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Credit information sharing, access to finance and bank risk: what do we know?

By Jeffrey Ighedosa

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Credit information sharing, access to finance and bank risk: what do we know?

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Abstract

We review a growing literature on the impact of credit information sharing through Credit Registry and Credit Bureau on firms' access to finance and bank risk. The literature agrees that where credit information is shared and used accurately, it reduces adverse selection and moral hazard problems which in turn increase bank lending and reduce default rates. These results are conditional on market competition and institutional development. Credit Registry and Credit Bureau have been less effective in reducing the effects of information asymmetry in many developing countries due to weak institutional development. There is growing rate of adoption of Online Collateral Registry across developing countries, more evidence is needed to establish whether it can address the current issues with both Credit Registry and Credit Bureau. We offer future policy-oriented Promising Research Ideas (PRIs) based on gaps identified in the literature.

Keywords: credit information, access to finance, information asymmetries, bank credit, bank risk.

JEL Classification: D82, G21

1. Introduction

In many countries, credit rationing stems from imperfections in credit markets, especially information asymmetry (Stiglitz & Weiss, 1981). This results in shortage of capital and firms' inability to finance profitable projects. Banks and firms are differentially informed about the quality of firms' projects when loan applications are made. In markets with imperfect information, firms seeking loans have better knowledge about their projects; consequently, banks are unable to separate bad borrowers from good ones. This creates adverse selection problem for banks. Further problems may arise after loans have been granted. It is unlikely that banks are able to supervise projects that loans have been granted for. Therefore, they are faced with *ex-post* incentive problems as they cannot control the behaviour of borrowers or directly influence the outcomes of their projects. Recognising these potential problems, banks are likely to take a more cautious lending approach to mitigate them. This increases credit rationing, and the overall negative effects on credit markets can be material as the group of rationed borrowers may include both "bad and good" firms (Kirschenmann, 2016).

Finance literature has identified several technologies that have been used in reducing asymmetric information by lenders. However, evidence from all types of credit markets is divided on the effectiveness of these techniques. The literature presents two sets of arguments for the use of collateral in reducing the effects of asymmetric information. From *ex-ante* private information perspective, the use of collateral as screening device helps to reduce adverse selection problems in a simple signalling process. Borrowers with good projects self-select to contract with higher collateral requirement and lower risk premium to signal their quality, whereas riskier borrowers are likely to select contract with lower or no collateral requirement but higher risk premium (Bester, 1985). This process helps lenders to differentiate good borrowers from bad ones. *Ex-post* argument on the other hand, is that collateral increases borrowers' costs of default; therefore, banks simply ask them to pledge collateral to reduce *ex-post* frictions (Boot et al., 1991). For both theories, by reducing adverse selection and *ex-post* incentive problems, collateral helps to encourage bank lending even in markets with imperfect information. Evidence has confirmed the validity of this argument, that positive association exists between collateral and credit availability (Aretz et al., 2020).

However, Berger et al. (2016) show that collateral is associated with higher rates of default. This appears to confirm Stiglitz & Weiss (1981) credit rationing model which demonstrates that in markets with imperfect information, increase in collateral may be associated with limited use of credit capital due to reactions from both demand and supply sides. They argue that with information asymmetries, lenders are likely to seek higher collateral which discourages risk averse higher-quality borrowers from taking loans to invest in positive NPV projects. Additionally, higher collateral requirement increases the financing of lower-quality projects as borrowers in this category only need to provide the required collateral, suggesting that collateral may increase adverse selection after all. They show that due to the negative effects of this adverse selection on returns, lenders are likely to prefer credit rationing in the presence of information asymmetry.

Relationship lending is another technology that has been used widely by lenders to close informational gaps between them and borrowers. In anticipation of long-term lending relationship, banks may grant credit to local firms that are currently credit rationed or excluded due to insufficient collateral, opacity, smaller loan size and many more (DeYoung et al., 2015; Berger et al., 2017). Banks are able to obtain private information from borrowers as lending relationship grows between the two. With many SMEs unlikely to meet collateral requirement for bank financing, relationship lending increases their access to credit especially those in developing countries (Beck et al., 2018). Again, it is not without drawbacks, relationship lending is associated with hold-up of borrowers which enables lenders to extract higher rents (Beatriz et al., 2018). Moreover, by protecting the privacy of borrowers' information, relationship lending inhibits market competition and increases informational distance between relationship bank and other banks.

A more recent technology which is the focus of this survey, is credit information sharing which evolves from the idea that past credit performance (credit history) of borrowers can give a reliable estimate of future performance. Therefore, when lenders exchange borrowers' credit history they can reduce adverse selection and improve the accuracy of estimated default probabilities (Pagano & Jappelli, 1993). Theoretically, information-based lending can correct the deficiencies in both collateralization (reduced lending standards and inability of many firms to meet collateral requirements) and relationship lending (impeding competition and exploiting borrowers). Information-based lending gained significant attention in the aftermath of 2008-2009 financial crisis. Perhaps, due to the role played by collateral in the build-up to the crisis, especially real estate (Altunbas et al., 2017).

In many countries, credit reporting system is made up of Credit Registry (CR) and Credit Bureau (CB) which are the two main providers of credit reports. CRs are owned and operated by a country's Central Bank to facilitate sharing of credit information by financial institutions in the country (World Bank, 2016). All financial institutions in a country are required to register with CR to report their borrowers' credit information, and to have access to data reported by other financial institutions. Reported data may include, depending on the country, credit exposure, defaults, interest rates, arrears, guarantees (Jappelli & Pagano, 2002). CRs serve two important purposes, to improve the quality of lending and loan assets of financial institutions, and to assist the government in bank supervision (World Bank, 2019). One of the key issues with CR is that registration is compulsory, and this creates significant incentive problems. Banks would normally keep information about higher-quality borrowers private for profits and competition purposes. Compulsory disclosure of such information to be used by competitors raises several incentive issues including manipulation of data before sharing.

CBs, on the other hand, are profit oriented, privately owned but regulated by the regulatory authorities, and collect information from both financial and non-financial institutions (World Bank, 2016). The multiple sources (private and public) of information used by CBs allow them to build more accurate creditworthiness profile for each borrower. However, Jappelli & Pagano (2002) identify conflict of interest as one of the key issues with

CBs in that they are, in some cases, owned by the same lenders who are users of the data. Moreover, CBs are profit making businesses, this may influence their data collation process or disincentivize reporting on smaller businesses. On the positive side, however, bureaus are regulated in most countries by financial sector regulators to make sure that the privacy of participants is protected and reports are reliable. In addition, lenders are made to sign contracts when joining a bureau, agreeing to share private information accurately to have access to other lenders' private information (Sutherland, 2018).

The minimum credit balance that can be reported by banks to a CR is set by the Central Bank to ensure that larger loans are reported in the database which is controlled by the regulatory authorities for supervisory purpose. This means CBs would normally report on smaller business and individual loans. It also means the minimum reporting threshold for CRs may affect competition in the reporting environment, and the operations and profitability of CBs which trade for profit. Therefore, it is important that the design of CRs and minimum reporting threshold encourage complementary reporting between the two. Both CR and CB have expanded rapidly in the last two decades, with 173 countries having either CB or CR, or both (World Bank, 2019). Figure 1.2 shows that reports based on information collected from both financial and non-financial institutions have more predictive power than credit reports based on information shared by banks only. Put differently, CB information makes better prediction of credit risk than that of CR.

Figure 1.2 types and sources of information and their predictive power

Types of Information / Sources of Information	Positive & Negative Information	Negative Information
"Full" (Information Shared by Banks, Retailers, NBFIs)	High Predictiveness (e.g. U.S., U.K., India)	Lower Predictiveness (e.g. Botswana, Ewatini)
"Fragmented" (e.g. Information Shared Among Banks Only or Retail Only)	Lower Predictiveness (e.g. Mexico, Kuwait)	Lowest Predictiveness (e.g. Malaysia, Botswana)

Source: World Bank. Doing Business 2019

In this survey, we review recent evidence on the linkages between credit information sharing and credit market performance. We do so from two important research avenues: First, whether the existence of credit information sharing mechanism(s) affect the dynamics

of credit availability, bank risk and overall market performance. Second, whether the effects of information sharing schemes vary by market type, with focus on the role of institutional development. This helps to provide explanation as to why credit rationing due to information asymmetry remains high in many markets even where there are CRs and CBs. The survey brings to the attention of authorities in charge of credit market reforms the weaknesses in the current information mechanisms, and we intend to provoke review of policies with our improvement suggestions. Finally, we provide Promising Research Ideas (PRIs).

The survey proceeds as follows: Section 2 is the survey methodology, section 3 presents the theoretical literature, section 4 covers empirical evidence on information sharing in relation to credit availability, bank risk, and incentive issues from both demand and supply sides. Section 5 covers the ongoing supervisory role of regulators and the effects of credit information sharing in developing countries, section 6 presents the concluding remarks and PRIs.

2. Methodology of the Survey

A systematic literature review has been followed in this survey. Having obtained large number of articles from wide range of financial journals, a sorting process based on journal ranking and year of paper publication was used in reducing the number articles whilst keeping the most recent and highly rated ones. This gives a more focused group of papers that directly address the survey objectives discussed in chapter one.

Many databases were used in the initial search, but the main ones include JSTOR, ScienceDirect and Wiley Online Library. "credit information sharing" are the key words representing the survey subject area and have been used in searching these databases for relevant articles. The results of this search identified over 1,200 papers that are related to credit information sharing. However, information asymmetry is very diverse, as discussed in the introduction section, there is absence of unanimity of evidence in relation to earlier technologies used in reducing the effects of information asymmetry (collateralization and relationship lending). Consequently, we wanted to make sure that our survey reflects the best evidence on information sharing technology, and that the identified patterns in the literature and our final conclusions are shaped by studies of highest quality. To reflect this, the search was refined to select papers on the basis of journal ranking, the focus here is making sure that papers that are published in at least 3-star journals are selected. According to the Chartered Association of Business Schools ranking, we know that papers published in journals that are rated 3 or more have the most citation impact factors in the field of finance. This process reduced the number of articles to 213.

Further, knowing that the adoption of CRs and CBs across developing countries is relatively recent, the period covered in the survey needed to be adjusted so that sufficient number of studies based on developing countries are included. This gives a fair representation of markets at different stages of development which is an important part of the survey objectives. For this, the search is further adjusted to sort the articles by date, and those

published between 2015 and 2021 give a final sample of 70 studies. However, some of the theoretical papers have been selected outside of this range to include those from earlier dates. This was considered necessary to create brief background on information asymmetry and the theoretical journey for credit information sharing technology. The final sample provides sufficient evidence to capture the current focus of studies in the literature.

Using topic, motivation and findings of individual study, these articles were grouped according to how they are connected to credit information sharing and information asymmetry. The groups include firms' opacity and use of formal credit, borrowers' disciplinary device, private information and lenders' incentive to share information, adverse selection and bank risk, the supervisory role of market regulators, and coverage of credit registries and bureaus in developing countries. With this design, the key characteristics of credit markets, recent evidence and trends in the credit information sharing literature are reflected in the survey conclusions and PRIs.

Although empirical papers published in lower-rank journals and those earlier than 2015 have not been included in this survey, we are not by any means suggesting that they cannot be used or add value to other survey papers with different motivation or target. However, because of the specific aim to position this paper with the top tier research possible, we believe that the selected sample provides the best opportunity for the survey.

3. Theoretical Literature

Theoretical literature suggests that by reducing information asymmetry, the effect of credit information sharing is fourfold: it reduces adverse selection in credit markets (Pagano & Jappelli, 1993); it reduces banks' ability to extract higher rents from borrowers' private information (Padilla & Pagano, 1997); it reduces moral hazard and increases borrowers' repayment incentive (Padilla & Pagano, 2000); it increases lenders' knowledge about borrowers' indebtedness which helps to avoid excessive borrowings from multiple lenders (Bennardo et al., 2015).

Pagano & Jappelli (1993) adverse selection model is the first in the credit information sharing literature. They propose that when Bank A and Bank B keep their borrowers' information private, one is an outsider to the customers of the other, and both face adverse selection problem. Whereas when they exchange their private information with each other, no one is an outsider, and they can both lend to a pool of borrowers in a more competitive market. This improves lenders' overall knowledge about loan applicants which helps to determine more accurate default probabilities. The underlying argument is that information sharing does not necessarily mean that all borrowers with risky projects would exit the market, but to equip lenders so that they are able to price loan based on borrower's risk profile. Identifying higher-quality borrowers means they can be rewarded with lower interest rates. It also means that banks can charge relatively higher interest rates to finance lower quality projects. Credit information sharing enables lenders who are risk-takers and willing to finance riskier projects to earn higher returns. Additionally, by increasing competition,

information sharing helps to reduce opportunistic behaviour of borrowers in relation to strategic defaulting, and lenders who would normally charge higher interest in less competitive markets. These incentive issues are addressed in detail in the moral hazard models below.

