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Information Sharing in Credit Markets: A Survey

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Tullio Jappelli* and Marco Pagano *

Abstract

Information sharing about borrowers' characteristics and their indebtedness can have important effects on credit markets activity. First, it improves the banks' knowledge of applicants' characteristics and permits a more accurate prediction of their repayment probabilities. Second, it reduces the informational rents that banks could otherwise extract from their customers. Third, it can operate as a borrower discipline device. Finally, it eliminates borrowers' incentive to become over-indebted by drawing credit simultaneously from many banks without any of them realizing. Understanding the effects of information sharing also helps to shed light on some key issues in the design of a credit information system, such as the relationship between public and private mechanisms, the dosage between black and white information sharing, and the "memory" of the system. Merging the insights from theoretical models with the lessons of experience, one can avoid serious pitfalls in the design of credit information systems.

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1. Introduction

Money and information are the two basic inputs of banks. The very survival of a bank in the marketplace crucially depends on its ability to collect and process information efficiently in screening credit applicants and in monitoring their performance. At the screening stage, lenders need information about borrowers' characteristics, including the riskiness of their investment projects. After credit is granted, lenders need information to control the actions taken by the borrower: he may relax his effort to avoid default or may hide the proceeds of his business to avoid repaying his debts.

Unfortunately, in general the data needed to screen credit applications and to monitor borrowers are not freely available to banks. To the extent that a bank does not have such information, it faces "adverse selection" or "moral hazard" problems in its lending activity. Adverse selection arises when some information about the borrowers' characteristics remain hidden to the lender (hidden information), and can lead to an inefficient allocation of credit, for instance to its rationing.[1] Moral hazard arises instead from the lender's inability to observe borrower's actions that affect the probability of repayment: for instance, about the level of effort that the borrower exerts to manage his project and avoid default on his debt (hidden action). This creates the danger of opportunistic behavior - or moral hazard - by the borrower. Also this type of informational disadvantage by the bank leads to an inefficient allocation of credit and possibly to credit rationing.[2]

To a certain extent, these adverse selection and moral hazard problems can be mitigated if the borrower can pledge collateral that the lender can seize in case of default, or if he has a considerable equity stake in the project or a good reputation to safeguard in the business

[1] To understand why, consider the case when credit applicants' projects differ only as to their riskiness, and not because of their expected return. The bank does not know the riskiness of each project, in contrast with the respective credit applicant. At first sight, the natural response to this problem by the bank would appear to be to require a higher interest rate to all its potential customers to compensate the expected losses borne to fund the riskier projects. However, only the debtors who are more likely to default will be willing to pay a higher interest rate, being protected bylimited liability in case offailure of their project, while earning a profit in case of success. The inability to distinguish between safe and risky projects implies therefore a wealth transfer from the best credit applicants (those with the safe projects) to the worst (those with the riskier projects). The higher the interest rate, the higher the probability that the best clients will not apply for a loan, thus increasing the average riskiness of the bank's customer pool. In some cases this adverse selection of the customer pool becomes so serious as to induce banks to deny credit altogether, and in other cases to ration credit rather than raise their interest rate and supply all the credit demanded at the specified rate.

[2] Also in this case, the seemingly most obvious solution, i.e. raising interest rates to cover the expected cost of a low borrower's effort, is not the optimal one. Increasing interest rates is equivalent to reducing the expected gain of the borrower, and therefore induces him to lower his commitment, making default more likely. Obviously, here the notion of "effort" is to be taken in a broad sense: opportunistic behavior by the borrower may consist in attempt to avoid repayment of the loan even when he could do so, for instance renegotiating the terms of the loan, possibly exploiting the inefficiency of the judicial system to get a better deal. The opportunistic behavior models in the literature include both of these cases: lack of effort in ensuring the project's success (for instance, Padilla e Pagano, 1997) and attempt to default partly on the loan by renegotiating it (for instance, Bolton and Scharfstein, 1990, and Hart and Moore, 1994).

community. In all these cases, the borrowers' incentives are well aligned with those of his creditors, and in some cases his intrinsic characteristics can be credibly communicated to lenders. But these mitigating factors are of no avail to many credit applicants, especially to young and small firms that typically lack sufficient collateral and equity capital and have a short track record.

Another route that a bank can usefully follow, especially when these mitigating mechanisms are unavailable or insufficient, is to attack the problem at its root, by acquiring the information about customers that it does not possess. It can do so by spending resources to collect information about them. At the screening stage, it can visit the credit applicants' plants, talk to their managers, and study their business plans. At the monitoring stage, it can require a constant flow of information from its borrowers, verify and analyze it, and take prompt action when there are symptoms that the project or the company is being mismanaged.

But it is often cheaper and more effective to acquire information by exchanging it with other lenders. Often borrowers apply for credit with different intermediaries during their life, and in so doing they leave a trail of information behind them. For instance, they may accumulate a record of punctuality in repayment or one of constant arrears and defaults. Their credit history may indicate that they often change residence, employment or line of business, or that they operate in a high-risk business. Finally, over time they may have accumulated a large amount of debt, possibly by borrowing relatively small amounts from a multitude of banks and credit card companies. Each individual bank typically has only some elements of this overall picture, and it may be able to discover the others only at a very high cost - if at all. But if all the lenders who have interacted with a specific individual or firm pool their data together, the overall picture will emerge: each lender will be able to have a much clearer idea about the credit risk implied by lending to that individual or firm.

In practice, we observe a considerable exchange of information among lenders. Casual observation suggests that this exchange sometimes takes place via informal contacts between local bank managers or loan officers. In this case, reputation concerns presumably ensure the truthfulness of the information exchanged about a customer. But much of this exchange of information takes place via formal mechanisms. Some of these are voluntary, while others are imposed by regulation.

