Financial Intermediation and the Incentives to Produce Information

Régis Breton
FORUM, University of Paris 10 at Nanterre

Address for correspondence
Université de Paris 10 - Nanterre
FORUM, Maison Max Weber (bât K)
200, avenue de la République
92001 Nanterre, France
regis.breton@u-paris10.fr
00 33 1 40 97 59 14 (Office)
00 33 1 40 97 78 86 (Fax)

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Abstract

This paper provides a stylised model of financial intermediation where informational rent is the motivating force underlying information production. Investors can initially engage in costly information production about firms, but this information is valuable in the future. Individual lenders cannot keep their information private because their investment strategy reveals it, which destroys ex ante their incentive to produce this information. Diversified intermediation naturally arises as a concealment mechanism allowing investors to extract informational rents in the second period. If past records reveal too much information, lowering accounting standards can stimulate information production.

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1 Introduction

A widely held view in financial intermediation theory is that one special feature of banks is their offering of information-intensive loans at low cost, thereby reducing informational asymmetries between lenders and borrowers (Diamond, 1984; Fama, 1985). However, this very process also creates informational asymmetries between the bank and uninformed potential competitors (banks or markets). The implied ability of banks to extract rent is generally seen as a distortion that should be circumscribed (Rajan, 1992; Sharpe, 1990). This paper challenges the view that informational rent in financial intermediation is a cost. The basic argument is that the search for informational rent can be the underlying force driving information production. In a second best world, privacy of information may then be a requisite for banks to perform well, for a reduction in informational rents can undermine the incentives to engage in costly information production about loan applicants. This insight is used to develop a theory of intermediation, whereby diversification arises endogenously as a dissimulating mechanism making long term lender - borrower relationships credible.

The above argument hinges on the trade-off between information production and diffusion, that naturally arises when information is costly to produce[1]. It also highlights another related specificity of banks put forward by Mayer (1988), i.e. *commitment* to a long term relationship. Much of the literature on financial intermediation and long term relationships assumes that information is costless. 'Inside information' is generated as a by-product of the long term bank-firm relationship (Rajan, 1992; Sharpe, 1990; Petersen and Rajan, 1995). Banks obtain bargaining power *ex post,* from private information they obtain about the firm during the course of the lending relationship. Hovever, one can argue that information production typically requires efforts and various costs that must be taken into account. Here, it is the prospect of a long term relationship that makes it profitable to engage in information acquisition. The logic is, so to speak, forward looking, while the usual argument has the history of the credit relationship producing information (backward looking).

[1] Acemoglu and Zilibotti (1996) analyses the consequence for development of markets / banks assuming that markets have an advantage in the diffusion of information, and banks in its production.

In the certification theory of financial intermediation, an intermediary produces information in order to resell it. The related problem is the reliability of information, and whether it can be credibly revealed (Allen, 1990). In contrast, intermediaries such as banks typically do not sell their information, but use it in the course of an enduring relationship. When information is costly to produce and transferable[2], its production may require informational advantage to be retained. A crude example will illustrate this. Consider an environment where a borrower's past records can be used to assess its creditworthiness. How can a young entrepreneur, i.e. with no public history, get financed? Choosing monitored finance allows a young firm to initiate its projects, and to build a reputation before going directly to the market (Diamond, 1991). Further, assume that monitoring is so costly that compensating for the cost necessitates a long term relationship. Public observation of the firm records or of the institution financing allows the firm to seek financing at lower cost. There is evidence that stock prices rise after a credit has been granted by a bank, and theory suggests that the presence of an intermediary has a positive signalling effect[3]. While this can be beneficial, one adverse consequence is that it limits the firm's ability to share future surplus. If this effect is strong enough, even monitored finance may be unable to finance the project in the first place. The building reputation process cannot be initiated.

The privacy of banks' information contrasts itself with information publicity about firms rated on the stock exchange. From an empirical point of view, it is a well established fact that bank-based and market-based financial systems strongly differ in their degree of information disclosure. In the former, a huge amount of information is public, while in the later most information about investments is privately held by banks and other financial intermediaries. While comparative advantages of markets and banks account for a large part of this stylised fact, the legal framework is also not neutral. The opacity of (continental) European systems have been recurently criticised by international investors. In contrast, legal disclosure requirements are much more stringent in market-based economies (e.g. standard of accounts, *corporate governance* charters). Demirgüçs-Kunt and

[2] In the sense that others can make profit if they happen to learn the information. So, we do not consider 'soft' or 'investor specific' information.

[3] See Yosha (1995) and the references therein. Holmstrom and Tirole (1997) or Diamond (1991) can account for the signalling effect.

Levine (1996) find that countries with lower accounting standards are more prone to have a bank-based financial system. Is there logic, hitherto unnoticed, to this correlation between the private nature of banks information and the opacity of the legal structure? This paper suggests that less informative accounting standard can foster information production and the formation of financial intermediaries, by legally protecting informational advantages. Conversely, transparency, allowing competitors to more easily poach one another's clients, can reduce *ex ante* incentive to produce information.

