases.

[7]Minelli-Modica (2003) have shown this is the most efficient policy (cheaper for the government) in this kind of asymmetric information setting.

4.2.1 Sub-case $\int_0^1 edF(e) \geq \int_0^1 CdF(e)$

If the total initial asset is sufficient to guarantee the same level of collateral, C, to every potential firm, we get a full separation. The bank is able to apply the screening system of equations (1) to every firm and all (and only) A firms are financed.

It is worth noting there are no expenses for the authority.

For pareto-efficiency the redistribution is viable only if:

$$\lambda \int_0^1 (ap_a - I)dF(e) \geq \lambda \int_C^1 (ap_a - I)dF(e) + \int_C^1 (e - C)dF(e), \quad (8)$$

where the left hand side represents the gross bank profits after the intervention since *all good* firms are financed. The right hand side is the sum between the pre-policy bank profits (with only *rich* and *good* firms financed) and the repayments due to the entrepreneurs who initially had an endowment bigger than C.

4.2.2 Sub-case $\int_0^1 edF(e) < \int_0^1 CdF(e)$

If the total initial wealth is not high enough to give everyone C, the government has to intervene covering that gap. The total cost of this policy is simply

$$\int_0^1 CdF(e) - \int_0^1 edF(e), \quad (9)$$

where the monetary expense clearly depends on the difference (9) and on the specific form of the distribution function.

Again we get a full separation. *All* good firms are financed and bad types are not.

In the next section the costs of the above two policies are compared. It is not, of course, an obligatory step in our analysis since the two interventions produce different results in terms of firms actually financed. Nonetheless, this becomes relevant if we want to have an idea about the sustainability of different policy alternatives.

5 Comparison between Policies

The redistribution policy is cheaper for the authority when the expression (7) is higher than (9), that is when

$$\int_0^C I dF(e) - \int_0^C a(\lambda p_a + (1-\lambda)p_b) dF(e) \tag{10}$$

$$\geq$$

$$\int_0^1 C dF(e) - \int_0^1 e dF(e). \tag{11}$$

The expression (10) represents the interest rate policy cost as the subsidy received by the bank. It is the difference between the total investments required to finance *all* poor firms and the pooling profits the bank gets fixing the common interest rate at the low level a. The expression (11) simply shows the redistribution policy cost as the public money necessary to fill up the difference between the amount needed to guarantee C to everyone and the initial total wealth.

In the next subsection a numerical example is presented showing there is a very large category of distribution functions and a very large parameters interval where (the interest rate subsidy is more expensive than the redistribution policy. Here note that, for (6), (H1) and the fact that $I > C$, we have $\int_0^1 edF(e) > \int_0^C IdF(e)$ and (10) is always larger than (11) if the following inequality holds:

$$\int_0^C IdF(e) - \int_0^1 \lambda IdF(e) > \int_0^C CdF(e) + \int_C^1 CdF(e). \qquad (12)$$

It can be shown that (12) always holds when $\lambda > \frac{C}{I}$. This gives us a shortcut rule to derive a threshold level of λ above which (10) is *always* larger than (11). Obviously, this happens for a larger interval depending on the values of all parameters.

5.1 A Numerical Example

To clarify the meaning of all the expressions in the analysis, it proves helpful to present a numerical example based on all the inequalities and assumptions used throughout the model.

Consider, as said, a distribution of people over the endowment level that can assume all the values between 0 and 1. For simplicity it will be used a frequency distribution function as the one in figure 1.

[FIG. 1 HERE]

It is the classic representation of the descendent portion of a parabola of

generic equation:

$$f(e) = 1 + \alpha(1 - e)^{\alpha},$$

where α, the degree of concavity of the function, also represents a measure of the proportion between poor and rich in the population. The higher the parameter α, the more agents are concentrated close to the origin and, consequently, the poorer is the population. In any case the total mass of population (the integral of the function) should be equal to 1 so that the vertical intercept corresponds to $\alpha + 1$.

Despite its simplicity, the above representation can clearly be a good approximation of the initial distribution of wealth in underdeveloped regions.

Consider the following numerical data, all satisfying the constraints of section 2:

$$p_a = 0.9 \qquad p_b = 0.4 \qquad a = 0.6 \qquad b = 1.$$

It is, as assumed, $p_a > p_b$, $a < b$ and $ap_a > bp_b$. The project B produces an higher outcome but with a lower probability.

With the data above, the screening system (1) requires a level of collateral, C, equal to 0.29. The condition of inefficiency (6) says that if $\lambda < 0.67$, pooling equilibria are not profitable for the bank and the government should intervene. Take $\alpha = 4$ as shown in figure 2.

[FIG. 2 HERE]

It obviously is

$$\int_0^1 5(1 - e)^4 de = 1,$$

that means there is a total population of mass 1.

Total wealth (equal to the average) is

$$\int_0^1 5e(1-e)^4 de = 0.25.$$

An overall redistribution policy gives everyone a level of collateral equal to $C = 0.29$. Since $0.25 < C$, we need a sovereign monetary effort to guarantee the same level to everyone. The total cost of this policy is $0.29 - 0.25$. After the intervention, total wealth has the trend depicted in figure 3.

[FIG. 3 HERE]

One of the main concerns about redistribution policies is the effective pareto-efficiency of the operation. To get through that, we need to satisfy the expression (8) or

$$\lambda \int_0^C (ap_a - I) dF(e) \geq \int_C^1 (e - C) dF(e).$$

In other words, the surplus produced by all good firms with wealth below C, should be at least equal to the amount needed to repay those people who originally had more than C. In figure 4, this happens when the value of the area below $f(e)$ from 0 to 0.29 multiplied to $ap_a - I$ is larger than the difference between the area below $ef(e)$ and the area below $Cf(e)$ both from 0.29 to 1 .

[FIG. 4 HERE]

With our data, this happens when $\lambda > 0.24$ leaving a large room for sovereign interventions.

Finally, the redistribution policy is always cheaper than the interest rate subsidy when (10) holds, that is when $\lambda > 0.36$. This last result, as said, is

not essential for the analysis since the two policies have different results in terms of firm types involved.

6 Conclusion

Economists have widely discussed about the positive and negative effects of redistribution policies. Some of them argued these type of interventions causes inevitable reduction on production incentives.

This paper tries to analyze this topic from another perspective. In a market (here a credit market, but the reasoning is quite the same in other contexts) where adverse selection forces creditors to ask for collateral to secure a loan, redistribution have undoubtedly beneficial effects. Namely, when the individuals wealth is not sufficient to allow the bank to screen types, some projects that may have a positive net value from a social standpoint cannot be financed. In such cases, the sovereign authority is somehow supposed to intervene. To my knowledge, the two most widely applied policies are the interest rate and the investment subsidy policy. Both solve the problem of credit rationing but produce pooling equilibria with all types of firms operating.

This paper proposal, instead, has the advantage of avoiding the rationing and at the same time it generates a separating equilibrium with only good firms in the borrowers pool. Nonetheless, the redistribution does not automatically imply a reduction on economic incentives if the policy is also

pareto-improving. Total redistribution is, of course, a polar case used to describe the beneficial effects this sort of intervention can have. It proves extremely important when an economy has potential good resources that cannot be exploited for the lack of information suffered by market participants. In this model example, the prospective wealth generated by all good projects may plausibly be so high as to have a positive net value for the society as a whole. The comparison between policy costs, gives us an indication about the practically attainability of such a radical result.

References

[1] Banerjee, A.V. and A. Newman (1993): Occupational Choice and the Process of Development, Journal of Political Economy 101, 274-298.

[2] Banca d'Italia (2002): Bollettino Statistico, IV.

[3] Benabou, R. (1996): Inequality and Growth, NBER Macroeconomic Annual.

[4] Besanko, D. and A. Thakor (1987): Collateral and Rationing: Sorting Equilibria in Monopolistic and Competitive Credit Markets, International Economic Review, 28(3), 671-689.

[5] Bester, Helmut (1985): Screening versus Rationing in Credit Markets with Imperfect Information, American Economic Review 75, 850-855.

[6] Bester, Helmut (1987): The Role of Collateral in Credit Markets with Imperfect Information, European Economic Review 31, 887-899.

[7] Choe C. (1998): A Mechanism Design Approach to an Optimal contract Under Ex Ante and Ex Post Private Information, Review of Economic Design 3, 237-255.

[8] Commission of the European Community (2003): Communication from the commission on the implementation of the 2002 Broad Economic Policy Guidelines.

[9] De Meza, D. and Webb, D.C. (1987): Too Much Investment: A Problem of Asymmetric Information, Quarterly Journal of Economics 102, 281-292.

[10] De Meza, D. and Webb, D.C. (2000), Does Credit Rationing Imply Insufficient Lending?, Journal of Public Economics 78, 215-234.

[11] Ghosh, Parikshit, Dilip Mookherjee and Debraj Ray (2000): Credit Rationing in Developing Countries: an Overview of the Theory, in A Reader in Development Economics, edited by D. Mookherjee and D. Ray, Blacwell.

[12] Innes, Robert (1991): Investment and Government Intervention in Credit Markets when There is Asymmetric Information, Journal of Public Economics 46, 347-381.

[13] Italian Treasury (2003): Fifth report on territorial Development.

[14] Mankiw, N. Gregory (1986): The Allocation of Credit and Financial Collapse, Quarterly Journal of Economics 101, 455-470.

[15] Minelli, Enrico and Modica Salvatore (2003): Credit Market Failures and Policy, Core Discussion Paper UCL.

[16] Piketty, T. (1997): The Dynamics of Wealth Distribution and the Interest Rate with Credit Rationing, Review of Economic Studies 64, 173-189.

[17] Stiglitz, Joseph E. and Andrew Weiss (1981): Credit Rationing in Markets with Imperfect Information, American Economic Review 71, 393-410.

[18] Stiglitz, Joseph E. and Andrew Weiss (1992): Asymmetric information in Credit Markets and its Implications for Macro-Economics, Oxford Economic Papers 44, 694-724.

[19] Townsend, Robert (1979): Optimal Contracts in competitive markets with Costly State verification, Journal of Economic theory 21, 265-293.

