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ABSTRACT

Does Relationship Lending Require Opaque (and Conservative) Financial Reporting?*

For many private firms, relationship lending is the only viable form of outside financing. Relationship lending typically relies on intertemporal loan pricing: losses from early years are recovered by information rents in later years, which stem from the lender's private information regarding the firm's creditworthiness.

Our model shows that overly transparent financial reporting reduces the relationship lender's information rent such that the lender has insufficient incentive to offer early stage financing as a result. During financial distress, private firms find it easier to obtain liquidity support from relationship lenders when financial reporting is sufficiently opaque. Conservative opacity enables relationship lending more effectively than aggressive reporting.

This paper seeks to explain why private firm financial reporting is (conservatively) opaque and raises concerns regarding recent regulatory efforts that require private firms to engage in more transparent financial reporting because such efforts may result in undesirable side effects.

JEL Classification: G21, G32 and M41
Keywords: accounting conservatism, financial reporting opacity, private firms, relationship lending and small and medium enterprises

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1 Introduction

Private firms engage in considerably less informative financial reporting than publicly listed firms (for evidence, see Ball and Shivakumar [2005], Burgstahler, Hail, and Leuz [2006], Bharath, Sunder, and Sunder [2008], and Peek, Cuijpers, and Buijink [2010]). This is surprising: more informative financial reporting should lead to better financial terms for such private firms, both for equity and debt financing (see Leuz and Verrecchia [2000], Wittenberg-Moerman [2008], and Bharath, Sunder, and Sunder [2008]). By contrast, opaque financial reporting is likely to induce inefficient and costly investment decisions (Gigler, Kanodia, Sapra, and Venugopalan [2009]). Why do private firms choose to remain opaque?

We argue that opacity in financial reporting is useful when the firm relies on *relationship lending*. Because of their limited track record and their lack of pledgeable assets, private firms often find it difficult to raise debt or equity. The only viable option for outside financing is then lending based on close and continued relationships (Berger and Udell [1998]). However, relationship lenders typically incur losses (bear costs) in their early years for different reasons, e.g., because of adverse selection problems, moral hazard, and legal interest rate ceilings that do not permit full or adequate pricing of the credit risk involved or because of considerable transaction costs required to set up the relationship.

Due to such "start-up costs," relationship lending relies on intertemporal loan pricing: losses in early years are repaid with information rents in later years (see Boot [2000], Bolton, Freixas, Gambacorta, and Mistrulli [2013]). Information rents are based on the lender's access to the firm's private information, which enables him to learn about the debtor's credit risk over time.[1] This information consists of, among other things, balance information regarding the debtor's credit cards, deposits, trust accounts, transaction activities and payroll data. Soft information is also important. Thus, the bank's credit manager may have known the firm for years, including on a non-professional basis, or at least knows the local community and has easy access to references. Empirical studies in the USA, Germany and Italy indicate that relationship lending increases credit availability for private firms (Berger and Udell [1995], Bharath, Dahiya, Saunders, and Srinivasan [2009], Harhoff and Körting [1998], Bolton, Freixas, Gambacorta, and Mistrulli [2013]). Relationship lenders are also more likely than other lenders to provide liquidity support in financial distress (Couwenberg and De Jong [2006], Brunner and Krahnen [2008], Puri, Rocholl, and Steffen [2013]).

[1] Relationship lenders are also said to have greater monitoring and screening abilities (see Bolton, Freixas, Gambacorta, and Mistrulli [2013]).

This paper offers a model that explains why private firms may voluntarily choose opacity with respect to their financial reporting. In the model, there is one firm with no initial funds in a competitive lending market. There are two potential types of firms, good and bad, that are unobservable to lenders. The game has two stages. In the *first* stage (the pre-contracting stage), the firm chooses a financial reporting system, i.e., the information structure of financial reporting that it will publish later. To begin the project, one lender must make an investment; he becomes the relationship lender for the remainder of the game. The cost of this investment is a shortcut for relationship lending, in which the lender is willing to incur a short-term loss in exchange for long-term information rents. This investment can be interpreted either literally as the cost, for example, of developing a prototype that is necessary for production in the second stage. Alternatively, the cost might be the consequence of losses from a short-term loan at an early stage, when the lemons problem is still substantial. In a third interpretation, the loss could stem from the cost of a liquidity injection from the relationship lender into the firm. Importantly, in all three interpretations the lender incurs a cost in an early stage in anticipation of later profits.