From a more theoretical point of view, this paper makes a simple though (we believe) fundamental point. Informational rents and informational asymmetries are not necessarily detrimental to welfare. Indeed, the very seeking of informational symmetries may well be the motivating force behind information production. Information and innovation share common features that account for this analogy between monopoly rents and informational rents. Indeed, a number of contributions pertaining to the economics of information suggests that information publicity is not necessarily beneficial. The Grossman and Stiglitz's (1980) paradox on the impossibility of (strongly) informational efficient equilibrium forcefully illustrates the trade-off between the production and the diffusion of information. Posterior research shows that informational efficiency is neither a necessary nor a sufficient condition for allocative efficiency (Dow and Gorton, 1997). Hirshleifer (1971) gives a seminal example of how early arrival of information can destroy insurance opportunities. It initiated a literature on the analysis of the optimality of equilibria when prices reveal information, showing that prices may convey too much information (Laffont, 1985). Hence, market incompleteness can be beneficial by reducing the informational content of prices (Marín and Rahi, 2000). At a microeconomic level, Crémer (1995) shows that the reduction of informational asymmetry in an agency relationship can weaken the agent's incentives and make the principal worse off. All these papers illustrate the idea that more information is not necessarily better. This paper contributes to this idea, with a focus on the intertemporal linkage between informational rent, long term relationships, and information production. The basic argument is that informational rent can be necessary for the production of costly information. This is analogous to the Grossman Stiglitz paradox on financial markets. The creation of informational asymmetries appears as a necessary condition for information production. Surprisingly, this kind of argument has not been applied to the analysis of financial intermediation,

though the logical argument extends quite naturally.

To formally address these questions, the next section develops a simple model where costly information has social value because it allows for the discrimination between investments. The value of information spreads itself over two periods. Investors can be compensated for incurring the cost of information only if they maintain an enduring relationship with borrowers, because short term profits fall short of the information cost. The general methodology is to characterise renegociation proof contracts under different financing mechanisms. By financing only profitable projects, an investor perfectly reveals the quality of its clients, therefore jeopardising his informational rent in period two. An unravelling argument then shows that *ex ante,* it is not individually rational to acquire information. The problem is that firms cannot use future value to compensate investors for the initial cost, because they cannot commit to an enduring relationship with the initial lender. Outside investors infer information from two sources; first period results, and the investor behaviour. A key result is that financial intermediation with diversification can improve on direct financing. We further show that the adoption of noisy accountings standard can help mitigate the underlying problem when it is severe.

The logic of the argument should hold under fairly general assumptions. *(a)* Valuable information can be acquired *ex ante*, allowing ressources to be more efficiently allocated among several invetsments, but this information is costly. *(b)* The present value of information offsets the initial cost, but the short term gain is insufficient. The intertemporal profile of the stream of gains is thus critical. *(c)* The investor's actions are observable, and likely to reveal part of his information. Finally *(d)* Agents have a limited ability to commit to long term contracts.

The rest of the paper is organised as follows. Section 2 presents the framework and characterises the first best equilibrium. Section 3 analyses direct finance. Section 4 shows how diversified intermediation can spur on the production of information. Section 5 analyses accounting standards. Section 6 discusses the relationship to the existing literature and concludes.

2 The framework

Consider an economy with entrepreneurs seeking external finance for projects. Entrepreneurs have no money of their own, and there is a continuum of *ex ante*

identical financiers who have access to a riskless interest rate, normalised to $r = 0$. All agents are risk neutral. There are two types of projects / entrepreneurs. The initial population of borrowers contains a proportion λ of type H and a proportion $1 - \lambda$ of type B. The proportions are public information. To focus on the aforementioned effects, we assume that entrepreneurs do not initially know their type[4]. This will make it clear that the main point lies not in *ex ante* information asymmetries, but in the linkage between information production and *ex post* information asymmetries (on the same side of the market, i.e. the lenders' side). A project lasts for two periods. At each period, an entrepreneur can invest up to $I = 1$ in his project. In the first period, a project succeeds with probability p_j $(j = H, L)$, yielding a revenu $\pi_1 > 1$. In the second period, a type L project fails with probability 1, and a type H succeeds with probability 1, yielding $\pi_2 > 1$. We make the following assumptions:

Assumption (A1). $p_H \pi_1 > 1 > p_L \pi_1$

Assumption (A2). $(\lambda p_H + (1 - \lambda) p_L) \pi_1 > 1$

Assumption A1 states that type H projects are profitable in period 1, whereas type L projects are not. Note that one consequence of A1 is that $p_H > p_L$. Under A2, a representative project is worth financing in period 1, even without knowing its type.

First period results are publicly observed, and constitute a signal about the project's type that can be used to assess the period 2 probability of success. Without any additional information about the project's type, revised probabilities upon observing the first period signal are given by Bayes' rule:

$$\begin{aligned} \Pr[H|s] &= \frac{\lambda p_H}{\lambda p_H + (1 - \lambda) p_L} \\ \Pr[H|f] &= \frac{\lambda (1 - p_H)}{\lambda (1 - p_H) + (1 - \lambda)(1 - p_L)} \end{aligned}$$

where s stands for 'success', and f for 'failure' in the first period. For convenience, it is worth characterising the information generated by the first period results

[4] This is a departure from much of the literature on credit market. This is not a crucial assumption, as with zero initial wealth for borrowers, screening is not possible. The same intuitions would therefore hold, with lenghier algebra. The main advantage of this assumption is to have a welfare criterion through the assumption of *ex ante* homogeneity.

through the financing decision it would lead to in period 2. Three cases should be distinguished.

Case 1. $\Pr[H|s]\,\pi_2 < 1$. Although a success in period 1 is interpreted as good news, it does not discriminate types sufficiently. Even a project that succeeded has negative net present value (NPV) in $t = 1$. Formally, one has the following condition on parameters:

$$\frac{\lambda}{1-\lambda}(\pi_2 - 1) < \frac{p_L}{p_H} \tag{2.1}$$

Case 2. $\Pr[H|f]\,\pi_2 < 1 < \Pr[H|s]\,\pi_2$. A project that has been successful has positive NPV at $t = 1$, while a project that failed has negative NPV. This corresponds to

$$\frac{p_L}{p_H} < \frac{\lambda}{1-\lambda}(\pi_2 - 1) < \frac{1-p_L}{1-p_H} \tag{2.2}$$

Case 3. $\Pr[H|f]\,\pi_2 > 1$. This is the converse to case 1. The first period result does not discriminate much, and there are enough valuable projects in the sample for even unsuccessful projects to have positive NPV. The condition on parameters is

$$\frac{1-p_L}{1-p_H} < \frac{\lambda}{1-\lambda}(\pi_2 - 1) \tag{2.3}$$

The wealth of a given investor is such that he can only finance one project per period. Investors can acquire information on the entrepreneur's type at $t = 0$, at a screening cost $c > 0$. In this case, both the financier and the entrepreneur perfectly learn the project type. This noiseless signal is private information, and cannot be credibly revealed to other agents. We now turn to the characterisation of the social optimum.

