

Credit markets under asymmetric information regarding the law

Abstract: This theoretical paper shows that asymmetric information regarding the law generates credit rationing, underinvestment and overinvestment problems. In contrast to the standard form of asymmetric information, these problems cannot be eliminated using loan collateral or personal guarantees. It is optimal to establish a centralized financial intermediary, a bank, which procures legal expertise and evaluates legal risks on behalf of depositors who lack this legal expertise. The bank provides fundamental asset transformation services to the economy by transforming complex loans (requiring legal expertise) into simple deposits (which do not require legal expertise).

Keywords: Banking, Financial Intermediation, Credit Rationing, Collateral, Law and Finance

JEL: G21, D8, K00

1. Introduction

This paper introduces a new research subject: *asymmetric information regarding the law in credit markets*. That is, few investors have the necessary legal expertise whereas nonprofessional investors lack legal expertise. Three questions will be addressed. What are the impacts of asymmetric information regarding the law in credit markets? How does it differ from the standard form of asymmetric information? How can it be eliminated? The analysis reveals how asymmetric information regarding the law may cause the same problems as the standard form of asymmetric information: credit rationing, underinvestment or overinvestment. The paper investigates whether financial intermediaries and designed security contracts will endogenously arise as to a response to these problems. The paper goes on to consider whether there are other solutions, e.g. inside or outside collateral or personal guarantees, to these information problems. The findings recommend the use of financial intermediaries having legal expertise.

To begin, the paper adduces a scenario in which asymmetric information regarding the law may generate the same kind of credit rationing equilibrium as in the classic article of Stiglitz & Weiss (1981). The law often provides special protection to a few debt categories (e.g. Tirole, 2006; Hilson, 2013). We label them as *senior debts*. Maybe the most common example is that wage and tax payments in many countries are senior to repayments on secured and unsecured loans. The number of specially protected debt categories can be large (Hilson, 2013). Now asymmetric information regarding the law implies that nonprofessional investors, lacking sufficient legal expertise, have no knowledge whether a borrower has this kind of senior debts. Even if they can contact the borrower and observe its liabilities, nonprofessional investors have no knowledge as to whether the existing debt represents senior debt because they lack sufficient legal expertise. Hence,

the borrower's other liabilities can become a risk to nonprofessional investors. This risk may generate credit rationing, underinvestment or overinvestment problems.

The paper introduces a few incidents of asymmetric information regarding the law. Under these circumstances investors who lack legal expertise are unwilling to invest directly in firms because they cannot evaluate the risks. An investor can develop his legal expertise. Yet, if each investor endeavours to qualify, the total costs of qualification multiply. To prevent useless multiplication, it is optimal to establish one centralized financial intermediary, a bank, to build up its legal expertise and evaluate legal risks on behalf of nonprofessional investors (depositors). The bank advances a groundbreaking *asset transformation* service to the economy by transforming complex loans (financial securities requiring legal expertise) into simple deposits (financial securities which do not require legal expertise). By investing in the latter securities, investors who lack legal expertise can protect themselves.

The paper touches on several strands of banking theory. First, the paper builds on research on *credit rationing*: e.g. Jaffee & Russell (1976), Stiglitz & Weiss (1981), Gale & Hellwig (1985) and Winton (1995). The contribution of this paper is to show that credit rationing is more common than the traditional theory suggests. This theory rests on asymmetric information regarding the borrower's assets; that is, project types (e.g. Stiglitz & Weiss, 1981). The novelty of our analysis is that asymmetric information regarding the law causes credit rationing under a fixed, commonly known project type and observable output. Now lenders do not know the borrower's other liabilities which generates risks.

Second, researchers have made significant progress in understanding *financial intermediation*: e.g. Diamond (1984), Ramakrishnan & Thakor (1984), Gale & Hellwig (1985), Calomiris & Kahn (1991), Winton (1995, 1997), von Thadden (1995, 2004), Boot & Thakor (2000) and Hellwig (2000, 2001). In these articles banks operate as financial intermediaries and *delegated*

monitors on behalf of the depositors. In this paper banks operate as financial intermediaries and *delegated legal experts* on behalf of the depositors. Consequently, the paper proposes a novel explanation for the existence of financial intermediaries in the economy.

The theory of financial intermediation emphasizes the banks' role in information acquisition under the standard form of asymmetric information. Banks, for example, screen good and bad borrowers. This task is, however, unnecessary under secured lending. Since full collateral makes a loan risk-free, bank monitoring is unnecessary. An investor observes the value of the collateral asset and can make a risk-free loan directly to the borrower without bank intermediation.

In reality banks favor fully secured loans (e.g. Koch & MacDonald, 2014, p. 533). In their study on small firms in U.S.A, Steijvers et al. (2010) find that 86.5% of the bank loans have collateral. Binks et al. (1988) report that for 85% of UK business loans the ratio of collateral provided to the size of the loan exceeds unity. As to small firms and their bank loans in France, Davydenko & Franks (2008) discover that at default the value of collateral and guarantees as a percentage of exposure is 124%. These observations challenge the traditional theories of financial intermediation. If monitoring is the main function of banks, why do banks grant mostly secured loans? Why do not investors make secured loans directly to borrowers without bank intermediation? This is realistic according to the traditional theories, because full collateral eliminates the standard form of asymmetric information, makes the loan risk free and thereby removes the need of bank monitoring. Asymmetric information regarding the law suggests one explanation: The law may make a full loan collateral or a personal guarantee risky (valueless). Banks are needed to evaluate and eliminate asymmetric information regarding the law and thereby alleviate legal risks in secured lending. Hence, banks advance fundamental financial intermediation services to the economy even if they grant only fully secured loans.

Third, the paper is related to research on *law and finance*: e.g. La Porta et al. (1997, 1998), Gropp et al. (1997), Franks & Sussman (2005), Davydenko & Franks (2008), Che & Spier (2008) and Calomiris et al. (2017). Our theoretical paper extends these empirical articles by developing a model in which the law causes risks to a lender who lacks legal expertise. The lender cannot evaluate the credit risk accurately, even if he knows the distribution of the project output, because the law has a crucial impact on the allocation of the output.

Finally, the paper extends the research on *collateral*: e.g. Boot et al. (1991), Rajan & Winton (1995), Manove et al. (2001), Udell (2004), Franks & Sussman (2005), Davydenko & Franks (2008), Steijvers et al. (2010), Love et al. (2016) and Calomiris et al. (2017). Our main contribution to this literature is to construct a theoretical model in which a fully secured loan is risky even if the value of the collateral asset is fixed and observable. The risk is based on law. The law does not, for example, assure the secured creditors the right to collateral in the borrower's reorganization process. As a result, a fully secured loan may be worthless. Hence, collateral and personal guarantees, which eliminate information problems effectively under the standard form of asymmetric information, are rather ineffective under asymmetric information regarding the law. To eliminate asymmetric information regarding the law it is optimal to create a financial intermediary which has legal expertise.