Padilla & Pagano (1997) present the first moral hazard model in which credit information sharing reduces hold-up and informational rents that banks extract from borrowers. In this model, the positive effect of information sharing is strong through the competition channel which helps to reduce borrowers' switching costs and lenders' rents seeking. Additionally, by expanding external financing options, competition reduces interest and default rates, increases credit availability and overall market performance. Padilla & Pagano (1997) argue that sharing information increases borrowers' incentives to service their loans due to reduction in interest rates. Held-up borrowers on the other hand, would have much lower incentives to perform due to higher interest payment. However, a possible problem that may arise in markets dominated by relationship lending is that the introduction of information sharing mechanism may remove the lending incentive created by lenders' ability to seek higher rents. Consequently, banks' willingness to lend would depend mostly on default probabilities of borrowers which must be very low as a result. Overall, this argument may result in more credit rationing as preference for significantly low default probabilities grows among banks.

Padilla & Pagano (2000) developed another model in which information sharing reduces moral hazard and increases borrowers' repayment incentive. In this model, lenders exchange information about past defaults rather than borrowers' characteristics. Their proposition is that sharing negative credit history helps to discipline borrowers. The fear of being punished in the event of default induces borrowers to make more efforts in servicing and repaying their loans.[1] As more credit markets move toward information-based lending, good credit reputation becomes borrowers' most important credit collateral. However, this model has at least one fundamental flaw as it fails to recognise other key factors that may shape the incentives of borrowers including the behaviour of other lenders and legal environment. Nonetheless, these factors have been addressed in a recent model by Bennardo et al. (2015). They offer a banking model which shows that when borrowers can borrow from multiple lenders in a market where the value of collateral is volatile and creditor rights are poorly protected, they tend to overborrow. The underlying argument is that over-indebtedness happens because banks are unaware of borrowers' dealings with other banks, or due to opportunistic behaviour of banks.[2] These credit markets are likely to be characterised by higher interest charges and credit rationing. However, information sharing can improve the behaviour of market participants and increase access to credit if collateral values are relatively stable.

Unlike earlier models, Bennardo et al. (2015) incorporate how information sharing interacts with other important market factors, this represents an upgrade from the three foundational models above. For this purpose, we provide further detail below from Bennardo et al. (2015) presentation of how weak creditor protection drive incentives to overborrow in the absence of information sharing. Entrepreneur (borrower hereafter) may carry out a small

project *S* with capital investment x, revenues y_S, and returns $v_S \equiv y_S - x$. Alternatively, he may go for a large project *L* with investment 2x, revenue y_L, returns $v_L \equiv y_L - 2x$. Small project has higher surplus than large project due to higher risk associated with undertaking large project, that is $v_S > v_L$.

Regardless of the choice of project, loan l_b from bank *b* is the only financing option available. Where loan is granted, contract $C_b = (l_b, r_b)$ is signed, and the pledged repayment is r_b. Borrower can apply to multiple banks for loans, and would normally do so for 2x investment in *L* project. This is because banks lack information on applicants' level of indebtedness and quality of their projects in this market. Having received x loan from bank1, borrower can easily apply to bank2 for further x loan to finance project *L* instead. Despite having higher risk and lower surplus, borrower has incentive to undertake *L* project because there is limited contract enforcement which allows appropriation of a portion $\phi \in (0,1)$ of large project revenues y_L. Banks are unable to seize this private benefit in the event of default. Therefore, the existence of poor information flows and limited contract enforcement encourage borrowing from multiple banks to invest in *L* project to appropriate ϕ of y_L, and borrower would do so even when large project is not viable, as in $(1 - \phi)y_L + 1 - 2x < 0$.

Additional moral hazard problem arises when the value of collateral is volatile. Borrower's pledgeable assets $\widetilde{w}$ with a standard deviation σ interval of (0, 1) has equal probability of being $1+\sigma$ or $1-\sigma$ due to future uncertainty. Note, $\widetilde{w}$ has a normalized expected value of 1. This high level of volatility gives incentives to default when collateral is low and the value that can be repossessed by bank has fallen significantly. Consequently, borrower would undertake large project because private benefits ϕy_L plus his wealth in good state $(1 - \phi)y_L + 1 + \sigma - r_1 - 2x)$, is greater than small project surplus which is $y_S - r_1$ plus expected wealth $E(\widetilde{w})$. Put together:

$$\phi y_L + \frac{1}{2}\big((1 - \phi)y_L + 1 + \sigma - r_1 - 2x\big) > y_S - r_1 + 1 \tag{1}$$

This volatility also gives incentives to other banks to lend opportunistically at the expense of existing creditors. Despite knowing that large project has higher risk and unlikely that a second loan will be recovered in bad state when borrower is likely to default, bank2 is willing to grant further loan with the intention to recover the loan in good state through higher rates. Meaning that bank2 would fund large project because the associated return is non-negative

$$\frac{1}{2}\{(1 - \phi)y_L + 1 + \sigma - y_S\} \geq x \tag{2}$$

y_S in equation 2 equals r_1 which presents a case scenario whereby bank1 demands highest repayment. However, this does not eliminate bank2 incentive to fund large project because it remains that profit or break-even can be made by requesting a repayment $r_2 \geq 2x$ in good state. The payoff for borrower or bank2 depends on borrower's choice of project $n \in (S, L)$, the level of debt *R* from all banks *B*, and the overall pledge repayment r_b:

$$R \equiv \sum_{b \in B} r_b$$

Borrower's payoff:

$$u_n(\widetilde{w}, R) \equiv \phi_n y_n + \max\{0, (1 - \phi_n)y_n + \widetilde{w} - R\} \tag{3}$$

where $\phi_n y_n$ represents borrower's appropriated revenue which cannot be seized by bank in the event of default; therefore, it is private benefit. Whether default occurs or not depends on the second part of equation 3, and there will be default when the total pledged repayment is greater than the pledgeable wealth $(1 - \phi_n)y_n + \widetilde{w} < R$.

If borrower invests in small project, it means loan is required from bank1 only, that is:

$$E_{\widetilde{w}}[u_S(\widetilde{w}, r_1)] = \tfrac{1}{2}\max\{0, y_S + 1 - \sigma - r_1\} + \tfrac{1}{2}\max\{0, y_S + 1 + \sigma - r_1\} \tag{4}$$

Recall that $\widetilde{w} = 1$, with equal probability of being $1 + \sigma$ or $1 - \sigma$. r_1 is the pledged repayment to bank1 which is the only bank in this case. Therefore, borrower's payoff is $y_S + 1 - r_1$. Note, there will be no default where repayment is less than small project revenue $r_1 \leq y_S$.

However, if borrower's choice of project is the large one, with additional loan from bank2, the expected utility is:

$$E[u_L(\widetilde{w}, r_1, r_2)] = \phi y_L + \frac{1}{2}\max\{0, (1 - \phi)y_L + 1 - \sigma - r_1 - r_2\}$$
$$+ \frac{1}{2}\max\{0, (1 - \phi)y_L + 1 + \sigma - r_1 - r_2\} \tag{5}$$

Banks' payoff:

$$E[r_b^n(\widetilde{w}) - l_b] = \tfrac{1}{2}r_b^n(1 + \sigma) + \tfrac{1}{2}r_b^n(1 - \sigma) - l_b \tag{6}$$

where $r_b^n(\widetilde{w})$ is the loan repayment as a function of borrower's wealth. If there is sufficient $\widetilde{w}$, borrower can repay pledged r_b. However, in the event of default bank1 represents superior creditor R^b which receives the first allocation of firm's pledgeable wealth. Therefore, bank2 b will receive the net of the wealth after R^b, that is if positive. Accordingly, payment to b is shown below:

$$r_b^n(\widetilde{w}, R^b) = \begin{cases} r_b & if\ (1 - \phi_n)y_n + \widetilde{w} - R^b > r_b, \\ \max\{(1 - \phi_n)y_n + \widetilde{w} - R^b, 0\} & otherwise. \end{cases} \tag{7}$$

The actual repayment to bank1 is $r_1 \leq y_S$, then $R^1 = 0$ and $R^2 = r_1$. Therefore, for funding the large project, bank2 actual repayment is:

$$r_2^L(\widetilde{w}, r_1) = \begin{cases} r_2 & if\ (1 - \phi_L)y_L + \widetilde{w} - r_1 > r_2, \\ \max\{(1 - \phi_L)y_L + \widetilde{w} - r_1, 0\} & otherwise. \end{cases} \tag{8}$$

The first line represents no default scenario, whilst the second represent default.

Bennardo et al. (2015) argument is that information sharing disincentivizes opportunistic lending and borrowing; therefore, reduces over-indebtedness, interest and default rates, and increases access to credit. However, they also present "the dark side of information sharing", that with poor creditor protection and volatile collateral, information sharing may result in credit rationing or market freeze. This is particularly applicable to developing countries where most borrowers have risky collateral.

In summary, theoretical models agree that information sharing enables lenders to assess default probabilities more accurately which helps to reduce default rates and increase credit availability. However, in comparison of Bennardo et al. (2015) with earlier predictions,[3] there are differences which are likely to be material when it comes to empirical testing. The first three models are unclear on how information sharing influences lending decisions or the channels through which its effects may be transmitted to the wider market or economy. From practical point of view, in markets with imperfect information, lenders are likely to consider multiple factors along with credit history of applicants. For example, whether they are able repossess collateralized assets in the event of default without court order. This link between information systems and wider environment forms the foundation of Bennardo et al. (2015) model. They demonstrate that the reaction of credit markets to information sharing does not depend only on information shared but also creditors' protection and market stability. Borrowers may default strategically even with information sharing if the legal system is weak, because the financial gain associated with defaulting in this market may outweigh the punishment that follows. This problem may be exacerbated in markets that are dominated by collateral-based lending, where loan officers are willing to lend to borrowers with collateral regardless of their credit history. It is clear why these external factors may determine the outcomes of information sharing schemes. As a matter of importance, empirical specifications should incorporate them to capture the true reaction of credit markets especially when studying data representing developing countries.

4. Empirical Literature

4.1. Information Sharing and Access to Credit

In line with theoretical predictions, empirical literature suggests that the quality of information systems and management of incentive conflicts are important determinants of credit availability and overall market performance. Kirschenmann (2016) investigates credit rationing in Bulgaria using the following model:

$$Share\ granted_{i,k,t} = a + \beta_1 A_{i,t} + \beta_2 B_{i,t} + \beta_3 L_k + \beta_4 R_i + \beta_5 T_t + e_{i,k,t} \tag{9}$$

Where $A_{i,t}$ is a vector of indicators that measure asymmetric information, $B_{i,t}$ and L_k are vectors of characteristics of firm and loan, R_i and T_t represent regional and year-quarter dummies which account for region-specific, macroeconomic and monetary conditions, bank's refinancing, bank's interest rate and collateral requirements for small loans. The finding is that lack of credit access is largely due to firm's opacity. However, the study shows that bank

loans received by previously rationed firms increase after some time of bank-firm relationship, indicating the presence of positive relation between relationship lending technique and availability of formal credit. In markets with low credit information flows, majority of banks engage in relationship lending to improve their knowledge of borrowers and their businesses (Wang et al., 2020). However, with growing market competition and FinTech development, the use of credit information sharing becomes inevitable in alleviating firms' opacity, reducing transaction costs and improving projects' financing. This has been widely studied, and majority of evidence shows that it has the potential to unlock informational frictions, promotes competition and access to credit, with greater effects on previously opaque or credit excluded firms (Bahadir & Valev, 2019; Wang et al., 2020).

Sutherland (2018) examines the effects of information sharing with a US bureau on firms' switching costs, access to credit and lenders' choice of lending technique (relationship or transaction lending). The following specification was estimated:

$$Y_{ijt} = \beta_1 * Share_{it} * Thin\ File_{jt} + \alpha_{jt} + \alpha_{it} + e_{ijt} \tag{10}$$

Where Y_{ijt} is an indicator for whether borrower has a contract or not with a lender two years after information has been shared ($Exit\ Relationship$), $Share_{it}$ is a measure of when lender joins a bureau to share information, $Thin\ File_{jt}$ measures the dollar amount of contracts in each relationship, and which lender is sharing information, α_{jt} and α_{it} are firm-quarter fixed effects and lender-quarter fixed effects respectively. The results show significant reduction in borrowers' costs of switching from one lender to another within the bureau. This suggests that exchanging credit history improves borrowers' bargaining power and allows *held-up* firms to break away from higher interest relationship banks. Borrowers with good credit reputation or higher quality projects can expand their access to funds at more competitive interest charges when current lender joins a bureau. Additionally, Sutherland (2018) finds that small and young firms are more likely to leave their relationship lenders for new ones after their credit history have been shared. Again, this demonstrates that the effect of information sharing is stronger for opaque borrowers such as MSMEs. Moreover, the study shows that having shared their borrowers' information, lenders transition from relationship lending technique to transaction technique with shorter contract maturity and less willingness to fund delinquent borrowers. These are indications that information sharing increases competition in credit markets.