2.1 First best equilibrium

When is it socially optimal to acquire *ex ante* information on the entrepreneurs' types? The welfare criterion is naturally the expected intertemporal utility of the representative entrepreneur.

First assume that information about types is not produced. Under A2, all entrepreneurs are financed in the first period, yielding a surplus $(\lambda p_H + (1-\lambda)\,p_L)\,\pi_1 - 1$. Refinancing is contingent on first period result, as it signals the underlying quality of projects. When (2.1) holds, any project has negative NPV, hence no refinancing

occurs. When (2.2) holds, only successful projects are refinanced. Finally, when (2.3) holds, every project is refinanced. If society does not acquire information, the social surplus is therefore given by

$$V^{ns} = \begin{cases} \lambda\left[p_H\pi_1 - 1\right] - (1-\lambda)\left[1 - p_L\pi_1\right] & \text{if (2.1)} \\ \lambda\left[p_H\pi_1 - 1 + p_H\left(\pi_2 - 1\right)\right] - (1-\lambda)\left[p_L + 1 - p_L\pi_1\right] & \text{if (2.2)} \\ \lambda\left[p_H\pi_1 - 1 + \pi_2 - 1\right] - (1-\lambda)\left[1 + 1 - p_L\pi_1\right] & \text{if (2.3)} \end{cases} \tag{2.4}$$

Now consider that types are known. Only positive NPV projects, i.e. type Hs, would be financed, yielding the result[5]

$$V^s = \lambda\left[p_H\pi_1 - 1 + \pi_2 - 1\right]$$

The social value of information is defined as the increment in welfare its use can yield, $V^s - V^{ns}$, while its cost is c. Therefore, the screening activity is socially beneficial if and only if its value offsets its cost:

$$V^s - V^{ns} > c \tag{FB}$$

It is useful to take one case, say case (2.2), to break down this condition. Eq. (FB) then writes

$$\underbrace{(1-\lambda)\left(1 - p_L\pi_1\right)}_{\text{period 1}} + \underbrace{(1-\lambda)\,p_L + \lambda\left(1 - p_H\right)\left(\pi_2 - 1\right)}_{\text{period 2}} > c$$

The value of information stems from the efficiency gains in the allocation of resources to projects. These gains spread over the two periods. In period 1, information on types allows the non financing of type L projects, avoiding the $(1-\lambda)\left(1 - p_L\pi_1\right)$ loss. In period 2, two inefficiencies are not borne, compared to the case where types are unknown. On the one hand, profitable projects that failed in the first period are no longer rejected (gain $\lambda\left(1 - p_H\right)\left(\pi_2 - 1\right)$). On the other hand, successful type L projects are not refinanced (gain $(1-\lambda)\,p_L$). For notational convenience, let v_1 be the current (i.e. first period) value of information, and v_2 the future (period 2) value. Cond. (FB) then rewrites

$$v_1 + v_2 > c \tag{FB}$$

[5] In this risk neutral world, there is no need for insurance against types, and no Hirshleifer effect.

with

$$v_1 = (1-\lambda)(1-p_L\pi_1) \tag{2.5}$$

$$v_2 = \begin{cases} \lambda(\pi_2 - 1) & \text{if (2.1)} \\ (1-\lambda)p_L + \lambda(1-p_H)(\pi_2 - 1) & \text{if (2.2)} \\ 1-\lambda & \text{if (2.3)} \end{cases} \tag{2.6}$$

Under (2.1), the first period inefficiency is the non financing of valuable projects, while under (2.3), it the refinancing of project with negative NPV. Figure 1 draws (as solid line) v_2 as a function of λ. Unsurprisingly, v_2 is zero for extreme values for λ. Information has a value insofar as the *ex post* distribution differs strongly from the *ex ante* distribution[6]. If one knows with near certainty that all projects are type H's, the optimal decision will hardly be influenced by the revealing of types.

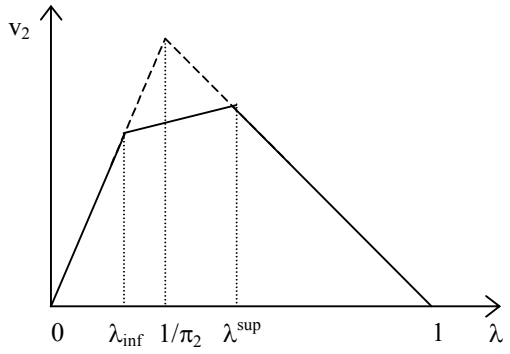

Figure 1: Future value of information (v_2)

In all that follows, cond. (FB) is assumed to hold. The driving question is the mechanism that implement this first best allocation; i.e. How can one insure that private investors have the incentive to acquire this costly information? Three successive settings will be analysed. They are direct financing, financial intermediation, and financial intermediation when privacy of information is incorporated into the legal framework. The analysis proceeds by characterising the conditions under which information production can take place. Figure 2 shows the general sequence of events. Figure 3 gathers the results of these sections, showing that all situations exist for some region in the parameter space.

[6] Hirshleifer and Riley (1979).