The paper proceeds as follows. Section 2 shows that a credit rationing equilibrium may occur when the law provides special protection to a few debt categories. In section 3 a financial intermediary, a bank, arises endogenously to eliminate asymmetric information regarding the law and Section 4 draws conclusions.

2. Credit rationing

This section studies an economy in which the law provides special protection to a few debt categories. The study reveals that credit rationing, underinvestment and overinvestment problems may occur and that these problems cannot be eliminated using inside collateral (business assets). In detail, in the case of a bankruptcy, payments on specially protected debt categories are senior to payments on unsecured loans and secured loans. In these circumstances, we examine the lending decision of *a nonprofessional investor* (who lacks legal expertise). Even if he observes that a loan applicant has an existing loan which belongs to debt category Z, he does not know whether Z represents specially protected debt. To shed light on these kinds of debts, we review a few examples. In bankruptcy procedures lenders are compensated according to priority rules regarding liquidation. Tirole (2006, p. 87) documents:

“For example, in the United States, (1) administrative expenses of the bankruptcy process are paid first, then come (2) unpaid taxes or debts to government agencies (e.g. the Pension Benefit Guarantee Corporation), (3) some wage claims (up to some ceiling), (4) secured and senior creditors, (5) junior creditors, (6) preferred shares, and, at last (7) equityholders.”

Further, competing liens strongly affect repayment. Hilson (2013, p. 11-2) reports from the U.S.A:

“Nowhere in the course of structuring and documenting an asset-based transaction is it more important to know your borrowers than in analyzing and anticipating the risks of competing liens or claims. It is not enough to craft a set of documents that will grant the investor an apparent first perfected lien or security interest in the desired collateral if some other creditor can come in and displace the investor from its first position when the borrower experiences financial difficulty. ...there are so many statutory provisions that have been enacted by the various states and the federal government to protect selected classes of creditors

at the expense of other classes. Farmers, cattle ranchers, potato growers, stevedores, construction traders, and movie labs are a few of the lucky businesses and industries that have been favored by legislative action and have been granted special liens with varying degrees of muscle when competing with other more traditional liens.”

Additionally, Hilson (2013) lists many common cases in which an investor will find its security interest junior to the security interest of the other party: collateral is transferred from another jurisdiction, nonfiling perfection (possession), a collateral asset may have a previous owner and a previous lien, purchase money obligation, etc.¹ In sum, Tirole (2006) and Hilson (2013) document several scenarios in which the law provides special protection to numerous debt categories and thereby has a dramatic influence on the allocation of loan repayments. We label these debt categories *senior debts*. In the model, a firm (borrower) retains this kind of senior debt or normal debt from the previous period. A nonprofessional investor grants a new loan (secured or unsecured) to a firm. Since he does not know whether the firm retains senior debt (asymmetric information regarding the law), the old debt of the firm causes a risk to him.

- (i) If the firm retains old senior debt, the repayments on the investor’s new loan are junior to the old senior debt. The investor receives a small repayment (if any) if the project is unsuccessful and the firm fails.
- (ii) If the firm inherits old normal debt, the investor with a new loan receives a substantial repayment if the project is unsuccessful and the firm fails.

We label type (i) borrowers high-risk firms and type (ii) borrowers low-risk firms. The names describe borrowers from the investor’s point of view. We will contrast asymmetric information regarding the law with the standard form of asymmetric information. Therefore, it is necessary to make the following definition.

¹ Hilson’s comprehensive book of 1200 pages cites numerous examples of this kind of legislation. We can give only a few scenarios here.

Definition (Standard form of asymmetric information): *Under the standard form of asymmetric information in finance the distribution of project output varies among projects. A risky project may, for example, succeed with a small probability but produce then a large output, whereas a safe project is successful with a high probability producing relatively low output. The project type may be given and varies between borrowers (adverse selection) or a borrower may choose the project type (asset substitution) or implicitly influence the distribution of output through the choice of effort (effort aversion).*

Under asymmetric information regarding the law only one project type exists and is commonly known. Yet, the allocation of the realized project output is affected by law which is not commonly known. We show that asymmetric information regarding the law causes the same kind of problems as the standard form of asymmetric information. Given the status of the Stiglitz & Weiss (1981) model, we aim to model the information problem in the same way. This makes it easy to compare the results. Subsection 2.1 sketches the economy. In subsection 2.2 a nonprofessional investor grants an unsecured loan and a credit rationing equilibrium occurs. In subsection 2.3 he makes a secured loan and credit rationing is again optimal. Subsection 2.4 offers more evidence.

2.1 Economy

Consider a risk-neutral economy with borrowers (firms) and nonprofessional investors. Everyone maximizes his expected return and firms are protected by limited liability. Firms are run by wealth-constrained owner-managers who must raise outside funds to cover the investment input. The model has one period. Yet, the firms retain ongoing investment projects from the previous period. The projects are funded by existing old debt (senior or normal) and a new loan from an investor. We begin by describing the characteristics of the projects and turn to funding options and interest rates.

Projects: Each firm has a similar project. It requires a $\frac{1}{2}$ units of new input at the start of the period, whereas $\frac{1}{2}$ units of input have been invested in the previous period. The output materializes at the end of the period. With probability p a project is successful and has value Y_H . With probability $1-p$ it is unsuccessful and has value Y_L , $Y_L < 1 < Y_H$. Here Y_L consists of factory buildings, land and equipment which represent collateral assets, whereas $Y_H - Y_L$ denotes the production output. A project has positive NPV: $pY_H + (1-p)Y_L > 1$.

Investors: Each investor is endowed with $\frac{1}{2}$ capital units and is ready to finance a project by granting a new loan for a period. Alternatively, he can store the endowment at no cost.

Liabilities and asymmetric information: Each firm inherits $\frac{1}{2}$ units of old debt from the previous period. Share $1-s$ of the firms are *low-risk firms* and retain $\frac{1}{2}$ units of old normal debt. Share s of the firms are *high-risk firms*, which inherit $\frac{1}{2}$ units of old senior debt. Both firm types contact investors to raise $\frac{1}{2}$ units of new loans. The firm type (low-risk, high-risk) is unobservable to the investors. They do not know whether the firm has old senior debt.