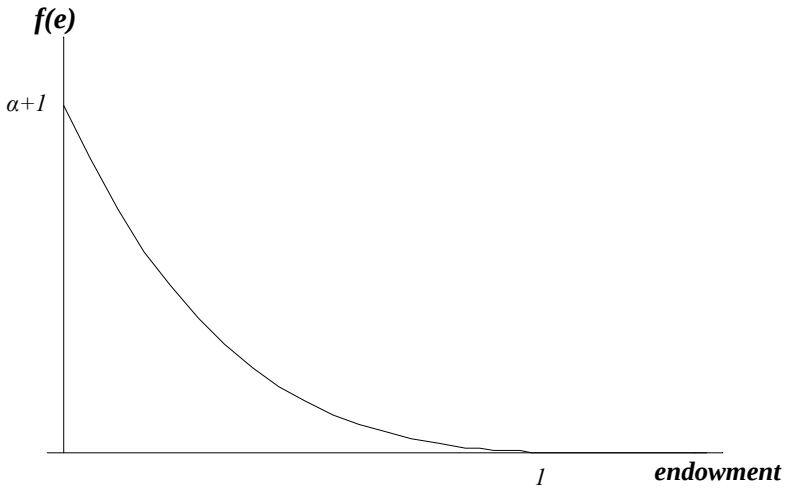

Fig. 1 *Distribution of population over e*

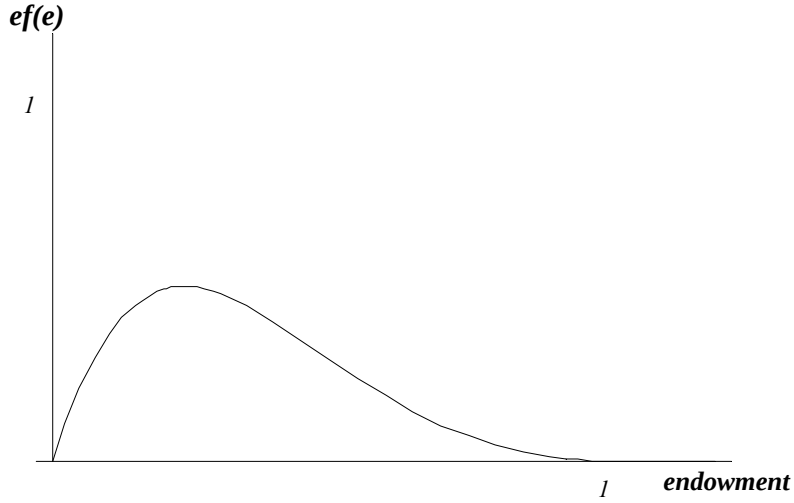

Fig. 2 *Wealth distribution*

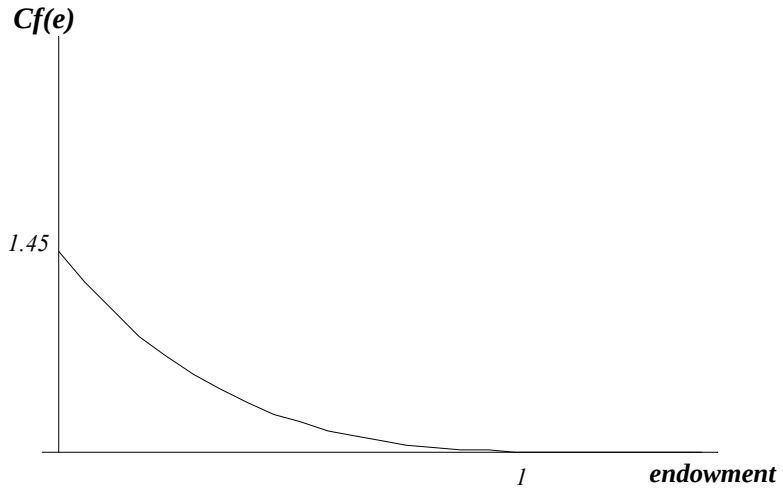

Fig. 3 *Egalitarian redistribution*

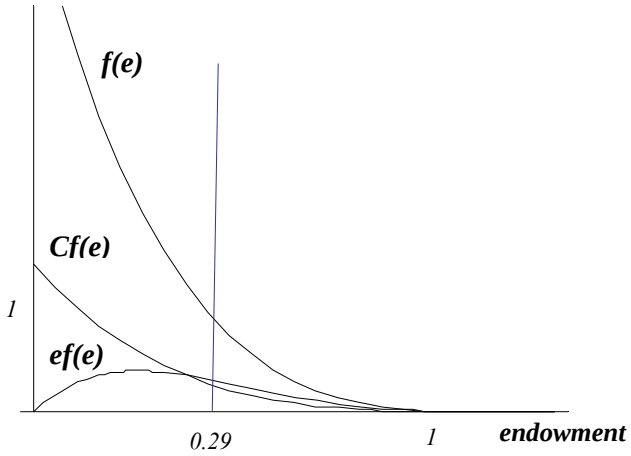

Fig. 4 *Pareto efficiency of the redistribution*

Moral Hazard in the Credit Market: The Case of Labor-Managed Firms in Italy after the Law n. 142/2001

Francesco Reito *

Abstract

Outside financing is often considered one of the most serious obstacles to a widespread development of labor-managed firms. Usually, these barriers are provisional for they are based on wrong believes or legislative constraints.

This paper analyzes the structure of creditors' priorities in case a firm goes bankruptcy and, in particular, money-lenders' likelihood of getting their capital back. It is argued the difference between labor-managed and profit maximizing firms in terms of efficiency (and moral hazard degree) can be affected by a sovereign legislative act. This work focuses on the Italian case: in accordance with the law n. 142/2001, labor managed firms has turned to be less competitive from banks' viewpoint for the position of workers-members as own firm creditors is strengthened during a liquidation. A proposed emendation may prove encouraging to enhance democratic firms' reputation.

JEL classification: J54; K31.

Keywords: *Labor Managed Firm, Screening, Bankruptcy Law*

*University of Catania, DEMQ (Dipartimento di Economia e Metodi Quantitativi), Corso Italia 55 95100, Catania, Italy. Tel. 0039 3288242694, e-mail: f.reito@unict.it, mail address: Via Altavilla 58 95126, Catania, Italy.

1 Introduction

The presence and economic sustainability of a system of labor managed firms or other non-capitalistic production assets, heavily depends on the possibility of persuading economists and politicians on the social and economic advantages of alternative systems.

The literature (since the seminal Vanek's (1970) paper has often focused on labor managed firms with several observations on their productivity level and growth opportunities. Most of the work has been devoted to the comparison between labor managed (LMF) and profit maximizing firms (PMF) in terms of final outcomes and global efficiency. In many cases the alleged superiority of LMFs was founded on the possibility of a lower unemployment risk degree and a higher sharing of moral values among co-workers. Nevertheless, one can seldom find examples in the literature of great advantages of LMFs in terms of productivity levels[1].

Outside financing is often considered one of the most serious obstacles to a broader LMFs growth. Note that frequently those obstacles are only based on some wrong deeply rooted beliefs or legislative constraints. In a capitalistic economy, the legislative structure may not be ideal for labor-managed firms as it naturally evolves in accord with the needs of private entrepreneurships. In particular, with respect to the available literature, this paper analyzes the given structure of creditors' priorities in case of bankruptcy (and so the possibility for lenders to recoup their loans) may rise the moral hazard

[1]See Jossa (1999) and Vanek (1970).

effect on cooperators' contributions to the common cause. It is the case of Italy, for instance, where in accordance with the law n. 142/2001 (and subsequent emendations[2]), the position of the member/worker of a LMF has profoundly changed[3]. Namely, his condition has been made equal to that of subordinate workers and all of them benefit from a first degree priority credit on non-immovable commodities in case of firm failure[4]. This legislative intervention helps coo-workers not to suffer from a high entrepreneurial risk but, consequently, lets them remain trapped in a simple prisoner's dilemma over their choice of effort level contributions. In other words, after the law 142/2001 the LMF moral hazard problem has turned out to be enhanced. So if the banks are entitled to benefit from the liquidation assets after the LMF members, they may not have incentives to finance workers/entrepreneurs, especially in case of limited loanable funds.

In the model examined here, one monopolistic bank has the possibility,

[2]Law n. 30/2003 and order in council n. 270/2003.

[3]See law 142/2001. The Italian cooperative is only an approximation of a typical LMF in the economic literature. Anyway, for our goals, in the case of outside financing models, it is better to use the LMF other than the WMF approximation (WMFs are self-financed workers cooperatives. The major problem in the WMFs is the famous Furubotn-Pejovich (1973) effect, that is members' concern about opportunity costs of self-financing in case they leave the firm. In the LMFs the main concerns are represented, instead, by outside financing and moral hazard).

[4]Before the law 142/2001 the state of uncertainty about the position of LMF members-workers, surely did not help this firm type expansion. In general, jurists and Italian courts did not consider a LMF member as a subordinate worker. See, among many others, Italian Supreme Court n. 451/1998.

for limited funds, of financing at most one firm, either PMF or LMF. The expected final outcome of each firm depends on the level of effort exerted by the workers (or managers) responsible for the project. Since effort is costly and unobservable, this creates a moral hazard problem that can force the bank to ration the credit.

The model also to show up one interesting feature of the moral hazard problem suffered by LMFs with particular reference to the strong influence legislative interventions have on firm types liability after bankruptcy. The credit-repayment relationship between the bank and the LMF, compared to the bank-PMF one, clearly has one stage missing: cooperators in a LMF are directly responsible for their commitments, while in a PMF the moral hazard on employees' effort contributions adds to the moral hazard problem of the PMF owner choosing the desired project. If LMF and PMF have the same production function, that difference in responsibility provides wide opportunities for LMFs to improve their reputation as safe debtors. For instance, LMFs can save on PMF owner's inspection costs of supervising the employees and improve efficiency if they behave cooperatively.

