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Enhancing Bank Transparency: What Role for the Supervision Authority?

Summary: We apply a three-tier hierarchical model of regulation, developed along the lines of Laffont and Tirole (1993), to an adverse selection problem in the corporate bond market. The bank brings the bonds to the market and informs the potential buyers about the bond risks; a unique benevolent public authority aims at maximising investors' welfare. The main goal is to investigate whether this unique authority is able to fully inform the market on a firm's true credit worthiness when banks, in order to recover doubtful credits, favour the placement of bonds issued by levered firms by concealing their true risk. By establishing the necessary conditions that allow optimal sanctions to produce the first best equilibrium, we show that the core problem of adverse selection in the corporate bond market does not lie so much in the benevolence of the delegated monitoring system, but rather in the possibility of affecting and sanctioning a firm's behaviour.

Key words: Corporate bond, Incentives, Collusion, Regulation.

JEL: D82, G28.

A well functioning capital market creates appropriate linkages of information, incentives and governance between firms and investors. This network is composed of different kinds of intermediaries: professional investors; information analysts such as ratings agencies; firm's internal and external auditors.

Despite corporate monitoring and governance[1], some important firms violated accounting standards in order to let (international) financial markets believe that performances were above the actual ones and thus obtain credit to repay old debts (Ponzi financing). As a side effect, this raised stock prices to unsustainable levels. It is widely acknowledged that collusion between managers and the monitoring system (Joel S. Demski 2003) played a major role in this process.

This fraudulent behaviour produced a mismatch between some investors' risk attitude and bonds' true risk. The main damages were inflicted to pension fund holders, like in the US cases of Enron[2], Worldcom[3] and Global Crossing, and corporate

[1] For a survey on this issue see Andrei Shleifer and Robert W. Vishny (1997).
[2] "Enron had used hundreds of special purpose entities by 2001 (…) to fund or manage risks associated with specific assets. Special purpose entities are shell firms created by a sponsor, but funded by independent equity investors and debt financing. For example, Enron used special purpose entities to fund the acquisition of gas reserves from producers" (Paul M. Healy, and Krishna G. Palepu 2003). See also Lev Baruch (2003) and Peter C. Fusaro and Ross M. Miller (2002).
[3] See Henry Sender (2002).

bond holders, like in the Italian cases of Cirio and Parmalat, where the characteristics of some securities were hidden to investors, so as to conceal their junk nature. More recently, similar arguments arose in the debate on the causes of the current subprime crisis (see Patrick Bolton, Xavier Freixas, and Joel Shapiro 2008).

These facts have stimulated a wide debate on how to meet the increasing demand for corporate governance reforms. They, have also undermined confidence in the market system of intermediaries and caused a re-evaluation of the role of government intervention. While the US Congress approved the Sarbanes-Oxley Act[4], raising the sanctions against fraudulent managers and auditors, in Italy the discussion centred less on sanctions and more on the opportunity to create a unique public authority aimed at maximizing savers' welfare through appropriate monitoring. As explained below, in our partial equilibrium context the maximization of savers' welfare means a perfect matching between investors' preferences and bonds' risk class (transparency), regardless of overall market riskiness (stability).

We apply Jean Tirole's (1986) and Jean-Jacques Laffont and Jean Tirole's (1991, 1993) models to an adverse selection problem in the corporate bond market. Several agents act in the economy: two kinds of firms (safe and unsafe) issue bonds to finance their investment projects; investors delegate a bank to monitor the firms (Douglas Diamond 1984, 1991); the bank brings the bonds to the market and informs potential buyers about the bonds' risk. The bank is hence the entity that should mitigate the information asymmetry between firms and investors. Even if in the real world this role is (at least in part) performed by rating agencies, we justify our simplifying hypothesis on the basis of the observation that banks have a better informative set and higher diagnosis skills than external institutions[5]. Which characteristics and instruments should a unique authority have to improve savers' (i.e. investors') welfare in the case of collusion between banks and firms?

Our paper is related to a growing literature focusing on the analysis of certification intermediaries and their incentives to disclose information to uninformed parties. The fact that firms cannot credibly transmit information to the market provides a rationale for such third parties to emerge and potentially collude with firms (see for example, Roland Strausz 2005; Eloic Peyrache and Lucia Quesada 2007; Bolton, Freixas, and Shapiro 2008; Anno Stolper 2009 and the literature there cited).

Strausz (2005) and Peyrache and Quesada (2007) analyse collusion between a certification intermediary and the seller of a product. While Strausz (2005) derives conditions under which reputation enables these intermediaries to resist a firm's capture, we follow Peyrache and Quesada (2007) in focusing on equilibria in which collusion may occur. Moreover, in our context, the possible emergence of collusion is the channel through which the public Authority can credibly threaten fraudulent firms' behaviour. Whereas in Stolper (2009) the regulator knows the firms' default rate within a rating category, but cannot observe whether the intermediary assigns

[4] Available at: http://fl1.findlaw.com/news.findlaw.com/hdocs/docs/gwbush/sarbanesoxley072302.pdf

[5] Roland Kirstein (2002) demonstrates that external ratings are more able than internal ratings to implement the goals of the Basle Committee's proposal, even if the rating agency has inferior detection skills. However, to obtain this result, Kirstein must assume, quite unrealistically, that the rating agency have undistorted preference "to maintain a reputation for good ratings when competing for potential customer". See also Christoph Kuhner (2001).

correct ratings, we assume that the regulator is endowed with a monitoring technology able to randomly detect collusive behaviour between firms and intermediaries. In our model collusion is an equilibrium outcome stemming from the incentives structure faced by intermediaries and firms.