"Credit bureaus" (sometimes called "credit reference agencies") are typical voluntary mechanisms: they are information brokers, which operate on the principle of reciprocity, collecting, filing and distributing the information supplied voluntarily by their members. The timeliness and truthfulness of the data reported by lenders to credit bureaus is enforced invariably by threatening deviants that they will be excluded from access to the common data base. The initiative of setting up a credit bureau has historically been taken by various subjects. Some bureaus are profit-oriented ventures created at the initiative of entrepreneurs; others are set up by coalitions of lenders as cooperative arrangements. Also credit rating agencies, such as Duns & Bradstreet in the US, can be regarded as voluntary information sharing mechanisms, insofar as they draw a large portion of their data from lenders and suppliers, who in return obtain preferential access to their data.

"Public credit registers", instead, are databases created by public authorities and managed by central banks. Their data are compulsorily reported by lenders, who then obtain a return flow of data for use in their lending decisions. Sometimes, special public registers exist for specific classes of debt contracts or securities: for instance, in many countries lease registers

record the real collateral assisting housing mortgage loans; similarly, in many civil law countries negotiable promissory notes are recorded upon default in a public register. Typically, these registers for special classes of debt have long predated the creation of modern public credit registers managed by central banks, which record bank loans and lines of credit.

The distinctive feature of public credit registers, beside the compulsory nature of participation by lenders, is their universal coverage of banking institutions. Where such a register exists, all the financial intermediaries under the regulatory authority of the central bank are required to file information with it. In contrast, a credit bureau's information is limited to the data supplied by the subset of banks that patronize it. However, even the data base of public credit registers is far from being universal: it typically fails to include data by financial companies, credit card companies, departments stores and retail stores, which are instead sometimes reported to credit bureaus. Moreover, public credit registers seldom impose reporting data for all loans: in most countries, loans below a statutory threshold size need not be reported.

For all these reasons, private credit bureaus tend to provide reliable data about consumer loans and small business loans, which are almost completely ignored by public credit registries. Conversely, they often provide a more complete picture of corporate bank loans, especially large ones.

The type of information pooled by lenders is at least as important as the mechanism that they adopt to exchange it. The most basic form of data that lenders share is "black" or "negative" information, which consists of defaults and arrears. In more sophisticated arrangements, also "white" or "positive" information is shared. This category may include the debtor's current overall loan exposure and guarantees, data from his past credit history other than defaults and arrears, and debtor characteristics, such as employment, income or line of business. For companies, balance sheet information and data about directors are often provided. Often the information received from borrowers is merged with data drawn from other sources, such as official registers, criminal records, tax records, etc. In some cases, credit bureaus process this wealth of information upon customers' request, assigning a "credit score" to borrowers based on statistical risk analysis.

The international diffusion of these formal information sharing mechanisms (documented by Jappelli and Pagano, 1999) witnesses its importance for lenders - be they banks, credit card companies, finance companies or even suppliers insofar as these provide trade credit to other companies. As argued so far, this exchange of information is useful because it allows lenders to overcome their inherent information disadvantage vis-à-vis their contractual counterparts, i.e. borrowers. But this is still a vague proposition, and the rest of the paper is devoted to clarify the benefits and shortcomings of information sharing, and to draw from this analysis - as well as from past experience - lessons for the design of credit information systems.

First, one needs to understand precisely why and how information exchange can help lenders. It stands to reason that it may also have negative effects on their profits: after all, by giving away their private information, lenders offer on a silver platter a potentially valuable asset to their competitors! Second, if on balance information sharing is beneficial, one should worry if the marketplace will provide it spontaneously or rather some form of public intervention is needed. Section 2 of this paper addresses these two key points.

Understanding the effects of information sharing also helps to shed light on some key issues in the design of a credit information system: the relationship between public and

private mechanisms, the dosage between black and white information sharing, and the "memory" of the system. Past experience offers some additional guidance concerning other important issues and possible pitfalls in the design of credit information systems - such as the need to consolidate liabilities of company groups and to account for debt owed to foreign lenders, especially in the presence of increasing international integration of capital markets. We address these and other issues in Section 3. Some issues of particular relevance to developing countries, such as those connected to informal lending and to poor protection of creditor rights, are discussed in Section 4. In Section 5 we offer some brief concluding remarks.

2. The role of credit information systems

In this section, we elucidate the various roles that information sharing can have in credit markets, bring out the predictions that can be drawn from models which have formalized them, and compare these predictions with the available evidence. We then turn to a less explored issue, that is, whether these effects can be expected to increase social welfare, and if so whether one can expect information-sharing mechanisms to emerge spontaneously in a decentralized equilibrium.

In principle, exchanging information about borrowers can have four effects.

First, credit bureaus improve banks' knowledge of applicants' characteristics and permit more accurate prediction of repayment probability. This allows lenders to target and price their loans better, easing adverse selection problems.

Second, credit bureaus reduce the "informational rents" that banks could otherwise extract from their customers. When a bank has superior knowledge about a borrower, it can charge him interest rates just slightly below those offered by an uninformed competitor and earn a rent from its information. Pooling information with other banks reduces this advantage and the implied rent, by forcing each lender to price loans more competitively. Lower interest rates increase borrowers' net return and augment their incentive to perform.

Third, credit bureaus work as a borrower discipline device: every borrower knows that if he defaults his reputation with all other potential lenders is ruined, cutting him off from credit or making it more expensive. This mechanism also heightens borrowers' incentive to repay, reducing moral hazard.

