BANKING, RISK AND FINANCIAL MARKETS

by

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1. Introduction

This paper analyses the question of financial risk in the relation between the banks and the firms: a problem of great significance for Euroland, a recent monetary union largely dominated by banking ("bank – centered") rather than equity markets ("market – centered ") in financing the economy. The rapid evolution of banking and financial markets, the prevailing competitive scenario, the trends towards globalization are determining intense changes within the banks and the banking industry. It is widespread opinion that in the next future European banks' competitive performance will be less and less based on the traditional mechanisms. In order to face the new conditions of intensified competition , higher transparency and increasing pervasiveness of financial markets and securitization, bank operators will have to adopt new behavioral models and and enterprise strategies. In particular, they will have to reassess their treatment of financial and systemic risk, in view of the fact that the adoption of a common currency has started a powerful movement of convergence towards common standards of operation and governance.

Within a scenario ever more competitive and global, the adoption of the Euro-currency has accelerated the process of "opening" to the market already initiated within the single countries: the common currency, in fact, is expected to bring about a a strong increase in market transparency, easing up the comparison between alternative investment proposals and cost benefit calculations. In this perspective, the road to increase competitiveness will be directed to a "repositioning" of the banks with innovative products and alternative sale channels (according with the so called "consumer oriented" culture). In this scenario, the recovery of efficiency and the containment of costs is expected to run in parallel to the commitment on the front of commercial and marketing strategies: the banks of larger size may use the leverage provided by standardization of financial products, and on their large diffusion, through price oriented policies, while smaller and local banks will have to become specialized operators.

Not only the European banks are thus expected to converge toward a common model, but this model is also expected to become increasingly similar, in terms of strategy, governance and structure, to the organizational and operational models

[1] University of Rome, Tor Vergata. The author is grateful to UNIDO for financial support of the research underlying this paper. The opinions expressed in the paper, however, are the sole responsibility of the author and do not necessarily reflect UNIDO's point of view.

characteristic of all modern industrial enterprises. At the same time, the growth of financial markets, with its powerful momentum toward globalization, will force the banks to operate within a common market of securities, rather than as players of a distant and privileged banking segment. This may be a momentous change for continental Europe, where, even though with different national nuances, the model that has historically dominated private and , indeed, public financing, has been largely based on a privileged relationship between the government, the banks and, as ultimate recipient, the (public and private) business sector.

The hypothesis developed and analyzed in this paper is that such a momentous change will not be able to come about without a profound reassessment of the relationship between the banks as sources of investment financing and the firm as originator and manager of the enterprise. The relationship between creditors and debtors, in other words, will have to be re-thought in terms of new criteria and new parameters. But is such a change likely to occur and is it possible that it is already occurring? Clearly, because the changes have just begun, it is not possible to test the empirical validity of such prediction on the basis of current data from Euroland. It is possible, however, to conduct an empirical test on models of finance and banking outside continental Europe, which may be regarded as possible examples to guide convergence. With this hypothesis in mind, in this paper I try to examine some of the current problems of business financing and debt, through a three tiered approach. This is based on: (i) an examination of the issue, in the light of current literature, (i) a theoretical analysis of the relationship between the bank and the firm and (iii) an empirical test of how this relationship has evolved in the major financial markets outside Euroland.

The plan of the paper is as follows. In section 2, I examine the problems arising from the contingent nature of the credit contract and the costs arising from the attempt at reducing the risks and the opportunism involved. Section 3 develops a model of a relationship between debtholders and shareholders (debtors), where the relative position of the bank and the firm depends on the possibility of engaging in some degree of integration (*relational banking*) and contract re-negotiability between the two. Section 4 applies a test of the model developed to three groups of banks taken from two extreme cases : the U. K. and the U.S., which, as market centered systems, can be considered a possible target for the long run convergence of the European system, and the Japanese case, which may be seen instead as a bank centered model, mirroring, in a somewhat more dramatic way, the traditional features of the European system.

2. Credit supply and risk evaluation

Let's first look at the determinants of creditworthiness for investment projects. Because of adverse selection (Stiglitz and Weiss, 1981), banks may not efficiently ration credit through interest rates. Thus, the main element that guides their decision to grant a loan to a firm is evaluating and controlling credit risks.

Once confronted with a loan request, in particular, credit institutions find themselves facing the need of a two-fold evaluation:

(a) select the enterprises that present a sufficient degree of creditworthiness;

(b) define, for the firms selected, loan conditions in terms of interest, timing and other characteristics of financing.

The concept of creditworthiness has a wider significance than the mere concept of credit capacity (Bottiglia, 1984). In fact, while the former derives from an evaluation of the degree of trust that the bank grants its client, the latter requires an appraisal of the particular situation of the enterprise and of the potential of the project whose funding has been sought. Thus, while creditworthiness may be considered an absolute: i.e. it either exists or it does not, credit capacity may vary instead with the circumstances and the risk embedded in the operation proposed.

The degree of risk created by a loan depends on the characteristics of both the creditor and the debtor. In addition to traditional instruments (debt covenants, maturity, building a relationship with the borrower), financial and technological innovations have in fact made available to credit institutions new instruments that allow a partial or total coverage for risk (e.g. securitizing the loan, swapping, etc.) or greater control (data banks, sophisticated surveillance systems). On the side of the debtor, risk depends on the structure of the balance sheet of the firm, the owner's wealth, the capacity of the enterprise to generate cash flow, thereby insuring that the loan will be repaid and the supply of collateral and guarantees.

Strictly connected with project risk is the interest rate, which plays a many-fold function:

- it is a charge for the risk of default of the borrower,
- is an instrument for risk sharing,
- is a premium for loss of liquidity,
- is a compensation to defer consumption.

Interest rates applied by credit institutions include all the charges corresponding to the functions above plus the coverage of implicit costs (loss of money purchasing power, credit risk), and the production costs (costs of provision, operational and administration expenses). Interest rates are inversely correlated to the price of debt and,

as a price-like variable, they summarize market information, in a way, which at least for a given range of rates, contributes to market efficiency. In particular, all other things being equal, the greater the risk of financing, the greater the interest charged by the credit institutions.

There is, however, a threshold of maximum acceptability for project risk (which is a function of the degree of the bank risk aversion and of innovation capacity) beyond which the credit institution will switch to straight out rationing. In this respect, two types of rationing may be distinguished:

a) *Type one rationing,* when all customers receive a quantity of credit lower than the one desired. In this case the client is considered creditworthy, but her demand is greater than the amount granted.

b) *Type two rationing,* when some customers are denied credit altogether. In this case the client does not pass the creditworthiness test.

The literature on credit rationing is rather extensive. Initially its interest was focused almost exclusively on the effects of the adjustment lags of the interest rates. Credit rationing was explained through hypotheses of price rigidities determined by exogenous factors, such as market imperfections, upper limits on interest rates, etc. In a second moment, Hodgman (1960), Freimer and Gordon (1965) claimed that the causes for rationing were to be found in factors internal to the bank and linked to the objective of profit maximization. These contributes identified the real cause for rationing in the fact that beyond a certain size of the loan, no increment in the interest rate would be capable to compensate the expected losses from the corresponding increment in bankruptcy risk.

More recent theories have tried to explain rationing from the existence of asymmetric information (Stiglitz and Weiss, 1981) and the hypothesis of multi-period contracts. The asymmetric information thesis[2] demonstrates that the fact that a perspective borrower possesses more information with respect to the banks on the probability of success of a project determines a situation where the banks, in order to avoid adverse selection and lack of incentives, do not finance investment projects that would be willing to pay high interest rates. Small firms seeking finance for high tech projects are clearly among the most difficult to assess and, as a consequence, the most likely targets of credit rationing exclusion.