Loan interests: Let r_s denote the fixed loan interest of an old senior debt. It is possible that r_s is specified by law, if the senior debt consists of unpaid taxes or pension payments. The following assumption shortens and simplifies the analysis:

Assumption 1. *Senior debt is risk free:* $\frac{1}{2}r_s < Y_L$.

The interest rate of old normal debt is r_n . Since old senior debt is risk free and old normal debt risky, we have $r_s < r_n$. Moreover, r refers to the interest of new loans that are granted by nonprofessional investors in the current period. They aim to set r so that their expected interest income is maximal.²

Time line: Firms and investors contact and investors grant loans. Firms invest the capital. At the end of the period the projects mature and financial claims are settled.

2.2 Credit rationing under unsecured lending

In this subsection investors' new loans are unsecured. If an investor grants a new loan to a low-risk firm and the project fails, the output, Y_L , is shared equally between the new loan and the old normal loan. If an investor grants a new loan to a high-risk firm and the project fails, the output is allocated mostly to cover repayments on the senior old debt, $\frac{1}{2}r_s$, and the new loan receives $Y_L - \frac{1}{2}r_s$. To begin, an investor aims to raise the interest of a new loan, r . Firms are profitable if r is sufficiently low. We make the following definition.

Definition 1. We define two loan interest rates, r_1 and r_2 , which meet: $\frac{1}{2}r_1 = Y_H - \frac{1}{2}r_n$ and

$\frac{1}{2}r_2 = Y_H - \frac{1}{2}r_s$. These imply $r_2 > r_1$.

² We examine only standard debt, which is derived as the optimal financial contract between borrowers and lenders in Diamond (1984) and Gale & Hellwig (1985). See also Hellwig (2000, 2001).

The value of the output is same in both firm types but low-risk firms pay more interest on old debt than high-risk firms, because old normal debt is more expensive than old senior debt, $r_n > r_s$. As a result, low-risk firms cannot pay as much interest on new loans as high-risk firms. In definition 1, $r = r_1$ ($r = r_2$) indicates the maximal interest on new loans for low-risk (high-risk) firms, $r_2 > r_1$. If the interest on new loans, r , is at most r_1 , both firm types apply for loans. If $r_1 < r \leq r_2$, low-risk firms are unprofitable and withdraw from the credit market but high-risk firms seek loans. If $r > r_2$ no firm seeks a loan. Lemma 1 follows.

Lemma 1. *If the interest of new loans, r , rises a bit over r_1 , the investor's expected return drops.*

Proof. At $r = r_1$ both firm types apply for loans and the investor's expected return is

$$\pi_i(r_1) = p \frac{1}{2} r_1 + (1-p)s(Y_L - \frac{1}{2} r_s) + (1-p)(1-s) \frac{1}{2} Y_L. \quad (2.1)$$

The first term on the R.H.S is the expected repayment from a successful project. The second (third) term indicates expected repayment from an unsuccessful project of a high-risk (low-risk) firm. If $r = r_1 + \varepsilon$ only high-risk firms apply for loans and the investor's expected return is

$$\pi_i(r_1 + \varepsilon) = p \frac{1}{2} (r_1 + \varepsilon) + (1-p)(Y_L - \frac{1}{2} r_s). \quad (2.2)$$

The first (second) term on the R.H.S is a repayment from a successful (unsuccessful) project. When loan interest rises from r_1 to $r_1 + \varepsilon$ a change in the investor's expected return is $\pi_i(r_1 + \varepsilon) - \pi_i(r_1)$, or $p\frac{1}{2}\varepsilon + \frac{1}{2}(1-p)(1-s)(Y_L - r_s)$. Here the second term is negative. The first term is positive but approaches zero when ε approaches zero. Thus, $\pi_i(r_1 + \varepsilon) - \pi_i(r_1)$ is negative. *Q.E.D*

Intuitively, if r rises a bit over r_1 , low-risk firms withdraw from the credit market due to the relatively large costs of borrowing and only high-risk firms apply for loans. Both firm types pay the same interest to the investor, r , when the project is successful. If it is unsuccessful, the investor receives a smaller repayment from a high-risk firm than from a low-risk firm, $Y_L - \frac{1}{2}r_s < \frac{1}{2}Y_L$. Thus, if r rises a bit over r_1 , the investor's expected repayment from an unsuccessful project drops because the low-risk firms withdraw from the credit market. As a result, the investor's expected return from the loan decreases if r rises a bit over r_1 . This is an adverse selection effect. In sum, if $r \leq r_1$ the investor's expected return increases with r . If r rises a bit over r_1 , the adverse selection effect occurs and the expected return drops. If $r_1 < r \leq r_2$ the expected return increases with r . Hence, either r_1 or r_2 maximizes the expected return. We get the following result.

Proposition 1. *Under unsecured lending either loan interest r_1 or r_2 maximizes the investor's expected return. If p and s are small, r_1 maximizes the expected return. If p and s are large, r_2 maximizes the expected return. Thus, credit rationing may be optimal.*

Proof. Now (2.1) gives the expected return if $r = r_1$, $\pi_i(r_1)$. If $r = r_2$ it is $\pi_i(r_2) = p \frac{1}{2} r_2 + (1-p)(Y_L - \frac{1}{2} r_s)$. Thus, $\pi_i(r_2) - \pi_i(r_1)$ is $\frac{1}{2} p(r_2 - r_1) + \frac{1}{2}(1-p)(1-s)(Y_L - r_s)$. Here the first term is positive and the second is negative. Hence, $\pi_i(r_2) - \pi_i(r_1)$ increases with p and s . If p is large (small) enough, $\pi_i(r_2) - \pi_i(r_1)$ is positive (negative) and $r = r_2$ ($r = r_1$) maximizes the expected return. *Q.E.D*

Intuitively, a high-risk firm yields minimal repayments to the investor if the project is unsuccessful. This risk is insignificant if the probability of success, p , approaches 1. Then, the investor does not make a desperate attempt to avoid high-risk firms. That is, if p is sufficient the investor favors interest r_2 to r_1 , even if r_2 attracts only high-risk firms. As for s , although r_1 attracts both firm types, this advantage is quite insignificant, if the share of high-risk firms is large in the economy; that is, s is large. Assume that 99% of the borrowers in the economy are high-risk firms so that $s = 0.99$. If an investor charges interest r_1 both firm types seek loans and 99% of borrowers are high risk. If he charges r_2 , only high-risk firms seek loans and 100% of borrowers are high risk. The difference in the share of high-risk borrowers, $100\% - 99\% = 1\%$, is likely to be so small that the investor prefers r_2 to r_1 even if r_2 attracts only high-risk firms. Suppose that $s = 0.05$. If the investor charges r_1 , 5% of borrowers are high risk. If he charges r_2 , 100% of borrowers are high risk. The difference in the share of high-risk firms, $100\% - 5\% = 95\%$, is so large that the investor may prefer r_1 to r_2 . Hence, if s increases, r_2 becomes relatively more profitable. We can illustrate credit rationing graphically.

