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**Protecting Savings: Do We Need a Supervision
Authority?**

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Abstract

We apply a three-tier hierarchical model of regulation, developed along the lines of Laffont and Tirole's (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 bonds' risk; a unique benevolent public authority aims at maximising savers' welfare. The main goal is to investigate whether this unique authority is able 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. We establish the necessary condition that allows the optimal sanctions to produce the first best equilibrium.

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Protecting Savings: Do We Need a Supervision Authority?^{*}

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1. Introduction

A well functioning capital market creates appropriate linkages of information, incentives and governance between firms and investors. This network is composed by different kinds of intermediaries: professional investors; information analysts, such as ratings agencies; firms' internal and external auditors. Despite corporate monitoring and governance¹, some important firms have 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 (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 Enron², Worldcom

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¹ For a survey on this issue see Shleifer and 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

(Sender, 2002) and Global Crossing, and corporate bond holders, like in the Italian experience with Cirio and Parmalat, where characteristics of some securities were hidden to some investors, so as to conceal their junk nature. These facts have stimulated a wide debate on how to meet the increasing demand for a corporate governance reform. While in the US the Congress approved the Sarbanes-Oxley Act³, 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 aiming at maximising savers' welfare through appropriate monitoring. As it is going to be explained below, in our contest the maximization of savers' welfare means a perfect matching between savers' preferences and bonds' risk class (transparency), regardless to the market overall riskiness (stability).

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. To this aim, we apply Tirole's (1986) and Laffont-Tirole's (1991 and 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 (Diamond, 1984 and 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

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" (Healy and Palepu, 2003). See also Baruch (2003), Fusaro and Miller (2002).

³ See on the web news.findlaw.com/hdocs/docs/gwbush/sarbanesoxley072302.pdf

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 skill than external institutions⁴. Which characteristics and instruments should a unique authority have to improve savers' welfare in the case of collusion between banks and firms?

The paper is organised as follows. The next section outlines the basic model where: (i) bonds 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. In section 3 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 4 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 firms' transparency in this respect is once again highlighted. In section 5 we establish that only a non-benevolent bank (necessary condition) allows the optimal firms' sanction to produce the

⁴ Kirstein (2002) demonstrates that external ratings are more able than internal ratings to implement the goals of Basle Committee's proposal, even if the rating agency has inferior detection skills. However, in order to obtain this result, he must assume, quite unrealistically, that rating agency have undistorted preference "to maintain a reputation for good ratings when competing for potential customer". See also Kuhner (2000).

first best equilibrium⁵. In fact, this condition allows the authority 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. Section 6 concludes.

2. The basic model

In the economy there exist two types of risk neutral firms: “safe” and “unsafe”. 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-averse investors trade off risk and expected return, so as to reach the security market line.

Define $Y = P_b b$ as the total investors outlay for b bonds purchased at price P_b , with $Y \in \{\underline{Y}, \bar{Y}\}$ and $b \in \{\underline{b}, \bar{b}\}$, where the underscore means “safe” and the upper bar means “unsafe”. Every bond has an expected rate of return $r \in \{\underline{r}, \bar{r}\}$. The marginal cost of the bond, $B \in \{\underline{B}, \bar{B}\}$ with

⁵ Even though in a different context, also Bac (2001) shows that greater transparency may cause greater inefficiency. See also Banerjee (1997), where red tapes may be caused by benevolent behaviour by the government, and Demsetz (1969).

$\underline{B} > \bar{B}$ and $\Delta B = \underline{B} - \bar{B}$, is the minimum price the firm is willing to accept to offer the interest rate $r \in \{\underline{r}, \bar{r}\}$.⁶

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 (B, P_b) . 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 $\bar{Y} = \bar{b}\bar{B}$ 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 $S(b)$ for every type of bond, i.e. $S(\underline{b}) = S(\bar{b})$, with $S'(b) = dS/db > 0$ and $d^2S/db^2 < 0$.⁷ Equilibrium values of b and B (for the two types of bonds) are determined by the intersection of $S'(b)$ with the marginal cost schedules.

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

⁶ It is worth to notice the standard inverse relation between B and r . (For instance, in a zero coupon bond, it implies that the return at maturity is constant).

⁷ It reflects the decreasing marginal benefit of the wealth, which depends on the bond's quantity because the return at maturity is supposed to be equal. (See footnote 6).

By contrast, under hidden information, savers can not 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 the 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 $(b, Y(b))$ ⁸.