The second line of thought, based on multi-period credit contracts[3], identifies in the stipulation of one period contracts between the bank and the borrower, a way to provide an incentive to the borrower to be repay her debt. If this does not happen, rationing occurs as a sanction. In other words, the possibility of exclusion from credit, combined with the existence of one period contracts, is used as a disincentive to default.

[2] Two classes of models refer to asymmetric information to justify credit rationing. They can be represented by the model, respectively, of Jaffee and Russel (1976) and of Stiglitz and Weiss (1981).

[3] See Kletzer (1989), and Stiglitz e Weiss (1983).

The relationship between the bank and the borrower may be framed by the principal- agent model, which has received much attention in the economic literature. (Arrow, 1970, Borch, 1963, Hart and Holmstrom, 1987). On one hand, in fact, we find the credit institution attempting to maximize the returns to the loan, while, on the other hand, its customers try to exploit as much as possible financial leverage, to maximize the enterprise net worth. Furthermore, the productive firm sends signals on its creditworthiness and credit capacity to the bank to obtain as high a rating as possible. The bank, on its part, tries to perform an effective selection, by denying credit to the unworthy and limit the size of the loans to expected capacity for the worthy ones.

Both the signals sent by the firm and the activities of the banks to assess credit risks are such, that small firms with little track record, involved in high tech products or markets are at comparative disadvantage in obtaining credit. This is particularly true if their projects appear to revolve on untested ideas, require technical expertise and are associated with risks that are difficult to diversify. Furthermore, while adverse selection via interest rate may be limited by rationing, the cost of appraising innovation may itself be correlated with project complexity and success chances. Thus, in a different form, adverse selection may re-enter the scene, since more complex projects may be discriminated against simply because they are more costly to assess.

In a hypothetical market without informational asymmetries, where both subjects (bank and client) would be able to obtain the same returns from the investments financed, there would be no reason for conflict. The two subjects are put on opposite positions, however, by the uncertainty of the business plans of the perspective borrowers and by their potential use of financial leverage as an instrument to gain value at the expense of the bank. A special form of conflict, in particular, arises for *start ups* and *high tech* projects, where enterprises naturally aim at postponing the production of cash flow favoring long term growth, against the banks' attempt to anticipate as much as possible debt repayment to minimize risk. Possible solutions to this conflict rely on two basic techniques: *monitoring* and *commitment.*

Monitoring activities on the part of the bank may be performed on an *ex ante* or an *ex post* base. *Ex ante* activities aim at improving the portfolio of bank investments, by granting credit on the basis of systematic evaluation of both projects and enterprises. These techniques, are less costly and difficult to set up, the higher is the degree of vertical integration between the bank and the firm. On the other hand, a higher involvement of bank management with the firms financed may have as effect the loss of perspective and a softening of the incentive to monitor.

Ex ante activities thus consist in the more traditional screening and evaluation types and concern the fundamentals of the subjects that are interested or potentially interested by financing, as well as project appraisal. As in all cases where it is necessary to undertake acceptance-rejection decisions, the possibility of error is two-fold. On one hand, it is possible to err by granting loans that should be refused (error of type one). On the other hand, one can incur in the opposite mistake of denying loans that should have been granted (error of type two). The proportion of loans of good and bad quality

depends on both error types and not, as it could appear on first sight, only on the error of type one. An excess of type two error, which is particularly likely for high tech, start ups and innovative projects, may have particularly nefarious consequences on economic growth and competition, and result in high social costs.

A special strain of economic literature (Stiglitz and Sah, 1984) has studied the effect on the two errors of the architecture of the economic systems, identifying two extreme typologies of organization: the hierarchy and the poliarchy. In a hierarchical organization, which we may assimilate to a traditional bank, in a system like the German or the Japanese, loan proposals are examined at each of the successive levels of a pyramid of decision makers. Credit is eventually granted if and only if the proposal has been considered acceptable at all levels of scrutiny. Type one error is clearly minimized in this decisional structure, while the probability of error of type two is comparatively higher, *coeteris paribus.*

In a poliarchyc structure, on the other hand, we are closer to the case of the U.K. and U.S:, where specialized credit institutions, such as the investment banks and the venture capitalists operate more widely, and projects proposed for financing are examined by a limited number (some times only one) of decision levels. The project is thus promptly accepted or rejected and does not have to go through a vertical line of positive evaluations to be financed. If it is rejected by one possible financing institution according with this procedure, the project does not receive the stigma that is inevitably associated to a candidate that is solemnly dismissed after a ponderous examination

This system clearly increases the probability of error of type one, while error of type two is minimized. Specialized institutions should be able, at the cost of a higher risk of being wrong, to capture a greater percentage of the best and most innovative projects.

The upshot of this discussion is thus that *ex ante* monitoring activities present a clear comparative advantage for projects based on innovation and for specialized institutions. These are called, one could say, to perform a social function, by discriminating among projects, with the objective of not letting the best opportunities escape for lack of sufficient attention to the error of type two. The same activity, on the other hand, is exposed to two different risks, which tend to attenuate its benefits, at least from the point of view of financial agents.

The first risk is the consequence of the fact that financial intermediaries, and specially the larger banks, deprived of the information and of the decision structure adequate to capture the best projects, are tempted to behave as free riders. They can do so by exploiting the monitoring activities of specialized operators, to select part of the projects, thereby avoiding to incur in direct monitoring costs. This risk may imply higher social costs, even though the optimal combination of hierarchy and poliarchy is decided by the interaction of the intermediaries and the market. Specialized operators, in fact, may see their competitive advantage severely compromised by the opportunistic behavior of larger and un-specialized banks, and, as a consequence, scouting and other monitoring activities aimed at finding new project ideas may be hampered.

The second risk concerns the so called “winner’s curse”, associated with the winner of a competitive auction, who discovers to have bid a higher price than what he should be willing to pay. The financial equivalent of this curse is the fact that the specialized operator, investment bank or venture capitalist, may be financing prevalently those projects which everybody else has rejected because of the excessive risks involved. This financing is apparently the fruit of competition, but at the same time it may be a poisonous fruit, since in the long run it may both do damage to the specialized operators, which will be affected by a higher degree of failures, and the high tech firms, which will find fewer financing opportunities.

Ex post activities aim at improving the performance of firms who have already been granted financing, through supervision and control. Because of the general uncertainty characterizing innovative projects, the often long gestation lags, the tenuous property rights and the prevalence of intangibles in the assets owned by the high tech enterprise, monitoring may be costly and only partially effective. The fact that the bank may try to audit the firm’s accounts and to prescribe actions of some sort does not generally help on the front of moral hazard. When it is tied to the possibility of renegotiating loan terms, it may hamper project success by either unduly restricting the firm’s impulse to grow (under-investment incentive), or by inciting it to take excessive risks (over-investment incentives) at the expenses of senior lenders who may not be able to renegotiate.

Ex post monitoring activities may be divided in two groups: (a) surveillance and control actions, to collect information on the firm that may be relevant for the bank and, (b) supervision actions. These include assistance, advice and provision of services, thereby involving prevalently information that may be useful to the firm financed. In a regime of *financial deepening*, with both banks and specialized operators competing to promote the success of the projects financed, both activities of type (a) and (b) should be growing. This would be specially true for start ups and projects that require technical expertise and innovative or at least state of the art technology to be successful. Both activities, however, are linked to a relationship between intermediary and enterprise that may go much beyond unilateral monitoring. Specialized operators may develop a competitive advantage in type (b) activities, but they may not be sufficiently numerous to satisfy the demand for know how and technical capability where innovation and technology is at stake.