The aim of this paper is mainly normative, that is to investigate which characteristics this unique authority should have to fully inform the market on firms' true credit worthiness when banks, in order to recover doubtful credits, favour the placement of bonds issued by levered firms by concealing their true risk. By establishing the necessary conditions that allow the optimal sanctions to produce the first best equilibrium, we show that the core problem of adverse selection in the corporate bond market does not lie so much in the benevolence of the delegated monitoring system, but rather in the possibility of affecting and sanctioning a firm's behaviour.

Even if we have constructed the model so as to sketch the collusive behaviour between firms and banks in a fashion similar to that experienced in recent financial scandals, a slightly different interpretation of the agents involved in our model allows us to better sketch some elements of the actual financial crisis. In particular, the agent who issues the bond may well be the investment banks that construct sophisticated securities to be placed among investors, and the agent that should mitigate the information asymmetry between sellers and investors can be interpreted as the rating agencies (or commercial banks).[6]

In fact, although the risks associated with extremely sophisticated securities were particularly tough to measure, collusive behaviours between commercial banks and certification intermediaries also contributed to underestimating the true risks (see George A. Akerlof and and Robert J. Shiller 2009). This more frequently happened in the case of *too-big-to-fail* companies, or government sponsored enterprises, who manage to place among investors bonds and obligations actually unsafe but rated as riskless.

The paper is organised as follows. The next section outlines the basic model where: (i) bond holders, in line with standard results, have to leave a positive rent to the unsafe firms, so as to eliminate their incentive in pretending to be of the safe type; (ii) the minimization of this rent produces a sub-optimal equilibrium with safe bond rationing. We demonstrate that the existing distortion in the separating equilibrium solution, with a benevolent bank, is lower than that emerging in the equilibrium without a bank. The first best is reached only in the limit, when the bank can perfectly observe the types.

In section 2 we introduce the Authority and show that, if the Authority's monitoring technology allows it to observe the real behaviour of the bank with positive probability and punish it in case of collusion with the lying firm, the optimal fine makes the bank benevolent, and thus does not eliminate the distortion. The role of firm transparency in this respect is once again highlighted. In section 3 we establish that only a non-benevolent bank (necessary condition) allows the optimal firm's sanction to produce the first best equilibrium[7]. In fact, this condition allows the au-

[6] We thank an anonymous referee for this alternative interpretation of the economic agents of our model.

[7] Even though in a different context, Mehmet Bac (2001) also shows that greater transparency may cause greater inefficiency. See also Abhijit V. Banerjee (1997) and Harold Demsetz (1969) where red tapes may be caused by benevolent behaviour by the government.

thority to internalize the effect of the fine rule on the firm's incentive constraint. More in general, our result suggests that, in the absence of direct monitoring by the authority, the latter should be endowed with instruments able to influence the firm's incentive constraint.

1. The Basic Model

Two types of risk neutral firms, i.e. "safe" and "unsafe"exist in the economy. A safe firm develops a "safe" investment project characterized by a fixed and certain return. By contrast, an unsafe firm develops an uncertain project with two possible outcomes, one positive and one negative, offering the same expected return. All projects are entirely financed by bonds issued by firms. The firm's type is private information, so that investors cannot distinguish between safe (risk free) and risky corporate bonds. Asset prices are determined by the capital asset pricing model (CAPM). Endowed with quadratic utility functions, risk-adverse investors trade off risk and expected returns, so as to reach the security market line.

$Y = P_b b$ is defined as the total investor's outlay for b bonds purchased at price P_b, with $Y \in \left\{\underline{Y}, \overline{Y}\right\}$ and $b \in \left\{\underline{b}, \overline{b}\right\}$, where the underscore means "safe" and the upper bar means "unsafe". Every bond has an expected rate of return $r \in \left\{\underline{r}, \overline{r}\right\}$. The marginal cost of the bond, $B \in \left\{\underline{B}, \overline{B}\right\}$ with $\underline{B} > \overline{B}$ and $\Delta B = \underline{B} - \overline{B}$, is the minimum price the firm is willing to accept to offer the interest rate $r \in \left\{\underline{r}, \overline{r}\right\}$.[8]

Given these assumptions, perfect competition in the bond market ensures that the market bond price equals the bond marginal cost, i.e. $P_b = B$ for every $\left(B, P_b\right)$. Hence, in equilibrium, the whole return on the project accrues to bond holders. In other words, the bond interest rate equals the expected capital marginal productivity, which is assumed to be constant.