Fourth, and finally, borrowers have the incentive to become over-indebted if they draw credit simultaneously from many banks without any of them realizing. Credit bureaus and public credit registers disclose to lenders the overall indebtedness of borrowers, and thereby eliminate this incentive, and the implied inefficiency in the provision of credit.

2.1. Reducing adverse selection

In the pure adverse selection model developed by Pagano and Jappelli (1993), information sharing improves the pool of borrowers, decreases defaults and reduces the average interest

rate. In the model, each bank has private information about the credit worthiness of credit applicants who reside in their market area but has no information about credit applicants who have recently moved into its market area. The latter therefore face adverse selection. However, they have borrowed in the past from the bank of their area of origin and therefore are known to that bank. If banks exchange their private information about their clients' quality, they can identify which of the credit seekers who have newly moved into their market area are creditworthy, and lend to them as safely as they do with their long-standing clients. As a result, the default rate decreases.

The effect on lending is ambiguous, however. The volume of lending may increase or decrease, because when banks exchange information about borrowers' types, the implied increase in lending to safe borrowers may fail to compensate for the reduction in lending to risky types. Banking competition strengthens the positive effect of information sharing on lending: when credit markets are contestable, information sharing reduces informational rents and increases banking competition, which in turn leads to greater lending.[3]

2.2. Reducing borrowers' holdup

The exchange of information between banks reduces the informational rents that banks can extract from their clients within lending relationships. Padilla and Pagano (1997) make this point in the context of a two-period model where banks are endowed with private information about their borrowers. This informational advantage confers to banks some market power over their customers, and thereby generates a hold-up problem: anticipating that banks will charge predatory rates in the future, borrowers exert low effort to perform. This leads to high default and interest rates, and possibly to collapse of the credit market.

If they commit to exchange information about borrowers' types, however, banks restrain their own future ability to extract informational rents. This implies that a larger portion of the total surplus generated by the financed projects will be left to entrepreneurs. As a result, these will have a greater incentive to invest effort in their project to ensure their success. This reduces the probability of default on their loans. The interest rate charged by banks will be reduced in step with the default rate, and total lending will increase relative to the regime without information sharing.

[3] This model also delivers predictions about lenders' incentives to create a credit bureau. Lenders have a greater incentive to share information when the mobility of credit seekers is high and the potential demand for loans is large. Technical innovations that reduce the cost of filing, organizing and distributing information should foster credit bureaus' activity. Banking competition, in contrast, may inhibit the appearance of credit bureaus: with free entry, a bank that supplies information about its customers to a credit bureau is in effect helping other lenders to compete more aggressively. Pagano and Jappelli (1993) bring international and historical evidence to bear on these predictions.

2.3. Disciplinary effect of default disclosure

An effect on incentives exists even when there is no hold-up problem. This effect is present when banks, instead of exchanging information about borrowers' quality, communicate to each other data about past defaults. Padilla and Pagano (1999) show that this creates a disciplinary effect. When banks share default information, default becomes a signal of bad quality for outside banks and carries the penalty of higher interest rates. To avoid this penalty, entrepreneurs exert more effort, leading to lower default and interest rates and to more lending.[4]

In this model, disclosing information about borrowers' quality, instead, has no effect on default and interest rates, in contrast with the result of Padilla and Pagano (1997). Ex-ante competition is assumed to eliminate the informational rents of banks anyway, so that their customers' overall interest burden cannot be reduced further. As a result, when information about their quality is shared, borrowers have no reason to change their effort level, and equilibrium default and interest rates stay unchanged. Information sharing about borrowers' quality can even reduce lending. When they share such information, banks lose all future informational rents and therefore require a higher probability of repayment to be willing to lend. So the credit market may collapse in situations in which it would be viable under no information sharing.

This suggests that communicating default data and disclosing borrowers' characteristics can have quite different effects on the probability of default. The disciplinary effect arises only from the exchange of default information. To the extent that banks also share data on borrowers' characteristics, they actually reduce the disciplinary effect of information sharing: a high-quality borrower will not be concerned about his default being reported to outside banks if these are also told that he is a high-quality client. But, as discussed above, exchanging information about borrowers' characteristics may reduce adverse selection or temper hold-up problems in credit markets, and thereby reduce default rates.

2.4. Eliminating incentives to over-borrow from multiple lenders

The previous three effects arise even if households and firms apply for credit with one lender at a time. "Exclusive lending" is a maintained assumption in all the models mentioned so far. But in practice credit seekers may apply simultaneously for credit from several lenders and often manage to get loans and lines of credit from more than one. As shown by Ongena and Smith (1998), multiple bank relationships are commonplace in most countries, especially for large companies. Their number is relatively low in some countries (on average, less than three for firms in the UK, Norway and Sweden, and between three and four in Ireland, Hungary, Poland, the Netherlands, Switzerland and Finland) but very large in others (ten or more in Italy, France, Spain, Portugal, Belgium).

[4] In this model there is no holdup problem because initially banks have no private information about credit seekers, and ex ante competition dissipates any rents from information acquired in the lending relation.

Maintaining multiple bank relationships has several advantages from the standpoint of a borrower. First, it may help reduce the cost of credit, by forcing the various providers of credit to compete. Second, each of the lenders will have to bear a smaller amount of credit risk, and therefore will require a lower risk premium in the interest it charges. Third, being able credit from multiple lenders insures the borrower against the risk that any of the lenders may suddenly call back his loan or withdraw his line of credit, for instance because of a liquidity shock, as argued by Detragiache, Garella and Guiso (1997).