The relationship between the intermediary and the enterprise has been recently evolving towards forms of delegated monitoring, where the incentives provided to the two parties constitute the essential elements of the financing relationship. Monitoring activities of type (a) and (b), in fact, tend to eliminate the problems of *moral hazard* deriving from the fact that the firm and the intermediary may both have an interest to hide information to one another and to operate under conflict of interest. The contract of delegated monitoring with incentives, instead, aims at creating a unity of behavior of the two parties, which may be particularly beneficial for long term performance.

Can we say that the specialized intermediaries hold a competitive advantage, at least a potential one, as agents for monitoring financing in behalf of banks and enterprises? While many activities may be conceivable as part of this type of a relation, it is evident that a contract of delegated monitoring may of great interest for small firms, local banks and operators, such as closed funds, that are also often operating on a local basis. This activity is very difficult to organize, because in most cases both banks and specialized operators are unprepared to go beyond traditional monitoring and control. On the other hand, the experience of *capital deepening* in the areas of concentration of technological progress, such as many industrial districts and science parks indicate that this may be a most productive area of business.

Commitment activities aim at reducing adverse selection and moral hazard by incorporating incentives in the structure of contracts or of its implementation procedures. They include a panoply of instruments, the most important being collateral, loan agreements, debt covenants and what is generally referred to as "building a relationship" (Cobham, 1999).

Collateral may take the form of a pledge of inside assets, i.e. assets owned by the firm, or outside assets, owned by the shareholders, sponsors or other stakeholders. Because it attenuates the implications of limited responsibility (the value of a failed project is negative rather than zero), collateral reduces both adverse selection and moral hazard. On the other hand, the fact that the bank has required an independent pledge to back the project, significantly reduces the value of the loan as a signal of approval and trust to the enterprise. Nevertheless, collateral is the main instrument to overcome the conflict of interest between the bank and the firm, specially in the case of SMEs, *start ups* and *high techs*. In the United States, about 40% of loans (Ang et al., 1995) and 60% of their value (Avery et al., 1998) to small business are backed by outside pledges.

Loan commitments are forward contracts committing lenders to provide loans over a given period, at fixed rates. Lines of credit are "generally pure revolving credits that allow the firm to borrow as much of the line as needed at any given time over the interval time specified" (Berger and Udell, 1998,p.28). Even though these instruments appear to be conceived to provide working capital, they may be used to finance machinery and innovation. It is also typically utilized to open a credit door to the firm by allowing her to slowly upgrade her credit capacity over time. In general, however, the short term and conditional nature of this type of credit, allows the banks to hold an option *not to finance* the enterprise, and limits its commitment to any longer term venture. While it may mitigate the effects of rationing for small enterprises, it makes them dependent on the credit institutions to the extent that they may not be able to implement a new project without prior consent from the main bank that finances their current operations. Loan commitments and lines of credit, furthermore, are not generally sensitive to positive news, including the favorable characteristics of good innovation projects. They tend to be, in fact, rather dependent on bad news, to deny credit when the firm enters the gray zone of financial difficulties, low cash flow and, depending on the circumstances, temporary low returns due to high growth prospects.

Debt covenants can stipulate that the borrower has to obtain the consensus of the lender before engaging in a new project or in a change of corporate policies. They are specifically designed to reduce the information problem and agency costs and may be rather effective for sufficiently large enterprises. Small firms, however, are more rarely disciplined by this type of instruments, because of the generally low quality of their auditing. In the case of innovative projects, furthermore, restricting the firm's ability to change its financial position may severely hamper management flexibility in the face of uncertainty, including its ability to take advantage of market and technological opportunities. More frequently, small firms are controlled through contracts of short maturity. These contracts enable the banks to monitor changes in the borrower and to renegotiate the terms of the loan if risk conditions have been modified by the evolution of its fundamentals, or by the adoption of riskier expansion policies. In the case of high tech SMEs this adds a further reason to their inability to obtain long term credit on the basis of projects' merits rather than on systemic risks.

The activities that lead to the development of a long term relationship between the lender and the borrower provide more efficient *commitment* than contractual instruments that restrict in any way the flexibility of one or both parties. Long term relations are particularly desirable because they may drastically reduce *agency costs.* These costs are due to the fact that the credit contract generally does not satisfy the requisite of time consistency. Efficient *ex ante* contracts may thus become *ex post* inefficient, if circumstances occur that determine a divergence in the interest of the two parties as to abiding by the contract terms, renegotiating, defaulting.

Under these conditions, developing a long term relationship between the bank and the firm may allow the bank to build up a credit history for the firm, by accompanying her through her life cycle and providing financing at the appropriate time with sufficient information. In the United States, for example, small business that define a commercial bank as their main financial partner have been receiving financing from the same bank for more than 9 years (Berger and Udell, 1998, from SBIC data). Bornheim and Herbeck (1998) illustrate the situation by contrasting gross marginal benefits from the relationship, which are shown to be a negative function of time, to costs, which are instead increasing with the length of the relationship. Costs are mainly due to what has been called the phenomenon of *information capture.* Marginal gross benefits are mainly due to the reduction of capital costs in response to the private information about borrower quality provided by the relationship. As a consequence the price of the loans falls (Petersen and Rajan, 1994), loan size rises over time and collateral demand also tend to fall (Boot and Thakor,1994).

Information capture shows up as a progressive loss of options for the firm. Once caught in a long term relationship, a small firm may find difficult to turn elsewhere for funding. The broader effect may be lowering competition among banks and higher costs to the firm. On the other hand, a long term relationship does not necessarily imply an exclusive one, both in the sense that the firm may try to build up long term financial ties with several intermediaries and because after a certain number of years it may be advisable to severe one's ties with the main lender.

Relational financing has been defined by Aoki and Dinc (1997) in a way directly dependent on the intermediary expected benefits, as the type of financing that is provided in the expectation of both further financing over time and the exaction of rents. In contrast, ordinary financing is referred to as *arm's length*. Relational financing is thus particularly important for start ups, high tech projects and SMEs because the prospect of the gain proposed is often sufficiently vague and long term that only the expectation of extracting a rent may provide the incentive to offer financing on a likely repeated basis. Relational financing thus includes commercial banks, investment banks and venture capitalists, but clearly favors specialized intermediaries which can fulfill the needs of growing firms through their higher closeness to the firm territory, their expertise in the firm operations, and their know how on the relevant markets.

3. Project risks and the financing structure of the firm

3.1 A model of bank – firm relationship

In order to develop an empirical test of some of the crucial determinants of financing and debt, I focus on the relationship between a firm and its creditors. In particular, I consider a firm whose cash flow has a present value of *Y*, where *Y* is a random variable distributed over the support $[-¥, Y_M]$ with a known distribution function *F(Y)*. Assume that the firm lasts only one period and is financed with a zero coupon bond of face value *D*, which is discounted at the market value at the beginning of the period and is due for repayment at the end of the period. *Y* is thus the variable embodying firm performance, which may be known *ex ante*, even under perfect information, only in terms of its distribution. Because of the possibility of going bankrupt with limited liability, the firm holds an option which may a priori cause a divergence between the value of the firm and the value of equity:

Proposition 1 - The value to the shareholders of a firm with one type of debt financing is independent of the debt-equity ratio and always greater than the net present value for the firm.