Bird et al. (2019) study the effects of voluntary disclosure of credit information by borrowers on access to credit, alleviating *hold-up* problem, and credit market performance. They use data representing users from across the world and the regression framework:

$$Y_{is} = \theta Disclose_{it} + \rho X_{it} + \omega_i + u_j + v_t + \xi_{it} \tag{11}$$

Where Y_{is} represents multiple outcomes for firm (switching lenders, spreads and loan amount), $Disclose_{it}$ is firm's information disclosure, X_{it} contains controls derived from loan agreement, ω_i, u_j and v_t are borrower, lender, and year fixed effects, and ξ_{it} is the error term. The results show that borrowers who share their credit information are 16% more likely

to switch to other lenders, experience 4% lower spread and 8% more loan amount than non-sharing borrowers. For borrowers with positive investment opportunities, it is more beneficial to voluntarily share their information to expand funding opportunities rather than being *held-up* and paying higher charges to current lenders. That said, the actions of borrowers in seeking more credit options may differ due to heterogeneity in their operations, projects' risk, benefits derived from credit, or their level of awareness. For example, it makes business sense for higher risk firms to remain in their existing lending relationships and pay higher charges because other lenders may not be willing to finance their projects. Whereas firms with higher quality projects may be more determined to self-report their credit information in anticipation of more funding options. Especially those operating in competitive credit markets where transactional lenders are willing to fund low risk borrowers with positive NPV projects at much lower interest charges (Bolton et al., 2016). Depending on market and existing institutional development, one concern that potential lenders may have is the reliability of voluntarily disclosed information. However, technology development has significantly improved comparability of databases and verification of information (Liberti & Petersen, 2019). There is growing number of online platforms which enable lenders to use information from multiple sources in assessing borrower's creditworthiness (Berg et al., 2020).

Evidence on the effects of CR and CB in developing countries is mixed and not as positive as that of developed markets.[4] whilst positive effects of information sharing have been reported (Sorge et al., 2017; Bahadir & Valev, 2019), negative effect has also been found (Loaba & Zahonogo, 2019). To investigate the effects of CR and CB on the volume of bank credit to private sector, Grajzl & Laptieva (2016) estimated the following model:

$$Loans_{it} = \beta.CB_{it} + \gamma.NBUCIS_{it} + \delta'X_{i,t-1} + \lambda_t + \alpha_t + \varepsilon_{it} \qquad (12)$$

Where i and t index bank and year. $Loans_{it}$ is the log of sum of bank i's household and firm loans in year t. CB_{it} is a dummy equals one if bank i is partnering with at least one private credit bureau and zero otherwise. $NBUCIS_{it}$ is a dummy equals one if bank i is participating in the credit information system administered by central bank and zero otherwise. They found that information sharing through Credit Bureau is associated with increase in bank loan. Whereas information sharing through Credit Registry administered by the central bank does not have similar positive impact on bank lending. Other studies focusing on developing countries have reported similar results that, whilst CB is effective, CR is weak overall (Kusi & Opoku-Mensah, 2018).

The establishment of CR is based on the theory that in markets where lenders would not share their private information willingly, government intervention is needed to request information sharing (Bennardo et al., 2015). This makes it compulsory for all financial institutions to register with CR to share their borrowers' information. However, forcing lenders to share private information with other lenders may encourage dubious reporting which undermines the quality of information shared. It also means that registries are less effective in improving access to finance in countries where this behaviour is common. For CB, an obvious question at this stage is that if it is effective in all markets as evidence suggests, why does the use of formal credit by MSMEs in developing countries with CBs remain low? A

possible explanation is lack of representation or low coverage of CBs across developing countries (Kusi & Opoku-Mensah, 2018; Loaba & Zahonogo, 2019). Interaction between credit reporting systems and other local legal and institutional factors may provide further understanding as to why the impact of information sharing varies on the basis of market development. Evidence appears to suggest that CR and CB are more effective in advanced markets because of higher level of institutional development in these countries.

These results suggest that for any information sharing mechanism to be effective in developing countries, it must address the problems that are embedded in the specific characteristics of their markets. Poor creditor protection, limited contract enforcement, and higher-risk collateral are important determinants of the effectiveness of information sharing mechanisms in developing countries (Bennardo et al., 2015). These factors must be given significant consideration, if not fully incorporated, when implementing any informational scheme in developing countries. Degryse et al. (2020) show in a study of internal bank data that greater creditor protection results in higher expected loan recovery rates, and higher recovery rate is associated with higher bank lending and lower creditors' liquidation bias. Reducing creditor rights results in fall in collateral values which, in turn, leads to reduction in credit availability and increase in interest rates (Cerqueiro et al., 2016).

Overall, the literature shows that the impact of information sharing mechanisms on credit availability depends on the scope, accessibility, and quality of credit information. Developed markets appear to have these characteristics, hence CRs and CBs have positive effects in these markets. In contrast, credit markets in many developing countries lack these key features to support wide coverage of credit reporting; consequently, information sharing schemes have been less effective. The interaction between informational environment and other key market factors especially creditor protection can impact on credit availability. This is because weak legal protection for creditors encourages borrowers to default strategically knowing that banks cannot force repayment (Schiantarelli et al., 2020).

4.2 Information Sharing as Borrowers' Discipline Device

In markets with imperfect information, borrowers behave opportunistically by borrowing from multiple lenders which increases default probabilities (Bennardo et al., 2015). Empirically, it is shown that firms with higher number of banking relationships are more likely to be credit rationed (Cenni et al., 2015). This suggests that banks expect borrowers with multiple borrowings to default. Information sharing increases lenders' awareness about borrowers' credit behaviour and existing indebtedness. To make sure that their credit information shared by lenders is not negative, borrowers increase their loan servicing efforts and engage in building good credit reputation. For example, one additional year of negative credit information in Sweden is associated with one-fourth decrease in credit (Bos et al., 2018).

Liberman (2016) estimates borrowers' willingness to pay for a good credit reputation in Chile, and the following regression model was used:

$$npv = \alpha + \beta renegotiation + \epsilon \qquad (13)$$

where npv is the sum of present value of monthly payments, $renegotiation$ is a measure of whether borrower renegotiates before write off or not, and ϵ is an error term. The estimate shows that borrowers are willing to pay up to 11% of their income. Renegotiation before write-off gives borrowers with certain balance an opportunity to negotiate additional payment equivalent to 11% of their income to maintain clean credit record. Credit history creates a reputation which is an important component of borrower's creditworthiness profile under information-based lending. Consequently, borrowers' effort to create good credit image is understandably high, and they are willing to achieve it at a cost that is significant when compared with their earnings. Knowing that borrowers are willing to give maximum efforts in protecting their credit reputation assures banks that loans would be serviced or repaid. Interestingly, positive actions by borrowers following reduction in their credit ratings do not immediately eliminate the negative effects associated with the initial damage to reputation, and these borrowers may exit the market within two to three years (Garmaise & Natividad, 2017). It is clear why borrowers value their credit reputation as much as 11% of income. The possibility of being downgraded helps to discipline borrowers who do not want the stigma of negative credit reputation or leaving the credit market altogether.

To investigate the effects of previous contract violation on future loans, Freudenberg et al. (2017) estimate the following regression model:

$$LCT = a + b * \text{prior covenant violation} + c * \text{loan characteristics} +$$
$$d * \text{borrower characteristics} + e * \text{other controls} + \mathcal{E} \qquad (14)$$

Where LCT represent loan contract terms. The finding is that previous contract violation results in tighter covenants and higher spreads in future loan contracts. In addition, the study reveals that defaults create stigma which increases average spread in subsequent loans by up to 18 bps. Similar stigma effect has been reported in Italy, information on rejected loan applications shared by banks results in rejected firms facing tighter screening process in their future applications (Albertazzi et al., 2017). Avoiding negative credit reputation is vital, especially for businesses that rely more on external financing. Therefore, it is not surprising that businesses exert more efforts in their credit dealings with lenders to maintain good credit reputation.

Overall, credit information sharing reduces moral hazard problems in credit markets. This is relevant in all types of market and to both business and household borrowers. It also applies to both secured and unsecured debtors. The disciplinary effects of negative credit information seems stronger in markets where lenders are willing to invest more in screening applicants. In these markets, borrowers recognise that good credit reputation is an important collateral and would do more to protect their positive creditworthiness.

4.3 Private Information and Banks' Incentive to Share

Banks obtain private information through their commercial dealings with borrowers which is only observable to them but not to other Banks (Gropp & Guettler, 2018). Many banks use this information for competition and profit making, especially local and smaller banks that provide the specific needs of local customers in a relationship lending arrangement. Why would banks want to share private information if it is an important competitive tool? Moreover, theory tells us that banks are unlikely to share private information where customers are loyal (Bennardo et al., 2015). Before looking for possible answers to this question, below are some of the benefits of relationship lending to borrowers, lenders and credit markets.

For borrowers, there are several arguments for relationship lending including relaxation of loan covenant tightness as lenders gain more knowledge about firms over the duration of their lending relationship (Prilmeier, 2017). Relationship lending allows smaller banks to offer credit facilities to opaque and small borrowers that have been denied by larger banks (DeYoung et al., 2015; Berger et al., 2017). Filling this funding gap is particularly important in lower income countries which rely on the economic activities of MSMEs. In markets with higher level of firm opacity, a perfect bank-firm match is crucial. If more opaque firms end up with transactional banks rather than relationship banks, the probability of credit rationing increases significantly (Ferri & Murro, 2015). Relationship banks charge higher interest rates in normal times, and many studies have shown that the extra cost is for liquidity insurance which ensures supply of credit to relationship firms at lower charges during financial crisis (Bolton et al., 2016; Beck et al., 2018; Botsch & Vanasco, 2019; Schafer, 2019). However, there are studies that have disagreed with liquidity insurance mechanism, they have found evidence that does not support its argument or any justification for the additional rents (Carvalho et al., 2015; Ferri et al., 2019; Li et al., 2019).[6] With mixed evidence on the insurance mechanism, a possible explanation for the higher interest rates is the *hold-up* effects, which enables relationship banks to extract higher rents from relationship firms. This is one of the major criticisms of relationship lending technique (Beatriz et al., 2018).

Relationship lending benefits lenders in many ways, empirical evidence shows that gathering soft information enables banks to acquire higher quality information (Kirschenmann, 2016), make accurate prediction of default probabilities and financial distress (Li et al., 2019), and lend to high-quality borrowers even during financial crisis (D'Aurizio et al., 2015). However, literature also identifies the danger of completely relying on soft information for internal ratings. Banks should recognise the power of bureaus to provide better prediction of bankruptcy and loan default in the long run (Nakamura & Roszbach, 2018).[7]

The impact of relationship lending on credit markets is not clear-cut; moreover, close-scrutiny is difficult because it is a private-information-based technique. However, studies have compared it with transaction lending technique on the basis of information production and market competition. Under transaction technique, lenders compete with shared information and target to at least break-even per loan per borrower (Sutherland, 2018). Relationship lenders on the other hand, compete with private information and anticipate

long-term dealings with borrowers. The two techniques are also different on incentive to invest in information production. Whilst relationship banks increase their spending in obtaining soft information as competition increases, transaction banks compete with costs efficiency that comes with hard information (Gropp & Guettler, 2018). This suggests that transaction banks make up for their informational disadvantage with costs efficiency of shared information and economies of scale associated with their ability to lend to larger pool of borrowers.

Ferri et al. (2019) use firm-level data from across Europe to study how bank lending technologies and information production affect credit availability. They employed the following probit regression model:

$$y_i^* = \alpha X_i + \beta Z_i + u_i \qquad\qquad (15)$$

Where y_i^* is credit rationing, X_i is the set of lending technologies and soft information production measures, Z_i is a vector of exogenous covariates, and u_i is the residual. The finding is that transaction lending technology is associated with more credit rationing, whereas relationship lending technology is associated with lower information asymmetry and higher access to credit. Additionally, larger banks are able to adopt both technologies, and the combination has positive effects on credit accessibility. In markets dominated by transaction lending technique, banks are more sceptical about the quality of borrowers because they rely on shared information which may be out of date or have been shared inaccurately. This argument is consistent with empirical evidence that firms with positive soft information self-select to relationship banks, and those with negative information go to transaction banks for credit (Gropp & Guettler, 2018). This also means that transaction banks may have to use other technologies such as collateral in addition to shared information in dealing with information asymmetries. The problem with this is that some firms with positive private information will be denied funding along with those that have negative information due to lack of collateral.

Clearly, there are numerous benefits of relationship lending and competing with soft information, including higher credit availability and reduction in asymmetric information between a relationship bank and its borrowers. However, because relationship banks are not sharing private information about their borrowers, it increases informational distance among banks and reduces market competition. Credit information sharing plays the important role of closing informational gaps between the two lending approaches. It drives market competition which helps to increase borrowers' bargaining power, reduces banks' informational rents and adverse selection problems (Sutherland, 2018; Gropp & Guettler, 2018; Wang et al., 2020). It is worth noting, however, that even in perfectly competitive markets, smaller banks are relationship oriented and may always compete with soft information whilst larger banks compete with transaction technique (Gropp & Guettler, 2018; Ferri et al., 2019).