During the first stage, the relationship lender is able to gain private information on the quality of the debtor's project (Boot [2000]). Then, the firm publishes its financial report. In the *second* stage (contracting stage), an investment project can be undertaken, and the firm requires financing. Lenders then compete regarding loan rates to grant a loan. Because of its private information, the relationship lender has an information advantage and can earn information rents, which might compensate the relationship lender for the costs at the pre-contracting stage. However, more transparent financial reporting indicates that more private (inside) information becomes public, which reduces the relationship lender's information rent. Thus, with overly transparent reporting, it may be that no lender is willing to incur the necessary cost at the pre-contracting stage, and relationship lending thus breaks down.

We model opacity using an information system with possible errors in both directions. Firms with a good project (good firms) are likely to generate a positive signal (e.g., high earnings) but might also have a negative report (e.g., low earnings). Firms with a bad project are likely to generate a negative signal, but might also have a positive report. Thus, recipients can never infer whether a firm is a good or bad firm (credit risk) with certainty. We differentiate between a conservative reporting system, which is biased toward negative signals, and aggressive reporting, which is biased toward positive signals. It is important to note that we explicitly distinguish between two characteristics of financial reporting: on the one hand, *transparency* refers to the probability of misleading reports; on the other hand, *conservatism* refers to a tendency to avoid too positive reports.

Our main result is that sufficiently opaque financial reporting enhances intertemporal debt contracting with relationship lenders. The basic idea is that overly transparent financial reporting reduces the relationship lender's information rent too much, such that losses in early years cannot be fully compensated with information rents in later years. Consequently, with transparent financial reporting, the relationship is not established in the first place—even when there are viable investment projects in the long run, the relationship lender will be unwilling to incur the pre-contracting stage first loss. In an extension of our model (appendix B), we also show that relationship lenders are more willing to provide liquidity support in financial distress when the information rents in later years are substantial enough to compensate for losses resulting from liquidity support.

A second important result is that the type of reporting matters: for a given level of opacity, conservative reporting is better suited to maintain the relationship lender's information advantage than aggressive reporting. Lenders have a concave pay-off function: the gain potential is limited to interest gains, whereas the entire principal is also at risk. Thus, outside lenders will hesitate to offer favorable terms when there is a bad accounting signal. The more conservative the financial reporting, the more likely that good debtors will report a bad accounting signal and the higher the relationship lender's expected profit from inside information. The relationship lender is able to earn information rents only from good debtors. The implicit advantages of conservatism fit the evidence of Ball and Shivakumar [2005] and Peek, Cuijpers, and Buijink [2010]; both of these studies suggest that private firms show relatively low levels of reporting transparency but in a conservative way.

Third, we show that from a welfare perspective, opaque financial reporting implies a trade-off. On the one hand, a sufficient level of opacity is necessary to incentivize relationship lending and efficient investment. On the other hand, higher levels of opacity increase the probability of financing projects with negative net present value (NPV) and/or the probability of not financing projects with positive NPV. Thus, the optimal level of opacity is the minimum opacity level that guarantees relationship lending. Because conservative reporting generates higher information rents than aggressive reporting for a given level of opacity, conservative opacity is welfare-optimal.