Finally a proposed legislative revision, stating that after firm insolvency co-workers should be entitled to gain only their pay as simple workers and to risk as any entrepreneurs when they use other people money, will prove helpful in restoring LMF credibility, leaving workers better-off and banks not worse-off.

This paper is organized as follows. Section 2 analyzes the market equilibria for labor-managed and profit maximizing firms based on the current

legislation on bankruptcy. Section 3 compares a PMF and a LMF to investigate which is the most profitable for the bank as a debtor. Section 4 proposes a slight emendation in order to enhance labor-managed firm reputation as good debtors and economic efficiency. Section 5 concludes.

2 Current Legislation Equilibria

As said, we will take into account the current Italian legislation on creditors' priorities in case of firm, PMF or LMF, bankruptcy. As regards chattels (or movable property) and other non-immovable commodities, labor creditors (that is employees in a PMF or members-workers in a LMF) are entitled to be satisfied with precedence with respect to the other creditors[5]. With the law n. 142/2001 LMF members and workers have been grouped in a single category while, in the past, they were separated in two classes and only the employees could benefit from the above-mentioned preferential terms. Before the legal intervention, LMF members were only considered entrepreneurs even if they give their services according to firm objectives[6].

We imagine a *two sector* model. In the traditional sector, a very large number of agents receive a self-employment wage working the land. In the

[5]Except, of course, trial expenses and taxes. See Italian Civil Code, art. 2751/bis and law 142/2001 and subsequent modifications. We do not consider immovable property as a guarantee for bank loans for, in this case, mortgages can affect creditors' priorities in the desired direction.

[6]See again Italian Supreme Court n. 451/1998 and Court of Cassation n. 1400/2000.

prospective industrial sector, firms need outside financing to start up their projects. Creditors face a moral hazard problem on firms behavior and the environment is considered so poor that firms cannot pose collateral to signal their types[7]. The moral hazard influences both PMF and LMF managers' effort levels and for simplicity we will handle a two-outcome effort model. Comparing just two performance results obviously gives the possibility of a direct intuitive interpretation without any loss of generality.

The banking system is considered to be *monopolistic*. Most of the literature on credit rationing considers the credit market to be competitive. For underdeveloped regions, anyway, a monopolistic bank is a good assumption for it describes the prevailing credit rationing and the higher interest rate contracts with respect to richer regions[8]. Considering the credit sector as competitive raises also the difficulty of the non existence of an unequivocal notion of competitive equilibrium in models with moral hazard.

All agents are *risk-neutral*. This is a good assumption when we handle entrepreneurs behavior but it hardly represents workers conduct. In this paper, risk-neutrality clearly eliminates some tiny difficulties present on *risk-aversion* analyses, but, nevertheless, these difficulties are not so productive since they would only enhance our final numerical solutions: at the end of the paper, we consider the choices of LMF members-workers. So, if they were

[7]The no-collateral case is, clearly, a polar approximation of an underdeveloped firm-bank economic structure. When firms can offer sufficient collateral, the bank can easily sort types. See Bester (1987) and Minelli-Modica (2003).

[8]The high spread between Italian regions (see the Italian Treasury Report (2003) and the Central Bank of Italy Data (2002)) is a plain evidence.

considered risk-averse, for the fear of bankruptcy, they would exert high effort levels with higher probability being, at the same time, satisfied with a lower *post-failure reform* income.

In the following two subsections, we consider the economic implications when a bank for limited funds availability can only finance finance either a PMF or a LMF.

2.1 The PMF Case

Assume one PMF with a one argument (labor) production function. To start up the project, the PMF entrepreneur-owner needs to hire two employees and to ask for outside financing. The expected final outcome, $Exp[y]$, depends on the level of effort exerted by the employees in the form of a logic product of probabilities:

$$Exp[y] = p_x p_x y^S + (1 - p_x p_x) y^B,$$

where y^S is the production level in case of success, y^B the lower one in case of bankruptcy and p_x represents the probability of success ($0 \leq p_x \leq 1$), related to the effort of a single employee, that can assume two values[9]:

$$p_x = \begin{cases} p_h & \text{if the employee exerts an high level of effort,} \\ p_l & \text{if the effort applied is low,} \end{cases}$$

[9]The product $p_x p_x$ can represent all the combinations $(p_h p_h, p_l p_l, p_l p_h, p_h p_l)$ between the two workers effort levels.

with $p_h > p_l$. For the remaining, efficiency will mean to exert the high effort levels just because we consider y^B so low that, for each x:

$$p_h p_h y^S + (1 - p_h p_h) y^B > p_l p_x y^S + (1 - p_l p_x) y^B.$$

Workers analysis: before proceeding, we need to analyze the PMF employees behavior. They have a given reservation wage, w_R, if they decide not to work for the firm. If one worker gets the job, he will have to choose his level of effort contribution. We will refer to the implicit contract theory or the efficiency wage model as it was introduced by Shapiro-Stiglitz (1984). In their model the performance is measurable but unverifiable. Effort choices are restricted to working, with effort level equal to e and shirking, with effort equal to 0. If a worker shirks, he is likely not to perform very well and therefore will be caught shirking with a given probability.

Consider a single worker choice. When the effort, e, is high, *independently*[10] of the other employee's choice, his final payoff will be[11]:

$$U^h = p_h p_x (w_h - e) + (1 - p_h p_x)(w_h - e) = w_h - e,$$

where $x = l$ or $x = h$ corresponds to the other employee's choice and w_h is the equilibrium wage level (*to be determined*) guaranteed in the industrial sector.

[10] When a PMF employee chooses his effort, he does not take into consideration the other employee's action, but only his responsibility towards the entrepreneur and legal provisions.

[11] Thanks to risk neutrality we can also pose the cost of effort, $c(e)$, equal to e.

The worker gets the same wage level both in case of success and bankruptcy for the current Italian legislation on bankruptcy assures the employee to be satisfied (and so recoup his payment) with precedence over the other firm creditors. This makes probabilities (risk) disappear. The effort, in any case, has already been applied.

When the employee shirks (effort = 0), he does not incur in the cost of effort, but faces the a probability, δ, of being detected and laid off, *independently* of the other employee's choice, so:

$$U^l = p_l p_x[(1-\delta)w_l + \delta w_R] + (1 - p_l p_x)[(1-\delta)w_l + \delta w_R] = (1-\delta)w_l + \delta w_R,$$

where w_l is the equilibrium firm wage (again to be determined) received with probability δ, and where, both in case of success or liquidation, the worker caught shirking, with probability δ, is not paid for the just reason law but gets the outside reservation wage, w_R.

Some remarks on the equilibrium wage level are in order. First of all, even in the case (to be examined later) the PMF owner find it profitable a lower probability of success for it is cheaper, it has to assure the employees a payoff at least equal to the outside utility: $(1-\delta)w_l + \delta w_R \geq w_R$, that implies, $(1-\delta)w_l \geq (1-\delta)w_R$ and in equilibrium $w_l = w_R$.

If the PMF entrepreneur wants its employee to work harder, it has to assure a wage also covering the cost of effort. This equilibrium wage should be at least equal to the low effort payoff: $U_h \geq U_l$, that implies, $w_h - e \geq w_R$. At the high effort equilibrium, $w_h = w_R + e$ and, although the workers reach (at least) the same utility, PMF expenditure will be higher (there is an effi-

ciency wage, $w_h > w_R$).

PMF owner analysis: consider the case the entrepreneur has *no initial endowment and cannot pose collateral* for the loan. Assume the only tasks the entrepreneur is assigned are asking for the loan and supervising the workers' (managers') action[12]. Bankruptcy means the final low outcome, y^B, is not sufficient to cover loan repayments, opportunity costs, workers wages and related charges such as supervising inspection costs.

Consider the choice of the entrepreneur between paying an efficiency wage or not. In the first case he faces an higher likelihood of getting a good final outcome but pays more for the workforce.

If the owner finds it favorable to force the high effort level, the PMF achieves:

$$p_h p_h (y^S - 2w_R - 2e - R) - I, \tag{1}$$

[12]That can be considered a realistic assumption for in most cases the managers are the only responsible and competent for the business activity, as, for instance, in a joint-stock company with distant shareholders. Supervising can be performed by the PMF entrepreneur or by a third outside firm-worker. In both cases, after liquidation, they would not have a credit priority with respect to their own firm laborers and banks.
Notice also that for the Italian law, entrepreneurs/owners can unlikely be, at the same time, subordinate workers especially when they are the *sole* responsible for the firm activity or when there is not the supervising of other entrepreneurs on their activity. Without further control, the unique PMF entrepreneur could fix himself a firm job-position only in order to defraud social security institutions. See Italian Court of Cassation, n. 3650/1994 and n. 1053/1995.

where $y^S - 2w_R - 2e - R$ is the high final outcome in case of success net of all wage costs and bank repayment, R. With probability $1 - p_h p_h$ the entrepreneur gets nothing since, after bankruptcy, he is allowed to be satisfied after the subordinate workers and other creditors (our assumptions make him get nothing since y^B is very poor). In any circumstance, success or failure, the inspection costs, I , has been charged.

For the individual rationality constraint, the expected income (1) must be larger than the wage level, w_R, the entrepreneur expects in the traditional sector.

If the PMF owner opts for less effort (every worker will shirk) he gets:

$$p_l p_l (y^S - 2w_R - R), \tag{2}$$

where nobody will chose to work hard and where, of course, it is useless to spend in effort compensation and inspection.

Now, interestingly[13], $y^S - 2w_R > y^S - 2w_R - 2e$ and the PMF will be efficient iff:

$$p_h p_h (y^S - 2w_R - 2e - R) - I \geq p_l p_l (y^S - 2w_R - R), \tag{3}$$

or (to get rid of symbols, take, without loss of generality, $I = e$):

$$R \leq y^S - 2w_R - \frac{e(2p_h p_h + 1)}{p_h p_h - p_l p_l} \equiv R_{eff}^{PMF},$$

[13]So, the model can be interpreted thinking of $y^S - 2w_R$ as the higher but riskier payoff since it is still $p_l < p_h$. In other words, the distribution of final outcomes with higher effort first order stochastically dominates the lower effort one (that means the average return is higher, but not viceversa). See Stiglitz-Weiss (1981) and Besanko-Thakor (1987).

provided the individual rationality constraint is satisfied.