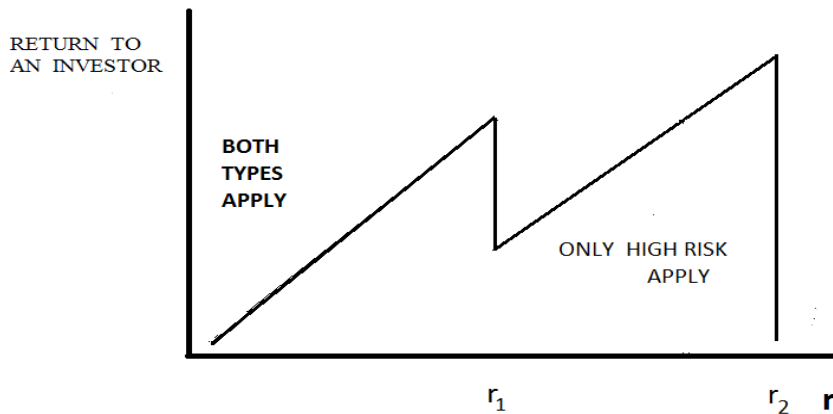


Figure 1. *The second local maximum is the global maximum.*

When $r \leq r_1$ in Figure 1 both low-risk firms (having normal old debt) and high-risk firms (having senior old debt) seek loans. When r is raised slightly above r_1 , the mix of borrowers changes substantially: low-risk firms become unprofitable and withdraw. Figure 1 resembles Stiglitz & Weiss (1981, p. 397). The models have the following differences.

- (i) In Stiglitz & Weiss (1981, p. 397) firms have different projects. A safe (risky) project succeeds with probability p_1 (p_2), $p_1 > p_2$. A successful safe (risky) project yields r_1 (r_2), $r_2 > r_1$. An unsuccessful project has no value. When the loan interest is raised slightly above r_1 , the mix of borrowers changes substantially: safe projects become unprofitable and only firms with risky projects apply for loans.
- (ii) Our model has only one project type. It succeeds with probability p producing Y_H and fails with probability $1-p$ producing Y_L . Now an unsuccessful project has a positive value and each firm has two lenders (new debt, old debt). The type of the old debt (senior or normal) is unknown and generates a risk to the investor granting a new loan.

Finally, assume $p \frac{1}{2} r_1 + (1-p) \frac{1}{2} Y_L > \frac{1}{2}$ (a new loan to a low-risk firm has positive NPV) and that $\frac{1}{2} > \pi_i(r_2) = p \frac{1}{2} r_2 + (1-p)(Y_L - \frac{1}{2} r_s)$, (a new loan to a high-risk firm has a negative NPV). Now

r_1 is the maximal interest, because r_2 attracts only high-risk firms which are now unprofitable borrowers. Investors charge interest r_1 , which attracts both firm types, or they do not grant loans. If r_1 yields non-negative expected returns to investors, both firm types seek loans and receive loans. An *overinvestment* problem appears, because under perfect information investors do not finance high-risk firms. If r_1 yields negative expected returns, investors do not grant loans. Asymmetric information regarding the law destroys the credit market. Now an *underinvestment* problem occurs, since under perfect information investors finance low-risk firms.³

2.3 Credit rationing under secured lending

Subsection 2.2 showed how asymmetric information regarding the law may cause credit rationing if the new loan is unsecured. This subsection achieves the same result when the new loan is secured. The economy is the same as in subsection 2.2. A borrower retains an old debt from the previous period. With probability $1 - s$ the borrower is a low-risk firm which inherits old normal debt with interest r_n . With probability s the borrower is a high-risk firm which has old senior debt with interest r_s . An investor aims to find out interest r , which maximizes his expected return from a new loan that is secured by business assets (inside collateral), Y_L . If the borrower is a low-risk firm,

³ Assume $Y_H = 1.2$, $Y_L = 0.8$, $p = 0.6$, $r_S = 1.14$, $r_n = 1.18$. This implies $r_1 = 1.22$, $r_2 = 1.26$. A project has positive NPV: $p \cdot 1.2 + (1 - p) \cdot 0.8 = 1.04$ because $p = 0.6$. A new loan to a low-risk firm is profitable: $p \frac{1}{2} r_1 + (1 - p) \frac{1}{2} Y_L \geq \frac{1}{2}$, because $0.526 > 0.5$. A new loan to a high-risk firm is unprofitable: $\frac{1}{2} > \pi_i(r_2)$, because $1/2 > 0.47$. Thus, r_1 is the interest or the investor does not lend at all. Given (2.1), r_1 attracts both types and yields expected return $0.526 - s \times 0.068$. If s is sufficiently small, we have $0.526 - s \times 0.068 > \frac{1}{2}$; the investor grants a loan to each loan applicant and the *overinvestment* problem occurs, because a high-risk firm gets a loan. If s is large enough, we have $0.526 - s \times 0.068 < \frac{1}{2}$; the investor does not grant loans and the *underinvestment* problem occurs.

the investor receives most of the proceeds in the bankruptcy, $\min(Y_L, \frac{1}{2}r)$. If the borrower is a high-risk firm with senior old debt, the investor receives only $Y_L - \frac{1}{2}r_s$ in the bankruptcy (recall Assumption 1). Importantly, secured loans are prioritized after old senior debt in the bankruptcy. As in Definition 1, $r = r_1$ ($r = r_2$) is the maximal interest for a low-risk (high-risk) firm. If $r \leq r_1$, both firm types seek loans. If $r_1 < r \leq r_2$ only high-risk firms seek loans. When $r \leq r_1$ the investor's expected return increases with r and when $r = r_1$ it is

$$\Pi(r_1) = p\frac{1}{2}r_1 + (1-p)(1-s)\min(\frac{1}{2}r_1, Y_L) + (1-p)s(Y_L - \frac{1}{2}r_s). \quad (2.3)$$

On the R.H.S the first term is the repayment from a successful loan. The second (third) term shows the repayment from an unsuccessful loan when the borrower is a low-risk (high-risk) firm. If $r = r_1 + \varepsilon$ the investor's expected return is expressed in (2.2). We get the following result.