Going back to why banks would want to share private information, there are no direct answers to this question. However, we have provided some evidence-based reasons why they

may do so. First, existence of regulatory requirement that all financial institutions in a country must register with the Public Credit Registry to report their borrowers' credit history (Giannetti et al., 2017). By introducing compulsory registration, financial sector regulators are making sure that credit information reporting is an integral part of market operations. In addition, because Credit Registry is operated directly by the central bank, it gives the authorities direct access to the database for monitoring stability in the banking sector. Second, although lenders are not required to join Credit Bureau, they voluntarily do so in order to have access to other lenders' private information. By joining a Credit Bureau, lenders are automatically agreeing that they would be sharing their private information with other members of the Bureau (Sutherland, 2018).[8] It is not uncommon, however, for lenders to share their information strategically with bureaus. For example, they may join or leave a bureau only when it benefits them to share or not to share their information.[9] Third, when the benefit of private information is small. Technology is reducing the difference between soft and hard information in some advanced credit markets. The process of hardening soft information is becoming faster and the difference between the two types of information in terms value is becoming smaller (Liberti & Petersen, 2019). Consequently, lenders are less reluctant to share information when the difference between private and shared information is immaterial. In addition to the three points discussed so far, liquidity problem may force banks to share private information including that of higher-quality borrowers. Banks that are faced with serious liquidity issue may need to liquidate loan assets by selling them in secondary markets. The only way to signal the quality of their higher loan assets is by sharing debtors' credit history.

In summary, relationship banks play key role in working with small and opaque local firms to bring them into the formal credit system. However, competition is needed to expand activities in credit markets and that comes from information sharing. The incentives to share private information is improving due to Fintech development. Reducing the value of private information is one of the key developments towards a competitive credit market. In a highly automated environment, the advantage derived from private information becomes smaller and for shorter time.[10] It is reported that US automated credit market has grown from 2% to 8% between 2010 and 2016 (Fuster et al., 2019), and relationship banks in the country give discount in normal times and switch to transaction lending once distress is expected (Li et al., 2019). These reports suggest that with low information asymmetry as it is in US market, relationship banks cannot extract higher rents from borrowers because the cost to non-relationship banks is significantly low. Technology appears to be the most sustainable of all the channels and most likely to drive wider coverage of information systems in future years.

4.4 Credit Information Sharing and Bank Risk

When it comes to managing risks associated with information asymmetry in credit markets, relationship lending and collateralization are widely used by banks. From empirical perspective, however, evidence shows that both models have met with various challenges and have failed to address bank risks in many cases. For collateralization, pledging sufficient assets increases borrowers' costs of default because lenders can easily repossess

collateralized assets or force repayment in the event of default. However, experience from the last global financial crisis teaches us the danger associated with collateralization especially in markets dominated by real estate (Altunbas et al., 2017; Liberti & Sturgess, 2018). Majority of banks that were mostly affected by the 2009 financial crisis are those with excessive real estate lending prior to the crisis (Altunbas et al., 2017). Relationship lending on the other hand, enables lenders to learn about borrowers and their businesses as relationship progresses between the two; therefore, helps to reduce information asymmetries and bank risk (Hirsch et al., 2018). However, relationship lending increases adverse selection problems faced by non-relationship lenders (Stroebel, 2016; Gropp & Guettler, 2018).

The failure of these earlier approaches to address the effects of information asymmetry in credit markets makes credit information sharing a perfect solution in principle. By exchanging borrowers' credit history, lenders do not only reduce information asymmetries between them and borrowers but also among themselves. Consistent with these predictions, evidence shows that credit information sharing reduces adverse selection and ex post moral hazard problems in credit markets (Sorge et al., 2017). Guerineau & Leon (2019) study the effects of credit information sharing on financial stability in 159 countires, the following probit model was used:

$$\Pr\left(BSF_{it} = 1\right) = \alpha + \beta IS_{it-1} + \Gamma X_{it} + \mu_t + \mathcal{E}_{it} \tag{16}$$

Where *BSF* is the country's financial fragility, *IS* is information sharing, *X* is a matrix of control variables and μ_t represent time dummies. The result is that information sharing reduces fragility in both advanced and emerging financial markets. It shows that information sharing reduces nonperforming loans where there is control of credit boom especially in developing countries. Similarly, Fosu et al. (2020) report in a study of 87 developing countries that increase in information sharing is associated with lower default rates, and this effect is higher in countries with competitive credit markets.

Transparent credit markets have higher loan quality, lower default probability, and lower losses upon default (Ertan et al., 2017). Despite these benefits, information sharing is a source of another major risk in credit markets, misrepresentation of information. Borrowers are more likely to overvalue rather than undervalue their assets; therefore, increases bank risks (excessive lending, poor quality loan assets, and high default rates). Garmaise (2015) shows that majority of a US bank's mortgage borrowers reported their assets above thresholds of which many were misreported. These borrowers were found to have 25% higher likelihood of becoming delinquent and unable to repay their loans. Garmaise (2015) use a regression discontinuity estimation:

$$Delinquent_{i,t} = \alpha + \beta I_{A_{i,t}} + \sum_{j=1}^{6} \omega_j^A A_{i,t}^j + \sum_{j=1}^{6} \xi_j^A I_{A_{i,t}} A_{i,t}^j + \gamma * controls_{i,t} + \lambda_t + \epsilon_{i,t} \tag{17}$$

Where $Delinquent_{i,t}$ is an indicator for whether loan subsequently becomes delinquent, $A_{i,t}$ is the personal asset claimed by borrower, $I_{A_{i,t}}$ indicates whether asset is above threshold, $controls_{i,t}$ is a vector of loan and property controls, λ_t is a month fixed effect, and $\epsilon_{i,t}$ is the

error term. In addition to the above findings, the study reports 40% rate of delinquency for borrowers with unverified assets. This suggests that on average, unobserved characteristics of borrowers have almost equal probabilities of being negative as being positive. Screening loan applicants on individual basis enables lenders to have a better prediction of loan performance. However, with growing use of hard information and shorter screening time, detailed assessment on individual basis is unlikely especially in competitive credit markets (Berg et al., 2020).

The fact that US mortgage loan market is characterised by misrepresentation of information (Griffin & Maturana, 2016) is consistent with the evidence that as information sharing increases market competition, more lenders adopt transaction lending technology (Sutherland, 2018). These lenders compete with small profit margin; therefore, reducing screening costs per borrower is inevitable. However, reducing screening costs and informational activities increase the probability that credit information is misreported either by lender or borrower, intentionally or unintentionally.

Competition influences how information is shared or used by banks. As the use of shared information increases, the risk of misrepresentation also increases. Banks may reduce lending standards to increase supply of credit which results in excessive lending (Daley et al., 2020), or misselling of financial products (Berg et al., 2020). Lowering credit standards to increase lending volume results in creation of low-quality loan portfolio. Rajan et al. (2015) recommend that when the underlying lending regime has changed, lenders must adjust their model variables with up-to-date information to reflect the new market. However, this is not always the case due to incentive issues, especially where up-to-date information does not favour lending increase. The use of hard data (shared information) allows key financial variables such as Loan-to-value (LTV) to be manipulated easily (Berg et al., 2020). This provides numerical support or justification for reckless lending.

Gorton & Ordonez (2020) explain "information cycles – the transit of financial system from a symmetric information regime to a symmetric ignorance regime". They demonstrate informational regimes that are consistent with business cycle whereby lenders have no incentives to obtain information about borrowers and their collateral during good times. Therefore, relaxing examination of collateral increases lending volume of which many are of lower quality and are likely to default *ex-post*. In addition to information about borrowers' characteristics, up-to-date information about collateral ownership or existing interest and quality enable lenders to establish assets' expected recovery rates in the event of default.

With higher banking competition, manipulation of hard information is common among employees of financial institutions. Berg et al. (2020) investigate manipulation of hard information by loan officers of a major European bank. They estimated the following difference-in-differences model:

$$Log(number\ of\ trials) = \beta_1 Treated + \beta_2 PostJan2009 + \\ \beta_3 Treated \times PostJan2009 + \delta X + \mathcal{E}, \qquad (18)$$

Where $number\ of\ trials$ is the number of scoring trials, $Treated$ measures the initial rating of loan applications, $PostJan2009$ is an indicator for loan applications made in or after January 2009, $Treated \times PostJan2009$ is the interaction term between $Treated$ and $PostJan2009$, and X is a set of control variables. Overestimation of borrowers' creditworthiness, increase in issue of lower quality loans, higher default rates, and 5-10% profit reduction were reported in the study. Other studies focusing on the effects of volume-based incentive in banking have shown similar results that it induces loan officers to originate more loans based on hard information and of lower quality (Cole et al., 2015; Agarwal & Ben-David, 2018). Where lending decisions are based on hard information, evidence shows that delegating authority to loan officers (Qian et al., 2015) or working together with a risk manager (Berg, 2015), may reduce loan officers' incentive issues. However, these approaches are unlikely to work where excessive lending is driven by bank's market-share-based policies to encourage new business prospecting.

Other than manipulation of credit information for internal purposes such as increasing the internal ratings of borrowers to increase market share as shows in the above paragraph, banks do intentionally misreport credit information to increase adverse selection problems faced by other banks. Giannetti et al. (2017) investigate the impact of banks' registration with CR as a regulatory requirement in Argentina using difference-in-differences specification:

$$Downgrade_{i,b,t}^{1to2,s} = \beta_0 + \beta_1 Treated_i + \beta_2 Treated_i \times Interim_t$$
$$+\beta_3 Treated_i \times Post_t + \xi_t + \lambda_b + \phi_{b,t} + \mathcal{E}_{i,t} \qquad (19)$$

Where $Downgrade_{i,b,t}^{1to2,s}$ represent downgrade of highest quality borrower by a lender, $Interim_t$ and $Post_t$ represent the interim and post periods of the registry reform announcement, $Treated_i$ represents borrowers with maximum borrowing below \$200,000 in pre-announcement period and are excluded from registry, ξ_t, λ_b and $\phi_{b,t}$ are time, bank and bank-time fixed effects. The finding is that banks downgrade higher quality borrowers and upgrade lower quality borrowers before sharing their information. They added that manipulating information allows banks to protect their informational monopoly, prevent borrowers' access to multiple borrowings and creditors run.[5] It is not uncommon for banks to protect their higher-quality borrowers even at the expense of other lenders because over-indebtedness impairs borrowers' financial capacity to service or repay existing loans. However, negative manipulation of information before sharing with CR increases the adverse selection faced by other banks relying on this information, this reduces the performance of credit markets.

On information sharing and financial crises, financial crises are described as informational events because information becomes more sensitive around crisis and reporting more precise data exacerbates the negative effects of shock which increases default risk of low performing banks (Brancati & Macchiavelli, 2019). This suggests that low performing banks are more likely to go into distress during crises when customer deposits are lower and shareholders' funds get eroded very quickly. It also means that highly performing banks can perform even better during financial crisis due to information sensitivity. Sharing precise information about their high performance and the quality of loan portfolio attract

businesses from higher-quality customers. However, banks in general limit production and sharing of information during financial crisis to avoid the negative effects (Armantier et al., 2015).

In sum, credit information sharing reduces bank risk arising from information asymmetry between banks and borrowers. Banks can estimate more accurate default probabilities, price credit more appropriately, and are able to protect their interest with higher interest charges when they decide to lend to lower quality borrowers. However, banks face higher risks arising from information asymmetry between banks, misrepresentation and manipulation of information among banks and their employees. As information sharing increases market competition, lenders tend to reduce costs to improve profitability and this includes costs of information and screening by simply relying on collateralization. As a result, information about collateral is as important as that of borrowers' characteristics in credit markets.

5. Effectiveness of Information Sharing Schemes and ongoing role of regulatory authorities

The literature has shown that the existence of Credit Registry, Credit Bureau or both can increase market competition and credit availability, reduce adverse selection, discipline borrowers, reduce hold-up problems and interest rates. These positive results certainly justify the establishment of credit information sharing schemes. However, the literature also presents some easily identifiable negative patterns, including misrepresentation of shared data and ineffectiveness of the current version of Credit Registry in developing countries. These results suggest that the role of central banks in ensuring effective credit information systems goes beyond the establishment of Registry. An ongoing monitoring of information regime and the behaviour of market participants are equally vital.

5.1. Excessive Credit Growth and Regulatory Response

We have seen that information sharing increases market competition, and competitive markets are dominated by transaction lenders who compete with limited profit but with higher lending volume. Joining a bureau means adopting transaction lending technique (Sutherland, 2018), this affects how banks compete considerably. Having identified higher quality borrowers or sector, banks reduce informational activities and lending standards but increase lending to these group of borrowers or sector until credit injection becomes excessive and unprofitable (Blek & Liu, 2018, Gorton & Ordonez, 2020). This is driven by the need to increase market share as competition grows. A considerable body of empirical work shows widespread misrepresentation and manipulation of shared information by banks and their employees to increase lending volume (Rajan et al., 2015; Berg et al., 2020). The problem with this is that granting more loans above what is needed for productive economic activities increases the creation of weaker loan portfolio and future nonperforming loans.