In a perfect information equilibrium both $\underline{Y} = \underline{b}\underline{B}$ and $\overline{Y} = \overline{b}\overline{B}$ hold. The marginal cost schedule can be considered as the bond supply function. In the CAPM scheme, the expected utility of an unsafe bond must equal that of a safe bond (certain equivalent utility), so that the unsafe expected return minus the certain return equals the risk premium. We define a unique benefit function $S\left(b\right)$ for every type of bond, i.e. $S\left(\underline{b}\right) = S\left(\overline{b}\right)$, with $S'\left(b\right) = dS/db > 0$ and $d^2S/db^2 < 0$.[9] Equilibrium values of b and B (for the two types of bonds) are determined by the intersection of $S'\left(b\right)$ with the marginal cost schedules.

[8] It is worth noting the standard inverse relation between B and r. (For instance, in a zero coupon bond, this implies that the return at maturity is constant).

[9] This reflects the decreasing marginal benefit of wealth, which depends on the bond's quantity because the return at maturity is supposed to be equal. (See footnote 9).

Under perfect information perfect competition ensures the *first best equilibrium* in which the marginal benefit of each kind of bond equals the associated marginal cost, i.e. $S'\left(\underline{b}^{FB}\right) = \underline{B}$ and $S'\left(\overline{b}^{FB}\right) = \overline{B}$.

By contrast, under hidden information, investors cannot distinguish between safe and unsafe firms; the latter could take an advantage by mimicking the other type. We recall the basic methodology of solving for optimal contracts when the firm's type is unknown. Since the investor does not observe the type of firm, he is forced to offer her a set of choices independent of her type. Without loss of generality this set can be described as $(b, Y(b))$[10].

The revelation principle allows us to restrict our attention only to direct revelation mechanisms[11]. In order to stimulate an honest revelation of types, investors have only to determine a couple of pair-wise contracts, maximizing the expected value of its objective function (using the *a priori* distribution on type v and $(1-v)$ for safe and unsafe, respectively), subject to the individual rationality constraints and the incentive constraints. Individual rationality implies that:

$$\underline{Y} - \underline{B}\underline{b} \geq 0 \tag{1}$$

$$\overline{Y} - \overline{B}\overline{b} \geq 0 \tag{2}$$

According to inequalities (1) and (2), by subscribing the contract settled for its type, a firm receives at least the reservation utility level.

Incentive compatibility constraints imply:

$$\underline{Y} - \underline{B}\underline{b} \geq \overline{Y} - \underline{B}\overline{b} \tag{3}$$

$$\overline{Y} - \overline{B}\overline{b} \geq \underline{Y} - \overline{B}\underline{b} \tag{4}$$

According to inequalities (3) and (4), if a firm subscribes the contract settled for its type, it can obtain at least the utility level obtainable by mimicing the other type[12].

[10] It is worth noting that in our simplified context, fixing the price and return rate is equivalent to fixing quantity and outlay.

[11] All the necessary conditions for applying the revelation principle (see, among others, Patrick Bolton and Mathias Dewatripont 2005, ch 2), are satisfied in our model.

[12] However not all these constraints are binding. The individual rationality constraint of the unsafe type is redundant and can be omitted, as inequalities (1) and (4) include the case described by constraint (2) (as long as $\underline{B} > \overline{B}$). The incentive constraint of the unsafe type has to be binding in the optimal solution, otherwise it would be possible to decrease $\overline{Y}$ so that (4) is still satisfied without violating any other constraint. This, in turn, would further increase the principal's payoff, which is a contradiction. For analogous reasons, the incentive

We now introduce another agent, who brings the bonds issued by firms to the market and informs potential buyers on the bond's risk. As such a role is usually played by credit institutions, we dub the rating agent as the "bank".

The bank is endowed with a monitoring technology which allows it to correctly observe the firm's type with probability ξ and to observe nothing with probability $(1-\xi)$. The bank should inform the bond buyer when observing an unsafe firm, while it should report nothing if the type is safe or not observed. Let $\sigma \in \{0, \overline{B}\}$ be the signal reported by the bank.

We begin by assuming a benevolent bank. If the report is $\sigma = \overline{B}$ investors can settle the first best contract; if the report is $\sigma = 0$ the investors update their beliefs according to Bayes' rule and settle a new incentive compatible contract.[13] The *ex post* probability that the true type is unsafe if the signal is blank ($\sigma = 0$) is given by:

$$\Pr\left(B = \overline{B} / \sigma = 0\right) = \frac{(1-\xi)(1-v)}{1-\xi(1-v)} < (1-v) \tag{5}$$

The maximization problem is:

$$\max_{\underline{b}, \overline{b}, \overline{Y}, \underline{Y}} E[S(b) - Y]$$

s.t. (1), (2), (3), (4), (5)