Lemma 2. *If the interest of new loans, r , rises a bit over r_1 , the investor's expected return drops.*

Proof. Now (2.2) and (2.3) give $\pi(r_1 + \varepsilon) - \Pi(r_1) = \frac{1}{2}p\varepsilon + (1-p)(1-s)[Y_L - \frac{1}{2}r_s - \min(\frac{1}{2}r_1, Y_L)]$.

On the R.H.S the second term is negative and the first approaches zero. This gives $\pi(r_1 + \varepsilon) < \Pi(r_1)$. *Q.E.D*

If $r_1 < r \leq r_2$, the expected return increases with r and if $r = r_2$ it is $\pi_i(r_2) = p\frac{1}{2}r_2 + (1-p)(Y_L - \frac{1}{2}r_s)$. Either r_1 or r_2 maximizes the expected return. A conclusion follows.

Proposition 2. *Under secured lending interest r_1 or r_2 maximizes the investor's expected return.*

If p is small (large), r_1 (r_2) maximizes the expected return. If s is small (large), r_1 (r_2) becomes relatively more profitable. Thus, credit rationing may be optimal.

Proof. Now $\pi_i(r_2) - \pi_i(r_1) = \frac{1}{2}p(r_2 - r_1) + (1-p)(1-s)[Y_L - \frac{1}{2}r_s - \min(\frac{1}{2}r_1, Y_L)]$. On the R.H.S the first term is positive and the second is negative. If p is large (small) enough, the R.H.S is positive (negative) and r_2 (r_1) maximizes the expected return. The R.H.S increases with s . If s rises r_2 becomes relatively more profitable. Q.E.D

The intuition is the same as in Proposition 1. Underinvestment and overinvestment are possible.⁴

⁴ Recall the economy of footnote 3. Given footnote 3, a project has positive NPV, a new loan to a high-risk firm is unprofitable and thus interest r_2 is unprofitable. A new loan to a low-risk firm is profitable, $\frac{1}{2}pr_1 + (1-p)\min(Y_L, \frac{1}{2}r_1) > \frac{1}{2}$, because $0.61 > 0.5$. Loan interest is r_1 or the investor withdraws. Now (2.3) reveals that r_1 attracts both firm types and yields expected return $0.61 - 0.152s$. If s is sufficiently small, the expected return is positive, $0.61 - 0.152s > 0.5$. The investor grants a loan to each loan applicant and the *overinvestment* problem occurs, because a high-risk firm gets a loan. If s is sufficiently large, the expected return is negative, $0.61 - 0.152s < 0.5$. The investor does not grant loans and the *underinvestment* problem occurs, since a low-risk firm cannot get a loan.

2.4 Evidence

This subsection offers more evidence and examples in which the law provides special protection to a few debt categories. To begin, La Porta et al. (1998) examine the legal rules covering creditor rights and find that many laws reduce these rights. Some countries do not, for instance, assure the secured creditors the right to collateral in the case of reorganization. In 19% of the countries studied by these authors secured creditors are subordinated to the government and workers, who have absolute priority. In these countries, a lender who lacks legal expertise may suffer unexpected losses even if he grants a fully secured loan.

Franks & Sussman (2005, p. 71-73) shed light on the order of seniority in the U.K. A *fixed charge* is a security on a specific asset such as real estate or heavy machinery. A *floating charge* is a security that may be extended to cover the whole pool of a company's assets. Trade creditors can incorporate a *retention of title* clause into the sale contract that allows them to reclaim – in bankruptcy – any goods supplied on credit. Wage arrears and debts owed to tax authorities (*preferential creditors*) are senior to the floating charge. In sum, titles of specific assets (a fixed charge or retention charge) are the most senior. Of the remaining pool of assets, the preferential creditors come first, then the floating charge holder and finally the unsecured creditors. Thus, an investor may suffer significant losses even if he has a floating charge security. These losses may be unexpected to an investor who lacks legal expertise.

Che & Spier (2008) focus on the tort victims of firms. Consider a firm with a riskless cash flow. Yet, there is a risk that the business activity of the firm will cause damages to outsiders. A taxi driver may, for example, cause a traffic accident. Consider two alternative laws. First, payments to tort victims have priority over payments to the firm's lenders. Second, debt is senior to the tort claims. The first law may cause unexpected losses to a lender who lacks legal expertise.

Love et al. (2016) find evidence that the introduction of collateral registries for moveable assets improves borrowers' access to financing. The registry notifies parties about the existence of a security claim and establishes the priority of the creditors. The findings support our results. In the absence of the registry a lender does not know whether his loan is junior or senior to the borrower's other debts, and this lack of information causes credit rationing and underinvestment.

To sum up, section 2 investigates how asymmetric information regarding the law influences the credit market. Credit rationing, overinvestment or underinvestment are possible. The same negative effects are usual under the standard form of asymmetric information. Now the effects appear under unsecured lending (Proposition 1) and under secured lending (Proposition 2). Hence, inside collateral does not eliminate these negative effects.

3. Financial intermediary

In section 2 asymmetric information regarding the law causes credit rationing, underinvestment and overinvestment problems. These problems cannot be eliminated using inside collateral (subsection 2.3). It is possible to demonstrate how these problems can be eliminated by establishing a financial intermediary which develops legal expertise and utilizes it in numerous loan contracts. Yet, in the economy of section 2 the task of the intermediary would be very similar to the traditional banking theory (e.g. Ramakrishan & Thakor, 1984). Therefore, we examine the role of the intermediary in an alternative model. We will also study whether asymmetric information regarding the law can be eliminated using personal guarantees or outside collateral (personal assets). To study this, we redesign the model so that both the standard form of asymmetric information and asymmetric information on law coexist. Personal guarantees and outside collateral prove to be effective under the standard form of asymmetric information but rather ineffective under asymmetric information regarding the law. Due to the inefficiency of these instruments banks arise endogenously to operate as financial intermediaries and as delegated legal experts between borrowers and depositors. The section achieves these results step by step. Subsection 3.1 characterizes an economy. In subsection 3.2 the standard form of asymmetric information appears but asymmetric information regarding the law is not present. Personal guarantees eliminate information problems. In subsection 3.3 asymmetric information regarding the law is also present and destroys the credit market. Now personal guarantees are ineffective. In subsection 3.4 both information problems coexist and a financial intermediary arises to eliminate them. Finally, subsection 3.5 enriches the analysis by exploring the usefulness of outside collateral.