Bank analysis: the monopolistic bank can decide whether to offer a contract that specifies, in the *absence of collateral*, the amount advanced, L, and the amount, R, the borrower has to repay if the project succeeds[14]. In case of firm failure the bank is entitled to be satisfied, during the liquidation procedure, after the labor credits which have a higher priority level. From this, bank's expected profits are[15]:

$$\begin{cases} p_h p_h R + (1 - p_h p_h)(y^B - 2w_R - 2e) - L & \text{if } R \leq R_{eff}^{PMF} \text{ (PMF high effort)}, \\ p_l p_l R + (1 - p_l p_l)(y^B - 2w_R) - L & \text{if } R_{eff}^{PMF} < R \leq R_{max}^{PMF} \text{ (PMF low effort)}, \\ 0 \text{ or no contract situation}, & \text{if } R > R_{max}^{PMF}, \end{cases}$$

where R_{max}^{PMF} is the highest possible interest rate repayment the bank can require when the chosen project is the inefficient one, that is when the entrepreneur rationality constraint is satisfied with equality:

$$p_l p_l (y^S - 2w_R - R_{max}^{PMF}) = w_R$$

or,

$$R_{max}^{PMF} = y^S - 3w_R.$$

[14]If we allow the bank to offer a share finance contract, we would attain the first best in any case. We do not study this case of interest in anti-trust analysis.

[15]Actually, y^B could be so low that we should consider:

$p_h p_h R + (1 - p_h p_h) \cdot max\{0, (y^B - 2w_R - 2e)\} - L$ and

$p_l p_l R + (1 - p_l p_l) \cdot max\{0, (y^B - 2w_R)\} - L$.

To avoid useless complexity, take $y^B - 2w_R - e$ and $y^B - 2w_R$ to be bigger than 0.

Clearly, if the bank asks a repayment larger than R_{max}^{PMF}, no firms will apply for a loan.

Since the bank is monopolistic, it will try to extract all possible surplus and will set $R = R_{eff}^{PMF}$ or $R = R_{max}^{PMF}$ depending on their profitability.

Equilibrium is efficient iff:

$$p_h p_h R_{eff}^{PMF} + (1 - p_h p_h)(y^B - 2w_R - 2e) \tag{4}$$

$$\geq$$

$$p_l p_l R_{max}^{PMF} + (1 - p_l p_l)(y^B - 2w_R), \tag{5}$$

Notice in the efficient region (given all parameters space) the firm gets positive *economic* profits (as $R_{eff}^{PMF} < R$ such that $p_h p_h(y^S - 2w_R - 2e - R) - e = w_R$), while in the inefficient set, $R = R_{max}^{PMF}$ and the entrepreneur gains nothing but his reservation pay (all the surplus is extracted).

It will be interesting to keep in mind bank's payoff to compare it with the following LMF solution.

2.2 The LMF Case

We will examine the possibility for two agents (They could be the two employees of the previous PMF) to run a LMF. They necessitate a loan from the bank and we know, the latter, for limited funds, has to choose between a LMF and a PMF on the grounds of its profitability (which firm is able to guarantee the higher payoff?). With respect to the PMF case, there is not the third figure of the entrepreneur supervising the employees' effort. We

implicitly assume the cooperators are as good as the PMF owner in asking for a loan and (potentially) reaching the same final expected return[16]. They do not (need to) supervise each other but face a prisoner's dilemma on effort contributions. Assume again risk neutrality.

The *workers* and *firm* analyses are, clearly, grouped.

Workers or firm analysis: remember the law 142/2001 has equalized workers and cooperative-members. In case of success the cooperators will perfectly share the final outcome, while in case of failure, the current legislation[17] allows them to recover their entire income-tax return. Again bankruptcy means the lower return, y^B, is not enough to cover all the operating costs (bank interest repayment and wages), but it could be sufficient for the members to recoup their labor income.

Clearly, free riding on effort levels is the typical problem cooperators face. It is better, then, to proceed drawing the payoffs of a single period prisoner's dilemma.

Each worker-member can adopt one of two possible strategies: he can either

[16]Remember the PMF entrepreneur's only activity is asking the bank for the loan and supervising the two managers.

[17]See the law n. 297/1982 that established the possibility for every worker of all categories to contribute and use a trust fund at the I.N.P.S. (National Institute of Social Security). This institute, in case of firm insolvency, will directly reimburse the workers for their last 3 monthly salaries and, most importantly, for the t.f.r. (end of business lifetime pay deductions or severance pay), and will substitute the workers in front of the liquidation official receiver during the trial procedures.

cooperate, exerting an high level of effort, or defect, choosing to work at a lower pace.

If he chooses to work hard, *independently* of the other's choice (that is $x = h$ or l), his final *economic* profit/payoff will be[18]:

$$\begin{cases} U^{(C|C)} = p_h p_h(\frac{y^S - R}{2}) + (1 - p_h p_h)(\frac{y^S - R}{2}) - e = \frac{y^S - R}{2} - e & \text{if the other cooperates,} \\ U^{(C|D)} = p_h p_l(\frac{y^S - R}{2}) + (1 - p_h p_l)(\frac{y^S - R}{2}) - e = \frac{y^S - R}{2} - e & \text{if the other defects,} \end{cases}$$

where $\frac{y^S - R}{2}$ is the one cooperator's half part of the firm outcome.
It is $U^{(C|C)} = U^{(C|D)}$ since the law, after firm failure, allows each cooperator to get his pay independently of the other member's choice.
For the individual rationality constraint, the above expected income must be larger than w_R in any case.

Two remark on the above expected income will be helpful: first, albeit on the grounds of law n.142/2001, the income each member is entitled to recover in case of liquidation is the labor salary and not the eventual entrepreneurial surplus, a rational agent is able to fix its expected salary at a level including the expected surplus. The law n. 142/2001 imposes a lower bound to each worker/member salary (the each category minimum wage), but it does not impose un upper limit. The minimum wage is fixed by a sovereign, government or trade union policy and, not to abuse in notation, for the remaining,

[18] Actually, it should be:

$$\begin{cases} U^{(C|C)} = p_h p_h(\frac{y^S - R}{2}) + (1 - p_h p_h) \cdot min\{\frac{y^B}{2}, (\frac{y^S - R}{2}) - e - w_R\} & \text{if the other cooperates,} \\ U^{(C|D)} = p_h p_l(\frac{y^S - R}{2}) + (1 - p_h p_l) \cdot min\{\frac{y^B}{2}, (\frac{y^S - R}{2}) - e - w_R\} & \text{if the other defects,} \end{cases}$$

but see footnote 15 and 17 about the law n. 297/1982 intervention.

we imagine it corresponds to our w_R.

Second, the legislation allows the cooperators not to suffer from the entrepreneurial risk (no probabilities appear in the expected return expression).

If the worker/cooperator puts a lower effort, *independently* of the other's choice, his final payoff will be:

$$\begin{cases} U^{(D|C)} = p_l p_h(\frac{y^S - R}{2}) + (1 - p_l p_h)(\frac{y^S - R}{2}) = \frac{y^S - R}{2} & \text{if the other cooperates,} \\ U^{(D|D)} = p_l p_l(\frac{y^S - R}{2}) + (1 - p_l p_l)(\frac{y^S - R}{2}) = \frac{y^S - R}{2} & \text{if the other defects,} \end{cases}$$

where no effort is exerted.

Again $U^{(D|C)} = U^{(D|D)}$.

Notice we always have

$$U^{(D|C)} = U^{(D|D)} > U^{(C|C)} = U^{(C|D)}$$

and, accordingly, it is not possible to escape from the dilemma. This imply the LMF produces the lowest final expected gross product:

$$p_l p_l y^S + (1 - p_l p_l) y^B. \tag{6}$$

Bank analysis: the bank knows with the current legislation the cooperators have no incentive to exert effort. So, to extract all possible surplus, the bank will set R such that $U^{(D|C)} = U^{(D|D)} = \frac{y^S - R}{2} = w_R$, or,

$$R^{LMF} = y^S - 2w_R,$$

leaving cooperators with w_R as expected income.

Bank's profit will be:

$$p_l p_l R^{LMF} + (1 - p_l p_l)(y^B - 2w_R) - L. \tag{7}$$

This is the payoff the bank will compare with its corresponding PMF equilibrium revenue in order to decide which is the most advantageous.

3 Comparison between a PMF and a LMF as bank debtors

To decide whether is favorable to finance a PMF or a LMF, the bank has to compare the corresponding profits made with each debtor. With the PMF the bank would gain, as explained in subsection 2.1,

$$\begin{cases} p_h p_h R + (1 - p_h p_h)(y^B - 2w_R - 2e) - L & \text{if } R \leq R_{eff}^{PMF} \text{ or} \\ p_l p_l R + (1 - p_l p_l)(y^B - 2w_R) - L & \text{if } R_{eff}^{PMF} < R \leq R_{max}^{PMF} \end{cases},$$

while with a LMF the bank makes

$$p_l p_l R^{LMF} + (1 - p_l p_l)(y^B - 2w_R) - L. \tag{8}$$

For a LMF to be financed, we should get:

$$p_l p_l R^{LMF} + (1 - p_l p_l)(y^B - 2w_R) \geq p_h p_h R_{eff}^{PMF} + (1 - p_h p_h)(y^B - 2w_R - 2e), \tag{9}$$

or,

$$p_l p_l R^{LMF} + (1 - p_l p_l)(y^B - 2w_R) \geq p_l p_l R_{max}^{PMF} + (1 - p_l p_l)(y^B - 2w_R), \tag{10}$$

that means bank's payoff achieved on a LMF must be bigger than any (low or high effort) PMF solution.

Consequently, with the current legislation, LMFs are not financed if p_l is very low compared to p_h. The LMF outcome is never efficient (the prisoner's dilemma always produces low effort equilibria) and co-workers only receive an expected income equal to w_R.