When the problem is solved taking into account only the binding constraints[14], it can be written as:

$$\begin{aligned} \max_{\underline{b}, \overline{b}} \quad & \xi(1-v)\left[S\left(\overline{b}\right) - \overline{B}\overline{b}\right] + \\ & + (1-\xi)\left(\begin{array}{l} \dfrac{(1-v)(1-\xi)}{(1-\xi)}\left[S\left(\overline{b}\right) - \overline{B}\overline{b} - \underline{b}\Delta B\right] + \\ + \dfrac{v(1-\xi)}{(1-\xi)}\left[S\left(\underline{b}\right) - \underline{B}\underline{b}\right] \end{array}\right) + v\xi\left[S\left(\underline{b}\right) - \underline{B}\underline{b}\right] \end{aligned}$$

rationality constraint of the safe type must be binding. Finally, the so-called monotonicity condition (i.e. $\overline{b} > \underline{b}$, which holds as long as the bonds benefit function is unique and $\underline{B} > \overline{B}$) ensures that constraint (1) is redundant (this standard condition is known as Spence-Mirrlees Single Crossing Condition, see *ibid. ch. 2 pp*. 9-10.)

[13] Also blank reports are of course informative.

[14] By substituting (1) into (4) we obtain: $\overline{Y} - \overline{B}\overline{b} = \underline{b}\Delta B$, where the right hand side represents the rent that must be given to the unsafe type in order to guarantee optimal truthtelling.

the first order conditions are:

$$S'\left(\overline{b}\right) = \overline{B}$$

$$S'\left(\underline{b}\right) = \underline{B} + \frac{(1-v)}{v}\left(1-\xi\right)\Delta B \tag{6}$$

Remark 1:

Coherently with standard results[15], the bond holders have to leave a positive rent to those types (the unsafe one, in the present case) who could take an advantage in mimicing other types. The minimization of such a rent requires a decrease in the quantity of safe bonds, thus leading to a sub-optimal (i.e., second best) equilibrium. The term $\left[(1-v)/v\right](1-\xi)\Delta B$ *represents a distortion on the safe bond quantity, which results lower than that associated with the first best equilibrium. The distortion is positively related to the price spread* ΔB *and negatively related to the share of safe bonds. Furthermore it is negatively related with* ξ *that can be viewed as the degree of a firm's transparency. As* $\xi \to 1$ *at the limit the bank perfectly overcomes the information asymmetry and distortion tends to zero, the same occurs when* $v \to 1$*, as information is no longer hidden.*

Proposition 1. *The distortion on safe bonds in the solution of benevolent bank equilibrium is lower than the one in the equilibrium without the bank (i.e. equation (6) with* $\xi = 0$*), though not eliminated.*

The rent to yield to the unsafe type is obtained as in footnote 15, after having weighted the incentive constraint of the unsafe type with the probability of eluding the bank's monitoring. The expected rent is equal to: $(1-\xi)\Delta B\underline{b}$. As noted in remark 1, the aim of the distortion is the minimization of this rent.

2. Authority and Collusion Proof Equilibrium

In this section we assume that, unless motivated otherwise, a non benevolent bank tries to appropriate the rent by hiding the report $\sigma = \overline{B}$. In other words, unsafe firms are willing to pay banks a bribe between zero and the total amount of the rent minus the collusion's transaction cost. In the case of a zero reported signal there would be either collusion or a real inability of the bank to detect the bond's risk class[16]. Now we can start analyzing the core questions raised in the introduction (see page 2): which characteristics should a public authority (aiming to maximise the investors' welfare) have in order to eliminate the collusion between firms and banks?

[15] See also Laffont (2000).

[16] When the bank observes an unsafe firm, there is a common interest in hiding this information. This is definitely the main interest of this class of models. However the possibility of conflicting interests between the bank and firm, even when the bank successfully observes the firm's type, could be a fruitful field for future research.

Even if the authority is benevolent, as we assume in our model, will it be sufficient to restore the first best equilibrium?

For this purpose, we introduce a new agent, the Authority, endowed with a monitoring technology, which allows it to verify with probability π the real behaviour of the bank and to see nothing with probability $(1-\pi)$. The Authority can check the behaviour of the bank but cannot directly control the firm.

If the Authority observes the real behaviour of the bank, it can punish the bank's collusive behaviour with a fine proportional to the amount of the charged bond, otherwise investors have to settle an incentive compatible contract leaving a positive rent to the colluding agents.

Assuming that the collusion bargaining power is completely in favour of the bank, it does not collude if the expected punishment is higher than the expected rent; hence $(1-\pi)\xi k\underline{b}\Delta B - \pi\xi p\underline{B}\underline{b} \leq 0$ where p represents the fine rate, $(1-k)$ is the unit collusion cost[17]. The bank's expected utility can hence be written as follows:

$$E(V) = Max\left[0,(1-\pi)\xi k\underline{b}\Delta B - \pi\xi p\underline{B}\underline{b}\right] \tag{7}$$

If the fine rate is higher than the zero cut-off value of the second term of equation (7), i.e. $p = \frac{(1-\pi)}{\pi}\frac{\Delta B}{\underline{B}}k = p^c$, then the bank is benevolent, reaching the zero reservation utility level.

The maximization problem can be solved in two steps: first by maximizing the objective function in the set of the incentive compatible contracts,[18] given the fine rate p (the investors' problem); secondly by minimizing the distortion of the safe bond with respect to the fine instrument subject to the bank's incentive constraint (the Authority's problem).