3.1 Standard form of asymmetric information

Consider a risk-neutral economy with N firms (borrowers), where N approaches infinity, and numerous investors. Everyone maximizes his expected return and firms are protected by limited liability. The gross interest rate of the economy is 1. Borrowers have market power and thus the competition for loan customers decreases the loan interest to the investors' breakeven level. The model has one period and firms do not retain old debt. Neither does the law provide special protection to any debt categories. Each firm can undertake an investment project. A project requires a unit of investment input at the start of the period and the output materializes at the end of the period. A successful project produces Y units and an unsuccessful project has no value. Two firm types exist. A project of a good firm succeeds with probability t_G and a project of a bad firm with probability t_B . The NPV of a good firm's project is positive, $t_G Y > 1$, and a bad project has negative NPV, $t_B Y < 1$. The project returns are independent across firms. Now an investor has a unit of capital and can finance the whole project. Under perfect information investors would finance only good firms. Yet, the standard form of asymmetric information is assumed to appear: the firm type is unobservable to outsiders. The share of good firms in the economy, α , is assumed to be so low that lending is unprofitable in the absence of information on borrower types:

$$\alpha t_G Y + (1 - \alpha) t_B Y < 1. \tag{3.1}$$

Hence, the standard form of asymmetric information destroys the credit market.

3.2 Personal guarantees eliminate the standard problem of asymmetric information

In next guarantees eliminate the standard form of asymmetric information which destroys the credit market (recall (3.1)). Asymmetric information regarding the law is not present. We make two assumptions.

Assumption 2. It is impossible to separate good and bad loan applicants by monitoring them.

Assumption 3. Each owner-manager of a firm has sufficiently personal assets to guarantee the repayment of his firm's business loan.

Since monitoring is ineffective each owner-manager must give a personal guarantee for the business loan of his firm.⁵ Personal guarantees have a positive selection effect. Since the projects of bad firms have negative NPV, these firms do not seek loans with personal guarantees. Only good firms whose projects have positive NPV seek loans. Hence, the standard form of asymmetric information is eliminated. Since guarantees make loans risk free, investors can then make loans directly to firms and there is no demand for financial intermediaries.

⁵ A personal guarantee is a signed promise to an investor-lender, back by the firm's owner's personal assets, that the firm will repay the loan. If the business is unable to pay back the loan, the personal guarantee authorizes the investor-lender to liquidate the owner's personal assets such as home, car and personal bank account to cover the business loan.

3.3 Both forms of asymmetric information coexist

In subsections 3.1 and 3.2 only the standard form of asymmetric information is present. Assumption 4 generates the problem of asymmetric information regarding the law.

Assumption 4. The share β of firms has a worthless personal guarantee. The share is the same among good and bad firms. Nonprofessional investors who lack legal expertise cannot observe whether a guarantee is valuable or worthless (asymmetric information regarding the law).

Intuitively, consider the following example. In the U.S.A *homestead exemption* protects guarantors in most states. If the property is the guarantor's principal residence, the guarantor is entitled to receive payment of homestead exemption from the sale proceeds, prior to the application of the proceeds to the obligation secured. The rules of homestead exemption are quite complex. Gropp et al. (1997) mention that in some states the level of homestead exemption is zero (e.g. Connecticut) and in others it has no upper limit (e.g. Texas). Gropp et al. (1997, p.218) go on: "Thus, even households with both high income and high assets can avoid repaying their debts in bankruptcy as long as their assets are below the applicable exemption level." Hence, our model can be interpreted as follows. The homestead exemption, which protects the guarantor, is either zero (the share $1 - \beta$ of borrowers) or has no upper limit (the share β of borrowers). These shares are common information. Everyone knows that a share β of firms have a worthless guarantee and the share $1 - \beta$ of them have a valuable guarantee. A nonprofessional investor has not more information. If he observes a guarantee, he does not know, whether it is valuable or worthless. Instead, an investor who has legal expertise knows the value of the guarantee.

Due to the standard form of asymmetric information a loan must have a guarantee (subsection 3.2). Unfortunately, asymmetric information regarding the law makes lending unprofitable under guarantees:

$$(1 - \beta)\alpha R + \beta[\alpha t_G + (1 - \alpha)t_B]R < (1 - \beta)\alpha + \beta, \text{ when } R = t_H Y . \quad (3.2)$$

Here (3.2) indicates that the share of borrowers with worthless guarantees is so high that lending is unprofitable even if the loan interest is at the upper limit. More precisely, the L.H.S of (3.2) shows the expected repayments. Each borrower knows whether his personal guarantee is valuable. As a result, bad firms with valuable guarantees do not apply for loans, because their projects have negative NPV. The first term denotes repayments from good firms with valuable guarantees. They always repay loans. The second term indicates repayments from firms whose guarantees have no value. This group involves both firm types and this kind of borrower repays a loan only if the underlying project is successful. The term on the R.H.S is the total amount of loans, which exceeds the expected repayments on the L.H.S. If interest R rises over $t_H Y$, good firms with valuable guarantees withdraw from the credit market. Then, the scenario is the same as in the absence of the guarantees and lending is unprofitable (recall (3.1)). Consequently, asymmetric information regarding the law destroys the credit market. An investor lacks legal expertise and cannot observe the quality of guarantees. He only knows that the share of valueless guarantees, β , is so high that lending is unprofitable. Personal guarantees are effective under the standard form of asymmetric information (subsection 3.2) but ineffective under asymmetric information regarding the law.

3.4 Financial intermediation

Subsection 3.1 introduces an economy with the standard form of asymmetric information. The problem is so difficult that it cannot be eliminated through monitoring. If only this problem appears, it can be eliminated using personal guarantees (subsection 3.2). Unfortunately, asymmetric information regarding the law coexists and this makes guarantees ineffective (subsection 3.3). If asymmetric information regarding the law can be eliminated, credit markets can operate using personal guarantees. In this subsection a bank arises endogenously to operate as a financial intermediary and a delegated legal expert between firms and investors. The bank eliminates asymmetric information regarding the law and lends entirely to borrowers whose guarantees are valuable. Thereafter, the guarantees eliminate the standard form of asymmetric information: only good firms seek loans.

Suppose that an investor can attain legal expertise and use it to find out the values of personal guarantees. Legal expertise incurs a fixed non-monetary cost $K > 0$ to an investor. Thereafter, he can utilize the expertise in evaluations. Each evaluation entails an extra non-monetary cost, $k > 0$, to him. Hence, if he participates only in one evaluation the costs equal to $K + k$. If he participates in the evaluations of n firms the costs add up to $K + nk$.