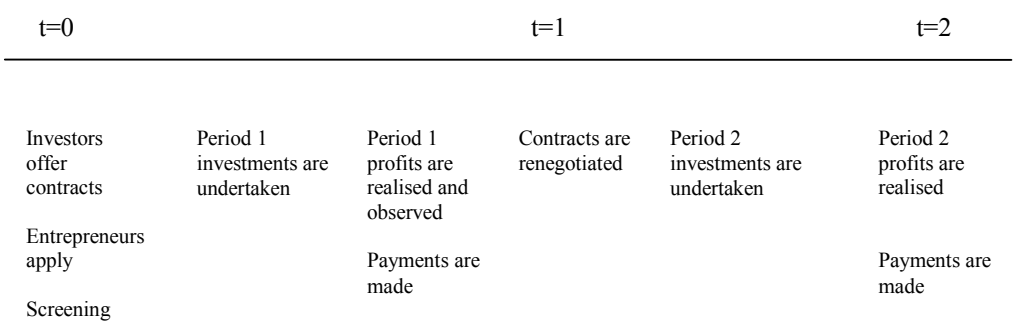

Figure 2: Timing of moves and arrival of information

2.2 Long term contracts

It is straightforward to see that long term contracts would allow the social optimum to be implemented. Suppose contract offers specify screening. Efficiency requires that only type H projects be financed, in both periods. Such a contract specifies state contingent payments (R^1, R^{2s}, R^{2f}) in case of success. Note that second period payments can be made contingent on first period result. An optimal long term contract formally resolves

$$\max_{R^1,R^{2s},R^{2f}} \lambda \left[p_H \left(\pi_1 - R^1 \right) + p_H \left(\pi_2 - R^{2s} \right) + (1 - p_H) \left(\pi_1 - R^{2f} \right) \right] \tag{2.7}$$

under the participation constraint for investors

$$\lambda \left[p_H R^1 + p_H R^{2s} + (1 - p_H) R^{2f} \right] \geq 2\lambda + c \tag{2.8}$$

and some resource constraints that we shall examine later. In equilibrium, investors just break even so that eq. (2.8) is at equality. Reinjecting this equality in (2.7), one gets for the entrepreneur's expected utility

$$V^{LT} = \lambda \left(p_H \pi_1 - 1 + \pi_2 - 1 \right) - c = V^s - c$$

Until now, we have assumed that (2.8) held. For this allocation to be attainable, the following resource constraints must hold:

$$R^1 < \pi_1 \qquad R^{2s} < \pi_2 \qquad R^{2f} < \pi_2 \tag{2.9}$$

In particular, cond. (2.8) requires that $\lambda\left[p_H\pi_1+\pi_2\right]\geq 2\lambda+c$, which is equivalent to $V^s-c>0$. As $V^s-c>V^{ns}$, one can conclude that long term contracts between entrepreneurs and financiers do implement the first best allocation. Note that, in this case, the average cost of information $\frac{1}{\lambda}c$ is payed by $p_HR^1+p_HR^{2s}+\left(1-p_H\right)R^{2f}$. The full future value of information can be commited to the repayment of the cost of information production.

What if long term contracts cannot be legally enforced? Doesn't the entrepreneur have an incentive in period 2 to seek finance from other investors (the market, convention adopted herein). Take the above long term contract, and use induction from $t=2$ backwards. Knowing that only type H projects have been financed, the mere fact of having obtained credit in period 1 perfectly signals the high quality of a given project to the market. The entrepreneur can then obtain finance at the riskless rate $r=0$. Any long term contract specifying a date 2 payment larger than 1 would then be terminated and renogotiated, no matter what contract was signed at the onset. We therefore have to focus on *renegociation proof* contracts. The investor's informational advantage disapearing in period 2, renegociation proofness simply requires that

$$\begin{aligned} R^{2s}&<1\\ R^{2f}&<1 \end{aligned} \tag{2.10}$$

These second period constraints add to the participation constraint (2.8) of investors. They set an upper bound on the share of the future value of information v_2 that can be used to compensate for the screening cost c. Investors are constrained to break even on the first period. Using constraints (2.10) and the investors' participation constraint leads to the following result:

Proposition 2.1. *Bilateral (direct) contracts implement the first best equilibrium if and only if*

$$\lambda\left(p_H\pi_1-1\right)\geq c \tag{2.11}$$

When cond. (2.11) holds, the expected profit in the first period is enough to compensate the investor for the acquisition cost: $p_H\pi>1+\frac{1}{\lambda}c$. How the entrepreneur gets financed in the second period does not matter at all. In the opposite case, $\lambda p_H\pi\leq\lambda+c$, short term remuneration is not enough to allow investors to acquire information, despite its social benefit. No long term (or short term) direct

(bilateral) contract specifying screening is possible. Direct finance then implements V^{ns}.

The logic follows an unravelling effect. The specified behaviour of the investor perfectly reveals at $t = 1$ the private information he has obtained at cost c. However the profit that he can make on a one period basis falls short of c. The anticipation that he will lose his informational advantage in period 2 undermines his *ex ante* incentives to engage in the screening activity. The next two sections are devoted to exhibiting mechanisms organising the privacy of information in order to restore these incentives. Typically, it requires being able to tie a share of period 2 surplus to the compensation for the acquisition cost c.