Formally, the maximization problem is (problem B):

$$\underset{\underline{b},\bar{b}}{Max}\ (1-\pi)\left\{\begin{array}{l}\xi(1-v)\left(S(\bar{b})-\bar{B}\bar{b}-k\underline{b}\Delta B\right)+\\ +\left[1-\xi(1-v)\right]\left[\frac{(1-v)(1-\xi)}{1-\xi(1-v)}\left(S(\bar{b})-\bar{B}\bar{b}-\underline{b}\Delta B\right)+\frac{v}{1-\xi(1-v)}\left(S(\underline{b})-\underline{B}\underline{b}\right)\right]\end{array}\right\}+$$

[17] In this kind of model costs of transaction are exogenous. They represent dead weight losses that reduce the amount of appropriable rent.

[18] "Tirole (1986) proves a principle of collusion proofness to show that there is no loss of generality in restricting the analysis to collusion-proof allocations. More general mechanisms in which the constitution would try to elicit if the politician and the firm have entered a collusive agreement are not considered since they could be nullified by the colluding partners." (see Laffont 1999, p. 656).

$$+\pi\left\{\begin{array}{l}\xi(1-v)\left(S(\bar{b})-\bar{B}\bar{b}+p\underline{B}\underline{b}\right)+\\ +\left[1-\xi(1-v)\right]\left[\dfrac{(1-v)(1-\xi)}{1-\xi(1-v)}\left(S(\bar{b})-\bar{B}\bar{b}-\underline{b}\Delta B\right)+\dfrac{v}{1-\xi(1-v)}\left(S(\underline{b})-\underline{B}\underline{b}\right)\right]\end{array}\right\}$$

The first order conditions are:

$$S'(\bar{b})=\bar{B}$$

$$S'(\underline{b})=\underline{B}+\frac{(1-v)}{v}\left[\Delta B(1-\pi)\xi k-\pi\xi p\underline{B}+\Delta B(1-\pi)(1-\xi)+\pi(1-\xi)\Delta B\right] \quad (8)$$

Minimizing the distortion (the second term of the equation [8]) subject to the incentive constraint of the bank leads to

$$\underset{p}{Min}\frac{(1-v)}{v}\left[\Delta B(1-\pi)\xi k-\pi\xi p\underline{B}+\Delta B(1-\pi)(1-\xi)+\pi(1-\xi)\Delta B\right]$$
$$sub\ E(V)=Max\left[0,(1-\pi)\xi\alpha\underline{b}\Delta B-\pi\xi p\underline{B}\underline{b}\right]$$

Three cases must hence be considered. Firstly, when $p\le p^c$ we minimize the following problem:

$$L=\frac{(1-v)}{v}\left[\Delta B(1-\pi)\xi k-\pi\xi p\underline{B}+\Delta B(1-\xi)\right]+$$
$$+\lambda\left[(1-\pi)\xi k\Delta B-(1-v)\pi\xi p\underline{B}\right]$$

We get:

$$p=\frac{(1-\pi)}{\pi}\frac{k\Delta B}{\underline{B}} \quad (9)$$

Substituting (9) into (8), yields: $S'(\underline{b})=\underline{B}+\dfrac{(1-v)}{v}(1-\xi)\Delta B$

that is the equilibrium with benevolent bank (see equation [6]). From this result the following proposition follows.

Proposition 2. *The optimal fine (that makes the bank benevolent) is unable to eliminate the distortion.*

We have thus found the cut-off value (equation [9]) of the fine rate above which the collusion is avoided and the bank acts as if it was benevolent. This value is negative related to the accuracy of the Authority's monitoring technology, the transaction cost of collusion and the absolute value of $\underline{B}$, on which the fine rate is applied.

Secondly, if $p = 0$ the outcome $S'(\underline{b}) = \underline{B} + \frac{(1-v)}{v}\Delta B\left[(1-\xi)+\xi k\right]$ represents the separation equilibrium obtained leaving the bank a positive rent high enough to respect its incentive constraint when it observes $\overline{B}$. It is as if the Authority positively motivates the honest behaviour of the bank instead of directly discouraging collusion. We call this the *incentive equilibrium.*

Thirdly, if $p \geq p^c$ the benevolent behaviour of the bank eliminates the first two terms from the distortion (see equation 8), which corresponds to the case in which it has observed the firm's type. We call this the *optimal collusion proof equilibrium*. The outcome $S'(\underline{b}) = \underline{B} + \frac{(1-v)}{v}(1-\xi)\Delta B$ equals that of the equilibrium with a benevolent bank (see equation [6]).

Finally when $0 < p < p^c$ the outcome: $S'(\underline{b}) = \underline{B} + \frac{(1-v)}{v}\left[\Delta B(1-\pi)\xi k - \pi\xi p\underline{B} + \Delta B(1-\xi)\right]$ is higher than that of the optimal collusion proof equilibrium, lower than that of the incentive equilibrium and monotonically related to the punishment.