If only one investor participates in the evaluation process of a firm, the costs total k . If two investors participate, the costs total $2k$. Hence, it is optimal that only one investor evaluates a firm. Suppose that $\hat{N} \leq N$ investors in the economy attain legal expertise and evaluate firms. This entails costs $\hat{N}K + Nk$ in the economy of N firms. These costs are minimal if only one investor attains legal expertise, $K + Nk$. It is optimal for an investor to assume the role of an investor-banker, who develops the legal expertise and establishes a bank, whereas other investors become investor-depositors who deposit their endowments in the bank.

Consider a bank with legal expertise. Due to the standard form of asymmetric information, each loan has a personal guarantee. Each good firm and all bad firms with worthless guarantees seek loans and the amount of loan applications is $[\alpha(1-\beta) + \beta]N$. The bank evaluates the loan applicants and grants loans to $\alpha(1-\beta)N$ firms with valuable guarantees. The breakeven loan interest of the bank is $R_b = 1 + [\alpha(1-\beta) + \beta]k / \alpha(1-\beta) + K / \alpha(1-\beta)N$. The time-line is the following.

1. An investor becomes an investor-banker and establishes a bank. He publicizes R_b as the loan interest. A loan must be secured with a personal guarantee.
2. The investor-banker promises gross interest 1 to investor-depositors (the other investors).
3. The investor-banker exerts its efforts to build up legal expertise.
4. Investor-depositors make their deposits. The amount of deposits is $(1-\beta)\alpha N - 1$. The investor-banker injects his endowment, 1, in the bank as equity capital.
5. The investor-banker grants $(1-\beta)\alpha N$ loans to firms with a valuable guarantee.
6. The project outputs materialize. Owing to full personal guarantees, each loan yields repayment R_b and the repayments total $(1-\beta)\alpha NR_b$. If we subtract from this the costs of legal expertise, $[\alpha(1-\beta) + \beta]k N + K$, we get $(1-\beta)\alpha N$, which covers the repayments to investor-depositors and to the investor-banker.

Hence, if the bank behaves well, each loan has a legitimate guarantee and yields the same repayment, R_b , to the bank. The repayments cover the costs of legal expertise and payments to the depositors and to the banker. Suppose that the banker misbehaves and does not develop legal expertise. In our model, as in Diamond (1984), the number of borrowers, N , approaches infinity and the project risks are independent. Owing to the law of large numbers perfect diversification

within the bank guarantees that the returns of the bank are fixed if it misbehaves.⁶ Now the fixed returns are low and insufficient to cover payments on deposits and the bank fails with certainty (recall (3.2)). Hence, the banker is motivated to develop legal expertise. Perfect diversification within the bank eliminates the incentive problem between the bank and depositors (the monitoring the monitor problem).⁷ Consequently, we need Diamond's assumption on infinite bank size and independent loan risks to eliminate the incentive problem. We do not need his assumption to make the bank risk free. If the banker behaves well and develops legal expertise, each loan is risk free with certainty owing to a legitimate guarantee.

The bank can issue risk-free deposits. Deposits have no collateral or personal guarantees and represent the same risk class: that is, no junior or senior deposits exist. Hence, investor-depositors can make deposits even if they lack legal expertise but the bank's operations must be supported by legal expertise. It is possible to say that the bank transforms complex loans, which require legal expertise, into simple deposits for which such expertise is unnecessary. The deposit contract between the bank and a depositor is very simple. These features protect the depositors who lack legal expertise, make demand deposits into a liquid security and allow deposits to act as a medium of exchange.

⁶For brevity, we omit the proofs on the laws of large numbers. The proofs often utilize Chebychev's inequality and are rather standard in this literature. Chebychev's inequality can also be used in our model, because project returns are independent random variables, each having the same mean and each having the same finite variance. For exact proofs on the laws of large numbers, see e.g. Rosenthal (2006). See also articles in footnote 7.

⁷ For diversification, see also Winton (1995, 1997), Ramakrishan & Thakor (1984) and Hellwig (2000).

Proposition 3. *Under asymmetric information regarding the law it is socially optimal to establish a financial intermediary, a bank, which builds up legal expertise and uses it in numerous loan contracts on the behalf of depositors who lack legal expertise.*

3.5 Outside collateral

Up to now, we have assumed that a bank eliminates the standard form of asymmetric information by using personal guarantees and that a bank is needed to ensure that the guarantees are legitimate. This subsection shows that it is possible to replace personal guarantees with outside collateral. Otherwise, the model is the same as in subsections 3.1-3.4.

In detail, the standard form of asymmetric information (investors cannot separate good and bad borrowers) makes lending unprofitable just as in subsection 3.1. The problem cannot be eliminated by monitoring borrowers. Fortunately, since each owner-manager of a firm has sufficient personal assets (Assumption 3), the information problem can be eliminated using outside collateral if asymmetric information regarding the law is not present. Under outside collateral only good firms apply for loans, because the owner-managers of bad firms are unwilling to pledge personal assets as collateral for projects whose NPV is negative. Hence, outside collateral eliminates the standard form of asymmetric information efficiently if asymmetric information regarding the law is not present. We, however, assume that this problem appears as follows. The legalities governing the collateralization process are assumed to be obscure or overly complicated. Therefore, a nonprofessional investor (who lacks legal expertise) may make a mistake in the collateralization process and the collateralization is not legitimate. As to the complexity of the collateralization process, Udell (2004, p. 226) describes this process in the U.S.A:

“The relative rights of creditors with competing liens to the same collateral are referred to as their priority. Priority is established by perfection. *Perfection* is a method by which a secured creditor puts

the world on notice of its interest in the collateral and establishes the priority of its claim to the collateral, as against other secured creditors and anyone else claiming an interest in the collateral.”

There exists a variety of detailed methods of perfection, depending upon the category of the collateral. Udell lists over ten different categories! Udell (2004, p. 227) goes on to comment:

“Also, the rules for perfecting a security interest may vary, depending on the category of collateral. If the wrong category is selected, the wrong method of perfection may be used, with the result that the security interest will be unperfected.”

Shouls & Change (2003) stress the complexity of the collateralization process as follows:

“Perfection of a security interest is often a rather complex matter Examples of the steps necessary, in different jurisdictions, to perfect a security interest include registration or filing of details of the charge with a public official or a public register; notarization of the document pursuant to which the security interest is created; segregating the collateral assets in a special collateral account; notification to other relevant party/ies; and taking possession of the collateral. Which, if any, of these steps will be necessary to perfect a security interest will depend on the type and location of the assets and the type and location of the counterparty. In some jurisdictions creation and perfection steps may be needed not just at the outset when collateral is first posted; they may also need to be repeated on the posting of additional or top-up collateral, or on the substitution of collateral.”