3 Direct financing

Financing by one individual investor is interpreted as direct financing. When cond. (2.11) does not hold, entrepreneurs cannot commit to tie to the initial lender, which in turn leads investors to stay uniformed (arms' lengh) at $t = 0$. Note that once the cost c has been sunk, the only rational behavior is to finance tye H projects, so that time consistent contracts specifying information acquisition must finance only type H entrepreneurs. The above discussion then yields the following result:

Proposition 3.1. *Suppose direct finance. If (2.11) holds, direct financing has screening to be undertaken by investors, yielding $V^s - c$ to entrepreneurs. If (2.11) does not hold, no screening takes place, and V^{ns} is implemented. The social optimum can be implemented by direct finance if and only if*

$$\lambda \left(p_H \pi_1 - 1 \right) \geq c \tag{C1}$$

When (C1) fails to hold, the initial lender and potential investors have access to the same public information. Thus, the contract is merely two successive short term contracts, with rates depending on the expected probability of success given this public information. In the first period, all entrepreneurs are financed (recall that A2 holds), at the gross rate

$$R^1 = \frac{1}{\lambda p_H + (1 - \lambda) p_L} \tag{3.1}$$

In the second period, the rating of a given entrepreneur is affected by the record of his success / failure.

Case 1. No project is financed in period 2

Case 2. Only succesful project are financed, with

$$R^2(s) = \frac{1}{\Pr[H|s]} = 1 + \frac{1-\lambda}{\lambda}\frac{p_L}{p_H} \tag{3.2}$$

Case 3. Both successful and unsuccessful projects are financed, with different conditions:

$$R^2(s) = 1 + \frac{1-\lambda}{\lambda}\frac{p_L}{p_H} \tag{3.3}$$

$$R^2(f) = \frac{1}{\Pr[H|f]} = 1 + \frac{1-\lambda}{\lambda}\frac{1-p_L}{1-p_H} \tag{3.4}$$

4 Diversified financial intermediary

When the condition (C1) is violated, we argue that intermediation can be essential. Suppose investors are able to form intermediaries. The important assumption is that an intermediary be able to finance numerous projects. It is straightforward to see that an intermediary with an undiversified loan portfolio cannot rationally hide its information. If an intermediary only finances entrepreneurs that he learns to be of type H, his private information will be perfectly revealed in $t = 1$. How can this intermediary (henceforth 'the bank') hide its information over the long run? This section shows that diversification, and the financing of unprofitable projects can act as a dissimulation device[7]. Diversification consists of financing at $t = 0$ not only type H projects, but also type Ls, in order to insure the privacy of the information. The informational advantage over potential investors gives the intermediary bargaining power over the surplus generated by good projects in period 2. In this simple framework, rent extraction has no distortive effect. Nevertheless, this concealment mechanism comes at a cost. This inefficiency is the initial financing of unprofitable type L projects.

Contracts offered by a bank have the following features. Any applying entrepreneur is financed in period 1, whatever his type. Assuming that entrepreneur's wealth be observable (or can be credibly revealed by entrepreneurs), another condition for information concealment is that both types pay the same amount, say R^b in case

[7] The conscious financing of unprofitable projects may seem provocative and counter-factual. Instead, one can think of a choice between a highly profitable projetc and a less profitable one.

of success[8]. Type L are rationed in the second period. All type Hs are financed in period 2, with conditions depending on first period results R^{bs}, R^{bf}. Before characterising optimal contracts, we determine the outcome of rent sharing in the second stage. Assuming that the intermediary consist of a continuum of financiers, applicants population contains a proportion λ of type H and a proportion $1-\lambda$ of type L. Reasoning is conducted with a unit mass population.

4.1 Rent sharing in the second stage

In period 2, the intermediary retains an informational advantage on its investments. As the financing strategy of the financial intermediary does not reveal any additional information, outside investors' information set reduces to first period results. This informational advantage differs among projects, depending on first period results As a consequence, the bank have bargaining power over the surplus generated by the firm in $t = 2$. It can use it to extract more payment than agreed at the outset (Rajan, 1992). Symmetricaly, the entrepreneur can seek financing in the market to obtain a lower payment than contracted upon.

The informational rent is defined as the amount of value that can be created by the initial investor and the entrepreneur above the value they can generate separetedly[9]. For simplicity, we assume that renegociation leads to a generalised Nash solution. Let μ and $1-\mu$ denote the shares of the rent that accrue to the intermediary and the entrepreneur, respectively[10]. The size of the rent naturally depends on the first period result. Outside the relationship, the bank gets nothing. Suppose that the observed creditworthiness of an entrepreneur is such that uninformed investors demand R. The entrepreneur's outside option is then $\pi - R$. With the banks, he is able to generate $\pi_2 - 1$. The size of the rent is thus $\pi_2 - 1 - (\pi_2 - R) = R - 1$, which makes clear how the size of the rent depends on the informational advantage. If the entrepreneur cannot obtain outside finance, the rent raises to $\pi_2 - 1$. With this in mind, it is straightforward to compute the rent that the bank is able to extract in period 2. We now turn to this issue.

[8] A simple look at the proofs makes it clear that nothing is altered if we allow for type contingent payments. This assumption simply helps to economise on notation, by setting $R^b_L = R^b_L = R^b$.

[9] I follow the standard definition of the rent in a bilateral relationship with specific assets.

[10] Formally, the bargaining solution solves $\max_{R^b} \left(R^b - r\right)^{\mu} \left(\pi_2 - R^b - V^{2m}\left(s/f\right)\right)^{1-\mu}$, where $V^{2m}\left(s/f\right)$ the entrepreneur's outside option.

Case 2. Successful type H projects can be financed by uninformed investors at the rate $R^2(s) = \frac{1}{\Pr[H|s]}$. The rent is then $R^2(s) - 1 > 0$, of wich the intermediary extracts

$$R^{bs} - 1 = \mu\left(R^2(s) - 1\right) = \mu\frac{1-\lambda}{\lambda}\frac{p_L}{p_H} \tag{4.1}$$

A rent exists if and only if there is an informational advantage. Moreover, $\mu = 0$ implies $R^{bs} = 1$. An entrepreneur that failed in the first period would be rationed by the market. The share that accrues to the intermediary is

$$R^{bf} - 1 = \mu(\pi_2 - 1) \tag{4.2}$$

yielding $R^{bf} = \mu\pi_2 + 1 - \mu$. The informational advantage being larger in this case, the extracted surplus is larger ($R^2(s) < \pi_2$).