The main insight we can derive from the model is that, even if the punishment is higher than the cut off value, we can at best restore the benevolent bank equilibrium, but the downward distortion of the safe bond can never be eliminated.

3. Rent Bargaining and Proportional Fines

We now suppose that the distribution of the rent is the outcome of a bargaining game between bank and firms; the bargaining power is split between the two agents and there is no cost of collusion. More precisely we consider three different ways of dealing with the Authority's fine instrument: i) the firm's fine exogenous and the bank's fine optimally settled; ii) the fair sharing rule, i.e. fines proportional to the amount of appropriated rents; iii) the bank's fine exogenous and the firm's fine optimally settled.

We demonstrate that only the last system is able, under specific conditions, to restore the first best equilibrium.

3.1 The Firm's Exogenous Fine

Let α and $(1-\alpha)$ be the shares of the total rent appropriated respectively by firm and bank. We assume two different fines: the bank's punishment is optimally settled by the Authority while the firm's punishment is exogenously fixed.[19] In other words the monitoring technology allows the Authority to detect the collusive behaviour of the bank but not the firm's risk. What matters is the Authority's target of motivating the truthtelling behaviour of the bank.

Let $p_1 = f$ be the firm's exogenous fine rate and p_2 the bank's fine rate; the maximization problem is analogous to problem [B] and the outcomes follow in a similar way. In this case (Problem C):

$$\underset{\underline{b},\bar{b}}{Max}\ (1-\pi)\left\{\begin{array}{l}\xi(1-v)\left[S(\bar{b})-\bar{B}\bar{b}-\alpha\underline{b}\Delta B-(1-\alpha)\underline{b}\Delta B\right]+\\ +\left[1-\xi(1-v)\right]\left[\frac{(1-v)(1-\xi)}{1-\xi(1-v)}\left(S(\bar{b})-\bar{B}\bar{b}-\underline{b}\Delta B\right)+\frac{v}{1-\xi(1-v)}\left(S(\underline{b})-\underline{B}\underline{b}\right)\right]\end{array}\right\}+$$

$$+\pi\left\{\begin{array}{l}\xi(1-v)\left[S(\bar{b})-\bar{B}\bar{b}+(f+p_2)\underline{B}\underline{b}\right]+\\ +\left[1-\xi(1-v)\right]\left[\frac{(1-v)(1-\xi)}{1-\xi(1-v)}\left(S(\bar{b})-\bar{B}\bar{b}-\underline{b}\Delta B\right)+\frac{v}{1-\xi(1-v)}\left(S(\underline{b})-\underline{B}\underline{b}\right)\right]\end{array}\right\}$$

The first order conditions are:

$$S'(\bar{b}) = \bar{B}$$

$$S'(\underline{b}) = \underline{B} + \frac{(1-v)}{v}\left[(1-\pi)\xi\Delta B + (1-\xi)\Delta B - \pi\xi(f+p_2)\underline{B}\right] \tag{10}$$

Minimizing the distortion leads to

$$\underset{p_2}{Min}\ \frac{(1-v)}{v}\left[(1-\pi)\xi\Delta B + (1-\xi)\Delta B - \pi\xi(f+p_2)\underline{B}\right]$$

$$sub$$

$$E(V) = Max\left[0,(1-\pi)\xi\alpha\underline{b}\Delta B - \pi\xi p_2\underline{B}\underline{b}\right]$$

Proposition 3. *When the Authority can uniquely settle the bank's punishment it is impossible to eliminate the safe bond rationing.*

[19] This follows from the assumption that the Authority is able to control the bank but not the firms: the bank's fine is the unique instrument of transparency regulation.

As in equation [9], $p_2^{\circ} = \frac{(1-\pi)}{\pi}\frac{\Delta B}{\underline{B}}\alpha$ is the cut-off value, below which the distortion increases and above which the optimal collusion proof equilibrium holds.

In other words the only instrument with which the authority is endowed does not affect the firm's incentive constraint. Moreover when the authority induces a benevolent behaviour of the bank even the exogenous firm's fine (whatever it is) becomes ineffective; in fact it is impossible to punish a firm without discovering the bank collusion.

3.2 Fair Sharing of the Fines

Let the firm's fine be a function of the bank's punishment through an exogenously fixed rule. The Authority has to incentivise truthtelling behaviour on the part of the bank, but in this context it internalizes the firm's fine rule. A reasonable settlement for punishing firms is the principle of "fair sharing" according to which the fine is proportional to the amount of the appropriated share rent, hence:

$$p_1 = p_2 \frac{1-\alpha}{\alpha} \tag{11}$$

By rewriting the first order conditions

$$S'(\overline{b}) = \overline{B}$$

$$S'(\underline{b}) = \underline{B} + \frac{(1-v)}{v}\left[(1-\pi)\xi\Delta B + (1-\xi)\Delta B - \pi\xi(p_1 + p_2)\underline{B}\right]$$

and by minimizing the distortion subject to the incentive constraint of the bank and to the fine rule, we can write:

$$\underset{p_2}{Min}\ \frac{(1-v)}{v}\left[(1-\pi)\xi\Delta B - \pi\xi(p_1 + p_2)\underline{B} + (1-\xi)\Delta B\right]$$

$$sub$$

$$E(V) = \max\left[0, (1-\pi)\xi\alpha\,\underline{b}\Delta B - \pi\xi\, p_2\underline{B}\,\underline{b}\right]$$

$$p_1 = p_2\frac{1-\alpha}{\alpha}$$

Proposition 4. *If the Authority knows the bargaining power and employs the fair sharing rule it is impossible to improve the benevolent bank equilibrium.*

Proof.