4 The LMF after the Proposed Reform

Consider the case where inequalities 8 and 9 are not satisfied and, accordingly, the bank prefers the PMF as a debtor.

The law n. 142/2001 had the declared purpose of aiding LMF workers in particular trying to avoid the 'hidden capitalistic firm phenomenon' where the cooperator status is used to conceal an actual subordinate relationship just to benefit from advantageous legislative structures[19]. The law, instead, has made LMFs less competitive than the twins PMFs in most situations.

This paper proposal needs the government to intervene in a different manner to avoid LMFs segregation. In case of bankruptcy, LMF co-workers should be entitled to get a wage payment, w_{new}^{LMF}, as bigger as to make banks preferring LMFs as debtors. In other words, we need to find a new loan repayment, R_{eff}^{LMF}, and the above-mentioned w_{new}^{LMF} to solve the following

[19]For example, the law n.300/1970 is applied to LMF members except the art. 18 stating the compulsory restoration of the employees dismissed for unjust reasons.

system:

$$\begin{cases} p_h p_h R_{eff}^{LMF} + (1 - p_h p_h)(y^B - 2w_{new}^{LMF}) \geq p_h p_h R_{eff}^{PMF} + (1 - p_h p_h)(y^B - 2w_R - 2e), \\ p_h p_h(\frac{y^S - R_{eff}^{LMF}}{2}) + (1 - p_h p_h) w_{new}^{LMF} - e \geq p_l p_h(\frac{y^S - R_{eff}^{LMF}}{2}) + (1 - p_l p_h) w_{new}^{LMF}, \\ p_h p_h(\frac{y^S - R_{eff}^{LMF}}{2}) + (1 - p_h p_h) w_{new}^{LMF} - e \geq w_R, \end{cases}$$

where the first equation guarantees the bank a payoff on a LMF at least equal to that on a PMF, the second represents the escaping dilemma condition for each cooperator, $U^{(C|C)} \geq U^{(D|C)}$, and the third equation, of course, is the LMF co-workers' individual rationality constraint.

Perhaps it would not prove interesting to show the numerical solutions for every parameter[20], but it is essential to note it exists a very wide parameters interval such that the above system holds. For example, if we fixed the new wage w_{new}^{LMF} equal to the outside reservation one,

$$w_{new}^{LMF} = w_R,$$

the above system always holds.
It means it is reasonable to allow cooperators to recover, after insolvency, only their contributions as subordinate workers and let them suffer the risk as any firm entrepreneur.

In equilibrium, in contrast to the current legislation case, we observe positive profit for the efficient cooperators because $R_{eff}^{LMF} < R$ such that $p_h p_h(\frac{y^S - R_{eff}^{L}}{2}) + (1 - p_h p_h) w_{eff}^{L} - e = w_R$, and not all the surplus is extracted. So, LMF managers' utility is larger that w_R. Remember in the previous two cases, the managers in a PMF or in a LMF reached an overall utility of w_R.

[20] Algebra available.

The bank is certainly not worse-off financing LMFs instead of PMFs. There are no expenses for the government intervention. And only after the proposed reform the LMFs can achieve efficiency and high effort equilibria with no restrictive (in a parameters space sense) conditions. Spontaneous cooperation also consents to save on (now) useless inspection costs.

5 Conclusion

In a very simple model, this paper shows the labor-managed firm profitability (at least in the Italian case) is strongly affected by pervasive legislative interventions. With respect to the available literature, the present work tries to focus on a very concrete example where laws alter economic incentives and production systems. Besides it explicitly expands the firm (PMF or LMF) production function and costs to realize some of the famous moral hazard problems on LMF loan repayment behavior occur just because co-operators/workers have no motivation to assume cooperative strategies. A disadvantageous credit priority over the liquidation assets may then force the banking system to avoid LMFs as debtors.

Modifying, partially, the bankruptcy legislation, the potential and hidden competitiveness of LMFs emerges without interventions on the technological or production structure. When we let co-members recovering just their contributions as workers and suffering from the classic entrepreneurial risk especially when they ask for outside loans, LMFs turns out to be efficient and more profitable as bank debtors. LMFs have clearly one moral hazard stage

missing compared to the twins PMFs: cooperators (agents) directly converse with the bank (principal) while in the PMFs the moral hazard problem of the employees about their efforts is followed by the moral hazard in the owner's choice over the firm project. The often alleged superiority of LMFs in terms of democracy level or unemployment risk can also be extended towards efficiency if the policy-maker properly encourages labor incentives. This paper is obviously a first attempt in a very productive field of study. It is a partial and static equilibrium model, but it gives the idea that the profitability of a given production system is often affected by the private property law. It means there could be a large room for a policy intervention in order to render more attractive and efficient an alternative and democratic economic system besides the profit maximizing one. Many times the poor expansion of labor-managed firms is due to a legislative structure not suitable for the needs of alternative-firm systems.

References

[1] Atkinson, A.B. (1973): Worker Management and the Modern Industrial Enterprise, The Quarterly Journal of Economics 87, 375-392.

[2] Banca d'Italia (2002): Bollettino Statistico, IV.

[3] Banerjee, A.V. - A. Newman (1993): Occupational Choice and the Process of Development, Journal of Political Economy 101, 274-298.

[4] Barbera, S. - Dutta, B. (2000): Incentive Compatible Schemes for Labour'Managed Firms, Review of Economic Design 5, 111-127.

[5] Barlett, W. et Al.. (1992): Labor'Managed Cooperatives and Private Firms in North Central Italy: An Empirical Comparison, Industrial and Labor Relations Review 46, 103-118.

[6] Besanko, D. - A. Thakor (1987): Collateral and Rationing: Sorting Equilibria in Monopolistic and Competitive Credit Markets, International Economic Review, 28(3), 671-689.

[7] Bester,Helmut (1985): Screening versus Rationing in Credit Markets with Imperfect Information, American Economic Review 75, 850-855.

[8] Bester, Helmut (1987): The Role of Collateral in Credit Markets with Imperfect Information, European Economic Review 31, 887-899.

[9] Choe C. (1998): A Mechanism Design Approach to an Optimal contract Under Ex Ante and Ex Post Private Information, Review of Economic Design 3, 237-255.

[10] De Meza, David - Webb, D.C. (1987): Too Much Investment: A Problem of Asymmetric Information, The Quarterly Journal of Economics 102, 281-292.

[11] De Meza, D. - D. Webb (2000): Does Credit Rationing Imply Insufficient Lending? Journal of Public Economics 78, 215-234.

[12] Domar, E.D. (1966): The Soviet Collective Farm as a Producer Cooperative, The American Economic Review 56, 734-757.

[13] Dow, G.K. (1993): Why Capital Hires Labor: A Bargaining Perspective, The American Economic Review 83, 118-134.

[14] Furubotn, E.G. - Pejovich, S. (1973): Property Rights, Economic Decentralization and the Evolution of the Yugoslav Firm 1965-72, Journal of Law and Economics 16, 104-124.

[15] Furubotn, E.G. - Pejovich, S. (1976): The Long Run Analysis of the Labor Managed Firm: an Alternative Interpretation, The American Economic Review 66, 104-124.

[16] Ghosh, Parikshit - Dilip Mookherjee - Debraj Ray (2000): Credit Rationing in Developing Countries: an Overview of the Theory, in A Reader in Development Economics, edited by D. Mookherjee and D. Ray, Blacwell.

[17] Innes, Robert (1991): Investment and Government Intervention in Credit Markets when There is Asymmetric Information, Journal of Public Economics 46, 347-381.

[18] Italian Treasury (2003): Fifth report on territorial Development.

[19] Jossa, B. (1999): Sulle Difficolta' di Finanziamento delle Imprese Gestite dai Lavoratori, Universita' degli Studi di Napoli Federico II, mimeo.

[20] Jossa, B. (2001): L'impresa Gestita dai Lavoratori e la Disoccupazione Classica e Keynesiana, Rivista Italiana degli Economisti 6.

[21] Meade, J.E. (1972): The Theory of Labour-Managed Firm and Profit Sharing, The Economic Journal 82, 402-428.

[22] Minelli, Enrico - Modica Salvatore (2003): Credit Market Failures and Policy, Core Discussion Paper UCL.

[23] Miyazaki, H. (1987): On Success and Dissolution of the Labor-Managed Firm in the Capitalist Economy, The Journal of Political Economy 92, 909-931.

[24] Pejovich, S. (1992): Why has the Labor-Managed Firm Failed?, Cato Journal 12, 461-473.

[25] Steinherr, A. (1985): Profit-Maximizing vs. Labor-Managed Firms: a Comparison of Market Structure and Firm Behavior, The Journal of Industrial Economics 24, 97-104.

[26] Stiglitz, Joseph E. - Andrew Weiss (1981): Credit Rationing in Markets with Imperfect Information, American Economic Review 71, 393-410.

[27] Stiglitz, Joseph E. - Andrew Weiss (1992): Asymmetric information in Credit Markets and its Implications for Macro-Economics, Oxford Economic Papers 44, 694-724.

[28] Vanek, J. (1970): The General Theory of the Labor-Managed Market Economies, Cornell University Press Ithaca, New York.

How Trade Unions Promote Cooperation Among Workers

Francesco Reito *

Abstract

Many of the alleged labor market reforms rely on the popular view that the high and rising European unemployment rate is due to several forms of harmful rigidities. The presence of strong trade unions is one of those distortions this paper is trying to understand better. What seems a wage rigidity may in fact be the result of a rational game theoretical agreement for the good of all workers, even unemployed.

By reducing the variance of expected income a trade union can encourage cooperation among members and provide a positive insurance effect. In a simple partial equilibrium model, I consider an economy where cooperation emerges in a given working category without compulsion. With respect to the solution proposed by Solow (1990), I explicitly take into account the possible explanation of a wage above the competitive level and the risky nature of each period workers' income.

Endogenous enforcement claims but still exogenous preference formation suggest non conventional implications for labor market reforms.

JEL classification: J51; J65.

*University of Catania, DEMQ (Dipartimento di Economia e Metodi Quantitativi), Catania, ITALY. Tel. 0039 3288242694, e-mail: f.reito@unict.it, mail address: Via Altavilla 58 95126, Catania, Italy.