Proof: If, for a given investment level of *I*, financing is obtained floating zero coupon notes of nominal value equal to *D*, the value of equityb to the shareholders, because of limited liability is:

(1) $V_A = \max [0, Y - D]$

and the expected value is:

(2) $EV_A = \int_D^{Y_M} (Y - D)\, dF(Y) = [1 - F_1(D)]\, EY - [1 - F(D)]\, D$

where $F(Y)$ is the distribution of the cash flow, in the interval $[-\infty, Y_M]$, and $F_1(D)$ is the ordinate of the Lorenz curve defined as (Kakwani 1980):

(3) $F_1(Y) = \dfrac{\int_{-\infty}^{Y} v\,dF(v)}{\int_{-\infty}^{\infty} v\,dF(v)}$

The market value of debt, on the other hand, is:

(4) $V_D = \max \{ \min [D, Y], 0 \}$

and its expected value is:

(5) $EV_D = \int_0^D v\,dF(v) + D\,(1 - F(D)) = [F_1(D) - F_1(0)]\, EY + (1 - F(D))\, D$

In order to finance the investment I, $EV_D = I$, i.e., substituting into (5) and solving for D:

(6) $D = \dfrac{I - [F_1(D) - F_1(0)]\, EY}{1 - F(D)}$

Substituting this expression for D into (2), we readily obtain:

(7) $EV_A = EY - I + |F_1(0)|\, EY$

where $|F_1(0)| >/ 0$ denotes the absolute value of $F_1(0)$.

q. e. d.

Comment : Expression (2) states that the expected value of the stock of a firm is made of two parts: (a) the share of the expected value of the cash flow in the states of nature where income exceeds debt payments and (b) the cost of paying the debt obligations in the same states of nature. Expression (5), on the other hand, states that the market value of the firm's bond is also made of two parts: (a') the share of the expected value of cash flow in the states complementary to (a) and (b') the value of debt payments in the same states as in (a). Thus, as Modigliani and Miller noted, a larger amount of debt financing will have two effects that will exactly counterbalance each other: (i) the amount financed by the stockholders will decline, giving a boost to the net cash flow accruing to them, (ii) the market value of the bonds will also decline forcing the firm to issue more bonds for the same amount of investment. Note also that the creation of a firm with limited responsibility creates a distribution effect in favor of both stakeholders and at the expenses of the owners of wealth external to the firm. The term $\hat{o}F_1(0)\hat{o}\,EY$ represents in fact the expected destruction of wealth not sustained by the stakeholders. The deadweight loss can be eliminated by an appropriate ad valorem tax on the cash flow Y. Such a tax should be raised at a rate equal to $F_1(0)\hat{o}/(1+\hat{o}F_1(0)\hat{o}-i)$ where $i=I/EY$. It would have to be, therefore, a function of the investment financed with debt.

Proposition 2 – The discount factor applied by the lender to the nominal value of the loan requested by the borrower will be directly proportional to a measure of Value at Risk of second degree or, equivalently, to the product of the expected shortfall of the cash flow from the amount of the loan, multiplied by the Value at Risk of first degree for the same debt level .

Proof: Given a p.d.f. F(y), the first degree Value at Risk (VaR) of order a is defined as the probability that the variable y will take values less than or equal to a, i.e. **VaR (**$a) = F(a)$**.** The second degree Value at Risk (SvaR) is defined, in analogy with the second degree stochastic dominance (SSD) as: **SVaR** $(a) = \int_0^a F(y)dy$**.** Developing by parts, we readily obtain : **SVaR** $(a) = \int_0^a (a-y)dF(y)dy =$ **VaR (**$E(a-y).$**).** Thus the second degree VaR is equal to the first degree **VaR** multiplied by the average shortfall from the selected a. Now, note that expression (5) may be written as:

$$(8) \quad EV_D = \int_0^D (v-D)dF(v) + D = D - \textbf{SVaR(D)}$$

q.e.d.

Note: VaR is a measure of risk based on the joint consideration of two elements:

1. The amount of money x_{VaR} that expresses the maximum loss of the financial product at the level of confidence chosen;
2. The pure number $F(x_{VaR})$, determined on the basis of the confidence level chosen, indicating the probability to undergo a loss greater than or equal to the maximum one.

Starting with this notion, it is possible to generalize the **VaR** measure , by successive integrations of the density function of the random variable involved, as shown in Figure 1. Corresponding to each level of integration we obtain a pure number $F_i(x_{VaR})$ (for i = 1, ..., + 8), that can be read on the vertical axis and expresses the limit between two exponentially weighted sums of probabilities of suffering losses greater than or equal to the maximum one. The weighting system is such that it assigns an exponentially increasing weight to the probabilities, the exponent being equal to the degree of integration used.

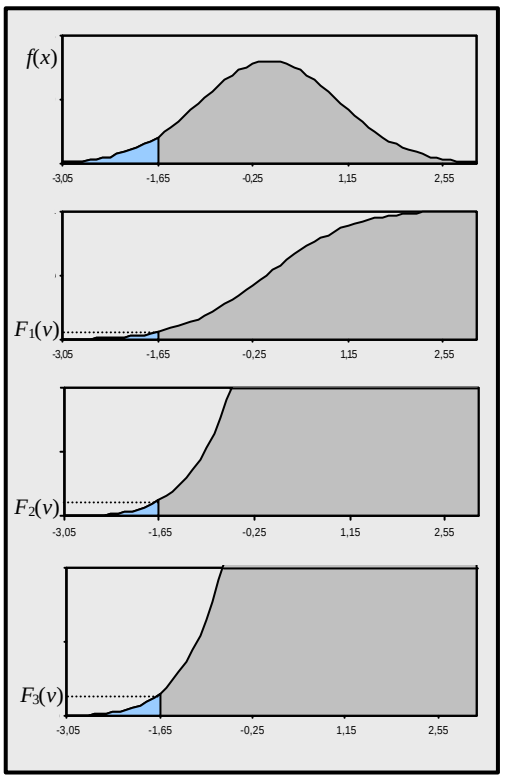


Figure 1

Comment: The first degree **VaR** is the most commonly used measure of risk both for a portfolio of securities and for bankruptcies. Because it gives equal weight to all outcomes below a given minimum level of income, however, **VaR** does not take into account the fact that incomes much below the minimum level are less desirable than incomes closer to it. The second degree **VaR**, or **SVaR,** on the other hand, takes into account the distances of the outcomes from the minimum level *a* and is larger, the larger the average distance and the larger the fist degree **VaR.** In the framework considered, the **SVaR** is also a measure of the value of the option to default that the lender implicitly sells to the borrower. This implies, by the definition in expression (6), that the equity value

is expected cash flow minus debt plus the value of the option to default given by **SVaR(**D**).** This measure is thus the key determinant of loan negotiation and the price of debt . If its estimate from the part of the lender is based on the default statistics from a given population of borrowers, in particular, the well known adverse selection effect will follow, because perspective borrowers with a risk measure lower than the mean will be discouraged from taking the loan.

Proposition 3 (Moral hazard)- The shareholders' value of a project financed through sale of junior debt may be greater, equal or lower than its net present value according to whether the SVaR of the firm cash flow, for a minimum level equal to the value of senior debt, increases, stays constant or decreases as a consequence of the project.

Proof: Denote with D_1 the senior notes and with D_2 the junior notes. The expected value of the firm for the shareholders is:

$$(9)\quad EV_A^* = \int_{D_1+D_2}^{\infty} z\,dG(z) - (D_1 + D_2)(1 - G(D_1 + D_2))$$

where $z = x + y$, y being the cash flow from existing activities and x the cash flow from the project. $G(z)$ is the distribution function of z.

The face value of senior notes is the same as in (5) with $D=D_1$, while the value of the junior notes is:

$$(10)\quad EV_{D_2} = \int_{D_1}^{D_1+D_2} (z - D_1)\,dG(z) + D_2(1 - G(D_1 + D_2)) = I_x$$

where I_X denotes investment costs of the new project, while the investment cost originally borne to create the firm is $I_y = EV_{D1}$.