If $p_2 = p_2^{\circ} \Rightarrow p_1 = p_1^{\circ} = \frac{(1-\pi)}{\pi}\frac{\Delta B}{\underline{B}}(1-\alpha)$, the benevolent bank equilibrium still holds. The unsafe firm's expected utility

$$\overline{Y} - \overline{B}\overline{b} = Max\begin{bmatrix} 0, (1-\pi)\xi(1-\alpha)\underline{b}\Delta B + \\ +(1-\pi)(1-\xi)\underline{b}\Delta B - \pi\xi p_1 \underline{b}\underline{B} + \pi(1-\xi)\underline{b}\Delta B \end{bmatrix} \tag{12}$$

becomes

$\overline{Y} - \overline{B}\overline{b} = (1-\xi)\underline{b}\Delta B > 0$;

If $p_2 > p_2^{\circ} \Rightarrow p_1 > p_1^{\circ}$, the benevolent behaviour of the bank eliminates from the distortion the cases in which it has observed the firm's type, so the Authority is not able to improve the optimal collusion proof equilibrium (i.e. the benevolent bank one) and does not lower the firm's rent $\overline{Y} - \overline{B}\overline{b} = (1-\xi)\underline{b}\Delta B > 0$;

If $p_2 < p_2^{\circ} \Rightarrow p_1 < p_1^{\circ}$, the equilibrium is sub-optimal with respect to that obtained with a benevolent bank. The distortion increases as long as the bank's fine moves away from the cut off value.

If $p_2 = p_1 = 0$, the outcome collapses to the incentive equilibrium analysed above, but without collusion cost ($k = 1$). We can observe that this is the worst separating equilibrium because a disincentive, as opposed to an incentive, is costless.

3.3 The Bank's Exogenous Fine

Let $p_2 = f$ be the bank's exogenous fine, not necessarily higher than the cut-off value: thus the benevolent behaviour of the bank is not assured. Although the Authority's monitoring technology is unchanged, now the policy instrument is the firm's fine, whose effectiveness is subject to the reconnaissance of the bank's behaviour. In fact, it is impossible to punish a firm without discovering the collusion with the bank. Now what matters is the target of the Authority to motivate a firm's truthtelling behaviour. The maximization problem is (problem D):

$$\underset{\underline{b}\overline{b}}{Max} \; (1-\pi)\left\{\xi(1-\nu)\left[S(\overline{b}) - \overline{B}\overline{b} - \alpha\underline{b}\Delta B - (1-\alpha)\underline{b}\Delta B\right] + \left[1-\xi(1-\nu)\right]\left[\frac{(1-\nu)(1-\xi)}{1-\xi(1-\nu)}\left(S(\overline{b}) - \overline{B}\overline{b} - \underline{b}\Delta B\right) + \frac{\nu\left(S(\underline{b}) - \underline{B}\underline{b}\right)}{1-\xi(1-\nu)}\right]\right\} +$$

$$+\pi\left\{\xi(1-\nu)\left[S(\overline{b}) - \overline{B}\overline{b} + (p_1+f)\underline{B}\underline{b}\right] + \left[1-\xi(1-\nu)\right]\left[\frac{(1-\nu)(1-\xi)}{1-\xi(1-\nu)}\left(S(\overline{b}) - \overline{B}\overline{b} - \underline{b}\Delta B\right) + \frac{\nu\left(S(\underline{b}) - \underline{B}\underline{b}\right)}{1-\xi(1-\nu)}\right]\right\}$$

The first order conditions are:

$$S'(\overline{b}) = \overline{B}$$

$$S'(\underline{b}) = \underline{B} + \frac{(1-\nu)}{\nu}\left[(1-\pi)\xi\Delta B + (1-\xi)\Delta B - \pi\xi(p_1+f)\underline{B}\right] \tag{13}$$

In order to minimize the distortion through p_1, we need to introduce a new constraint, that is, the firm's expected utility (equation [12]), while the old bank constraint lacks any policy instrument.

$$\underset{p_1}{Min}\frac{(1-v)}{v}\left[(1-\pi)\xi\Delta B+(1-\xi)\Delta B-\pi\xi(p_1+f)\underline{B}\right]$$

sub

$$E(V)=Max\left[0,(1-\pi)\xi\alpha\underline{b}\Delta B-\pi\xi f\underline{B}\underline{b}\right]$$

$$\overline{Y}-\overline{B}\overline{b}=Max\left[0,(1-\pi)\xi(1-\alpha)\underline{b}\Delta B+(1-\pi)(1-\xi)\underline{b}\Delta B-\pi\xi p_1\underline{b}\underline{B}+\pi(1-\xi)\underline{b}\Delta B\right]$$