In terms of intervention, whether excess credit growth is considered highly volatile or crisis inducing and therefore warrant supervisory or regulatory intervention depends on a

number of factors including the rate of growth and market fragility. Increase in lending is good for entrepreneurs who need funds for their projects, for banks' profitability and markets' overall performance. Credit booms are very common (Gorton & Ordonez, 2020), whereas boom-busts are relatively rare (Jorda et al., 2015). Even so, an important question is when can regulators intervene and with what policies? Separating crisis-inducing credit growth from good ones is difficult. However, literature suggests that fragile financial sector measure by rising credit-to-GDP ratios, low credit spreads, rising loan-to-deposit ratios and house prices are preconditions for financial crisis (Jorda et al., 2015; Richter et al., 2020). These ratios can help regulators to monitor market performance and identify when loan growth becomes abnormal or requires intervention. The literature is divided on controlling credit growth and which policies are more appropriate. The use of any regulatory policies depends on the volatility of excess credit and crisis probability (Gourio et al., 2018), and policymakers are advised to use these policies with caution (Adrian & Liang, 2018). For example, the central bank may use monetary policy to control excess credit growth, this can reduce the probability of crisis. However, Svensson (2017) shows that the costs of such policy are higher than the benefits because it may lead to a weaker economy whether crisis eventually occurs or not.

When there is stability in the financial sector, regulatory response to excess credit growth may focus on adjusting existing policies. For example, the behaviour of banks when it comes to risk taking is likely to be influenced by the existence of government bailout, or capital requirement and how they are estimated. Evidence shows that where banks are allowed to use their internal risk estimates in determining capital requirements, the incentive to report lower risk also grows (Plosser & Santos, 2018). Banks have complex information structure which makes it difficult for regulators to verify internal ratings. Consequently, this creates incentive to take higher lending risk and manipulate internal ratings data to influence their overall risk estimates. Banks with low capital base consistently underreport risk estimates (Firestone & Rezende, 2016; Begley et al., 2017; Plosser & Santos, 2018). To disincentivize misrepresentation in the US, the accuracy of internally generated risk estimates is one criterion for Basel III adoption (Plosser & Santos, 2018). In other markets, regulators use a 'backtesting' procedure which assesses bank's risk model, a penalty is given for poor model, plus increase in capital requirement for consistent inaccurate risk reporting (Begley et al., 2017).

Overall, the control of credit risk has been heavily debated, and different measures are used in different countries to determine when intervention is needed. However, where credit growth is driven my widespread negative manipulation of ratings data especially in advanced markets as the literature has shown, it is useful to know which market characteristics are associated with this lending behaviour. More specifically, establishing which macroprudential policies that incentivize this lending behaviour will expand existing knowledge in the literature.

5.2 Information sharing schemes in developing countries and Regulatory responses

Credit Registry and Credit Bureau have not delivered the anticipated positive results in developing countries (Giannetti et al., 2017; Loaba & Zahonogo, 2019). Credit rationing remains high, and lenders continue to rely on relationship lending to gain awareness about borrowers and their business operations (Kirschenmann, 2016; Wang et al., 2020).

There are two possible explanations for the low impact of both CR and CB in developing countries. First, low representation. Both CR and CB report information about borrowers' credit history. However, around 80% of firms in developing countries do not have access to formal credit (Sultanov et al., 2019); therefore, they do not have formal credit history. This means the reporting systems only represent around 20% of firms in these markets.

Figure 5.1 Regional Coverage of Credit Registry
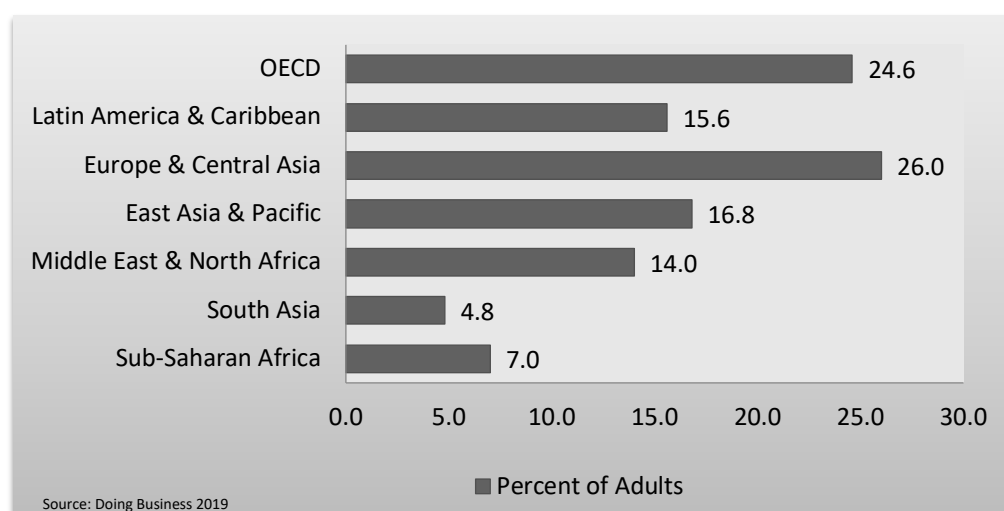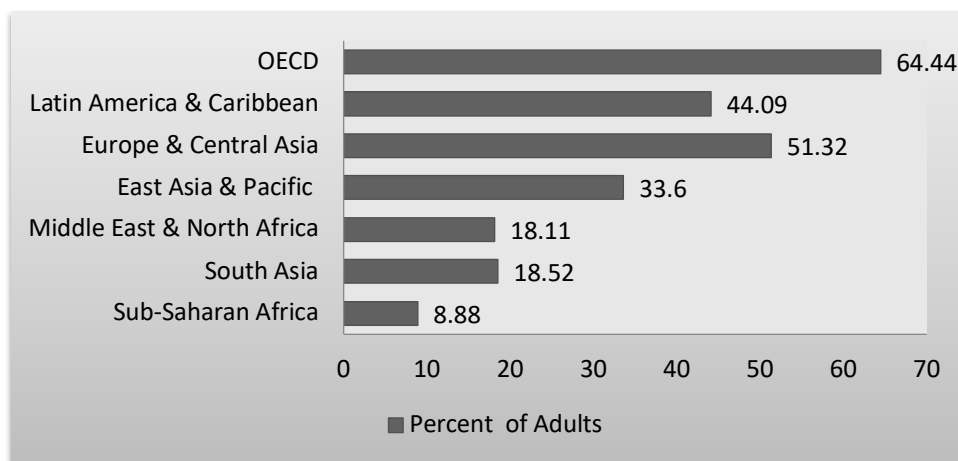

Source: Doing Business 2019

Figure 5.2 Regional Coverage of Credit Bureau

These figures clearly demonstrate weak coverage of information reporting systems across developing countries. For example, figure 5.1 shows that CR coverage is only 4.8% in South Asia and 7% in Sub-Saharan Africa. Similarly, in figure 5.2, CB only covers 18.5% of South Asia and 8.8% of Sub-Saharan Africa. With low coverage of information reporting systems coupled with limited access to credit, it is not surprising that empirical evidence has revealed minimum impact. Higher coverage of information system is needed across low- and middle-income countries. Second, higher transaction costs. CR reports are generally for larger loans whilst CB reports are for individual and smaller business loans. If majority of businesses in a country are MSMEs as it is in most developing countries, the reporting role of CB is vital. However, because CBs trade for profit, they can only provide profitable reports, and this means it might not be profitable to report on much smaller businesses. Consequently, majority of small businesses are completely excluded from credit reporting systems. In fact, for those that reports can be obtained, the associated costs may outweigh the returns for lenders. Low-cost information is needed in developing countries.

Those in charge of market reforms in many developing countries have recognised that reforms are required to directly address these problems from within by focusing on country-specific issues. For example, weak legal and institutional development have contributed hugely to the poor performance of existing information sharing mechanisms. The choices of reform in many of these countries in recent years suggest that they are finding alternative ways to improve credit market activities rather than relying on what works in advanced markets. The following two reforms have become popular in recent years.

Collateral Law Reforms: Not having the right or sufficient collateral is one of the biggest problems facing borrowers in developing countries. Consequently, many have reformed their collateral laws in a scheme "Secured transactions law reform" which allows the use of movable assets as collateral in debt contracting (Chavez et al., 2018). As a way of promoting stability in the banking sector, collateral laws in many emerging countries do not permit the use of most types movable assets as collateral (Sultanov et al., 2019). This has been identified as missed opportunity, not only because movable assets are heavily collateralized in developed markets (Calomiris et al., 2017), but because about 78-80% of total assets of firms in developing countries are movable assets (Chavez et al., 2018). By establishing legal and institutional environment that permit the use of firm's specific assets as collateral, this reform is expected to expand the market. Empirically, the effectiveness of movable collateral law reform has been tested. Campello & Larrain (2016) show that following movable assets collateral reform in Romania, firms with more movable assets have borrowed significantly more and their business activities have improved significantly too. Similarly, Calomiris et al. (2017) report a cross-country evidence which also confirms rise in firms' use of bank loans due to their ability to collateralize movable assets.

Registry Reforms: Security Rights Registry or Collateral Registry is a publicly available database of security interests in assets, business or other forms collateral (Chavez et al., 2018). Security Rights Registry allows Incorporated and unincorporated businesses and households to register their inventory, receivables, equipment, farm, business operation, or entire self-employed for credit. There are no formalities required, users can easily register

online from any part of the country and doing so connect them to formal credit market automatically. The registries are established and controlled by financial sector regulators which enables them to monitor information about credit performance, risk and contribution to the financial stability (Sultanov et al., 2019). On empirical level, the only evidence on the effectiveness of collateral registry is the study by Love et al. (2016) which shows that it is associated with higher access to bank finance in seven countries. This study has shown that collateral registry has the informational capacity that it has been designed for. However, further evidence is needed on its wider coverage and access to formal credit by different groups of borrowers, quality of loans and real economic activities in developing countries.

In summary, emerging markets are responding to the failure of CRs and low coverage of CBs with reforms that are designed according to their needs. Collateral registry is one of the most recent reforms; however, without sufficient evidence, its effectiveness cannot be determined. This area provides important research opportunities in the literature to investigate the introduction of online-based registries in markets where there have been CRs and CBS. This can be extended to markets where there have been movable collateral law reforms for some years before collateral registry is introduced. If the theoretical promises of online-based registry can be empirically proven and the market environment where it is most likely to be successful is established, it would have significant policy implications.

6. Conclusion and Promising Research Ideas

6.1 Concluding Remarks and Gaps in Existing Research

Theory predicts that by reducing adverse selection and incentive conflicts in credit markets, information sharing increases access to credit and reduces bank risk. In this survey, we provide a review of recent evidence from advanced and developing countries.

Evidence agrees that the exchange of past defaults information by lenders is an effective way to discipline borrowers. It discourages opportunistic borrowing and over indebtedness. Other than defaults due to genuine economic shock, majority of borrowers are committed to servicing their loans to avoid damaging credit reputation and the stigma that comes with it. Credit information sharing reduces adverse selection and default rates where information is shared or used accurately. However, significant number of studies show that the use of shared information in loan screening exercise is associated with misrepresentation of data including manipulation of borrowers' ratings to increase market share. This appears to be a common characteristic of both developing and advanced markets. Additionally, there is strong evidence that information sharing reduces credit rationing and increases the number of firms using bank loans. However, these results depend on legal and institutional development, market characteristics and the quality of information shared. The effects of Credit Registries and Bureaus in developing countries are not as positive as they are in advanced markets. Whilst Bureaus have made positive impact in some developing countries, Registries have been poor overall, with evidence of negative impact on credit availability in many countries. We discover significantly low coverage of both Registries and Bureaus in

developing countries which suggests low representation of businesses in the information systems.

Overall, the literature presents evidence that the effectiveness of credit information sharing is conditional on market development. Both Credit Registry and Bureau lack the power to address information asymmetry and financing problems in less developed countries. However, the adoption of Collateral Registry has grown in these countries in recent years. Evidence is needed to establish whether it can improve credit activities and the quality of information. Future policy-oriented Promising Research Ideas have been provided in section 6.2 to fill the gaps identified in the literature.

6.2 Promising Research Ideas (PRIs)

Online Collateral Registry: Democratization of Credit and the role of creditor protection. Focusing on developing countries where CRs and CBs have not been effective, this paper will examine the effectiveness of Collateral Registry in expanding access to credit. For the purpose of this study, 'Democratization of credit' means access to formal credit by all firms including small, young, rural, and those excluded from formal credit markets (Aretz et al., 2020). With widespread adoption of mobile phones in the last decade across developing countries, most businesses including MSMEs in rural areas can voluntarily register their information regardless of their location. It is expected that stronger representation and low-costs information can be achieved where there is Online Collateral Registry. However, credit reporting may not increase lending in developing countries when there is weak creditor protection coupled with risky collateral (Bennardo et al., 2015); therefore, these factors will be taken into account.

Online Collateral Registry: Innovation and entrepreneurship. Lenders involvement with borrowers on the platform goes beyond lending, it provides opportunities for entrepreneurs to benefit from the expertise of lenders. Some of the credit arrangements that Online Collateral Registry facilitates give secured interest creditors a stake-like interest in a firm's current and future cash flows (Degryse et al., 2020). For example, the revolving line of credit whereby a lender commits to grant credit that will be paid to a borrower over agreed period and series of events. Knowing that the overall performance of loan depends on the outcomes of these events, lenders help firms to succeed. Interest in future cash flows of firm also help to reduce liquidation bias in favour of reorganization in the event of default. accordingly, the new Collateral Registry is expected to drive firms' innovation and entrepreneurship.