Substituting into (8) expressions (5) and (9) yields:

$$(11)\quad EV_A^* = \left[\int_0^{\infty} z\,dG(z) - I_y - I_x\right] + \left[\int_0^{D_1} y\,dF(y) - \int_0^{D_1} z\,dG(z)\right] + D_1(G(D_1) - F(D_1))$$

Developing the integrals in the second square parenthesis by parts, we obtain:

$$(12)\quad EV_A{}^* = \left[\int_0^{\infty} z\,dG(z) - I_y - I_x\right] + \int_0^{D_1} (G(u) - F(u))\,du$$

Subtracting the expression for EV_A:

$$(13)\ EV_A^* - EV_A = (EX - I_x) + \int_0^{D_1} (G(u) - F(u))\, du$$

q.e.d.

Comment: The second term on the RHS in expression (13) is the variation of **SVaR.** It measures the extent to which the project changes the value of the option to default on senior debt. If such a value increases, to the burden that falls on senior debt corresponds a benefit for the shareholder, who, as a consequence, has a an incentive to undertake the project even where NPV is negative (over- investment). By the definition of **SVaR,** this incentive has two possible components: (i) an increase in the probability of default (equal to **VaR**) and, (ii) an increase in the average income shortfall from the level of senior debt. Conversely, if either the probability of default to senior debtors decreases or their expected share of the cash flow increases, the shareholders will count this as an increase in cost, and may reject projects that cause these effects even though their NPV may be positive. Note that financing through venture capital, business angels or project financing may be assimilated to junior debt. These forms of finance, in fact, are generally shaped as shares in the capital of the firm, but are covered either by explicit repurchase agreements, or by an understanding that the shares themselves will be "cashed in" by the participating capitalist through an IPO.

Corollary (Information capture) - If only the senior creditor holds perfect information on the firm, the shareholders value of a project financed through sale of junior debt to the senior creditor is minimum or maximum according to whether the project is risk increasing or risk decreasing in the SVaR sense.

Proof: Assume first that the new project is risk increasing in the **SVaR** sense. If the senior creditor knows the new distribution function G(.), it will negotiate a price for the junior debt that will take into account the increase in cost of the older debt. The value of the project in this case will thus be the project NPV and no over-investment will result. This value will be lower than any other lender holding perfect information would offer for the project. If the investment proposed is risk decreasing, on the other hand, the senior lender will take into account of the re-valuation of the previous debt and should be prepared to negotiate a better price for the new loan than any fully informed lender.

Comment: If a firm is linked by a long term relationship with a bank, this may capture some information that the firm, for opportunistic motives, might want to

maintain private. The corollary suggests that this "information capture" is not necessarily adverse to the firm, but it may induce her to seek finance from the same creditor preferably in the cases of projects that decrease the overall risk of its operation. The greater the spread between the new and the old distribution (in the sense of the second degree VAR), the greater the gain that the firm may obtain by selling junior debt to a different creditor.

3.2 Default risk and VAR

Using a very simple framework, we can obtain the effects of project adoption on equity by comparing the probability levels (for example p and h) associated with the unfavorable state before and after the beginning of the project. Risk-shifting incentives can result in a change in the default risk of debt: for example, if the default risk is $p(X-F)$ where p is the probability associated to the unfavorable state, X is the cash flow from the project in the same state and F is the face value of debt, a project that modifies the "bad-state" probability from p to h has a direct impact on debt default risk and shareholders claim. That is, in a very simple framework, equity value can be related simply to the difference between two "absolute levels" of probability. On the contrary, if we do not consider that project adoption can modify the probability distribution of project results, we obtain only a partial measure of risk. In fact, by doing so, we neglect the "shape" of the probability function of firm value, in particular of the distribution on the "left" of the nominal value of the debt [4].

A more complete default risk evaluation can be obtained by (12) that shows the changes in equity value subsequent to the project acceptance:

$$DAZ = NPV + \int_0^{D_1} (G(u) - F(u))\, du$$

where $G(.)$ and $F(.)$ are the cumulative distribution functions of firm results before and after the start of the project while the integral shows the risk-shifting effect

[4] The measure of risk given by the difference between "absolute" levels of default probability in different states is called Value at Risk or VAR. It is similar to the "head count ratio" in the income distribution literature, in which the degree of poverty is obtained as percentage of individuals that have an income below the poverty line. As in that case, in which shifts in income that happen below the poverty lines have not any relevance, the use of two probability levels can hide shifts of risk due to the change in the tails of distribution function. Cfr. A. Sen, Issues in the measurement of poverty, Scandinavian J. of Economics, 1979, 285-307, Barr N., The economics of the welfare state, Oxford Univ. Press, 1993, Stiglitz J.E., Economics of the public sector, W.W.Norton, 1988.

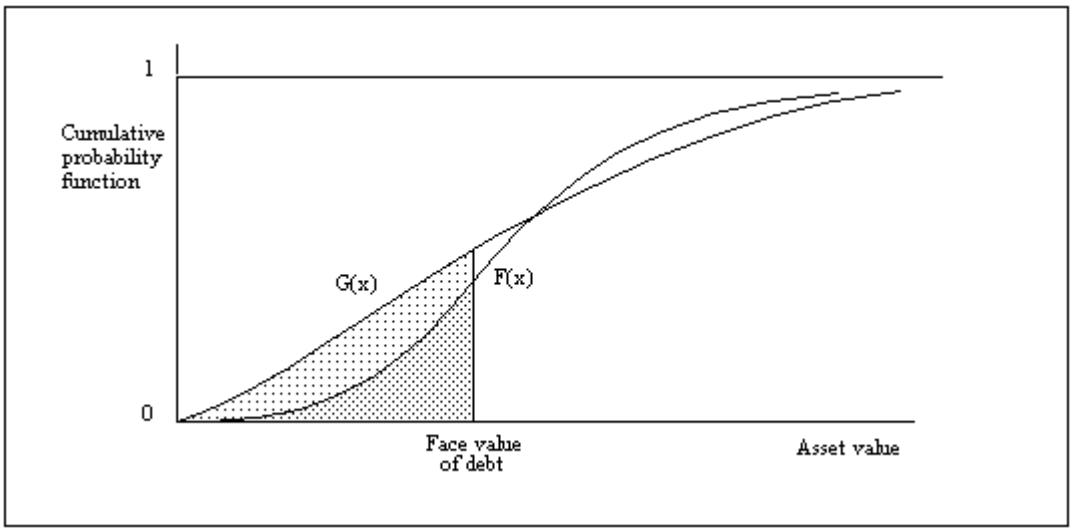
according to the Value at Risk of the second degree (**SVaR**). In fact, $\int_0^{D_1} (G(u) - F(u))\, du > 0$ implies that the project causes a change in the cumulative distribution function of the firm cash flow, from *F(u)* to *G(u)*. This change in turn implies a shift of probability from the center of the distribution to the tails and a subsequent increase in the probability that the value of the firm will be insufficient to pay debt obligations. If not renegotiable, existing debt bears the increased risk of the firm through the reduction of its market value.

The criterion of second degree **VaR** differs from the standard approach on bankruptcy risk because the latter assumes that if firm value (or project results) is normally distributed, the risk level may be obtained just from the ordinate of the probability function, or from the **VaR** of first degree. S.C.Myers and G.A.Pogue, for example, define a financial trouble situation as the area of normal density function (as the percentage of total area) in which the firm net worth is less than face value of debt. In the same way, E.H.Kim and R.Castanias use the normal density function to evaluate bankruptcy risk and corporate debt capacity.

More generally, a normally distributed density function allows to use a M-V criterion when comparing different portfolios, thus permitting to determine the risk level on the basis of the ordinate of the probability function. This procedure is analogous in the result to the first degree stochastic dominance but less "severe" than SSD criterion.

Fig. 1 - Second degree VaR (SVaR) of F over G

The comparison is based on the area below the cumulative function rather than on the ordinate of the function itself



The measure of risk proposed here is consistent with the SSD criterion, but less demanding, because the comparison between two functions is limited to the area on

the left of the ordinate of the face value of debt in the cumulative probability function.