Case 1. No entrepreneur gets financed in the market in the second period. The rent is $\pi_2 - 1$ for all type H and the intermediary gets

$$R^{bf} - 1 = R^{bs} - 1 = \mu(\pi_2 - 1) \tag{4.3}$$

Case 3. All entrepreneurs can get financed, although at distinc rates. The bank extracts on successful and unsuccessful projects, respectively:

$$R^{bs} - 1 = \mu\left(R^2(s) - 1\right) \tag{4.4}$$

$$R^{bf} - 1 = \mu\left(R^2(f) - 1\right) \tag{4.5}$$

Let ρ_{DIV} denote the entire rent extracted by the bank.

$$\rho_{DIV} = p^H\left(R^{bs} - 1\right) + \left(1 - p^H\right)\left(R^{bf} - 1\right) \tag{4.6}$$

Next result links ρ_{DIV} to the value v_2. By retaining an informational advantage in the long term, the bank is able to extract the future value of information v_2 up to its bargaining power μ.

Lemma 4.1. *Denote by ρ_{DIV} the expected rent extracted on a type H entrepreneur. Then $\lambda\rho_{DIV} = \mu v_2$.*

Proof. Use eq. (4.1) to (4.2), and subsitute for $R^2(s)$ and $R^2(f)$ using eq. (3.2) to (3.3). Straightforward computation for ρ_{DIV} then yields the following. For case 1, $\rho_{DIV} = \mu(\pi_2 - 1)$. For case 2, $\rho_{DIV} = \mu\left(p_L\frac{1-\lambda}{\lambda} + (1 - p_H)(\pi_2 - 1)\right)$. Finally, for (2.3), $\rho_{DIV} = \mu\frac{1-\lambda}{\lambda}$. Comparing with the expressions (2.6) for v_2 concludes. □

We now turn to the characterisation of the optimal contract with intermediation.

4.2 Optimal contract with diversification

The expected profit at $t = 0$ over the lifespan of a credit relationship can be written as

$$\mathrm{E}_{t=0}\left[\Pi_b\right] = \lambda\left[p_H R^b - 1\right] + (1-\lambda)\left[p_L R^b - 1\right] + \lambda\rho_{DIV} - c \tag{4.7}$$

The loss entailed by financing negative projects is $(1-\lambda)\left[1 - p_L R^b\right] > v_1$. Hence, the first period value of information v_1 cannot be realised. Thus, an optimal contract with diversification solves:

$$\max_{R^b, R^{2s}, R^{2f}} \lambda\left[p_H\left(\pi - R^b\right) + p_H\left(\pi - R^{2s}\right) + (1-p_H)\left(\pi - R^{2f}\right)\right] + (1-\lambda)\, p_L\left(\pi - R^b\right)$$

submitted to the participation constraint

$$\left(\lambda p_H + (1-\lambda)\, p_L\right) R^b + \lambda\rho_{DIV} \geq 1 + c$$

Using the above condition with equality, as well as and lemma 4.1, the programme simplifies to

$$\max_{R^1} \lambda\left[p_H\left(\pi - R^1\right) + \pi - 1 - \rho_{DIV}\right] + (1-\lambda)\, p_L\left(\pi - R^1\right)$$

$$\text{s. t.} \qquad \left(\lambda p_H + (1-\lambda)\, p_L\right) R^b + \mu v_2 = 1 + c$$

This last condition can be solved for R^b. The participation contraint of the intermediary is feasible if and only if $R^b < \pi_1$, or equivalently (using (2.5))

$$\lambda\left(p_H \pi_1 - 1\right) + (1-\lambda)\left(p_L \pi_1 - 1\right) + \mu v_2 \geq c \tag{4.8}$$

For $\mu = 0$, cond. (4.8) reduces to $\lambda\left(p_H \pi - 1\right) > c + v_1$, which cannot hold when cond. (C1) is violated. The concealment mechanism is costly (loss of v_1) but no rent extraction occurs ($\mu = 0$). For $\mu = 1$ the banks can extract the entire informational rent, so that (4.8) reduces to $\lambda\left(p_H \pi - 1\right) + v_2 \geq c + v_1$. If this condition holds, there exists a threshold μ^* such that financial intermediation with diversification

is a second best equilibrium, provided that it generates higher welfare than not screening, i.e. if and only if[11]:

$$v_2 > c \tag{SB}$$

We shall refer to this situation as the second best optimum. Hiding information necessitates to give up the present value of informatio; v_1 can then be interpreted as the cost of dissimulation. Compare with (2.11); diversified intermediation potentially lengthens the horizon of the investors' participation constraint when $\mu v_2 > v_1$. Preserving the information asymmetry allows to transfer more future value v_2 to compensate for the screening cost incurred at date $t = 0$. The following result summarises the above discussion.

Proposition 4.2. *Suppose that (SB) holds. If (C1) does not hold, then diversified intermediation attains the second-best optimum, and improves on direct finance if and only if:*

$$\lambda (p_H \pi_1 - 1) + \lambda \rho_{DIV} \geq c + v_1 \tag{C2}$$

Corollary 4.3. *Suppose that (SB) holds, and that (C1) does not hold. Then if* $\lambda (p_H \pi_1 - 1) + v_2 \geq c + v_1$*, then there exists* μ^* *such that intermediation dominates direct finance iff* $\mu > \mu^*$*.*

Financial intermediation raises the incentives to produce information inasmuch as the rent that can be extracted offsets the inefficiency due to the financing of type L. Figure 3 shows that the situation described in proposition 4.1. exists for some parameter region.