1 Introduction

The theoretical and political success of the walrasian paradigm is partly founded on two of the most controversial assumptions in the economic analysis. Namely, exogenous enforcement claims and exogenous preference formation. The first assumption states contractual claim enforcements are imposed at no cost on exchanging parties. It means infinite and perfectly competitive agents do not need to (and cannot) strategically influence each other. The second one eliminates the endogenous shaping of preferences caused by social-economic relationships.

Market interactions, from this viewpoint, allow neither for persuasion strategies, nor for social norms and changes in tastes. All human features, incompatible with self-interested maximizing agents, are simply taken out from the neoclassical framework. Consequently, economic models become not excessively complex and perfect business cycle forecasting devices. As an example, labor market dynamics consider workers as isolated agents aiming at their goals without the need of any human relationship. The market wage level takes on all the responsibility of signalling given tastes and final choices.

Apart from several interpretations, precise and definite political implications stem from this subtle description. When a certain working category suffers from a persistent level of unemployment, there is just one recommendation for governments to pursue: cut down wage levels and encourage labor flexibility. Labor institutions, social norms, trade unions are the lone culprits for a sluggish, imperfect labor market response to business cycle fluctuations.

Trade unions, in particular, are usually depicted as harmful instruments, just taking care of a few strong and sectarian workers.

In this paper the possibility of endogenous preference (or utility) formation is not considered. Stigler and Becker (1985) have shown it is not always necessary to get rid of stable utility functions to explain social behavior and, I believe, the analysis would become unproductively intricate and open to infinite subjective interpretations[1].

New prospects come, instead, when the assumption of exogenous enforcement claims does not hold. Here I will focus on the vexed argument of labor market rigidities and consequent explanations. In particular, this work investigates the rational motivation for workers not to compete with each other for the same job even if it means remaining unemployed for a while.

Instead of invoking social norms, I suppose workers to be non-myopic income earners. It will be referred to the famous Williamson's (1985) 'self-interest with guile' to recognize a more sophisticated agents' behavior, using strategic actions to achieve their ends. But economic strategies, such as the ones used not to get trapped in a prisoner's dilemma, are costly to adopt and, for this reason, this paper will take into account endogenous persuasion costs. I argue it is more appropriate and realistic to pay a price or receive a rent to require or to guarantee an expected conduct.

In the following model, a group of identical workers can go for one of two possible strategies when facing a typical prisoner's dilemma. They can either

[1]Many studies blame the unrealistic assumption on reputation variables dynamics. See, for example, Akelrof's hypothesis (1980) of identical code of behavior among agents.

cooperate with each other, planning to keep the wage above the competitive level (to benefit from this when employed and from a reservation wage if unemployed), or they can defect behaving as free riders willing to work for less.

In a similar context, Solow (1990) showed wage stickiness would emerge when overall cooperative behavior renders cooperation a best response with respect to defectionist job searching strategies. He suggested infinite interactions to give workers the opportunity of being instructed on the advantages of social collaboration in keeping the wage at a non-market clearing level. It suits workers to cooperate when the sector employment rate is high enough to keep unemployment periods not so frequent.

With respect to that solution, I propose a different interpretation. There are, in particular, *two* points I am interested in. *First*, the actual explanation of a wage above the competitive level. Is it really appropriate, without formal justifications, to take a certain wage as given (I will not address the question in terms of a general equilibrium model)? *Second*, the explicit recognition of the risky nature of labor income streams. Do not workers realize they face a simple lottery each period between high and reservation wages?

To get an answer, I suppose workers voluntarily organize a trade union with the aim of turning cooperation to profit. We know a trade union is in a position to decide a monopolistic real wage as to maximize its members' utilities. Some authors, however, argue that in most cases union's membership is compulsory or dictated by social laws.

The aim of this paper is to show that Trade unions can exist without com-

pulsion and, with respect to the available literature, without incorporating sociological factors into the traditional utility maximizing model. Besides, I argue this organization raises the utility also by providing an important *insurance effect*. Namely, at the maximizing wage, the employed is asked to pay a *membership fee* to enter the trade union. At the same time, the unemployed receives a member's *benefit* besides the outside reservation wage. The variance of expected income distribution is then reduced up to the point where workers become encouraged to adopt cooperation strategies. Since union members are supposed to take advantage of Axelrod's (1984) *Tit-for-Tat* strategy as a threat of termination, in each period they either receive a *rent* or suffer a *cost*. The rent consists on the difference between the *high* and the *reservation* wage when people have a job. Who remains unemployed, instead, bears the consequent cost of using the endogenous enforcement as a means of persuasion. The trade union insurance policy, anyway, supports the burden of the aftermath[2].

Finally, this model has clear theoretical and political implications. With respect to the theory, we do not derive labor market clearing in equilibrium. Since the unemployed would prefer to work at the market wage, we also observe involuntarily unemployment. The *key* feature of the model is that unemployment goes with higher utility level for every associate. In fact, the jobless, joining the trade union, can account on a benefit compensation far above the reservation return. If a worker decides to defect, offering his labor

[2]Bowles and Gintis (1993) would likely locate this paper in the upper-right cell of their matrix.

force for less, he knows he will bust the social insurance system. As a result, retorsion strategies will condemn him to a lifetime reservation income stream.

As the policy implications, the most direct one is the impossibility of persuading unionized workers about the damages of non competitive pays and the advantages of complete flexibility. A better way here is to focus on *non-wage* employment policy interventions. *Lower wages*, instead, would imply a *lower utility* for every laborer.

Finally, notice that even without the trade union preference shaping (through a non-well determined reputation effect), the external economic environment is not given once and for all. Social norms are not considered here, and we do not also need loyalty among workers for everyone is interested in cooperating only to pursue rational objectives. Nevertheless, introducing reputation variables would obviously enhance our numerical conclusions.

The paper is organized as follows. Section 2 contains a slight variation on the basic model proposed by Solow (1990). Section 3 proposes a cooperative equilibrium sustained by the presence of a trade union and Section 4 concludes analyzing some policy implications.

2 A Basic Model

One specific economic sector is analyzed. There is a large number of *risk-neutral* workers and perfectly competitive firms maximizing over capital and labor inputs. All workers are identical in ability and preferences, but have

sector specific individual skills. It will prove helpful to briefly describe labor market conditions when agents are not unionized[3]. In this simple case, competition would allow firms to offer a wage at least equal to a given reservation level. Labor market would clear with no possibility for involuntarily unemployment.

Assume from now on, workers have the possibility, for *unexplained reasons*, to keep the wage (that happens to be, again for unexplained reasons) above the market result. Assume also each agent can adopt one of two possible strategies. They can either *cooperate* with each other, keeping the wage at the high level, or *defect*, as free riders, willing to work for less (to avoid unemployment).

If they choose to cooperate, each period they will expect to gain the high wage when employed, w_M, or a reservation compensation, w_R, when laid off. Denote this expected value with

$$EV = ew_M + (1 - e)w_R, \tag{1}$$

where e represents the sector employment rate.

With infinite market interactions, the final expected value of this alternative[4] is $EV + \delta EV + \delta^2 EV + ...$, or, for the properties on geometric progressions,

$$\frac{EV}{(1 - \delta)}, \tag{2}$$

[3]This is a slight variation on the solution provided by Solow (1990).

[4]Here risk neutrality (or linear utility functions) allows utility levels to be equal to their correspondent arguments, that are, here, monetary values (workers do not perceive the risk).

where δ is the discount factor (or the probability opponents meet again).

If a single worker free rides, in the first period he certainly gains a bit less than the high wage (so for simplicity keep it equal to w_M), but he knows[5] the others will react with a punitive strategy until the wage falls to its minimum level, w_R. With the same reasoning as above, the expected payoff this time is

$$w_M + \frac{\delta w_R}{(1-\delta)}, \tag{3}$$

where, from the second period on, the worker receives the reservation wage.

From an infinite prisoner's dilemma perspective, a worker is better-off cooperating if the first strategy, "cooperate when the other cooperates", $(C|C)$, has a larger payoff with respect to the second one, "defect if the other offers cooperation", $(D|C)$.[6]

This happens iff

$$\frac{EV}{(1-\delta)} \geq w_M + \frac{\delta w_R}{(1-\delta)}, \tag{4}$$

or when the employment rate is above a specific threshold: $e \geq 1-\delta$.
This logic produces an equilibrium wage over the competitive solution, a consequent involuntarily unemployment and a precise arithmetical rule against living off other workers stealing their jobs.

[5]I assume *Tit-for-Tat* punitive strategies. See Axelrod (1984) for a refresh on prisoner's dilemma escaping strategies.

[6]Since we are interested in *Tit-for-Tat* as a best response with respect to *initial cooperation*, we do not need to examine the other two strategies, $C|D$ with final payoff $w_R + \delta w_R/(1-\delta) = w_R/(1-\delta)$, and $D|D$ with exactly the same payoff. So, if defection is a best response when the opponent cooperates, it is, of course, a best response when he chooses to defect.

It is important to observe that the previous result is based on the restrictive assumption of *risk neutrality*. Moreover, we need a proper explanation of the rationale of taking non-competitive wages as given. Section 3 will argue on these issues.

3 Trade Union Equilibrium

Assume the same economic sector as before with a trade union interested in maximizing a given welfare function, $V(.)$.

With regard to workers' utility, consider $U(.)$ as their *Bernoulli* utility function on amounts of money with $U'(.) > 0$ and $U''(.) < 0$. Workers have the same set of strategies of the preceding section, but now are *risk-averse* and voluntarily decide to join the trade union or not.

The trade union chooses[7] a wage level such that its own utility, $V(.)$, is maximized. In the present model, it is not important to know the specific form of the trade union utility function or the relative arguments. $V(.)$ can actually be the simple expected income of a representative worker, that is, the trade union may want to maximize

$$e(w)U(w) + (1 - e(w))U(w_R). \tag{5}$$

Whatever maximization program it chooses, we are *only* interested in the solution, that is the monopolistic wage that, for notational use, we will call

[7]Actually, a single worker may form a trade union and make the proposal.

w_M even if it is not necessarily the same of that in Section 2.
With this simple program, and therefore by the presence of a trade union in the labor market, it is possible to solve the first indetermination of the basic model. In other words, we are able to observe and treat a wage level above the competitive one without taking it as exogenously given. Keep in mind that we are not interested in the exact value of the equilibrium wage, but only in its future sustainability as an instrument of cooperation strategies.