Multiple bank relationships have also costs, however. They discourage each bank from monitoring the borrower closely (lest other lenders free-ride on its monitoring effort) and prevent the intertemporal sharing of rent surplus that would be possible within an exclusive bank-firm relationship, as argued by Petersen and Rajan (1994).

The costs of multiple lending relationships escalate if each potential lender has no clear information about how much credit the borrower has already obtained or will be able to obtain from other lenders. A borrower's default risk, from the viewpoint of a given lender, depends on the overall indebtedness of the borrower when his obligation towards that lender will mature. If this information is unavailable to the lender, however, the borrower has the incentive to over-borrow. To understand why, consider a borrower seeking credit from two banks, who do not tell each other how much he borrows from each. Assume that his probability of default is an increasing function of his indebtedness. When he applies for a loan from each of the two banks, each additional dollar he borrows reduces the probability of repayment of the capital and interest to the other bank, who cannot modify the terms of its loan contract in response to such behavior. Thus, his expected interest burden per dollar of total debt is a decreasing function of his total debt and he has the incentive to over-borrow. Anticipating this moral hazard, lenders will ration the amount of credit supplied and/or require a higher interest rate, or even deny all credit unless assisted by collateral or by covenants restricting total debt. Notice that a lender is not only threatened by the borrower's prior debt commitments, but also by those that he may contract in the future, as shown by Bizer and DeMarzo (1992). The available evidence (summarized by Ongena and Smith, 1998, Table 4) indeed suggests that the number of bank relationships has a negative impact on the availability of credit, whereas is ambiguous regarding its impact on interest rates.

This particular form of moral hazard is eliminated, instead, if lenders agree to reveal to each other the magnitude of the loans and lines of credit that they have extended to each client. This suggests that when lenders share information about outstanding loans they can be expected to increase the supply of lending and/or improve the interest rates offered to credit seekers. Borrowers will therefore prefer these lenders to those that do not agree to communicate to each other such information. This explains why banks may want to pool data about the amount lent to each of their client. Bennardo and Pagano (1999) develop this argument formally in work in progress.

A side effect of this type of information sharing is to reduce the implied cost of entertaining a large number of credit relationships, and therefore to make them more attractive to borrowers, on balance. This may partly explain why firms have a relatively large number of credit relationships in Italy, France, Spain, Portugal, and Belgium, where public credit registers provide very accurate information about the overall indebtedness of firms (see Jappelli and Pagano, 2000). Banks operating in those countries may feel confident to provide credit to companies that are also served by many other lenders, since they can easily keep a tab on their overall indebtedness.

2.5. Theoretical predictions and empirical evidence

The models mentioned so far not only highlight different channels through which information sharing affects the credit market, but also show that by exchanging different types of information lenders may control different informational problems. Exchanging information about borrower characteristics relieves adverse selection and hold-up problems. Pooling default information tends to correct moral hazard problems, and its ability to do so is actually reduced if borrower characteristics are also disclosed. Finally, exchanging information about borrowers' debt exposure removes the particular form of moral hazard deriving from borrowers' ability to borrow from multiple lenders.

Despite the variety of the informational problems considered, on the whole some of the predicted effects of information sharing are similar. All the models predict that information sharing (in one form or another) reduces default rates, whereas the prediction concerning its effect on lending is less clear-cut.

However, the prediction about default is unambiguous only if referred to the probability of default of an individual borrower. When one considers the average default rate, composition effects may overturn the prediction. Suppose that information sharing gives lower-grade borrowers access to credit. Even if each borrower's probability of default is reduced, the aggregate default rate may increase because the relative weight of lower-grade borrowers increases in the total pool. If empirical tests rely on aggregate measures of the default rate, this composition effect may introduce a bias against the models' prediction.

The predictions about the effects of information sharing are tested in Jappelli and Pagano (1999) on cross-country evidence, building upon a new, specially designed data set mainly collected via questionnaires. They find that the breadth of credit markets is associated with information sharing. Total bank lending to the private sector scaled by GNP is larger in countries where information sharing is more solidly established and intense. This relation persists even when one controls for other economic and institutional variables, such as country size and growth rate, and variables capturing respect for the law and the protection of creditor rights (drawn from La Porta, Lopez-de-Silanes, Shleifer and Vishny, 1998). They also find evidence that public and private information sharing mitigates defaults, in accordance with the theory. This evidence is somewhat weaker, however, perhaps owing to the poor quality of their proxies for defaults.

The evidence also shows that the impact of private information sharing arrangements is similar to that of public credit registers. In fact, public credit registers are more likely to be established in countries where private arrangements have not yet arisen. They are also more likely to do so where creditor rights are poorly protected. This suggests that they are introduced to compensate, at least partly, for the weak protection that the state offered to creditors' interests, and thus to remedy heightened moral hazard in lending.

2.6. When is public intervention useful?

Having illustrated the various ways in which communication among lenders corrects the problems deriving from information asymmetries in credit markets, one might be tempted to conclude that information sharing always improves social welfare and may marvel at the fact

that it is not spontaneously produced by market forces in all countries. In fact, both the desirability of information sharing arrangements and the need of public intervention in this area deserve closer scrutiny.

There are models in which information sharing is socially beneficial. For instance, in the model by Padilla and Pagano (1997) the regime with information sharing about borrowers' characteristics turns out to be Pareto-superior: lenders gain because they are able to lend more and therefore earn larger profits; borrowers gain because they get access to valuable credit opportunities that would be precluded otherwise.