Proposition 5. *When the bank is not benevolent the Authority can reach the first best equilibrium because a higher fine on the unsafe firm, able to extract all the rent, is now feasible.*

If $f < p_2^{\circ}$ then the bank is not benevolent and it is possible to settle p_1 such that the firm's expected utility is equal to zero, the unsafe bond market becomes transparent and the unsafe market is no longer rationed. This cut off value of p_1 is:

$$p_1^{*}=\frac{(1-\xi)+(1-\pi)(1-\alpha)\xi}{\pi\xi}\frac{\Delta B}{\underline{B}}>p_1^{\circ}$$

If $p_1 > p_1^{*}$, both the firm's expected utility and the bond distortion remain at zero level;

if $p_1 < p_1^{*}$, there is a positive rent that induces a downward distortion of the safe bond.

If $f \geq p_2^{\circ}$, the bank is benevolent and we can at best reach the optimal collusion proof equilibrium. The threat to punish the firm is not credible and p_1 is not an effective policy instrument any more. As we have just explained, it is impossible to punish a firm without discovering the bank collusion.

So if the bank fine induces benevolent attitudes then the firm is aware that the Authority cannot discover any collusion, but at the same time the bank's monitoring technology is not infallible so the firm still has the possibility of concealing its type without being punished by the Authority.

Remark 2.

In order to reach the first best equilibrium, the Authority has to internalize the effect of the fine rule on the firm's incentive constraint. The main insight of this

model is hence that, in the absence of direct monitoring the Authority should be endowed with instruments able to act on the firm's incentive constraint.

Another way of o internalizing the effect of the fine on the firm's incentive constraint could be to consider an Authority who may commit judicial errors, like in Kirstein (2002)[20].

The analysis developed in this section highlights that the core problem of adverse selection in the corporate bond market has not much to do with the benevolence of the delegated monitoring system, but rather with the plausibility of affecting and sanctioning the firm's behaviour. In our model, if the information between firms and investors is asymmetric, the first best is paradoxically reached if and only if the bank is not benevolent, since this is the only way to endow the Authority with the right instrument.

4. Conclusions

The application of Tirole's (1986) model to a context of banking intermediation provides fruitful insights on the issue investigated in this paper. We have shown that if the Authority's monitoring technology allows it to discover the true behaviour of the bank with positive probability and to punish it in the case of collusion with the lying firm, the optimal fine makes the bank benevolent but is unable to eliminate the distortion. We have also shown that, in order to reach the first best equilibrium, the Authority has to internalize the effect of the fine rule on the firm's incentive constraint. The conclusion that the first best is reached if and only if the bank is not benevolent is due to the fact that this is the only way to endow the Authority with the proper instrument.

The main insight of the model is hence that the Authority should be endowed with instruments affecting the firm's behaviour even in the absence of direct monitoring. The core problem of adverse selection in the corporate bond market does not lie so much in the benevolence of the delegated monitoring system, but rather in the possibility of affecting and sanctioning a firm's behaviour.

This suggests that the Italian reform instituting a unique Authority in charge of the supervision of bonds placement in the secondary market: (i) could induce intermediaries to espouse benevolent attitudes; (ii) this would be insufficient to solve the problems raised by asymmetric information.

The core issue is the false information provided by firms, and the policy implication is that the best way to deal with this problem is, on the one hand, to enhance the transparency of firm's accounts and, on the other hand, to improve the efficiency and the effectiveness of the system of sanctions. Feasible instruments to enhance transparency are, for example, the regulation of off-shore financial markets, or a greater attention paid to the unconventional use of innovative financial instruments. As for the sanctions, the Sarbanes-Oxley Act (2002) appears more effective than the Italian reform, according to which sanctions are lower and sometimes contradictory.

[20] In this case, the effect of wrong punishment on the participation constraints should also be considered. In Kirstein (2002), where a bank's participation constraints are not considered, a positive fine is sufficient in order to provide the right bank incentives without setting any fine-roof.

Some interesting conclusions can be derived in the light of the recent financial crisis as, for example, mortgage securitizers and rating agencies can be interpreted as the firms and the banks in our model. Akerlof and Shiller (2009, p. 37) summarized the role played by corruption and bad faith behaviour during the subprime mortgage crisis and the recession that began in 2007 in the following way: "those who brought these highly rated junk packages had no great incentive to look too carefully at them. It takes considerable sophistication to question an AAA rating. Those who packaged the junk of course wanted their fees (…). There was thus an economic equilibrium that encompassed the whole chain, from the buyers of the properties, to the originators of the mortgages, to the securitizers of the mortgage, to the rating agencies, and finally to the purchasers of the mortgage backed securities. They each had their motives". In the same vein, by investigating the presence of new kinds of corruption or bad faith behavior, Akerlof and Shiller's (2009, p. 38) conclusions are not different from our arguments: "Part of the answer is that there are variations through time in the perceived penalties for such behavior".

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