The revelation principle allows to restrict our attention only to direct revelation mechanisms⁹. In order to incentivate a honest revelation of types, savers 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:

$$\underline{Y} - \underline{B}\underline{b} \geq 0 \quad (1)$$

$$\bar{Y} - \bar{B}\bar{b} \geq 0 \quad (2)$$

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:

⁸ It is worth to notice that in our simplified contest, fixing price and return rate is equivalent to fixing quantity and outlay.

⁹ All the necessary conditions to apply the revelation principle (see, among others, Bolton and Dewatripont, 2005, ch 2), are satisfied in our model.

$$\underline{Y} - \underline{B}\underline{b} \geq \bar{Y} - \underline{B}\bar{b} \quad (3)$$

$$\bar{Y} - \bar{B}\bar{b} \geq \underline{Y} - \bar{B}\underline{b} \quad (4)$$

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.

The maximization problem is:

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

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

Not all these constraints are however 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 $\underline{B} > \bar{B}$). The incentive constraint of the unsafe type has to be binding in the optimal solution, otherwise it would be possible to decrease $\bar{Y}$ 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 rationality constraint of the safe type must be binding. Finally, the so-called monotonicity condition (i.e: $\bar{b} > \underline{b}$, which holds as long as the bonds benefit function is unique and $\underline{B} > \bar{B}$) ensures that constraint (1) is redundant¹⁰.

¹⁰ This standard condition is known as Spence-Mirrlees Single Crossing Condition, see *ibidem*, ch. 2 pp. 9-10.

When the problem is solved taking into account only the binding constraints¹¹, the following first order conditions are obtained:

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

$$S'(\underline{b}) = \underline{B} + \frac{(1-v)}{v} \Delta B \Rightarrow \underline{b} < \underline{b}^{FB} \quad (5)$$

Remark 1:

Coherently with standard results¹², 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 to decrease the quantity of safe bonds, thus leading to a sub-optimal (i.e., second best) equilibrium. The term $\Delta B(1-v)/v$ represents the 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. As $v \rightarrow 1$ at the limit, the distortion tends to zero, as information is no longer hidden.

3. Delegated monitoring and bond rating

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

¹¹ By substituting (1) into (4) we obtain: $\bar{Y} - \bar{B}\bar{b} = \underline{b}\Delta B$, where the right hand side represents the rent that must be given to the unsafe type in order to guarantee optimal truthtelling.

¹² See also Laffont (2000).

such role is usually played by credit institutions, we dub the rating agent as “bank”.

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

3.1 Equilibrium with benevolent bank

We begin by assuming a benevolent bank. If the report is $\sigma = \bar{B}$ savers can settle the first best contract; if the report is $\sigma = 0$ the savers update their beliefs according to the 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:

$$\Pr(B = \bar{B}/\sigma = 0) = \frac{(1-\xi)(1-\nu)}{1-\xi(1-\nu)} < (1-\nu)$$

The maximization problem described in the above section becomes (Problem A):

$$M_{bb}^x \quad \xi(1-\nu)[S(\bar{b}) - \bar{B}] + (1-\xi) \left(\frac{(1-\nu)(1-\xi)}{(1-\xi)} [S(\bar{b}) - \bar{B} - \underline{b} \Delta B] + \frac{\nu(1-\xi)}{(1-\xi)} [S(\underline{b}) - \underline{B}] \right) + \nu \xi [S(\underline{b}) - \underline{B}]$$

¹³ Also blank reports are of course informative.

And the first order conditions are:

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

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

the term $\left[(1-v)/v\right](1-\xi)$ represents the distortion on the safe bond quantity. As in equation (5) it is positively related with the price spread and negatively related to the share of safe bonds; furthermore it is negatively related with ξ that can be viewed as the degree of firms' transparency. As $\xi \rightarrow 1$ at the limit the bank perfectly overcomes the information asymmetry and distortion tends to zero.

Proposition 1. *The distortion on safe bonds in the solution of benevolent bank equilibrium is lower than the one in the equilibrium without bank, though not eliminated.*

Proof. *Compare equation (5) and (6).*

The rent to give up to the unsafe type is obtained as in footnote 11, after having weighted the incentive constraint of the unsafe type with the probability to elude the bank's monitoring. The expected rent is equal to: $(1-\xi)\Delta B\underline{b}$. As we noticed in remark 1, the aim of the distortion is the minimization of such rent.