The trade union is well-aware that when its members cooperate (treating w_M as given) they actually face a simple lottery, each period, between an high wage when employed and a reservation one when unemployed.

This time, for *risk-aversion*, we have to consider the classic utility notation. Now we need to satisfy[8]

$$U\left(C|C\right) \geq U\left(D|C\right), \tag{6}$$

since the specific form of the *workers' utility function* now matters. Instead of the expected lottery value of

$$EV = ew_M + (1-e)w_R,$$

as derived in Section 2, we have to consider the expected utility

$$Exp\left[U\left(.\right)\right] = eU\left(w_M\right) + \left(1-e\right)U\left(w_R\right), \tag{7}$$

[8]Risk neutrality helps not to consider the specific form of the utility function and to take care only of the given argument. Here, with risk aversion (non linear utility functions), we are not allowed to treat simple monetary values to compare the payoffs of different strategies. So, the expected utility of each period income depends on the particular form (degree of risk) of the function.

where, again for notational use, we consider $e(w)$ simply as e.
Note with risk aversion, we have in every period

$$Exp\left[U\left(.\right)\right] < U(EV).$$

Instead of inequality 4, this time we need to satisfy

$$\frac{Exp\left[U\left(.\right)\right]}{1-\delta} \geq U(w_M) + \frac{\delta U(w_R)}{1-\delta}, \tag{8}$$

because agents do not perceive only the monetary value of their income, but suffer the risk of an aleatory income too.

Notice that now it proves very difficult to compare the payoffs of each strategy since we should know the specific utility function of the agents. To be more precise, observe that in the expression $eU\left(w_M\right) + \left(1-e\right)U\left(w_R\right)$, we have a weighted sum of utility levels. So, even with simple utility representations, such as the exponential or the quadratic form, the inequality 8 becomes too hard to manipulate. As a result, it is not possible to derive equilibria or logic rules that are valid *in general* without an exact utility representation.

So, we need to find a way to associate to each utility (or vertical axes) value a single monetary (or horizontal axes) value without assuming a determinate functional form. The remainder of this Section is devoted to finding a new method of comparing the strategies outcomes as in Section 2.

[Fig.1 here]

3.1 From Utility Levels to Certainty Equivalent Values

Remember that with a concave *Bernoulli* utility function, as the one depicted on Fig. 1, the *certainty equivalent*, CE, of a simple single period lottery is the pecuniary value such that

$$Exp\left[U\left(.\right)\right] = U\left(CE\right). \tag{9}$$

The key feature of the value of CE is that it is a *single value* and not a lottery.

With R we name the *risk premium* level satisfying $CE = EV - R$.
So, each period union members perceived utility will be equal to[9]

$$U\left(EV - R\right) = U(CE), \tag{10}$$

that, as said, is not a lottery anymore. In this case, the inequality 8 becomes:

$$\frac{U(CE)}{1-\delta} \geq U(w_M) + \frac{\delta U(w_R)}{1-\delta},$$

or

$$\frac{U(EV-R)}{1-\delta} \geq U(w_M) + \frac{\delta U(w_R)}{1-\delta}. \tag{11}$$

Since we get rid of lotteries and the utility function considered here is monotone, we obtain a single value on the vertical axes for each value on the horizontal one. Consequently, *now* we are entitled to go on with monetary (or horizontal axes) values. This allows us to obtain general results irrespective of the utility function adopted by the trade union.

[9]With many periods, $U(EV-R)/(1-\delta)$ that is a series of certainty equivalent values.

Cooperation now holds iff

$$\frac{EV - R}{1 - \delta} \geq w_M + \frac{\delta w_R}{1 - \delta}, \tag{12}$$

that is an expression whose arguments *are not* utility levels anymore.

In this last inequality, we know EV but we need to compute the value of R. In the appendix we show the way to isolate the risk premium from a given, although *not specified*, utility function. Thanks to Taylor's expansion, we derive $R = -\frac{1}{2}\sigma^2 ARA$, where σ^2 is the variance of each period expected income and ARA is the Arrow-Pratt measure[10] of absolute risk aversion level, $-U''(.)/U'(.)$.

We reach a market equilibrium when *no agents* is better-off deviating from the current strategy. This notion corresponds to Grossman (1971) definition of equilibrium in analyses of effective market exchanges.

3.2 The Insurance Scheme

We showed a trade union is able to find a monopolistic wage level as to maximize members' utility and encourage cooperation. In order to make the analysis a bit interesting, assume that inequality 12 is not satisfied and we are out of the cooperative equilibrium. *All* workers are then condemned to the lowest payoff outcome of w_R for any period of life.

Keep in mind that the monopolistic wage was chosen as to maximize

[10] Given an utility function, this coefficient gives the degree, in absolute terms, of the risk aversion perceived by the agent when he faces a lottery between several possible payoffs.

overall utility and a variation would cause unbearable unemployment and/or loss of welfare.

Rewrite 12 as

$$\frac{e(w_M) + (1-e)w_R - R}{1-\delta} \geq w_M + \frac{\delta w_R}{1-\delta}. \tag{13}$$

A feasible remedy to restore our favorite equilibrium is to reduce R up to a determinate value, R_{new} such that 13 holds.

It is interesting to note that we achieve the same result by reducing the variance of expected returns and, accordingly, augmenting the certainty equivalent level.

To achieve that desired *insurance effect*, we assume the trade union requires a membership fee from the employed, ϵ_1, and provides a related sum, ϵ_2, to assist the unemployed. We consider ϵ_2 as the unemployment benefit granted by the union organization[11].

Since the insurance system is *actuarially fair* (if the trade union is a non-profit organization), we have

$$e\epsilon_1 + (1-e)\,\epsilon_2 = 0. \tag{14}$$

This gives an idea of the *financial viability* of the insurance system.

[11]Trade unions usually gain a great political influence on sovereign authority and other social-economic organizations. Hence, realistically, we may consider another sum, ϵ_3, representing the transfer from other public or private institutions in addition to ϵ_2. In this case the total sum received when unemployed would be $\epsilon_2 + \epsilon_3$. Obviously, this is not essential for the analysis.

The new distribution of each period income,

$$(w_R + \epsilon_2, w_M - \epsilon_1), \tag{15}$$

has the key feature of having the same mean, EV, of the last one,

$$(w_R, w_M). \tag{16}$$

However, the variance of expected income is lower as well as the risk premium level. See Fig. 2 for a geometric illustration.

Our latest version of inequality 13 can be written as[12]

$$\frac{e(w_M - \epsilon_1) + (1-e)(w_R + \epsilon_2) - R_{new}}{1-\delta} \geq w_M + \frac{\delta w_R}{1-\delta}. \tag{17}$$

[Fig.2 here]

The trade union succeeds to shift the yy' line not parallelling to the old xx' for *diminishing marginal utility* and for $\epsilon_2 \geq \epsilon_1$ in absolute values. As a shortcut rule, note that 17 is always satisfied when $e \geq 50\%$. [13]

Now the trade union has *two* instruments, w_M and ϵ_1 in order to maximize the overall utility and satisfy the cooperation strategy. It is simple to argue, from a quick inspection of figure 2, that if the trade union maintains the Section 2 maximizing wage, w_M, the expected utility raises to $Exp\left[U\left(.\right)\right]_{new}$ thanks to a reduction on the variance of expected income.

[12] Utility function representations, as said before, are not necessary.

[13] If the union has a strong political activity (through the parameter ϵ_3), we could even assume $e < 50\%$.

We could solve the inequality 17 with respect to the union fee, ϵ_1, for example[14]. Deriving 17 or from a graphic intuition, it is possible to infer that the fee, ϵ_1, decreases when workers are *less* risk-averse. It happens because EV is closer to CE and the risk premium is reduced (a less risk averse worker perhaps belongs to a more elite working category[15]). The model also allows the employment rate not to be so high as it would be with Solow (1990) interpretation in a similar setting[16].

When the expression 17 holds, the employed and the unemployed are *better-off* if they opt for cooperation strategies.

Think about workers' strategy when they either choose not to form a trade union or offer to work for a lower wage. In the first case, we do not have trade unions and, as said in Section 2, firms only need to concede at least the reservation wage to attract employees. It is for sure a situation *worse* than the very remote one of being in a trade union while always unemployed, that is

$$w_R < w_R + \epsilon_2. \tag{18}$$

[14]Algebra available.

[15]Economics sometimes refer to social norms averting the possibility of living-off other workers for the same job. These rules say workers are not willing to offer their labor force at a lower wage because it is considered unjust and humiliating. But most workers frequently go through uncertain periods, so it is proper to limit social concerns in this kind of analysis. This is a reminder argued, among others, by Piore (1975) and Bowles and Gintis (1975) cited in Granovetter (1985). Here it is argued trade unions are mainly supposed to defend non-elite job positions where it is more difficult to refer to non-economic rules.

[16]Here it could be, perhaps not realistically, even less than 50%.

The second case assumes the other workers' vengeance strategy leading to a lower and lower wage until it again reaches the lowest possible one, w_R.

With not excessively restrictive assumptions and still with *exogenous* preference definition, the trade union has proved efficient as an *insurance supplier* and cooperation motivating arrangement. This organization, as mentioned above, gives the possibility of observing (without keeping it for unknown reasons) an equilibrium wage above the natural, competitive level.

4 Policy Implications and Final Discussion

Many of the alleged labor market reforms rely on the popular view that the high and rising European unemployment rate is due to several forms of harmful rigidities. The presence of strong trade unions is one of those distortions this paper is trying to understand better. As a matter of fact, in this paper, what seems a wage rigidity may in fact be the result of a rational game theoretical agreement for the good of all workers, even unemployed.