5 Public accountability

Suppose (SB) holds, but not (C2). The future value of information offsets its cost, but intermediaries cannot extract enough second period rent, because μ is too low. Another reason is that too much information is naturally revealed to outside investors at the end of the first stage. As a consequence, the intial lender is unable

[11] Under this situation, the representative entrepreneur gets $V^{DIV} = V^s - c - v_1$. It is a *second best* equilibrium iff $V^{DIV} > V^{ns}$. Using $V^s = V^{ns} + v_1 + v_2$, one gets $v_2 > c$.

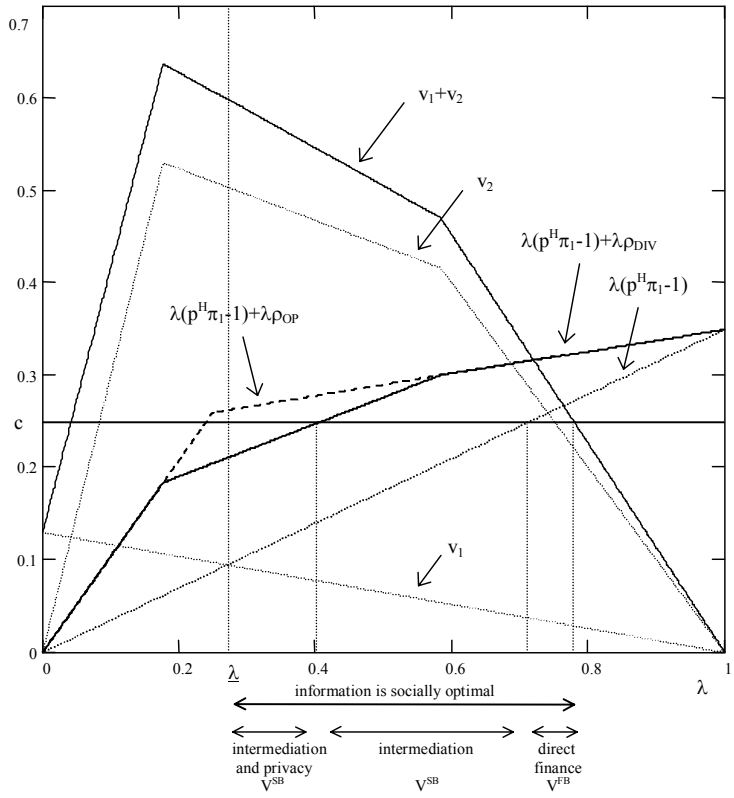

Figure 3: Illustration of propositions 3.1, 4.2 and 5.2. ($c = 0.25$; $\pi_1 = 1.5$; $\pi_2 = 4$; $p_L = 0.58$; $p_H = 0.9$; $\mu = 0.23$.)

to extract enough second period surplus to compensate for c. We now ask the following question. If entrepreneurs and investors could agree on accountability standard prior to $t = 0$, would they choose a legal structure with less information revealed to investors? The idea is simple: legal accounting standard can be used to put some noise into the project result[12]. To capture this idea, we simply analyse a situation where first period results become unobservable by outside investors.

How does this affect the bank's ability to extract rent? If outside investors have no interim information (signal), the rating of any project follows from the prior probability λ of a project to be of type H. Entrepreneurs can then obtain finance in period 2 at the rate $\frac{1}{\lambda}$ if $\lambda\pi_2 \geq 1$, and are rationed if $\lambda\pi_2 < 1$. The informational rent is thus given by $\pi_2 - 1$ in the later case, and by $1 - \frac{1}{\lambda}$ in the former. Denote by

[12] Logically, it is equivalent to think of reform as making things more open or less transparent. This way of presenting the issue highlights the fact that more information is not necessarily better.

ρ_{OP} the rent extracted on type H entrepreneurs. Then,

$$\rho_{OP} = \mu \left(\min \left(\frac{1}{\lambda}, \pi_2 \right) - 1 \right) \tag{5.1}$$

The following result verifies that the rent that can be extracted increases.

Lemma 5.1. *If outsiders do not observe first period results, the informational rent increases. More precisely,* $\rho_{OP} > \rho_{DIV}$ *iff (2.2) holds. For either case 1 or case 3,* $\rho_{OP} = \rho_{DIV}$.

Proof. See the appendix. □

The intuition behind this result is straightforward[13]. In cases 1 or 3, the first period signal does not improves allocation efficiency compared with no signal at all. Accounting opacity does not rise the informational rent. Conversely, in case 2, this interim signal is economically valuable. Therefore, opacity positively affects the *ex post* rent that intermediaries can extract. The participation constraint of a bank can be written as:

$$\left(\lambda p_H + (1-\lambda) p_L\right) R^1 + \lambda \rho_{OP} \geq 1 + c$$

which in turn requires that

$$\lambda \left(p_H \pi_1 - 1\right) + (1-\lambda) \left(p^L \pi_1 - 1\right) + \lambda \rho_{OP} \geq c \tag{5.2}$$

As any inefficiency is ultimately borne by entrepreneurs, entrepreneurs get $V^{OP} = V^s - c - v_1$ (see footnote 11, p.17). This case differs from the preceding in one but important dimension, i.e. the renegociation proof constraints, and the ability to extract rent in $t = 2$. Comparing (4.8) and (5.2) shows that when $\rho_{OP} > \rho_{DIV}$, the less transparent legislation allows more future information value to be used for compensating c.

[13] Take figure 1. The value of the costly information compared with no information at all is drawn as dotted lines. Difference with v_2 defines the value of the public signal generated by first period results. This signal is valuable insofar as the discrimination among projects is strong enough to be used in economic decisions.