4. 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 $\sigma = \bar{B}$. 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 class¹⁴. 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 savers' welfare) have in order to eliminate the collusion between firms and banks? even if the authority is benevolent, as we assume in our model, will it be sufficient to restore the first best equilibrium?

At this scope we introduce a new agent, the Authority, endowed with a monitoring technology, allowing 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 savers have to settle an incentive compatible contract leaving a positive rent to the colluding agents.

¹⁴ Only when the bank observes an unsafe firm there is a common interest to hide this information. This is definitely the main interest of this class of models. However the possibility of conflicting interests between bank and firm, even when the bank observes successfully the firm's type, could be a fruitful field for future research.

Assuming that the collusion bargaining power is completely in favour of the bank, she 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 cost¹⁵. The bank's expected utility can hence be written as follows:

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

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 maximizing the objective function in the set of the incentive compatible contracts,¹⁶ given the fine rate p (savers' problem); second minimizing the distortion of the safe bond with respect to the fine instrument subject to the bank's incentive constraint (Authority's problem).

Formally, the maximization problem is (problem B):

¹⁵In this kind of model costs of transaction are exogenous. They represent dead weight losses that reduce the amount of appropriable rent.

¹⁶ "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." (Laffont, 1999).

$$\begin{aligned}
& \frac{Mx}{\underline{b}\bar{b}} (1-\pi) \left\{ \xi(1-\nu) \left[S(\bar{b}) - \bar{B}\bar{b} - \underline{b}\underline{B} \right] + [1-\xi(1-\nu)] \left\{ \frac{(1-\nu)(1-\xi)}{1-\xi(1-\nu)} \left[S(\bar{b}) - \bar{B}\bar{b} - \underline{b}\underline{B} \right] + \frac{\nu}{1-\xi(1-\nu)} \left[S(b) - \underline{B}\bar{b} \right] \right\} \right\} \\
& + \pi \left\{ \xi(1-\nu) \left[S(\bar{b}) - \bar{B}\bar{b} + \underline{b}\underline{B} \right] + [1-\xi(1-\nu)] \left\{ \frac{(1-\nu)(1-\xi)}{1-\xi(1-\nu)} \left[S(\bar{b}) - \bar{B}\bar{b} - \underline{b}\underline{B} \right] + \frac{\nu}{1-\xi(1-\nu)} \left[S(b) - \underline{B}\bar{b} \right] \right\} \right\}
\end{aligned}$$

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

$$\begin{aligned} &Min_p \frac{(1-v)}{v} [\Delta B(1-\pi)\xi k - \pi\xi p\underline{B} + \Delta B(1-\pi)(1-\xi) + \pi(1-\xi)\Delta B] \\ &sub E(V) = Max[0, (1-\pi)\xi\alpha\underline{b}\Delta B - \pi\xi p\underline{B}\underline{b}] \end{aligned}$$

Three cases must hence be considered.

Firstly, when $p \leq p^c$ we minimize the following problem:

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

We get

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

Substituting [9] into [8]

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

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 with 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.

$$\text{Secondly, if } p = 0 \text{ the outcome } S'(\underline{b}) = \underline{B} + \frac{(1-v)}{v} \Delta B [(1-\xi) + \xi k]$$

represents the separation equilibrium obtained leaving to the bank a positive rent sufficiently high to respect its incentive constraint when it observes $\bar{B}$. 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 from the distortion (see equation 8) the first two terms, which corresponds to the case in which it has observed the firm's type. We obtain 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 $S'(\underline{b}) = \underline{B} + \frac{(1-v)}{v}[\Delta B(1-\pi)\xi k - \pi\xi p\underline{B} + \Delta B(1-\xi)]$ is higher than that of the optimal collusion proof equilibrium, lower than that of the incentive equilibrium and monotonically related with 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.

5. 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 to deal with the Authority's fine instrument: i) firm's fine exogenous and bank's fine optimally settled; ii) fair sharing rule, i.e.: fines proportional to the amount of appropriated rents; iii) bank's fine exogenous and firm's fine optimally settled.