4. Empirical test of the model[5]

4.1 The basic hypotheses

As a general result, the model presented above underlines the damage to the debtholder's claim when a risk-increasing project is accepted by shareholders able to shift away to debtholders a large share of the project risk. This can occur because *relational financing* cannot take place or is reduced by market globalization. Viceversa, a project that reduces the default risk of debt or cash flow, via *relational financing* and *information capture* is beneficial to debtholders because it reduces their share of total risk. This type of financing has been indeed a characteristic of the European system, but the era of the common currency is likely to register a general reduction of its use. As noted before, however, we can expect it to expand for specialized banking.

These risk-shifting incentives take place only if debtholders and shareholders are not able to renegotiate their position by signing a new contractual agreement which considers the changes occurred in risk and profitability parameters. Under the hypothesis that short term debt has a degree of re - negotiability greater than long term debt, risk-shifting incentives are more likely to occur when the share of short term debt on total debt is reduced. Convergence under the common currency, in other words, by increasing the share of long term debt and equity financing, may reduce the degree of re-negotiability on the part of the banks, while enhanced competition may increase it for the firms.

In this section, the following hypothesis will be empirically tested:

1. Shareholders' claim is positively affected by a project that reduces the expected value of the claim of previous debtholders by increasing the risk of default of debt. Thus, a lower degree of integration between banks and firms (reduced relational banking) increases shareholders claims.

2. The gain for shareholders is negatively related to the degree to which lenders can re-negotiate existing debt. The more the existing debt is renegotiable (i.e short term) by the debtholder, the lower is the incentive for the shareholders to shift the risk from new projects onto previous creditors. If the market realizes this incentive when valuing corporate equity, firm market value should progressively approximate book value when the share of short term debt increase. This effect is enhanced by lower degrees of relational banking and information capture.

[5] This section has been completed with the collaboration of Marco Cucculelli, the University of Urbino.

3. A positive response to improvements in financial and operating performance, should be expected in firm market value. An operating margin higher than market average margin, together with a good financial performance, should positively affect the market valuation of the firm, resulting in a higher premium with respect to the firm book value.

4. A more diversified capital structure should generate, coeteris paribus, a higher market value for the firm. A more complex capital structure, in fact, allows the market to exploit the different elasticities of the demand for the assets issued by the firm. Again, a lower integration between the bank and the firm, with a higher reliance on the market, may be beneficial to both.

4.2 Data and methodology

The empirical test has been performed using a panel data of 261 firms of three different countries: United States, United Kingdom and Japan.

The expression used for the test is the following:

$$VM\_CALL_t = a + b_0 RO\_FAT_t + b_1 OF\_FAT_t + b_2 BRE_t + b_3 SIZE_t + b_4 SETT_t + b_5 GD + b_6 GCF + b_7 VM\_CALL_{(t-1)}$$

where:

VM_CALL_t = difference between firm market value and firm "call" value
RO_FAT_t = operating income on total sales
OF_FAT_t = interest expenses on total sales
BRE = percentage of short term debt on total debt
SIZE = logarithm of firm total debt
SETT = sectorial dummy
GD = default risk of existing debt
GCF = default risk of cash flow
$VM\_CALL_{(t-1)}$ = lagged dependent variable

Dependent variable VM_CALL_t has been obtained as the difference between firm market value and firm "call" value. Market value for each of 261 firms has been obtained from Datastream and includes yearly observations from 1984 to 1993. Call value for the firms has been calculated by the Black-Sholes option pricing formula reported hereafter:

$$c(V, K, s, t, r) = V N(d_1) - K N(d_2)$$

where $c(.)$ represents the value of the call option, V the firm net assets, K the face value of debt (strike price), s the volatility of the assets, t the term of the option and r the risk-free interest rates. $N(d_1)$ and $N(d_2)$ are the values of the normal cumulative function calculated in d_1 and d_2, with:

$$d_1 = [\log(V/K) + rst^{1/2}]/st^{1/2} \qquad d_2 = d_1 - st^{1/2}$$

Asset volatility in each year for each firm has been approximated by the standard deviation in the preceding five years. The net interest rate on government bonds has been used as a proxy for the risk free interest rates in each of three countries. The expiring date of the call option has been set at one year.

The dependent variable *VM_CALL* has been chosen in order to isolate the effects of changes in the financial structure on the firm market value. The application of call option pricing allows to evaluate shareholders claim on the basis of "objective" determinants of firm value, such as the debt/equity ratio and business risk, and it does not consider the changes in the seniority or riskness of different debt claims. That is, given the total amount of debt, net asset values and the asset riskness, the "option" value of the firm net worth is not dependent on the changes occurring in the relative seniority of debt. Two firms showing the same levels for the three variables listed above should have the same call option value. Therefore, differences in their market value will be attributed to financial risk or to different growth perpectives.

With respect to the latter, it is important to underline that the firm market value includes the present value of firm growth options as described in Myers (1977) and Kester (1984). In particular, Carl Kester has estimated the value of growth options as the share of firm market value in excess of the capitalization of the firm operating income: the difference between the market value and the discounted value of the future stream of operating incomes (supposed constant each year) gives an estimate of the growth perspectives that the market attributes to the firm. More generally, two firms with the same amount of annual operating income should have the same "objective" value, even if differences in asset value, debt or net worth are observed and properly assessed by the market.

On the contrary, our estimate of the "objective" value of the firm has been obtained from its "call option" value as a proxy of firm net worth, including also the share of non distributed earnings. Given that the call value depends on 1) the firm net asset value, 2) the total amount of debt and 3) the firm business risk, two firms with the same calculated "call" value can present different market valuation only if when their profitability on sales is different. In other words, differences in market values are allowed only if the market discounts the difference in operative performance and accepts to pay an extra-premium for the firm that has a higher profit margin (or a higher operating income to sales ratio). In this framework, therefore, a positive correlation between the dependent variable *VM_CALL* and the operating income margin (*RO_FAT*) should be observed: furthermore, differences in relative operating performance should explain a share of market value in excess of book value.

If jointly considered, the variables *RO_FAT* and *OF_FAT* account for the total effect on market value of the operating income margin and financial risk-return relationship. From an investor standpoint, a higher operating margin results in a

better investment opportunity for a given level of risk. Viceversa, the higher the interest expenses on sales, the less attractive is the firm for the investor, because of the financial risk involved. As a result, if the firm operating and financial performance is good with respect to the average market performance, the market value should present a positive extra-premium with respect to the firm call value. The expected relationship with the dependent variable is positive for the operating performance and negative for the interest expenses to sales ratio.

Variable *BRE* is used as a proxy for the re- negotiability of debt. Given that short term debt allows a "continuous" adjustment of credit conditions to changes in risk and profitability parameters, the higher is the share of short term on total debt, the lower will be the potential shift of risk/wealth from debtholders to shareholders. Considering the extreme case in which the debt were instantly renegotiable, the market value of the firm should not present any significant deviation from the call value. In the opposite case, if the debt is locked in a long term agreement, the market value will diverge from the call value any time project adoption allows shareholders to shift a part of the risk to debtholders. The expected relationship between *BRE* and the dependent variable will present a negative correlation.

SIZE is the logarithm of the firm liabilities and shows the effects of debt diversification on equity. A more complex (diversified) financial structure should allow the shareholders to exploit the different elasticities of demand for the different types of debt issued by the firm. If we assume that diversification is directly related to the amount of debt - that is, if a firm has to issue a great quantity of debt, she will likely use many different types of it - more debt should be related to an increasing ability of shareholders to issue at the best conditions for them, thus implying a positive relation with the dependent variable.

SETT is a dummy variable indicating the sector distribution of the firms included in the sample. The sectors considered are the following: electric, electronic, chemical, aerospace, mechanical and pharmaceutical.