But this need not always be the case. Padilla and Pagano (1999), for instance, highlight that information sharing may increase or reduce efficiency depending on the level of effort to ensure repayment that is elicited by the disciplinary effect. There are situations in which sharing information about defaults may elicit an equilibrium level of effort which exceeds the socially efficient level and others in which it still falls short of it.[5] However, they also show that in some instances the first-best level of effort can be elicited as an equilibrium outcome by a careful design of the information sharing mechanism. This happens when sharing only default information would induce an excessive level of effort, relative to the social optimum. Then, sharing also a certain amount of data about borrowers' characteristics can temper the disciplinary effect of default disclosure. One can thereby "fine-tune" the system to achieve the efficient outcome. This indicates that the social efficiency of information exchange between lenders also depend on the type of information shared and, more generally, on the design of the sharing mechanism - an issue that will form the object of next section.

Another reason why a compulsory information sharing mechanism such as a PCR may be damaging is that it may discourage banks from searching for information on their own and thereby reduce their screening and monitoring activities. On one hand, each bank may find it cheaper to free ride on the information collected by others. In the other, it would not want to expend costly resources in searching for information that other may then easily exploit. Compulsory information sharing may therefore kill relationship lending, which by its very nature rests on a high level of screening and monitoring activity by the lender. However intuitively appealing, this argument should be taken with great care. First, it does not apply to spontaneous information sharing, such as that taking place via credit bureaus: in that case, banks can refrain from becoming part of the agreement, and keep their data for themselves; alternatively, they can choose to share certain data and not others. Second, the free-riding problem could be solved or attenuated by an appropriate pricing of the information contributed by banks to the bureau: banks who are net suppliers of information to the system should be compensated for it, and banks who are net buyers of data should pay for such compensation. If the access fees of the information system can be designed so as to implement such transfer payments, even a PCR may not discourage the production of information by banks, because they would expect to be compensated for such production. But of course if such a system is not (or cannot be) engineered, it should be acknowledged that forced communication between lenders can reduce their information production. This can be socially damaging, insofar as it leads to a worse allocation of credit.

[5] The situation is complicated further by the multiplicity of equilibria, characterized by different levels of effort and therefore by a different probability of default.

So information sharing among lenders is not always efficient. It would be a comforting thought, however, if one could conclude that whenever it is, market forces will spontaneously produce an information sharing arrangement, designed so as to maximize efficiency. Unfortunately, we cannot be sure of this either.

In some cases, information sharing might be efficient but generate winners and losers (i.e. fail the Pareto criterion), and still not be introduced because the relevant initiative can only be taken by the would-be losers. In the adverse selection model by Pagano and Jappelli (1993), for instance, if banks have no other source of monopoly power except their superior information about their local clients, they will never want to share information because this would eliminate their profits and transform the market into a perfectly competitive one. This would be socially efficient and in principle consumers could compensate banks for the profits they lose, but it is hard to imagine a private scheme through which could happen. Alternatively, one could ask why potential borrowers themselves do not set up an arrangement to certify and publicly disclose their credit-relevant information. The answer is that most likely they cannot easily coordinate on such a scheme, because they are too dispersed and individually have too feeble an interest to set it up. Therefore, if information sharing depends on the banks' initiative, here we have an instance in which it will not be implemented despite its social efficiency. It would elicit too much competition for banks to introduce it.

However, one can imagine a policy intervention capable of introducing it and compensating the banks with adequate transfers. One can alternatively argue that since households are the banks' shareholders, compensating transfers are not even needed: all that is needed is the introduction of a compulsory information sharing mechanism, such as a public credit register. Such policy intervention could be justified exactly on the same grounds as any antitrust policy: as an act designed to stimulate competition and attain the associated efficiency gains. In other words, the introduction of a public credit register may be justified as part of antitrust policy in the credit market.

Another reason why the creation of a public credit register may be justified is to enhance the stability of the banking system. Bank managers may take an inefficiently high level of risk (for instance, because of the moral hazard caused by public deposit insurance or by the implicit public bailout promise of the government). In this respect, the existence of a public register may help indirectly by making real-time data on the lending policies of banks available to the central bank for supervision and prudential intervention. In practice, this may have been a decisive reason for the establishment of a public credit register in many countries. A public credit register could also help directly by reducing banks' mistakes in the evaluation of credit risks, and thereby making them less likely to enter distress. However, the latter effect may be balanced by the banks' greater tendency to take risks, under the pressure of the more aggressive competition brought about by information sharing.

Finally, a public credit register may even help conglomerate banks to get a clearer picture of their own overall consolidated liability position. We were surprised to discover that some Italian conglomerate banks have no internal method to assess routinely their consolidated liabilities and rely instead on the Italian PCR for this task. The complexity of some bank holding groups makes this less surprising than may appear at first sight.

3. Issues and pitfalls in the architecture of credit information systems

In the previous section we have discussed the effects of information sharing on the performance of credit market. Now we build on this discussion to evaluate some critical issues in the design of credit information systems.

3.1. Relationship between private and public systems

As already pointed out, information sharing arrangements are often created spontaneously by groups of lenders or by individual entrepreneurs, in the form of credit bureaus or of rating agencies. The design of a public credit registry cannot disregard how much information sharing the private sector is already exchanging spontaneously. Clearly, the case for the introduction of a PCR is comparatively stronger in countries where private information sharing arrangements among lenders do not exist or are primitive and limited in coverage and scope. In fact, as mentioned in Section 2.5, empirically the probability that a PCR is introduced is lower in countries with pre-existing private information-sharing arrangements. Private and public arrangements are substitutes in this area.