In addition, Hilson (2013) documents numerous examples of complex legislation in collateralization processes. Flesing et al. (2006, p.23) survey worldwide evidence and report their findings as follows:

“Many legal systems place needless restrictions on creating security interests excluding economically important property, agents and transactions. Where such gaps exist, lenders cannot be sure that a secured transaction, such as a loan agreement using collateral (a security agreement), will be lawful and that a court will enforce it. Special statutes authorizing the creation of security interests in moveable property may restrict the parties able to undertake the transaction, the nature of the transaction, and the type of the property that can serve as collateral. Under this fragmented approach a law may have limited application: Some laws may apply to banks, registered businesses, consumers, microentrepreneurs, or farmers. Some

may apply only to pledges, leases, mortgages, trust agreements, or sales with retention of title. And some may apply only to cattle or mining equipment. The end result is that some loans cannot be secured with moveable property, some property cannot secure a loan, and some borrowers and lenders cannot use some types of instruments or give or take a security interest in some types of property.”

In the absence of professional legal expertise an investor faces the risk of making a mistake in the collateralization process and his secured loan is in fact unsecured. We assume a nonprofessional investor makes this kind of mistake with probability β . Hence, if the owner of the firm pledges his personal assets as outside collateral for the loan of his firm, the collateralization has no value with probability β . The risk is the same as above in the context of personal guarantees; a guarantee is valueless with probability β . Asymmetric information regarding the law, which now becomes apparent if a nonprofessional investor makes a mistake in the collateralization process, makes lending unprofitable

$$(1 - \beta)\alpha R + \beta[\alpha t_G + (1 - \alpha)t_B]R < (1 - \beta)\alpha + \beta, \text{ when } R = t_H Y . \quad (3.3)$$

Here (3.3) is the same as (3.2) above. Each borrower knows whether his collateralization is legitimate. If it is legitimate, only good borrowers whose projects have positive NPV accept loan offers (the first term on the L.H.S). Bad borrowers with legitimate collateralization withdraw and do not borrow. If the collateralization is illegitimate, good and bad borrowers apply for loans (the second term on the L.H.S). The R.H.S indicates the volume of lending. A nonprofessional investor anticipates correctly his risk to make a mistake, β , and knows that lending is unprofitable.

Owing to the standard form of asymmetric information, an investor is ready to grant fully secured loans only (recall (3.1)). Unfortunately, owing to asymmetric information regarding

the law a large share of the collateralizations is illegitimate, which makes lending unprofitable (recall (3.3)). This generates the need for a bank. In subsection 3.4 the bank uses its legal expertise to evaluate personal guarantees. In the current subsection, the bank uses legal expertise to ensure that collateralizations are legitimate. Hence, the bank attracts deposits, develops legal expertise and makes loans. Each owner-manager of a firm must pledge his personal assets as collateral for the business loan of his firm. The collateralizations are legitimate, because the bank has legal expertise. Since the bank grants only fully secured loans, each loan – and the bank – is risk free. Perfect diversification within the bank again eliminates the incentive problem between the bank and depositors.

It is possible to summarize the key ideas of section 3 as follows. In contrast to the traditional banking theory, the main task of a bank is not to acquire information about borrowers and the profitability of their projects. Now these information problems are so difficult that banks cannot eliminate them through monitoring. These can be eliminated using personal guarantees or outside collateral. These instruments ensure that only good firms apply loans. The main task of a bank is to develop legal expertise so that it can evaluate and eliminate the legal risks of personal guarantees and collateralization processes. The bank advances seminal financial intermediation services to the economy even if it grants only loans which are fully protected by personal guarantees or collateral.

A famous article by Manove et al. (2001) argues that banks may be lazy, because they do not invest sufficiently in project monitoring preferring instead to grant mostly secured loans.⁸ With full agreement on the importance of these findings, our paper suggests an alternative explanation. It may be that banks are not lazy but that their key task is something different. Perhaps the key task of banks is to use legal expertise in secured lending and other details of financial contracts?

⁸For lazy banks, see also Franks & Sussman (2005).

4. Conclusions

This paper studies asymmetric information regarding the law in credit markets. What are its impacts? How does it differ from the standard form of asymmetric information? How can it be eliminated? The study reveals that asymmetric information regarding the law causes the same problems as the standard form of asymmetric information: credit rationing, underinvesting and overinvesting. The main difference between these two information problems is that the standard form of asymmetric information can be eliminated using collateral or personal guarantees. These methods are rather ineffective under asymmetric information regarding the law if the investor lacks legal expertise. Obviously, it is possible to build up legal expertise. Unfortunately, most of us have such limited funds available for lending that the small volume of lending makes qualification unprofitable. To eliminate the negative effects of asymmetric information regarding the law, it is optimal to establish a financial intermediary, a bank, which builds up its legal expertise and utilizes it in numerous loan contracts on behalf of the depositors, enabling us to make deposits without legal expertise. Asymmetric information regarding the law is most likely to generate problems in multinational lending. Foreign lenders usually have less information about the legal system than domestic lenders. Misinterpretation may be significant if the legal system differs considerably from one's own. This highlights the task of banks in multinational finance.

We have analyzed few incidents of asymmetric information regarding the law. It can appear in several alternative forms. Consider the following example. Davydenko & Franks (2008, p. 566-567) describe the values of collateral assets:

“While real estate collateral is the most important source of banks' recovery in Germany and the United Kingdom, it is far less valuable in France, both because sales proceeds there are diluted by

preferential creditors such as employee wages and bankruptcy fees, and because French bankruptcy courts tend to sell assets below their potential market prices in order to preserve employment. By contrast, accounts receivables and personal guarantees can be realized by French banks directly, and the proceeds are not subject to dilution by creditors. As a result, these collateral types are used more often than real estate at loan origination in France.”

Assume that a firm pledges its business assets as inside collateral. The lenders share these collateral assets when they make loan contracts. In the absence of local legal expertise a nonprofessional investor may choose valueless collateral assets (real estate) whereas an investor with legal expertise selects valuable collateral assets (receivables). As result, the latter investor obtains high proceeds in the bankruptcy process whereas an investor who lacks legal expertise receives low proceeds. It is possible to show how credit rationing, underinvestment or overinvestment problems appear in this scenario and create a demand for a financial intermediary.

Interestingly, information advantage may vary between different types of asymmetric information. Consider a venture capital fund and a firm developing a new product. With regard to the standard form of asymmetric information, the firm may be better aware of the value of the new product (the quality of technology or the quality of the medicine) than the venture capital fund. As to the asymmetric information regarding the law, consider the complex financial contracts between the fund and the firm. The venture capital fund is likely to understand the implications of the contract details better than the entrepreneur. We leave these ideas for new research projects.

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