4.3 Construction of GD and GCF series

GD and *GCF* series have been obtained from the assumption that the firm cash flow and net asset values are normally distributed random variables with means equal to the values of the variable in each year and variances equal to those observed in the previous five years. This allows to use a Montecarlo simulation with the estimated probability function of in order to produce a time-series data set for each firm included in the sample.

If we consider for a moment only the *GD* variable, its construction requires starting with the following assumptions: 1) the firm asset value observed in each year is drawn from a probability distribution whose mean is the observed asset value itself; 2) the standard deviation of the distribution is the standard deviation of the firm asset values in the preceding five years: thus, it represents a type of measure of risk because it is directly related to the variability of the asset values. Consequently, for each observation included in the panel - 2.610 observations from a cross section of 261 firms over 10 years - it is possible to generate a "simulated" density function and a related probability (cumulative) function in order to evaluate the default risk of debt.

A simple comparison between two density functions or between two ordinates of the cumulative distribution does not provide, in general, complete information on the changes that occur in risk levels. For example, if we have two density functions with the same mean value but with two different standard deviations (mean-preserving spread), the areas on the left of the mean values in the density function (the ordinates of cumulative function) are the same in the two cases, even if differences in the risk distribution are observed. That is, applying the first degree stochastic dominance criterion, as in most of the existing literature, does not allow a complete specification of the risk.

The use of the second degree stochastic dominance criterion (SSD) implies the evaluation of the area below the cumulative probability function. According to that criterion, the dominance of *F* over *G* requires that the area of the cumulative function F is smaller than the area of the function *G* for each value of the independent variable. On the contrary, the measure of riskness proposed here is based on the partial comparison between the areas on the left of the ordinate corresponding to the face value of debt, and not between total areas as for the SSD criterion. Even if consistent with SSD, however, the proposed risk measure is a necessary but not sufficient condition for such a dominance. The proposed measure of risk takes in account only the left-part of the total area and attributes a corresponding risk level at each observation. The comparison over time of those levels allows to describe the temporal pattern of the default risk of debt for each firm included in the sample.

With reference to the proposed risk measure, once a "simulated" cumulative function has been obtained for each of 2.610 observations, the area below this curve can be obtained through a Montecarlo simulation. It implies a great number of iterations in which a series of random numbers is extracted and associated with a specific probability level in the cumulative function. Furthermore, a probability level for the debt is also obtained from the cumulative function by providing an exogenous specified face value of debt. This is successively compared - for each of 1.000 iterations - with the probability level of the asset value: if the difference between asset value and debt probabilities is negative, the single iteration belongs to the left

side of the cumulative distribution, thus indicating a default state of debt. Viceversa, if the difference is positive the single iteration does not indicate a default state. By summing up all the results and dividing them for the total number of iterations, we obtain an estimate of the default risk of debt based on the second degree VaR and consistent to the SSD criterion: that is, the effect of the variance on the shape of the distribution function is explicitly taken in account.

As for the *GD* variable, also the *GCF* variable is obtained through a Montecarlo simulation: the only difference consists in the variables included. In the latter case, the default risk of the cash flow is calculated as the probability that the cash flow is not sufficient to repay the interest expenses plus the financial debt repayable within one year, thus originating a cash flow default state.

4.4 Empirical results

This section summarizes the empirical results of econometric estimates.

The *F* statistic reported in table 1 cannot reject the null hypothesis of overall homogeneity -for both the intercept and the slope- only for the British and the American firms. This allows the use of OLS estimates directly on the pooling of data (Hsiao, 1986), without testing more specific restrictions on the slope or the intercept for the whole sample. Furthermore, the F tests for the US and UK sub-samples reported in table 2 cannot reject the null hypothesis of a costant slope but a different intercept (conditional on a costant slope), thus supporting the use of a fixed-effect model in the panel estimate. In general, a constant slope/different intercepts combination is more frequently expected when dealing with firm data, making a fixed effect model more appropriate.

With regard to Japanese firms (and also to the whole sample), the F tests do not support the hypothesis of "homogeneity" of intercept and slope among the firms: in any case, given the nature of the data, a fixed effect on the intercept appears more likely to occurr.

The OLS estimates on UK and US data show that the coefficients of the *GD* variable (default risk of debt) and *GCF* variable (default risk of cash flow) are statistically significant and confirm also the expected relation with the dependent variable. Furthermore, these coefficients are larger and statistically more significant than those obtained in previous estimates, in which the risk measure was provided by the ordinate of the probability function instead of the area underlying the function itself.

With regard to the UK firms, all the variables included in the estimates are significant and confirm the expected relations, except for dummy *SETT* which indicates the sector each firm belongs to. It is worth noting, moreover, that this last variable has shown a very low degree of significance in all the sub-samples considered.

US data give results similar to the British ones, except for the variable *BRE* that synthesizes the degree of renegotiability of debt: its coefficient is approximately zero and shows a relation with the dependent variable in the direction opposite than expected.

In the OLS estimates, the coefficients for the US sample are on average larger than the UK ones: the intercept is -0,34 for UK and -0,42 for USA; the coefficients of *MOL*, *OF_FAT* and *SIZE* are also larger, and so are the coefficient of *GD* variable

that gives the effect on market value of the default risk of debt. Conversely, the coefficient of *GCF* -that is the market valuation of the cash flow default risk- is lower in the US sample than in the UK sample, and close to zero.

Tables 2 and 3 report the estimates using the fixed and random effect model. In both cases, the results achieved for UK and US data are confirmed, even though the overall significance of the regression is lower than with OLS (see R-squared statistics). Furthermore, the coefficients of *GD* and *GCF* variables are quite similar to those obtained with OLS.

On the contrary, the results for the Japanese database do not support the theoretical model, at least for some important variables such as the financial ones. *OF_FAT*, *BRE*, *GD* show low coefficients or low significance, together with the "wrong sign" in the relationship with the dependent variable. This result could be attributed to the specificity of linkages that exist between financial and manufacturing firms in Japan.

The results for the whole sample database resemble closely the Japanese ones, with the difference that the variables expressing the debt and the cash flow default risk present coefficients quite stable in all the three models considered (plain OLS, fixed and random model). The results obtained seem to support the hypothesis that the default probabilities of debt and cash flow are relevant for the determination of the equity value, given that changes in these probabilities are associated with corresponding changes in equity values.

The difference between firm market value and firm "call" value on the other hand, reflects the market "opinions" about 1) firm growth options and 2) market valuation of the risk associated with the firm financial structure. In this respect, a positive and stable relationship has been found between the dependent variable and the *MOL* variable, that is a proxy for the firm growth opportunities. A positive relation has also been found between the dependent variable and the default risk of debt calculated according to the SVaR criterion. However, this relation appears to hold only in the UK and US samples.

As a proxy for the degree of re-negotiability of debt, the variable *BRE* has shown a very poor performance: a good contribution of this variable in explaining the dependent variable has been observed only for the UK and US samples.

5. Conclusion

With a view at assessing comparative performance of bank centered and market centered financial systems, in this paper I have reviewed some of the problems affecting the relation between a bank and a firm engaged in costly (and possibly risky) expansion. While the literature has examined conflicts and costs on both sides of this relationship, credit and the role played by the banks appear to be important determinants of the value of the firm accruing to shareholders. Long term relationship and multiple financing are two basic options open to the enterprise and they both offer costs and benefits to the possible partners.

Uncertainty about project payoff, in particular, can result in a shift of risk between claimants when the project is financed by issuing debt. This implies that the financial structure produces a systematic removal from the standard NPV rule if (i) the returns of the project are uncertain and, (ii) the seniority of the new debt allows for the possibility for the existing debt to become risky or to modify its level of riskyness.