By the same token, however, public arrangements can "crowd out" private ones. The introduction of a cost-effective PCR can put out of business existing credit bureaus or discourage the creation of new ones. In this sense, the crucial parameter in the design of a PCR is the minimum reporting threshold, since it effectively delimits the market segment left to private credit bureaus. In countries where an effective PCR operates, credit bureaus tend to specialize in loans to households and to small business, whose size is typically below the reporting threshold of the PCR. The higher this threshold, the larger the scope for private initiative in the industry, other things being equal.

The substitutability between public and private information sharing arrangements, however, should not be exaggerated. There are also reasons why the two sources of information may be complements. For instance, credit bureaus may provide a greater degree of detail than PCRs, may merge other types of information with banking records and provide credit-scoring services to its customers. Therefore, a lender may obtain a clearer assessment of a credit applicant's solvency by accessing both the relevant PCR and a credit bureau than by confining himself to one of these two sources of information.

3.2. Dosage between black and white information

The type of data reported is another key element in the design of a credit information system. The simplest and most inexpensive systems are "black lists", which contain only information on defaulters. As explained in Section 2.3, these are most effective in correcting moral hazard problems in the credit market, owing to their disciplinary effect via reputational mechanisms.

Intermediate systems also include reporting of loan amounts, so that lenders may form a more precise estimate of the total indebtedness of credit seekers. Such information helps to

correct the moral hazard problems that may arise if loan contracts are non-exclusive, as explained in Section 2.4.

Finally, the most sophisticated systems will also include other forms of positive information about borrowers' characteristics, such as demographic information for households and accounting information for firms. As explained in Section 2.6, however, in this area it need not be true that "more is better". A system that provides much information about borrowers' characteristics may lead banks to identify more easily high-quality borrowers, but by the same token such borrowers will be less worried to be reported as defaulters, trusting that their reputation will not be stained by such an event. As a result, they may exert less effort to avoid default.

3.3. Memory of the system

The number of years a credit information system "remembers" the default or arrear by a given borrower is another important parameter in the design of a credit information system. More specifically, in setting the memory of the system, one has to ask two distinct but related questions. First, how long are default records kept? Second, are they removed after (late) repayment? Both of these features in fact impinge on the degree of "forgiveness" of the system.

At one extreme, a system with infinite memory, where borrowers have no chance to exit from the "black list" even after late repayment, may create a high incentive to repay on time, but may ex ante deter the decision to take any debt. The risk of being eternally black listed in case of default may be so large as to deter from borrowing even entrepreneurs with relatively solid prospects. Ex post, it would prevent defaulted debtors from ever making a comeback. Once he defaults, a debtor would have very little opportunity to start a new economic activity, and therefore to repay his past debts. Even if a borrower is simply late in meeting his obligations, he may have little incentive to effect a late repayment since his reputation is permanently marred anyway.

At the other extreme, a system where records are kept for a very short time and immediately erased upon late repayment would exert very little discipline on borrowers and correspondingly provide very little information on their track record to lenders.

This suggests that neither extreme will generally be desirable. The difficult issue, of course, is how to set the memory and therefore the "forgiveness" of the system between these two extremes. That is, which point to choose in the trade-off between the need to discipline borrowers and the need to give them a "second chance". The difficulty is that this point will generally differ from country to country. In countries where creditor rights are less protected, for instance because of poor judicial enforcement, the need to discipline borrowers may be more pressing than elsewhere, and therefore one may want to make the memory of the system longer and less forgiving.

A particularly interesting memory design is found in the Belgian Central Office for Credit to Private Individuals, a PCR that records only default information concerning household debt. Borrowers who redeem their debt disappear more quickly from the register than borrowers for whom a repayment commitment continues to exist. In case of repayment of

arrears the information is automatically removed after one year; in case of repayment of defaults it is removed only after 2 years. Irrespective of the type and status of the obligation, the database does not keep any registration for more than 10 years. So "punishment" is stricter for more serious misconduct (defaults are pushed more than arrears), but eventually there is forgiveness for everybody.

Apart from its role in the design of a PCR, this parameter is also a public policy variable, insofar as policy-makers may set a ceiling to the memory of private credit bureaus too. For instance, Danish credit bureaus are entitled to register and distribute at most 5 years of data relevant to assess the financial situation of business and individuals. In the US the Fair Credit Reporting Act of 1970, amended in 1996, prohibits dissemination of adverse information (such as bankruptcy) that is more than 7 years old.

3.4. Monopolistic dangers of private information sharing

In some instances, information-sharing arrangements may lead to a reduction of competition via the creation of an additional barrier to entry for outsiders. This may appear in contradiction with the argument presented in Section 2 that information sharing tends to increase competition among banks by eliminating their information advantages. But in fact the contradiction is only apparent. In a situation in which banks are already competing, information sharing increases competition between them. In a situation in which they are already colluding, an information sharing agreement can be used as a collective tool to prevent entry by outsiders and further reinforce collusion.

This is exemplified by the Mexican case, where a few years ago the Mexican Bank Association formed a private credit bureau ("Buro de Credito") in partnership with Duns & Bradstreet and Transunion. The only two firms who have attempted to set up competing credit bureaus have found it impossible to obtain information from the banks. Hence they are really struggling, and one of them already went out of business. Essentially the banks have become vertically integrated with a monopolistic credit bureau, with which they have an exclusivity deal. This strategy allows the banks to use the bureau as a collective entry prevention against entrants in the credit market: no outside bank can compete in Mexico with the banks subscribing to the "Buro de Credito", being at a strong informational disadvantage.