Online Collateral Registry: credit allocation and efficiency. The literature suggests that CRs and CBs credit reports are associated with excessive supply of lower quality loans (that is, misallocated loans). The intention in this paper is to investigate whether the establishment of Online Collateral Registry can improve the allocative efficiency in credit markets. Additionally, this study will be extended to investigate whether the presence of misallocation is due to risk-taking or lower quality information.

Impact of Regulatory Policies on the Effectiveness of Information Sharing: This study will examine the linkages between existing regulatory policies in a country and lenders' incentives to share or use borrowers' information accurately. Misrepresentation of shared data by lenders to increase lending volume and underreport risk is widely reported. Which regulatory policies incentivize this behaviour?

Covid-19 and the Effectiveness of Credit Information and Reporting: The aim of this study is to investigate the impact of covid-19 on the use of credit information in both formal and informal markets. Small businesses in many developing countries rely on informal financing, the outbreak of Covid-19 may have heightened this reliance. it would be interesting to find out whether the impact on the flow of credit information has shifted the market either way.

Notes

[1] Punishment may include expensive future loans or complete credit refusal.

[2] Banks offer more loans to already indebted borrowers to earn higher interest rates. However, this increases the risk associated with borrowers' existing loans.

[3] The theoretical predictions include:

Prediction 1: information sharing reduces adverse selection problems faced by lenders.
Prediction 2: information sharing reduces interest rates and borrowers' switching costs.
Prediction 3: information sharing reduces borrower moral hazard through the disciplinary channel.
Prediction 4: information sharing disincentivizes over-borrowing from multiple lenders.

[4] Theoretical literature predicts that information sharing may not improve financing in all cases, especially in emerging markets with high collateral volatility and poor creditor rights protection (Bennardo et al., 2015).

[5] Giannetti et al. (2017) added that where credit information is manipulated before sharing with public registry, market performance and access to credit are unlikely to be enhanced.

[6] Justifying liquidity insurance is difficult because smaller banks that are more likely to compete with relationship lending technique are also more likely to face liquidity problems during crisis. Therefore, they unable to fund customers' project during crisis.

[7] For example, the true quality of most long-term collateralized loans is not known until many future years. Banks can rely on historical records to make better predictions about future performance rather than soft information.

[8] when lenders decide to join a Bureau, they have equally decided to share their borrowers' credit files.

[9] Sutherland (2018) shows that as soon as lenders have joined a US Bureau, they become transaction banks, all loan contracts become shorter in terms of maturity, covenants, and frequency of payment.

[10] Automation has significantly improved the accuracy of default predictions and comparability of databases across the world (Buckak et al., 2018; Fuster et al., 2019).

References

Agarwal, S. & Ben-David, I., 2018. Loan prospecting and the loss of soft information. *Journal of Financial Economics*, 129, pp. 608-628.

Adrian, T. & Liang, N., 2018. Monetary policy, financial conditions, and financial stability. *International Journal of Central Banking*, 14, pp. 73-131.

Albertazzi, U., Bottero, M. & Sene, G., 2017. Information externalities in the credit market and the spell of credit rationing. *Journal of Financial Intermediation*, 30, pp. 61-70.

Altunbas, Y., Manganelli, S. & Marques-Ibanez, D., 2017. Realized bank risk during the great recession. *Journal of Financial Intermediation*, 32, pp. 29-44.

Aretz, K., Campello, M. & Marchica, M.-T., 2020. Access to collateral and the democratization of credit: France's reform of the Napoleonic Security Code. *Journal of Finance*, 75(1), pp. 45-90.

Armantier, O., Ghysels, E., Sarkar, A. & Shrader, J., 2015. Discount window stigma during the 2007-2008 financial crisis. *Journal of Financial Economics,* 118(2), pp. 317-335.

Bahadir, B. & Valev, N., 2019. Credit information sharing and the shift in bank lending towards households. *International Journal of Finance and Economics*, 1, pp. 1-13.

Balduzzi, P., Brancati, E. & Schiantarelli, F., 2018. Financial markets, banks' cost of funding, and firms' decisions: Lessons from two crises. *Journal of Financial Intermediation*, 36, pp. 1-15.

Beatriz, M., Coffinet, J. & Nicholas, T., 2018. Relationship lending and SMEs' funding costs over the cycle: Why diversification of borrowing matters. *Journal of Banking & Finance*, In Press.

Beck, T., Degryse, H., De Haas, R. & Van Horen, N., 2018. When arm's length is too far: Relationship banking over the credit cycle. *Journal of Financial Economics*, 127(1), pp. 174- 196.

Begley, T. A., Purnanandam, A. & Zheng, K., 2017. The strategic underreporting of bank risk. *Review of Financial Studies*, 30(10), pp. 3376-3415.

Bennardo, A., Pagano, M. & Piccolo, S., 2015. Multiple bank lending, creditor rights, and information sharing. *Review of Finance*, 19, pp. 519-570.

Berger, A. N., Bouwman, C. H. S. & Kim, D., 2017. Small bank comparative advantages in alleviating financial constraints and providing liquidity insurance over time. *Review of Financial Studies,* 30(10), pp. 3416-3454.

Berger, A. N., Frame, S. W. & Ioannidou, V., 2016. Reexamining the empirical relation between loan risk and collateral: The roles of collateral liquidity and type. *Journal of Financial Intermediation*, 26, pp. 28-46.

Berg, T., 2015. Playing the devil's advocate: The causal effects of risk management on loan quality. *Review of Financial Studies*, 28(12), pp. 3367-3406.

Berg, T., Burg, V., Gombovic, A. & Puri, M., 2020. On the rise of FinTechs: Credit scoring using digital footprints. *Review of Financial Studies,* 33(7), pp. 2845-2897.

Berg, T., Puri, M. & Rocholl, J., 2020. Loan officer incentives, internal rating models, and default rates. *Review of Finance*, 24(3), pp. 529-578.

Bester, H., 1985. Screening vs. rationing in credit markets with imperfect information. *American Economic Review*, 75(4), pp. 850-855.

Bird, A., Karolyi, S. A. & Ruchti, T. G., 2019. Information sharing, holdup, and external finance: Evidence from private firms. *Review of Financial Studies*, 32(8), pp. 3075-3104.

Blek, A. & Liu, X., 2018. Credit expansion and credit misallocation. *Journal of Monetary Economics*, 94, pp. 27-40.

Bolton, P., Freixas, X., Gambacorta, L. & Mistrulli, P. E., 2016. Relationship and transaction lending in a crisis. *Review of Financial Studies*, 29(10), pp. 2643-2676.

Boot, A. W. A., Thakor, A. V. & Udell, G. F., 1991. Secured lending and default risk: Equilibrium analysis, policy implications and empirical results. *Economic Journal*, 101(406), pp. 458-472.

Bos, M., Breza, E. & Liberman, A., 2018. The labor market effects of credit market information. *Review of Financial Studies,* 31(6), pp. 2005-2037.

Botsch, M. & Vanasco, V., 2019. Learning by lending. *Journal of Financial Intermediation*, 37, pp. 1-14.

Brancati, E. & Macchiavelli, M., 2019. The information sensitivity of debt in good and bad times*. Journal of Financial Economics*, 133(1), pp. 99-112.

Buckak, G., Matvos, G., Piskorski, T. & Seru, A., 2018. Fintech, regulatory arbitrage, and the rise of shadow banks. *Journal of Financial Economics,* 130(3), pp. 453-483.

Calomiris, C. W., Larrain, M., Liberti, J. & Sturgess, J., 2017. How collateral laws shape lending and sectoral activity. *Journal of Financial Economics*, 123(1), pp. 163-188.

Campello, M. & Larrain, M., 2016. Enlarging the contracting space: Collateral menus, access to credit, and economic activity. *Review of Financial Studies*, 29(2), pp. 349-383.

Carvalho, D., Ferreira, M. A. & Matos, P., 2015. Lending relationships and the effects of banks distress: Evidence from the 2007-2009 financial crisis. *Journal of Financial and Quantitative Analysis,* 50(6), pp. 1165-1179.

Cenni, S., Monferra, S., Salotti, V. & Sangiorgi, M., 2015. Credit rationing and relationship lending. Does firm size matter? *Journal of Banking and Finance,* 53, pp. 249-265.

Cerqueiro, G., Ongena, S. & Roszbach, K., 2016. Collateralization, bank loan rates, and monitoring. *Journal of Finance,* 71(3), pp. 1295-1322.

Chavez, E., Koch-Saldarriaga, K. & Quesada, M., 2018. Improving access to finance for SMEs: Opportunities through credit reporting, secured lending and insolvency practices*.* [Online] Available at: https://www.doingbusiness.org/content/dam/doingBusiness/media/Special-Reports/improving-access-to-finance-for-SMEs.pdf

Cole, S., Kanz, M. & Klapper, L., 2015. Incentivizing calculated risk-taking: Evidence from an experiment with commercial bank loan officers. *Journal of Finance*, 70(2), pp. 537-575.

Daley, B., Green, B. & Vanasco, V., 2020. Securitization, ratings, and credit supply. *Journal of Finance*, 75(2), pp. 1037-1082.

D'Aurizio, L., Oliviero, T. & Romano, L., 2015. Family firms, soft information and bank lending in a financial crisis. *Journal of Corporate Finance*, 33, pp. 279-292.

Degryse, H., Ioannidou, V., Liberti, J. M., Sturgess, J., 2020. How do laws and institutions affect recovery rates for collateral? *Review of Corporate Finance Studies,* 9(1), pp. 1-43

Deyoung, R., Gron, A., Torna, G. & Winton, A., 2015. Risk overhang and loan portfolio decisions: Small business loan and supply before and during the financial crisis. *Journal of Finance*, 70(6), pp. 2451-2488.

Diamond, D. W., Hu, Y. & Rajan, R. G., 2020. Pledgeability, industry liquidity, and financing cycles. *Journal of Finance*, 75(1), pp. 419-461.

Doing Business, 2017. Equal opportunity for all. [Online] Available at: https://www.doingbusiness.org/content/dam/doingBusiness/media/AnnualReports/English/DB17-Report.pdf.

Ferri, G. & Murro, P., 2015. Do firm-bank 'odd couples' exacerbate credit rationing? *Journal of Financial Intermediation*, 24(2), pp. 231-251.

Ferri, G., Murro, P., Peruzzi, V. & Rotondi, Z., 2019. Bank lending technologies and credit availability in Europe: What can we learn from the crisis? *Journal of International Money and Finance*, 95, pp. 128-148.

Firestone, S. & Rezende, M., 2016. Are banks' internal risk parameters consistent? Evidence from syndicated loans. *Journal of Financial Services Research*, 50, pp. 211- 242.

Fosu, S., Danso, A., Agyei-Boapeah, H., Ntim, C. G. & Adegbite, E., 2020. Credit information sharing and loan default in developing countries: The moderating effect of banking market concentration and national governance quality. *Review of Quantitative Finance & Accounting,* 55, pp. 55-103.

Freudenberg, F., Imbierowicz, B., Saunders, A. & Steffen, S., 2017. Covenant violations and dynamic loan contracting. *Journal of Corporate Finance,* 45, pp. 540-565.

Fuster, A., Plosser, M., Schnabl, P. & Vickery, J., 2019. The role of technology in mortgage lending. *Review of Financial Studies*, 32(5), pp. 1854-1899.

Garmaise, M. J., 2015. Borrower misreporting and loan performance*. Journal of Finance*, 70(1), pp. 449-484.

Giannetti, M., Liberti, J. M. & Sturgess, J., 2017. Information sharing and rating manipulation. *Review of Financial Studies*, 30(9), pp. 3269-3304.

Gorton, G. & Ordonez, G., 2020. Good booms, bad booms. *Journal of the European Economic Association*, 18(2), pp. 618-665.

Gourio, F., Kashyap, A. & Sim, J. W., 2018. The trade offs in leaning against the wind. *IMF Economic Review,* 66, pp. 70-115

Grajzl, P. & Laptieva, N., 2016. Information sharing and the volume of private credit in transition: Evidence from Ukrainian bank-level panel data. *Journal of Comparative Economics,* 44(2), pp. 434-449

Griffin, J. M. & Maturana, G., 2016. Who facilitated misreporting in securitized Loans? *Review of Financial Studies*, 29(2), pp. 384-419.

Gropp, R. & Guettler, A., 2018. Hidden gems and borrowers with dirty little secrets: Investment in soft information, borrower self-selection and competition. *Journal of Banking & Finance,* 87, pp. 26-39.

Guerineau, S. & Leon, F., 2019. Information sharing, credit booms and financial stability: Do developing economies differ from advanced countries? *Journal of Financial Stability,* 40, pp. 64-76

Hirsch, B., Nitzl, C. & Schoen, M., 2018. Interorganisational trust and agency costs in credit relationships between savings banks and SMEs. *Journal of Banking & Finance*, 97, pp. 37-50.