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

5.1 Firm's exogenous fine

Let α and $(1-\alpha)$ be the shares of the total rent appropriated respectively by firms and bank. We assume there exist two different fines: the bank's punishment is optimally settled by the Authority while the firms' punishment is exogenous fixed.¹⁷ In other words the monitoring technology allows the Authority to detect the collusive behaviour of the bank but not the firm risk. What matters is the Authority's target of motivating a 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 analogue to problem [B] and the outcomes follow in a similar way. In this case (Problem C):

$$M_{bb} = (1-\pi) \left\{ \xi(1-\nu) \left[S(\bar{b}) - \bar{B} - \alpha \Delta B - (1-\alpha) \underline{b} \Delta B \right] + [1-\xi(1-\nu)] \left[\frac{(1-\nu)(1-\xi)}{1-\xi(1-\nu)} [S(\bar{b}) - \bar{B} - \underline{b} \Delta B] + \frac{\nu}{1-\xi(1-\nu)} [S(\underline{b}) - \underline{B}] \right] \right\} + \pi \left\{ \xi(1-\nu) \left[S(\bar{b}) - \bar{B} + (f+p_2) \underline{B} \right] + [1-\xi(1-\nu)] \left[\frac{(1-\nu)(1-\xi)}{1-\xi(1-\nu)} [S(\bar{b}) - \bar{B} - \underline{b} \Delta B] + \frac{\nu}{1-\xi(1-\nu)} [S(\underline{b}) - \underline{B}] \right] \right\}$$

The first order conditions are:

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

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

Minimizing the distortion leads to

¹⁷ 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.

$$\begin{aligned}
& \underset{p_2}{\text{Min}} \frac{(1-v)}{v} \left[(1-\pi)\xi\Delta B + (1-\xi)\Delta B - \pi\xi(f + p_2)\underline{B} \right] \\
& \underset{\text{sub}}{E(V)} = \text{Max} \left[0, (1-\pi)\xi\alpha\underline{b}\Delta B - \pi\xi p_2 \underline{B}\underline{b} \right]
\end{aligned}$$

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

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 to 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 at all, in fact it is impossible to punish a firm without discovering the bank collusion.

5.2 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 incentivate a truthtelling behaviour on the part of the bank, but now 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:

$$p_1 = p_2 \frac{1-\alpha}{\alpha} \quad (11)$$

By rewriting the first order conditions

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

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

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

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

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

$$\bar{Y} - \bar{B}\bar{b} = \text{Max} \left[0, (1-\pi)\xi(1-\alpha)\underline{b}\Delta B + (1-\pi)(1-\xi)\underline{b}\Delta B - \pi\xi p_1 \underline{b}\underline{B} + \pi(1-\xi)\underline{b}\Delta B \right] \quad (12)$$

becomes

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

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

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.

5.3. 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 and punishing the bank. Now what matters is the target of the Authority to motivate firms truthtelling behaviour. The maximization problem is (problem D):

$$M_{bb} = (1-\pi) \left\{ \xi(1-\nu) \left[S(\bar{b}) - \bar{B} - \alpha \underline{b} \Delta B - (1-\alpha) \underline{b} \Delta B \right] + [1-\xi(1-\nu)] \left(\frac{(1-\nu)(1-\xi)}{1-\xi(1-\nu)} [S(\bar{b}) - \bar{B} - \underline{b} \Delta B] + \frac{\nu}{1-\xi(1-\nu)} [S(\bar{b}) - \underline{B}] \right) \right\} + \pi \left\{ \xi(1-\nu) \left[S(\bar{b}) - \bar{B} + (p+f) \underline{B} \right] + [1-\xi(1-\nu)] \left(\frac{(1-\nu)(1-\xi)}{1-\xi(1-\nu)} [S(\bar{b}) - \bar{B} - \underline{b} \Delta B] + \frac{\nu}{1-\xi(1-\nu)} [S(\bar{b}) - \underline{B}] \right) \right\}$$

The first order conditions are:

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

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

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.

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

sub

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

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

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 have the possibility to conceal 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 to internalize 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)¹⁸.

The analysis developed in this section highlights that the core problem of adverse selection in corporate bond market has not much to do with the benevolence of the delegated monitoring system, but rather with the plausibility to affect and sanction the firm's behaviour. In our model, if 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.

6. 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 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 highlighted 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.

¹⁸ In this case, also the effect of the wrong punishment on the participation constraints should be considered. In Kirstein (2002), where banks' participation constraints are not considered, a positive fine is sufficient in order to provide the right bank's incentives without setting any fine-roof.

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 to affect and sanction the 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 side, to enhance the transparency of firms' accounts and, on the other side, 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 as more effective than the Italian reform, according to which sanctions are lower and sometimes contradictory.

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