The most alarming aspect of the Mexican case is that this vertically integrated arrangement has proved very resilient to actions by regulators. There is a public information register managed by central bank, although it contains only financial information concerning large debtors. Banco de Mexico has introduced a regulation that forces private bureaus share only negative information (at a cost) with other private credit bureaus, but that has not been enough to promote competition. This illustrates a potential danger of information sharing arrangements. It also suggests that in some cases the only way to create sufficient competition to private credit bureaus is setting a very low - possibly zero - threshold in public credit registers, as indeed is the case in several Latin American countries (see Jappelli and Pagano, 1999).

3.5. Identifying company groups

If a credit information system must go beyond "black information" and provide data about the overall indebtedness of each debtor, it must identify debtors and their liabilities unambiguously. While for individuals this is a relatively simple task, this may not the case for companies, which are often parts of complex group structures, generally led by a financial holding. If one neglects these corporate structures, even knowing the overall degree of indebtedness of an individual company may be a very poor guide to assessing its credit worthiness. A subsidiary may have a very limited debt exposure, while the group it belongs to may be greatly over-indebted. In fact, a distressed group will want to disguise its true leverage by borrowing new funds via relatively healthy subsidiaries.

This suggests that for credit bureaus and PCRs to give accurate information on corporate indebtedness, they should be able to consolidate their data along the lines of company groups. This is a very difficult practical task, because it presupposes an up-to-date and complete knowledge of the complex pyramidal structures and cross-shareholdings that interconnect companies within a group, and competent use of such information to compute consolidated debt figures. The complexity of certain conglomerates is such that, as already mentioned, some Italian banks rely on the Italian PCR to assess their own consolidated debt position, rather than computing it themselves.

The consolidation of liabilities for company groups is further complicated by two obstacles. First, the loans to the various subsidiaries may go undetected to a PCR because each of them does not exceed the PCR's minimum reporting threshold. While this is unlikely to happen for large corporations, whose loan sizes are quite large anyway, it can happen for smaller groups. For instance, in some countries - such as Italy - the group structure is commonplace even for small and medium-sized enterprises (see Barca and Becht, 1999). The leverage of a small group with several subsidiaries may easily go undetected if its subsidiaries borrow - possibly repeatedly - amounts that are individually smaller than the PCR's reporting threshold.

Second, often corporate groups transcend national borders. A group may take large amounts of debt via its foreign subsidiaries. But the latter will typically not be detected by the group's domestic PCR, i.e. that of the country of incorporation of the group's holding company. As a result, domestic banks will not have a clear picture of the group's total indebtedness. So will foreign banks, which may fail to get reliable and complete data about the company's domestic exposure.

This is exemplified by the case of the Italian Ferruzzi group, whose huge debt buildup in the early 1990s was facilitated by an incomplete perception of the group's total exposure, according to several commentators. In 1992 the Ferruzzi group was the second industrial group in Italy and had a hugely complex financial structure, with an Italian holding company and nearly 300 controlled companies, of which only 100 registered in Italy. The group borrowed heavily both in Italy and abroad, via its many subsidiaries, and in 1993 it entered a state of financial distress. Its total indebtedness was almost US $ 20 billion, an amount that "exceeded the entire private external debt of the Philippines ($ 14 billion), and was not far from that of Malaysia ($ 28 billion) at the end of 1997" (Penati and Zingales, 1998, p. 2). About one quarter of its total unsecured bank debt ($ 15 billion) was owed to foreign banks. Much of this debt had been transferred within the group from one company to another via a complex set of intra-group loans.

The problems created by access of companies to foreign credit, however, do not arise solely due to the possibility of borrowing via foreign subsidiaries. Even when a company borrows directly from foreign banks, it debt may go unreported to the domestic PCR. A multinational group structure compound the problem, but the problem itself derives from cross-border lending. To this, therefore, we turn our attention next.

3.6. Cross-border lending

It is almost trite to point out that real and financial markets are becoming increasingly integrated across national boundaries, both at the regional level (e.g. EU, Asean, Mercosur, etc.) and at a global one, via foreign trade, creation of foreign subsidiaries, acquisitions of foreign companies, etc. One of the consequences of such integration is the increasing flow of cross-border lending. Companies can increasingly access foreign credit markets via their foreign subsidiaries, and use such credit to diversify their sources of funds, reduce their cost of capital or overcome domestic credit constraints. To the extent that companies grow integrated into the world capital market, national credit information systems become unable to identify their total indebtedness.

So far credit bureaus have adopted one of two alternative strategies to respond to this challenge: direct entry in foreign markets or alliances with foreign bureaus. Direct entry can be implemented by setting up local branches in foreign countries or by taking over national credit bureaus. The US-based Experian and Dicom have followed this strategy in Asia and Latin America, and are now starting to adopt it in Europe as well.[6] Other bureaus are instead trying to create a web of transnational alliances in order to resist this wave of consolidation. For instance, in 1998 the main Italian credit bureau (CRIF) announced a link-up with other European credit bureaus. By creating a two-way flow of information across independent national credit bureaus, these bureaus hope to provide the same services as truly multinational entities without surrendering their independence.

The same problems arise for public credit registers, and also here a possible solution is to coordinate national registers and create interfaces between their information systems. Of course, this is more easily said than done: apart from the problems deriving from the differences in the information technology they rely upon, these registers often feature a totally different design. Just to mention some, their coverage, reporting thresholds, type of information reported and privacy protection clauses are so different as to pose formidable problems to their integration. These substantive problems are compounded by the inertia that is so often typical of bureaucratic organizations, which operate under a soft budget constraint and lack the competitive pressure under which private organizations operate.