IFC, 2019. SME initiatives. [Online] Available at: https://www.ifc.org/wps/wcm/connect/REGION__EXT_Content/Regions/Sub Saharan+Africa/Advisory+Services/SustainableBusiness/SME_Initiatives/.

Jorda, O., Schularick, M. & Taylor, A. M., 2015. Betting the house. *Journal of International Economics*, 96(1), pp. S2-S18.

Kirschenmann, K., 2016. Credit rationing in small firm-bank relationships. *Journal of Financial Intermediation*, 26, pp. 68-99.

Kusi, B. A. & Opoku-Mensah, M., 2018. Does credit information sharing affect funding cost of banks? Evidence from African banks. *International Journal of Finance & Economics*, 23, pp. 19-28.

Liberman, A., 2016. The value of a good credit reputation: Evidence from credit card renegotiations. *Journal of Financial Economics*, 120, pp. 644-660.

Liberti, J. M. & Petersen, M. A., 2018. Information: hard and soft. *Review of Corporate Finance Studies*, 8, pp. 1-41.

Liberti, J. M. & Sturgess, J., 2018. The anatomy of a credit supply shock: Evidence from an internal credit market. *Journal of Financial & Quantitative Analysis,* 53(2), pp. 547-579.

Li, Y., Lu, R. & Srinivasan, A., 2019. Relationship bank behaviour during borrower distress. *Journal of Financial & Quantitative Analysis,* 54(3), pp. 1231-1262.

Loaba, S. & Zahonogo, P., 2019. Effects of information sharing on banking credit and economic growth in developing countries: Evidence from the West African Economic and Monetary Union. *International Journal of Finance & Economics*, 24(3), pp. 1079-1090.

Love, I., Peria, M. S. M. & Singh, S., 2016. Collateral registries for movable assets: Does their introduction spur firms' access to bank finance. *Journal of Financial Services Research,* 49, pp. 1-37.

Nakamura, L. I. & Roszbach, K., 2018. Credit ratings, private information, and bank monitoring ability. *Journal of Financial Intermediation*, 36, pp. 58-73.

OECD, 2018. Enhancing SME access to diversified financing instruments, *Discussion Paper*. [Online] Available at: https://www.oecd.org/cfe/smes/ministerial/documents/2018-SME-Ministerial Conference-Plenary-Session-2.pdf.

Padilla, J. A. & Pagano, M., 1997. Endogenous communication among lenders and entrepreneurial incentives. *Review of Financial Studies*, 10(1), pp. 205-236.

Padilla, J. A. & Pagano, M., 2000. Sharing default information as a borrower discipline device. *European Economic Review*, 44(10), pp. 1951-1980.

Pagano, M. & Jappelli, T., 1993. Information sharing in credit markets. *Journal of Finance*, 48(5), pp. 1693-1718.

Plosser, M. C. & Santos, J. A. C., 2018. Banks' incentives and inconsistent risk models. *Review of Financial Studies*, 31(6), pp. 2080-2112.

Prilmeier, R., 2017. Why do loans contain covenants? Evidence from lending relationships. *Journal of Financial Economics*, 123(3), pp. 558-579.

Qian, J., Strahan, P. E. & Yang, Z., 2015. The impact of incentives and communication costs on information production and usage: Evidence from bank lending. *Journal of Finance,* 70(4), pp. 1457-1493.

Rajan, U., Seru, A. & Vig, V., 2015. The failure of the models that predict failure: Distance, incentives, and defaults. *Journal of Financial Economics,* 115(2), pp. 237-260.

Richter, B., Schularick, M. & Wachtel, P., 2020. When to lean against the wind. *Journal of Money, Credit & Banking*, Forthcoming.

Rodano, G., Serrano-Velarde, N. & Tarantino, E., 2016. Bankruptcy law and bank financing. *Journal of Financial Economics,* 120, pp. 363-382.

Schafer, L., 2019. "Forgive but not forget": The behavior of relationship banks when firms are in distress. *Review of Finance*, 23(6), pp. 1079-1114.

Schiantarelli, F., Stacchini, M. & Strahan, P. E., 2020. Bank quality, judicial efficiency, and loan repayment delay in Italy. *Journal of Finance,* 75(4), pp. 2139-2178.

Stacchini, M. & Degasperi, P., 2015. Trust, family businesses and financial intermediation. *Journal of Corporate Finance*, 33, pp. 293-316.

Sorge, M., Zhang, C. & Koufopoulos, K., 2017. Short-term corporate debt around the world. *Journal of Money, Credit & Banking,* 49(5), pp. 997-1029.

Stiglitz, J. E. & Weiss, A., 1981. Credit rationing in markets with imperfect information. *American Economic Review*, 71(3), pp. 393-410.

Stroebel, J., 2016. Asymmetric information about collateral values. *Journal of Finance*, 71(3), pp. 1071-1112.

Sultanov, M., 2017. Secured transactions & collateral registry reforms. [Online] Available at: https://www.iiiglobal.org/sites/default/files/media/Pen%20Law%20Feb%2009%20P anel%2 01%20Msultanov%20final.pdf.

Sultanov, M., Wilson, J. M., MacEachern, E., Salamina, L. M., Chhabra, P., 2019. Secured transactions, collateral registries and movable asset-based financing: Knowledge guide. [Online] Available at: http://documents1.worldbank.org/curated/pt/193261570112901451/pdf/Knowledg e Guide.pdf.

Sutherland, A., 2018. Does credit reporting lead to a decline in relationship lending? Evidence from information sharing technology. *Journal of Accounting & Economics*, 66(1), pp. 123-141.

Svensson, L. E., 2017. Cost-benefit analysis of leaning against the wind. *Journal of Monetary Economics*, 90, pp. 193-213.

Wang, X., Han, L. & Huang, X., 2020. Bank market power and SME finance: Firm-bank evidence from European countries. *Journal of International Financial Markets, Institutions & Money*, 64, pp. 101162.

World Bank, 2016. The role of credit reporting in supporting financial sector regulation and supervision. [Online] Available at: http://pubdocs.worldbank.org/en/954571479312890728/CR-2016-role-creditreporting-in-supporting-financial-regulation.pdf.

World Bank, 2019. Credit reporting knowledge guide 2019. [Online] Available at: http://documents1.worldbank.org/curated/en/262691559115855583/pdf/Credit Reporting-Knowledge-Guide-2019.pdf.

World Bank, 2019. Getting credit - credit information. [Online] Available at: https://www.doingbusiness.org/en/data/exploretopics/getting-credit/reforms.

Appendix

Table 1 A: Theoretical Literature Papers

No	Author (year)	Main idea	Model	Findings	Comments
1	Bennardo et al. (2015)	A model which demonstrates that information sharing over-indebtedness	Theoretical model	Information sharing reduces borrowers' over-indebted especially through multiple-bank borrowing	Note: with weak creditor protection and risky collateral information sharing may not reduce multiple and overborrowing.
2	Daley et al. (2020	Develop a framework to understand the effects of credit rating on loan origination	theoretical framework	Ratings leads to lower retention of low quality loans by banks, but increases the origination of more negative NPV loans.	That is, ratings shift the market from *signalling* equilibrium to *originate-to-distribute* equilibrium.
3	Diamond et al. (2020)	A framework that explains why firms take on more debt when valuations are expected to rise, and why they perform poorly.	Theoretical Proposition	Markets allow firms to borrow more when higher liquidity is expected. However, this reduces firms' incentive to perform.	This creates several moral hazard problems including borrowings from multiple lenders.
4	Gorton & Ordonez (2020)	Model which differentiates good credit booms from bad ones	Theoretical model	The likelihood of crisis increases during credit boom that displays significant decline in productivity.	The difference between bad and good booms is at the later sage, as all booms start with positive effects.
5	Liberti & Petersen (2019)	A theoretical analysis of hard and soft information.	Theoretical analysis	Theoretical definition of Hard and soft information, how they are collected, processed, and communicated.	FinTech will reduce the value of soft information and increase lenders' incentive to share private information
6	Padilla & Pagano (1997)	"Endogenous communication	Theoretical Model	Moral Hazard model	Information sharing reduces

		among lenders and entrepreneurial incentives"			banks' rents extraction
7	Padilla & Pagano (2000)	"Sharing default information as a borrower discipline device	Theoretical Model	Moral Hazard model	Information sharing induces borrowers to service their loans.
8	Pagano & Jappelli (1993)	"Information sharing in credit markets"	Theoretical Model	Adverse selection model	Information sharing reduces adverse selection in credit markets

Table 1B: Empirical Literature Papers

No	Author (year)	Main idea	Model	Data	Main Findings
1	Agarwal & Ben-David (2018)	Study how lending officers use soft & hard information when making lending decision	Regression Model, With Diff-in-Diff Specification	loan applications processed by 130 loan officers of a US commercial bank in 2004 and 2005 Bank (unnamed)	Loan officers give greater weight to hard information, and overlook Soft information that is unfavourable to loan prospecting.
2	Albertazzi et al. (2017)	Investigate the use of borrowers' past failed loan applications information in bank lending decisions	A linear probability regression model.	Data is from the Italian Credit Register	The higher the number of failed applications in the last 6months, the higher the probability that a borrower will not be granted loan
3	Altunbas et al. (2017)	Study of bank characteristics around the 2007-2009 financial crisis.	Probit and Linear regression models, with OLS specification	Data has been collected from Datastream. Sample includes European and US banks	Aggressive lending, less reliance on deposit funds, and larger real estate betas are key pre-crisis characteristics.
4	Aretz et al. (2020)	Examine the impact of reformed French Napoleonic Security Code on access to credit.	Differences-in-Differences	Data is from Bureau Van Dijk's AMADEUS database and French Census (INSEE)	Expanding collateralizable assets results in more debt taking of firms, with higher effects on financially constrained firms.
5	Armantier et al. (2015)	An investigation of the cost of stigma associated with borrowing from Federal Reserve's Discount Window	Probit and Linear Regression	Federal Reserve Bank of New York	Banks would rather pay higher premium for funding elsewhere than using Discount Window, because it is a signal of financial weakness
6	Bahadir & Valev (2019)	Investigating how increase in information sharing impact on household loans compared to business loans.	Linear regression	Data comes from the European Credit Research Institute database, the world Development indicator, the World Bank Doing Business database, and the	Information sharing disproportionately increases credit to households relative to business, with higher effects in countries that

				international country risk guide database	introduced information sharing for the first time
7	Beatriz et al. (2018)	Investigate how relationship lending affects interest rates.	Regression model	Data source: Banque de France. Data is for 11,278 French firms	Relationship banks charge higher rates in normal times and lower interest rates in bad times, but no benefits for high risk firms.
8	Beck et al. (2018)	Investigating whether banks' relationship lending techniques influence the cyclicality of credit	Probit and Linear Regression models.	Face-to-face interview with bank CEOs across 21 countries, World Bank's Business Environment and Enterprise Performance Survey	Although relationship lending is not associated with credit constraints during a credit boom, it alleviates constraints during a downturn.
9	Begley et al. (2017)	Investigate banks' underreporting of risk to meet regulatory expectations.	VAR	Data comes from BankScope, Datastream, Federal Reserve Bank and Bloomberg	Banks underreport risks when they have lower equity capital. especially during systemic risks
10	Berg (2015)	Studies the impact of risk manager's involvement in loan screening and granting process.	Regression Discontinuity and Difference-in-Differences specification	Data was collected from a major European bank (unnamed)	Having Loan officer and risk manager involved in lending processes can help facilitate efficient screening and decision making.
11	Berg et al. (2020)	Examine borrowers' digital footprints for their ability to predict borrowers' loan default rates.	Regression model	Data includes the characteristics of 250,000 purchases. The data comes from an E-Commerce company based in Germany	Result shows that Information left online by users can accurately predict their loan default rates.

12	Berg et al. (2020)	Investigate loan officers use of hard-information when faced with volume-based incentive contracts.	Linear Regression, with Diff-in-Diff estimator	Data is from a major European bank (unnamed)	Loan officers faced with volume-based incentives manipulate customer ratings to increase lending
13	Berger et al. (2016)	Investigate the relationship between collateral characteristics and loan risk.	Regression model with OLS specification	Central de Informacion de Riesgos Creditcios (CIRC) and Superintendent of Banks and Entities (SBEF)	Use of Collateral reduces risk-taking, and liquid collaterals are associated with low risk premium and better performance.
14	Berger et al. (2017)	Study the comparative advantages of small banks over larger banks in alleviating credit constraints.	Regression with OLS Specification	The National Federation of independent Businesses (NFIB),	Small banks are better at servicing local customers than larger banks, including during financial crisis.
15	Bird et al. (2019)	Investigate whether borrowers' voluntary sharing of their credit information can increase access to credit.	Linear Regression Model	Loan pricing corporation (LPC) DealScan database.	Borrowers who voluntarily share their Information have more access to credit, pay lower costs of borrowings, and receive larger Loan amount.
16	Bolton et al. (2016)	Examine the characteristics of relationship and transaction lending during financial crisis and in normal times.	Regression Model	Data comes from Italian credit register	Relationship banks charge higher during normal times, and keep supply of credit at more favourable terms than transaction banks during crisis.