The model presented in section 3 provides an extended approach to the incentives that prevent shareholders from investing according to the NPV rule when project results are depicted as a random variable and some default states are allowed for. More specifically, the effect of changes in the distribution function of cash flows is evaluated with reference to the default risk of existing debt and to the expected value of cash flow in those states in which it is no sufficient to repay the debt obligation.

As a more general result, the model relates firm performance and credit risk on the basis of a definition of under- and overinvestment incentives based on a measure of second degree Value at Risk (VaR). This measure is consistent with the criterion of second degree stochastic dominance, and provides an NPV rule-integration term that reflects the changes in the cash flow distribution function. That is, the comparison between cumulative probability functions of the cash flow, before and after the project adoption, provides a ranking of distributions that reflects the existence of the incentives discussed above. This result has been empirically tested by estimating default risk with a Montecarlo based second degree VaR. This measure is consistent with the SSD criterion, in the sense that it is a necessary condition for the SSD criterion to be satisfied.

The estimates confirm the expected effect on shareholders' claim of a change in the default risk of debt, by showing a positive relationship between the market valuation of the firm and the risk faced by debt - holders. Residual claimants' wealth increases (or, equivalently, new investors are willing to pay an extra premium) when the share of the risk that accrues to debt holders increase. Thus, bank-centered systems appear to be consistent with higher valuations of firms, even though relational banking and information capture may somewhat erode this effect. Because these results appear to hold only for the US and UK sample, i.e. for the two countries that, unlike Japan are not bank centered, they suggest: (i) a greater effectiveness of

market centered systems in evaluating firms claims and related risk and, (ii) the more important role of default risk of debt when the links between claimants are less tight.

Table 1 - Total (plain OLS) estimate - Balanced data

Dep. Variable: *VM_CALL*	**TOT**	**UK**	**USA**	**JAPAN**
C	-.874489 (-10.191)	-.343118 (-5.560)	-.424082 (-3.734)	-.590481 (-6.564)
VM_CALL1	.866538 (64.485)	.870180 (14.310)	.881297 (10.138)	.819375 (23.158)
MOL	.306787 (2.993)	.415313 (5.610)	.604352 (4.353)	.315853 (2.610)
OF_FAT	-.428304 (-.583)**	-1.21302 (-2.325)	-1.40081 (-2.608)	.179052 (.323)**
BRE	-.696007 (-5.215)	-.310946 (3.244)	.173076E-06 (1.531)**	-.366709 (-2.994)
SIZE	.150610 (10.205)	.056579 (5.195)	.068233 (3.730)	.096604 (6.263)
SETT	.887672E-02 (1.593)**	.010454 (2.248)*	.992711E-02 (1.468)**	.013676 (1.965)*
GD	.044866 (2.192)*	.129985 (5.555)	.175441 (5.255)	-.047279 (-1.308)**
GCF	.033070 (1.877)**	.106851 (7.456)	.023423 (2.201)*	.028945 (1.157)**
F-stat for A,B=Ai,Bi	1.8904 [.0000]	1.1931 [.0991]	0.86743 [.8709]	1.7583 [.000]
D.of F.	(1836, 795)	(546, 145)	(562, 149)	(880, 301)

Mean of dependent var.	1.52151	.147335	.203953	.271734
Std.dev.of dependent var.	1.46359	.250628	.464090	.571751
Sum of squared residuals	276.622	8.73219	21.6132	78.9466
Variance of residuals	.105140	.012637	.030398	.066847

Std.error of regression	.324252	.112415	.174351	.258548
R-squared	.951066	.801121	.860432	.796887
Adjusted R-squared	.950917	.798819	.858862	.795511
Durbin-Watson statistic	2.26206	2.24084	2.06438	2.24729
Chow test	18.1238	6.78415	2.55662	4.18837
LR het. test (w/ Chow)	295.242	315.984	272.347	293.561
F-statistic (zero slopes)	6391.94	347.935	547.911	579.186
Log of likelihood function	-768.235	541.165	240.505	-74.3393
Number of observations:	2.610	700	720	1190
Number of firms:	261	70	72	119

i) t-stat. in parenthesis
ii) S.E.s and variance are heteroskedastic-consistent estimates. The ROBUST option causes TSP to compute standard errors that are consisten even in the presence of unknown heteroskedasticity by using the data to estimate its magnitude.
iii) * and ** are 5% and 1% significance levels

Table 2 - Within (fixed effect) estimate

Dependent variable: **VM_CALL**

Country	**TOT**	**UK**	**USA**	**JAPAN**
Variable				
VM_CALL1	.456114 (24.644)	.724270 (22.332)	.628737 (18.808)	.489073 (18.167)
MOL	.767595 (5.140)	.220962 (2.146)	.633687 (4.103)	.432439 (2.614)
OF_FAT	.856091 (2.142)*	-1.88841 (-3.924)	-1.97878 (-2.675)	.552807 (1.592)**
BRE	.1084756 (1.481)*	-.424663 (-1.850)*	-.549175E-08 (-.004)**	.668323 (1.036)**
SIZE	.221856 (6.466)	.093559 (4.509)	.100798 (3.251)	.206267 (5.863)
GD	.064788 (2.483)	.121070 (4.549)	.147525 (3.625)	-.011275 (-.329)**
GCF	.053064 (2.097)*	.095570 (8.504)	.021567 (3.305)	.058291 (2.254)
R-squared	.295787	.471828	.435978	.332944
F-stat for Ai,B=Ai,Bi	1.5308 [.0000]	1.1450 [.1653]	0.80608 [.9538]	1.4909 [.0000]
D.of F.	(1573, 795)	(477, 145)	(491, 149)	(762, 301)
F-stat for A,B=Ai,B	2.9873 [.0000]	1.3730 [.0295]	1.5175 [.0056]	2.5779 [.0000]
D.of F.	(263, 2368)	(69, 622)	(71, 640)	(118, 1063)

Table 2.1 - Elasticities

Country	**TOT**	**UK**	**USA**	**JAPAN**

VM_CALL1	0,45	0,63	0,71	0,48
MOL	0,04	1,24	2,71	0,61
OF_FAT	0,08	-2,63	-4,61	0,02
BRE	0,11	0,91	0,00	0,15
SIZE	0,99	0,27	0,52	0,86
GD	0,04	0,69	0,81	-0,01
GCF	0,02	0,25	0,13	0,00

Table 3 - Variance Components (random effect) estimate

Dependent variable:	***VM_CALL***			
Country	**TOT**	**UK**	**USA**	**JAPAN**
Variable				
C	-1.46921 (-15.512)	-.369572 (-6.887)	-.474753 (-6.037)	-.818862 (-8.074)
VM_CALL1	.752633 (60.441)	.844312 (31.319)	.850278 (41.993)	.711502 (35.862)
MOL	.417807 (4.013)	.411459 (6.202)	.625806 (6.316)	.400075 (3.709)
OF_FAT	-.189784 (-.553)**	-1.31649 (-4.297)	-1.55131 (-3.227)	.337614 (1.140)**
BRE	-.250182 (-1.113)**	-.3776319 (-2.096)	.124750E-06 (.102)**	-.5733006 (-.970)**
SIZE	.256231 (17.810)	.061219 (7.111)	.076732 (6.074)	.136508 (8.631)
SETT	.020908 (2.334)	.012359 (2.379)	.012502 (1.539)*	.018484 (1.608)*
GD	.054735 (2.375)	.128562 (4.907)	.172513 (4.315)	-.027338 (-.899)**
GCF	.044714 (1.933)*	.056103 (7.185)	.023569 (4.128)	.048552 (1.029)*

R-squared	.878305	.766525	.814090	.652569
Hausman test FE vs. RE	489.42	52.108	71.394	159.83
D.of F.	CHISQ(8)	CHISQ(8)	CHISQ(8)	CHISQ(8)

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