Does this make national PCRs obsolete organizations, bound to be displaced the growth of private, transitional private credit bureaus? The answer probably hinges on how many years

[6] Of course, this is unlikely be the only reason for the strategy of foreign acquisitions pursued by these large U.S. credit bureaus. Other likely reasons are the economies of scale present in the industry, the superior technical knowledge accumulated by large bureaus, and the desire to diversify their revenue structure.

ago a PCR was established. In Europe, where national PCRs are quite old and feature deeply ingrained differences, the seven countries which have them find it difficult to agree on a common set of rules, so that the danger of their displacement by private multinational bureaus is increasing (Jappelli and Pagano, 2000). By the same token, however, countries that are just establishing a public credit register for the first time have the opportunity of designing them so as to ensure compatibility with the systems of their main commercial partners. In this dimension, late comers may be better positioned than their predecessors.

3.7. Privacy protection

Credit information provision finds an obvious limit in the set of legal provisions designed to protect individual privacy. Such provisions differ widely both within Europe and between the US and European countries, and these differences appear to have had profound effects on the development of credit information systems (see Jappelli and Pagano, 2000). For instance, France's strict privacy protection laws have prevented the development of private credit bureaus in that country.

However, one should not necessarily take a negative view of the effect of privacy laws on credit information systems. As already pointed out in our discussion of the desirable memory of such systems in Section 3.3, divulging certain types of information may lead people to become "too cautious", that is, may reduce risk taking and entrepreneurship below the socially desirable level. Therefore, a moderate concern for privacy may indirectly serve also economic efficiency.

In addition, there is one privacy-protection rule that directly improves the accuracy of the data stored by credit information systems: entitling individuals with the right to inspect and correct mistaken information about them. Such feedback not only improves the quality of information, but also helps to correct the negative bias in reporting that credit bureaus are often blamed for. Such bias is easily explained: when a negative credit report is mistakenly filed, the lender will generally deny credit and therefore is unlikely to ever find out about the mistaken information, while the opposite would happen if a positive report was filed for a bad credit risk. Therefore, credit bureaus prefer to err on the negative side.

4. Designing information sharing systems in developing countries

Some issues in the design of credit information systems are particularly relevant for developing countries. We discuss them separately in this section.

4.1. Informal markets

In most developing countries, the role of informal lending is much larger than in developed economies. Since typically both credit bureaus and PCRs base their information on data reported by formal lenders, their utility is much reduced in these countries. This limitation of information sharing systems could be overcome by opening access of PCRs also informal

lenders, such the non-governmental organizations (NGOs) that manage microcredit programs. For instance, Trivelli, Alvarado and Galarza (1999) reports that one of the main limitations of the Peruvian PCR is its insufficient coverage of data about debts with informal and rural lenders: "the majority of the clients [such lenders] work with never had any relation with the formal system or have had only small loans (less than 13,000 soles), and therefore they are not registered" in the PCR (p. 25).

4.2. Poor protection of creditor rights

PCRs are more frequent in countries where creditor rights receive a relatively poor protection and the law is less effectively enforced, as recalled in Section 2.5 and documented by Jappelli and Pagano (1999). In this sense, PCRs appear to act as a partial substitute for the lack of good judicial enforcement. Also credit bureaus can of course play this role. The disciplinary effect of black information can be particularly effective to this purpose, as argued before. For instance, in Brazil information sharing mechanisms allow widespread reliance on post-dated checks as a debt instrument. Pinheiro and Cabral (1999) report that "the easy and low-cost access to reliable information on a person writing a check together with the high cost to a consumer of entering a 'black list' have made post-dated checks a widely used low-cost credit instrument in financing the purchase of non-durable consumer goods and basic services" (p. 17).

4.3. Inducement to change banks' lending policies

The availability of better information may in some cases lead banks to shift somewhat from a collateral-based lending policy to an information-based one. In many developing economies, it is often complained that formal lenders request their loans to be assisted by collateral whose value often greatly exceeds the value of the loan and pay little attention to the intrinsic cash flows that can be generated by the project they are financing. The availability of more readily usable information, together with the acquaintance with credit scoring techniques, may contribute to a shift in their lending strategy, as highlighted by Trivelli et al. (1999) in their study of the recent Peruvian evidence.

4.4. Designing the interface with credit grantors

Finally, in developing countries, it is important to design credit information systems so that they are "usable" by relatively unsophisticated bank personnel: one must take into account the quality of the human capital in the relevant banking institutions, and avoid importing excessively sophisticated systems (which presuppose very detailed positive information, or relies on very complex scoring systems).

Most developing countries may usefully start with simple "black information" systems, possibly complemented by data on loan exposure, and later proceed to enrich them with additional white information (e.g. information on corporate accounts and management,

personal information such as employment and criminal records, etc.). It is important to rely on an information technology that will allow the system to evolve over time if necessary.

5. Conclusions

This paper offers the first comprehensive overview of the economic effects of information sharing systems, drawing together theory and empirical evidence, with an eye to obtaining directions for the design of credit information systems.

We have started with an analysis of the reasons why lenders may want to share credit data and of the effects that such information exchange has on credit market performance. One of the key insights of this analysis is that the type of information exchanged and the detailed design of the mechanism used to share it matter at least as much as the decision to set up an information sharing mechanism. We have also discussed extensively if the marketplace is capable of providing spontaneously the socially desirable information sharing mechanism or rather some form of public intervention is needed.

This analysis of the effects of information sharing has helped us to shed light on some key issues in the design of a credit information system: the relationship between public and private mechanisms, the dosage between black and white information sharing, the "memory" of the system, and several others. We have also attempted to merge the insights from theoretical models with those deriving from past experience, to gain additional guidance concerning possible pitfalls in the design of credit information systems. Finally, we have discussed some issues of particular relevance to developing countries, such as those connected to informal lending and the poor protection of creditor rights.

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