17	Bos et al. (2018)	Measuring the effects of negative credit reputation on borrowers' and income	Linear regression model, with OLS estimations.	Data collected from Kronofogden (Swedish National enforcement Agency) and the tax Authorities	Results show that negative credit information reduces employment, earnings, and people's mobility.
18	Botsch & Vanasco (2019)	Investigating bank learning through relationship lending with customers.	Linear regression model.	All data is from DealScan	As relationship progresses, banks adjustment loan contracts to incorporate new knowledge, which reflect in subsequent contracts especially cost of borrowing.
19	Brancati & Macchiavelli (2019)	Investigate information production and sensitivity of bank debt around financial crisis.	Regression Model, with OLS and GMM estimators.	Data on global banks covering 2004 to 2012 period comes from Markit, I/B/E/S, and Bankscope.	Producing more precise information around financial crisis amplifies the effects of market expectations. This increases the default risk faced by poor performing banks.
20	Buckak et al. (2018)	Study how technology development and regulatory factors contribute to recent growth in shadow banking mortgage loans.	Linear Probability	The Securities Exchange Commission (SEC), US Department of Housing and Urban Development.	Results show that higher regulatory constraints, lower income and Fintech development are associated with rise in shadow banking.
21	Calomiris et al. (2017)	Investigating how collateral law reforms for movable assets shape lending and sectoral activities.	Linear Regression with Difference-in-Differences	Data is from World Bank doing Business and UNIDO data on countries' sectoral allocation of production	Loan-to-value ratios with movable assets collaterals are lower in countries with weak collateral

				laws, relative to immovable assets
22	Campello & Larrain (2016)	The impact of movable assets collateral law reform on credit availability.	Linear Regression Model with Difference-in-Differences specification	Data compiled by Bureau Van Dijk, collected from Amadeus	Firms with more movable assets have borrowed more since reform compared with period before the reform.
23	Carvalho et al. (2015)	Investigate the effects of bank distress on relationship firms during financial crisis.	Linear Regression Model.	Firm-level data from across 34 countries collected from DealScan	Shows that bank distress is transmitted to Firms with strongest lending relationship with banks
24	Cenni et al. (2015)	Investigate how different characteristics of bank-firm relationship impact on credit rationing.	Probit model	Data source: Capitalia-Unicredit. A survey of Italian firms.	Multiple banking relationship increases credit rationing for SMEs. However, there is negative relation between length of relationship and credit rationing.
25	Cerqueiro et al. (2016)	Study the role of collaterals in loan contracting and the behaviour of lenders when there are major market changes.	Linear Regression. Differences-in-Differences specification	A major Swedish Commercial Bank (unnamed)	Banks respond immediately to reduction in collateral values due to legal reform by increasing interest rates and tightening credit limits.
26	Cole et al. (2015)	An investigation of the effects of performance-based compensation on risk assessment and lending decisions.	Randomized field experiment	The sample includes loan applications of a large commercial lender in India for self-employed and small businesses (unnamed).	Incentives distort credit risk assessment, and career concerns and personality traits affect loan officers' behavior.
27	D'Aurizio et al. (2015)	Investigate which type of	Log-Linear Regression	Surveys of Italian banks and firms by	Family ownership reduces agency

		firm benefits more from bank-firm lending relationship.		the Bank of Italy in 2009.	problems and credit constraints during financial crisis.
28	Degryse et al. (2020)	study the relation between creditor rights and expected loan recovery rates.	Regression with Difference-in-Differences	Data is from a global bank (unnamed), and World Bank's Doing Business	Greater creditor protection increases the expected collateral recovery rates. This results in increase in lending.
29	Deyoung , et al. (2015)	To determine changes in US SMEs' bank loans during the global financial crisis	Linear Regression Model with 2SLS	The federal Reserve's Senior Loan Officer Opinion Survey on Bank Lending Practices (SLOOS). Data cover 1991 Q4 to 2010 Q4.	Results show significant reduction in business loan, driven by increased risk overhang and significant fall in bank liquidity.
30	Ertan et al. (2017)	Study the effects of changes in reporting transparency on credit practices of banks	Linear regression models, with OLS estimator	European DataWarehouse (ED)	Loans that were originated under the transparency regime are of better quality with significantly lower probability of default.
31	Ferri & Murro (2015)	Examine the impact of imperfect firm-bank relationship on firms' financial constraints.	Probit Regression model	Survey of manufacturing Italian firms, supplied by Tenth Survey	Where there is a mismatch and opaque firm is matched with a transaction bank rather than a relationship bank, credit rationing increases.

32	Ferri et al. (2019)	Study how different lending techniques and use of information affect firms' access to credit during financial crisis.	Probit Regression model	survey of Italian manufacturing firms	Transaction lending technique is associated with credit rationing, whereas firms in relationship lending arrangement have more access to credit
33	Firestone & Rezende (2016)	Examine how member banks of the same syndicated loans report risk estimates on the same loan.	Linear Regression model	DealScan Database	Different banks assigned different probability of default to the same loans, banks with higher syndicated shares assign lower risk.
34	Fosu et al. (2020)	investigate the relationship between credit information sharing and default rates of banks.	Regression model	World Bank Doing Business (WBDB)	Information sharing lower default rates. However, the significance of this effect depends on banking market concentration.
35	Freudenberg et al. (2017)	Investigate the impact of loan covenant violation on future loan contracts.	Logit and Linear Regression models	Data provided by Security and Exchange Commission (SEC), DealScan, National Information Centre (NIC)	Covenants violation creates negative stigma which makes subsequent loan contracts terms stricter.
36	Fuster et al. (2019)	Examine the effects of Fintech lending on mortgage market in the US.	Log-Linear and Linear Probability models	Home Mortgage Disclosure Act (HMDA) Reports, and The Federal Housing Administration (FHA) Ginnie Mae dara	Fintech has reduced application processing time by 20%, and the quality of credit decisions has improved significantly.
37	Garmaise (2015)	Examines assets misreporting by mortgage	Regression discontinuity techniques.	mortgage loans data from a US bank (unnamed)	Many borrowers overestimate their assets, and these

		borrowers and the impact on loan outcomes.			assets are 25% more likely to become delinquent.
38	Garmaise & Natividad (2017)	Estimate the impact of unfavourable credit events on future financing of borrowers	Linear Regression, with OLS estimator	The Peruvian banking regulator Superintendencia de Banca, Seguros, y AFPs (SBS).	borrowers who face credit downgrade experience a 3-year reduction in financing.
39	Giannetti et al. (2017)	Examine the behaviour of banks in sharing customers' information through public registries.	Linear Regression, with Diff-in-Diff specification	Administracion Federal de Ingresos Publicos (AFIP)	Banks downgrade high-quality customers and upgrade low-quality customers before sharing their information.
40	Grajzl & Laptieva (2016)	Study the effects of information sharing on lending volume	Two-way fixed effects regression model	National Bank of Ukraine	Whilst Credit Bureaus are associated with increase in lending, Credit Registry is not.
41	Griffin & Maturana (2016)	Investigate the existence of misreporting and its impact on loan outcomes.	Logit Regression Model	Lewtan's ABSNet Loan and HomeVale data sets and DataQuick's Assessor and History files.	Result shows that around 48% of loans exhibit at least one indication of false information, and this has 51% higher likelihood of delinquency.
42	Gropp & Guettler (2018)	Investigate the role of soft information in the competition between transaction and relationship banks.	Linear Regression model with OLS estimator	Data provided by German Savings Bank Association	Relationship banks compete with soft information and invest more in it. Whereas transaction banks invest less and use both hard and soft information.
43	Guerineau & Leon (2019)	An investigation of the impact of information	A Probit model	Bankscope, World Development	Information sharing reduces financial fragility and the

		sharing on financial stability.		Indicators and Doing Business	detrimental impact of credit boom.
44	Hirsch et al. (2018)	They study how trust affects agency costs in relationship lending arrangement.	Structural Model based on Partial Least Square	Data files of 81 credit relationships of two German banks (unnamed)	Result shows that trust in lending relationship reduces agency costs, bank monitoring intensity and improve credit renegotiations.
45	Kirschenmann (2016)	An investigation of the extent of loan size rationing.	Linear regression model with OLS	Loan data comes a Bulgarian bank (unnamed)	the study reveals that opaque firms receive lesser than transparent firms at the beginning of their relationship. with their banks.
46	Kusi & Opoku-Mensah (2018)	Investigate whether credit information sharing affects banks funding cost.	2step GMM Regression	Data collected from BankScope database and the World Development Indicators database.	Higher quality of information and coverage of bureaus result in lower cost of banks funding. However, result for public registry is not significant
47	Li et al. (2019)	Examine the behaviour of relationship banks when relationship firms are in distress.	Logistic and Linear Regression with OLS	DealScan and Compustat databases.	There are no benefits for relationship firms in distress. They are charged higher in normal times and do not receive further credit during crisis.
48	Liberman (2016)	Quantifies borrowers' willingness to pay for a good credit reputation.	Fuzzy Regression Discontinuity	Chilean Statistics Bureau	Borrowers are willing to pay up to 11% of their income for a good credit reputation.
49	Liberti & Sturgess (2018)	Investigate bank credit rationing in the presence of	Linear regression, with	Data is from a large multinational bank (unnamed)	Borrowers with established relationship or

		credit supply shock.	OLS and fixed effects		pledged assets are less rationed.
50	Loaba & Zahonogo (2019)	Examine the effects of information sharing on lending and economic growth.	Two Stage Least Squares	Banque Centrale des Estats de l'Afrique de l'Ouest (BCEAO), and the World Bank and global Financial Development statistics	Increase in information sharing does not lead to significant growth in lending and economic growth in developing countries.
51	Love et al. (2016)	Investigate the relation between Collateral Registry reporting and access to credit	Regression, Difference-in-Difference	World Bank's Doing Business, Enterprise Survey and	The introduction of collateral registry is associated with access to finance
52	Nakamura & Roszbach (2018)	Examine collection and use of private information by banks in rating borrowers.	Logit and Linear Regression models, with OLS estimation	Four Swedish commercial banks and Upplysningscentralen AB (UC) i.e. Swedish credit Bureau.	Loan officers use soft information more than bureau information in lending decisions.
53	Plosser & Santos (2018)	They study banks' incentive to report bias risk estimates.	Fixed effects Regression Model	National Credit (SNC) Program, administered by The Federal Reserve System in the US.	Regulatory capital requirement drives underestimation of risk by banks, lowly capitalized banks are more likely to report inaccurate risk estimates.
54	Prilmeier (2017)	Investigates how relationship lending affects the use of loan covenants.	Linear Regression model with OLS	Data includes individual firms and syndicate loans from DealScan Database	The finding is that as relationship grows, the tightness of loan contract's covenants is relaxed over the duration of relationship.
55	Qian et al. (2015)	Examine banks' use information to set loan interest rates	Linear – Probit Regression. OLS Estimator	Data is from a Chinese state-owned bank and cannot be named.	Bank internal risk rating becomes a strong predictor of

		loan and outcomes.			loan interest rates and performance.
56	Rajan et al. (2015)	investigate why models that are designed to predict default and loan performance fail.	Regression - Logit and OLS	Data is from New Century Financial Corporation (NCFC) and LoanPerformance,	As securitization increases, lenders only consider initial variables which enable them to originate highly rated loans.
57	Rodano et al. (2016)	Investigate the effects of Italian Bankruptcy law reform on firms' credit conditions.	Regression with Difference-in-Differences framework	Bank of Italy	Reorganization increases interest rates and lower investment. whereas liquidation with more creditor rights results in lower interest rates and higher investment.
58	Schafer (2019)	Studies the behavior of relationship banks when relationship firms are in distress.	Linear Probability Model	The Armenian Private Credit Registry (ACRA), and Banking Environment and Performance Survey (BEPS) II.	Unlike transaction banks, relationship banks tolerate temporary poor loan performance, and grant follow-up loans but at higher costs.
59	Schiantarelli et al. (2020)	Examine how bank performance and existing legal framework influence borrowers' behaviour.	Linear Probability Model.	The Italian credit Register, Balance Sheet Register, Italian Ministry of Justice, and Bank of Italy Supervisory Reports.	Poor creditor protection is associated with firms' strategic defaulting with poorly performing banks.
60	Stroebel (2016)	A study of how lenders with different information about the expected return on the same loan compete	Probit model	Data from the Universe of Ownership-changing Deeds in Arizona, USDA's Soil Survey Database, and Home Mortgage Disclosure Act's (HMDA) loan application registry	Lenders with superior information lend against high quality collaterals, whilst those with poor information face adverse selection problem but

		with different strategies.			charge higher rents.
61	Sutherland (2018)	Whether the relationship between lenders and borrowers prior to sharing information is different from their relationship after sharing information.	Regression with OLS specifications	World Bank Doing business and PayNet (a web-based bureau).	Information sharing reduces borrowers' switching costs and increases access to credit. For lenders, they transition from relationship to transaction contracting after sharing information.
62	Wang, et al. (2020)	They estimate the effects of bank market power on SMEs financing.	Probit and logit models.	Data is for 19 European countries, collected from BvD Amadeus database.	They find that bank market power increases SMEs credit constraints, whereas competition increases access to credit.