By reducing the variance of expected income a trade union can encourage cooperation among members and provide a positive insurance effect. This result is undoubtedly more requested in periods of extreme future uncertainty. Agell (1999) refers to this as a genuine demand for economic security.

With respect to the relevant literature on this subject, although reputation variables and preference formation dynamics are not considered in this paper, self-interest decisions are incorporated in a model of social relations

where actors decide within a social context. Endogenous enforcement *costs* and *rents* allow us to treat the pursuit of economic goals as a civilized, subtle activity and not as a wild passion[17].

An advantage of this kind of construction is the apparent redelivery of power to economic analysis at the expense of political debate and future behavioral science explanations. Without the help of reputation variables in the utility function, it becomes even more consistent for workers to make their choices on the basis of their lifetime income streams and to act strategically. In other words, we merely observe a rational adaptation of individualistic agents to their specific environment.

This idea, after all, needs the argument referring to self-regarding interest as the main source of a certain social norm against living-off rules. We need to be well aware of the importance of social custom on economics, anyway. As said before, reputation variables would reinforce the previous numerical solutions enhancing the need for insurance cover.

From this perspective, it is somehow obvious to turn on to efficiency concerns. To avert untimely conclusions, policy authorities should verify the presence of incomplete contracts when they estimate market outcome efficiency (seeking for income insurance is a plain sign).

Trade unions may improve efficiency proving workers with the assurance they require and with a significant protection in collective bargaining. *Endogenous* enforcement claims but still *exogenous* preference formation,

[17]Notice the absence of the undermining process on useful or useless social norms. Here the cooperation conduct is monetary advantageous and, so, hard to undermine.

suggests non conformist inference for labor market reforms[18].Governments should focus on alternative (demand side) expansive labor market interventions instead of persuading voters about the goodness of labor flexibility.

It is, of course, a partial equilibrium analysis. Further studies will try to focus on the final impact on the entire economic system when trade unionism is extended to more than one professional category. We will need, of course, to take into account the effect on aggregate demand and supply when firms employ fewer workers and people have a higher expected income to spend.

[18]Following Granovetter (1985), atomized behavior has not been eliminated transferring the analysis to larger group observation. I simply recognizes the fact that an agent can be part of a member group.

5 Appendix

The utility level of the certainty equivalent, CE, is

$$U(CE) = U(EV - R) = eU(w_M) + (1-e)U(R). \tag{19}$$

To get the risk premium, R (that is inside the function), we need to take Taylor series approximations[19] of both sides of 19. In the left-hand side, if R is not very large compared to w_M, we can ignore second and higher terms in the series. So, we have:

$$U(EV - R) \approx U(w_M) - U'(w_M)R$$

For the right-hand side of 19, we need the second order terms to derive the *Arrow-Pratt* absolute risk aversion coefficient,$-U''(.)/U'(.)$.
So, letting $U(EV + a) = U(w_M - \epsilon_1)$ and $U(EV - b) = U(w_M + \epsilon_2)$, we have:

$$eU(EV + a) + (1-e)U(EV - b) \approx U(w_M) - U'(w_M)R. \tag{20}$$

Solving 20, we obtain:

$$R = -\left(a^2 + b^2\right)\frac{1}{2}\frac{U''(.)}{U'(.)},$$

where $a^2 + b^2$ is the variance of each period income distribution.

The *Arrow-Pratt* coefficient can be decreasing in the utility function argument. In our case, a decreasing ARA would clearly reinforce cooperation strategies.

[19] $f(x+j) = f(x) + \frac{1}{1!}f\prime(x)j + \frac{1}{2!}f\prime\prime(x)j^2 + ... + \frac{1}{n!}f^n(x)j^n$.

References

[1] Agell, J. and Lommerud, K. E. (1992), Union Egalitarianism as Income Insurance, Economica, 59, pp.295-310, Aug.

[2] Agell, J. (1999), On The Benefits From Rigid Labor Markets: Norms, Market Failures and Social Insurance, The Economic Journal, 109, pp. 143-F164, Feb.

[3] Akerlof, G. A. (1980), A Theory of Social Custom, of Which Unemployment May be One Consequence, The Quarterly Journal of Economics, 94, pp.749-775, Jun.

[4] Axelrod, R. (1984), The Evolution of Cooperation, Basic Books, New York.

[5] Booth, A. L. (1985), The Free Rider Problem and a Social Custom Model of Trade Union Membership, The Quarterly Journal of Economics, 58, pp.253-261, Feb.

[6] Bowles, S. (1998), Endogenous Preferences: The Cultural consequences of Markets and Other Economic Institutions, Journal of Economic Literature, 36, pp.75-111, Mar.

[7] Bowles, S. and Gintis, H. (1985), Contested Exchange: Political Economy and Modern Economic Theory, The American Economic Review, 78, pp.145-150, May.

[8] Bowles, S. and Gintis, H. (1993), The Revenge of Homo Economicue: Contested Exchange and the Revival of Political Economy, The Journal of Economic Perspective, 7, pp.83-102, Mar.

[9] Diamond, P. and Helms, J. and Mirrless J. (1980), Optimal Taxation in a Sthocastic Economy: a Cobb-Douglas Example, Journal of Public Economics, 14, pp.1-29, Dec.

[10] Elster, J. (1984), Social Norms and Economic Theory, The Journal of Economic Perspectives, 3, pp.99-117, Autumn.

[11] Gintis, H. (1974), Welfare Criteria with Endogenous Preferences: The Economics of Education, International Economic Review, 15, pp.415-430, Jun.

[12] Granovetter, M. (1985), Economic Action and Social Structure: The Problem of Embeddedness, American Journal of Sociology, 91, pp.481-510, Nov.

[13] Grossman, H. L. (1971), Money, Interest and Prices in Market Disequilibrium, Journal of Political Economy, 79, pp.943-961, Sep.

[14] Horn, H. and Svensson, L. E. (1986), Trade Unions and Optimal Labour Contracts, The Economic Journal, 96, pp.323-341, Jun.

[15] Kahneman, D. and Knetsch, J. L. and Thaler R. H. (1986), Fairness and the Assumption of Economics, The Journal of Business, 59, pp.S285-S300, Oct.

[16] Kahneman, D. and Knetsch, J. L. and Thaler R. (1986), Fairness as a Constraint on Profit Seeking: Entitlements in the Market, The American Economic Review, 76, pp.728-741, Sep.

[17] Layard, R. (1982), Is Income Policy the Answer to Unemployment?, Economica, 49, pp.219-239, Aug.

[18] Lindbeck, A. and Nyberg, S. and Weibull, J. W. (1999), Social Norms and Economic Incentives in the Welfare State, The Quarterly Journal of Economics, 114, pp.1-35, Feb.

[19] Malcomson, J. M. (1983), Trade Unions and Economic Efficiency, The Economic Journal, 93, pp.51-65, Supp. Conf. Papers.

[20] McDonald, I. M. and Solow, R. M. (1981), Wage Bargaining and Employment, The American Economic Review, 71, pp.896-908, Dec.

[21] Oswald, A. J. (1982), The Microeconomics Theory of the Trade Union, The Economic Journal, 92, pp.576-595, Sep.

[22] Solow, R. M. (1980), On Theories of Unemployment, The American Economic Review, 70, pp.1-11, Mar.

[23] Solow, R. M. (1990), The Labour Market as a Social Institution, Oxford, Basil Blackwell.

[24] Stigler, G. J. and Becker, G. S. (1985), De Gustibus Non Est Disputandum, The American Economic Review, 67, pp.76-90, Mar.

[25] Varian, H. (1980), Redistributive Taxation as Social Insurance, Journal of Public Economics, 14, pp.49-68, Oct.

[26] Williamson, O. E. (1985), The Economic Institutions of Capitalisml, The Free Press.

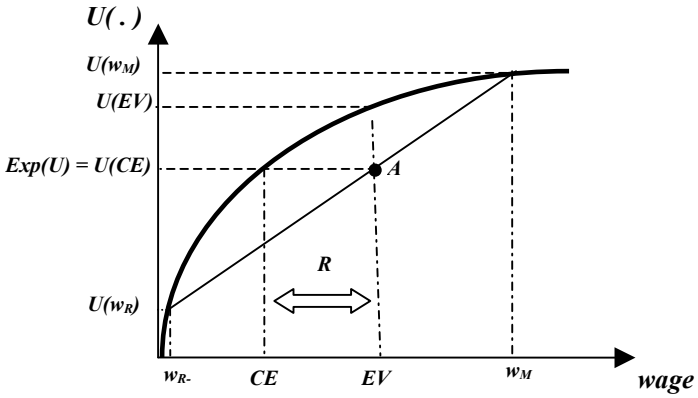

Fig. 1 One Period Simple Lottery with Risk Aversion

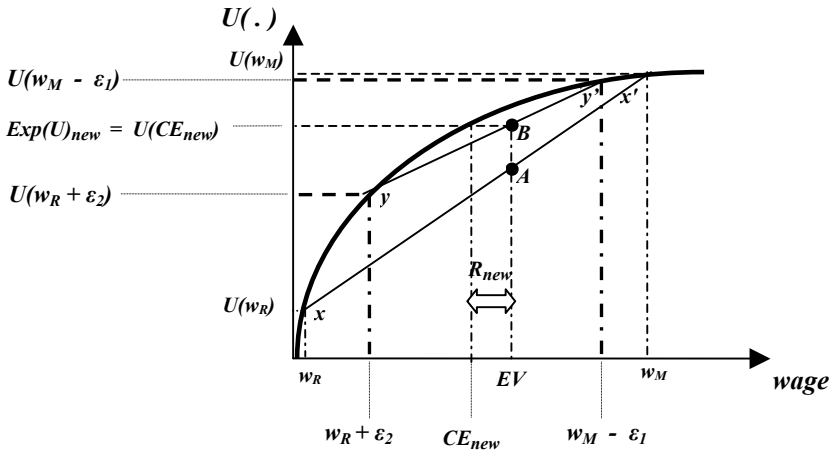

Fig. 2 The Trade Union reduces income variance and raises *Exp(U)*