Proposition 5.2. *Suppose (SB) holds. If (C1) does not hold, then diversified intermediation under accounting opacity attains the second best optimum, and is essential if and only if*

$$\lambda\left(p_H\pi_1 - 1\right) + \lambda\rho_{DIV} < c + v_1$$

and

$$\lambda\left(p_H\pi_1 - 1\right) + \lambda\rho_{OP} \geq c + v_1 \tag{C3}$$

Legal protection of information is essential if and only if intermediation by itself is not sustainable. Figure 3 shows that this case does arise.

6 Conclusion

In comparison with the existing literature, this paper offers a new, though sometimes complementary explanation for diversification within an intermediary. Diamond's (1984) seminal paper shows that diversification is essential for intermediary to act as a delegated monitor, thereby economising on information costs. Diversification reduces the agency problem between the monitor and final lenders. Here, diversification arises as a strategy that allows to dissimulate private information, thereby providing future payments for the costly information production. This is a potential explanation for diversification at early stage by venture capital.

We have sketched a theory of intermediation where *ex post* rent extraction in a long term relationship provides the stimulus for costly *ex ante* information production. It is close to Petersen and Rajan (1995) regarding the importance of future monopoly power, but the focus on active informational production yields some original contributions. Diversified intermediaries naturally arise as a mechanism hiding private information, allowing for an enduring borrower - lender relationship. The main argument is that when information is costly, its diffusion can hamper its production. While rent extraction can be experienced as an *ex post* source of inefficiency, it can be beneficial *ex ante* for it raises the incentive to engage in costly information production. Legal factors that make it more difficult to hide information may have adverse effects. Similarly, financial innovation allowing outside investors to assess more precisely the borrowers' creditworthiness out of past results could lead to disintermediation. Disclosure of proprietary information vis a vis their

competitors plays an important role in the choice of financing sources by firms, as analysed in Bhattacharya and Chiesa (1995) and Yosha (1995)[14]. We show that a similar problem can arise with the information intermediaries have about firms. Furthermore, we provide a rationale for the private nature of intermediaries' information that does not stem from the soft nature of information, nor from exogenous assumptions.

As for normative prescription, the above arguments suggests that reducing information asymmetries does not necessarily improves the overall efficiency of a financial system. One must take into account that legal framework changes can have a bearing on the sustainability of close relationships, and can jeopardise banks' activity. Mayer (1988), Petersen and Rajan (1995) and Allen and Gale (2000) all make the point that *commitment* or implicit contracts supported by long term relationships can be destroyed by increased competition. Financial system reforms and banking regulation reform should keep this possibility in mind.

As for future work, two additional implications are worth noting. *Conglomerate discount.* There is a growing empirical literature on assessing whether financial markets command a discount over highly diversified firms, on the ground that such practices allow firms to subsidise unprofitable activities with profitable ones. Empirical findings are not conclusive. The ideas developed herein provide a counter argument, as we suggest that diversification can be a strategy to avoid information leakage about investment projects. *Financial system evolution.* In the last decade, european financial systems have experienced a major change, with a shift away from bank-based systems to market-based sytems. How can this be explained? Is this change related to a Pareto improvement, or to other factors? This paper suggests that innovation in financial methods may have destroyed valuable credit relationships, and undermined information production by banks. While better screening techniques improves on the allocations that can be attained under direct finance, they can also bring pressure to bear on information-intensive intermediation. The effect is thus ambiguous. Furthermore, this type of exogenous change can account for either a shortening of relationships or disintermediation, i.e. a shift from intermediation to direct financing

[14] The argument that the choice of financing sources can be motivated by the need to hide strategic information was first pointed out by Campbell (1979).

A Proof of proposition 5.1

Case 2. One need to show that $\rho_{OP} > \rho_{DIV}$. (i) if $\lambda\pi_2 < 1$ then $\rho_{OP} = \mu(\pi_2 - 1)$, and $\rho_{OP} > \rho_{DIV}$ is equivalent to $\pi_2 - 1 > p_L\frac{1-\lambda}{\lambda} + (1-p_H)(\pi_2 - 1)$ or $p_H(\pi_2 - 1) > p_L\frac{1-\lambda}{\lambda}$ which is true by (2.2). (ii) if $\lambda\pi_2 > 1$. $\rho_{OP} = \mu\frac{1-\lambda}{\lambda}$ and $\rho_{OP} > \rho_{DIV}$ is equivalent $\frac{1-\lambda}{\lambda} > p_L\frac{1-\lambda}{\lambda} + (1-p_H)(\pi_2 - 1)$ or $(1-p_L)\frac{1-\lambda}{\lambda} > (1-p_H)(\pi_2 - 1)$ which is true by (2.2).

Case 3. $\Pr[H|f]\,\pi_2 > 1$. A project that failed is refinanced. This implies $\lambda\pi_2 > 1$, so that $\rho_{OP} = \mu\frac{1-\lambda}{\lambda}$. Moreover, those projects are financed at a rate $R^f = \frac{1}{\Pr[H|f]} = 1 + \frac{1-\lambda}{\lambda}\frac{1-p_L}{1-p_H}$, whereas a succesful project obtains $R^s = 1 + \frac{1-\lambda}{\lambda}\frac{p_L}{p_H}$. Consequently, $\rho_{DIV} = \mu\left(p_H(R^s - 1) + (1-p_H)\left(R^f - 1\right)\right) = \mu\frac{1-\lambda}{\lambda}$, hence $\rho_{DIV} = \rho_{OP}$.

Case 1. $\Pr[H|s]\,\pi_2 < 1$. A success in the first period being good news, this case requires $\lambda\pi_2 < 1$. Then, no entrepreneur get financed in the second period whatever the informational structure $\rho_{DIV} = \mu(p_H(\pi_2 - 1) + (1-p_H)(\pi_2 - 1)) = \mu(\pi_2 - 1) = \rho_{OP}$.

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