In the beginning of the second stage, firms with a good project have an incentive to signal their creditworthiness through less opaque financial reporting. Thus, firms that want to commit to opaque reporting may have a commitment problem, and relationship lending based on opaque financial reporting may suffer from time inconsistency. Relationship lending can still work (a) if sufficient opacity is required by mandatory Generally Accepted Accounting Principles (GAAP), (b) if more informative reporting implies high marginal costs, such as costs related to opening separate accounts for financial and tax accounting,

or (c) if a firm and a relationship lender can contract upon lower financial reporting transparency. Implicit contracting and relationship lending may also be efficient when the debtor's expected benefits from relationship lending outweigh the costs of higher interest charges. One important benefit in this regard is the willingness of relationship lenders to help in case of the borrower's financial distress.

Overall, our results raise concerns as to whether recent regulatory efforts to make financial reporting by private firms more informative (see, e.g., IASB [2009]) might have undesirable side effects. In particular, the IFRS for small and medium-sized firms may have adverse effects on debt financing and investment.

Literature. This paper contributes to the literature in several ways. First, it argues that private firms may need *opaque* financial reporting to make relationship lending work, which differs from other papers that argue that private firms have less need for *transparent* financial reporting because of concentrated ownership or better monitoring abilities and well-informed concentrated debt (Ball and Shivakumar [2005], Bharath, Sunder, and Sunder [2008], Peek, Cuijpers, and Buijink [2010]). In addition, our argument differs from the claim that opacity might be driven by tax and dividend payout considerations (Burgstahler, Hail, and Leuz [2006]).

Second, we add a new explanation as to why firms do not voluntarily choose to reveal as much information as possible in their financial reports. Disclosure theory suggests that disclosure costs, investor uncertainty with regard to private information, increased agency costs and the potential loss of information advantages versus product-market rivals might be reasons for opacity (Verrecchia [2001], Beyer, Cohen, Lys, and Walther [2010], Burkhardt and Strausz [2009]).[2] We put forward a new argument: with young private firms, relationship lenders must maintain a sufficient information advantage vis à vis outside lenders.[3] What our paper has in common with the above papers is that it highlights the trade-off between ex ante and ex post efficiency of information [Arya, Glover, and

[2]Plantin, Sapra, and Shin [2008] show that transparent information can destabilize banks in a setting with global games. Also Goldstein and Sapra [2014] argue that the reaction to public disclosure can be inefficient.

[3]When the firm matures, financial distress is less likely to occur and type uncertainty is less pronounced such that relationship lending becomes less necessary to the firm. Considering the costs of relationship lending, debtors may find arm's length debt to be more favorable (Rajan [1992]). Arm's-length debt requires *informative* financial reporting (Sengupta [1998], Baber and Gore [2008]). There is evidence that the relationship lenders' information advantage shrinks considerably once a firm goes public (Hale and Santos [2009]).

Sunder, 1998, 2003]. In an individual setting,[4] less information cannot be efficient from an ex post perspective, but it is efficient ex ante because it ensures relationship lending and efficient investment at the pre-contracing stage

Third, we show that the type of bias in the report matters (also from a welfare perspective). Conservative opacity is more suitable to enhance relationship lending than is aggressive opacity. Gigler, Kanodia, Sapra, and Venugopalan [2009] find that conservatism decreases the efficiency of debt contracting because it increases the cost of falsely liquidating a project and this cost is greater than the benefit of decreasing the cost of falsely continuing a project. While Gigler, Kanodia, Sapra, and Venugopalan examine arm's length debt financing, we consider relationship lending to be characterized by the relationship lender requiring a sufficient informational advantage compared with outside lenders. In contrast to Gigler, Kanodia, Sapra, and Venugopalan, both Caskey and Hughes [2012] and Göx and Wagenhofer [2009] suggest that conservatism might be desirable in debt contracting: Caskey and Hughes [2012] find that conservatism might be helpful to avoid inefficient project selection, whereas Göx and Wagenhofer [2009] argue that conservative reporting on the value of pledged assets is more likely to finance viable projects than unbiased information. The reasoning behind these arguments is that unadjusted book values of the pledged asset provide good news to the arm's length lender. Pooled information on high asset values increases the probability of financing and efficient investment in the first place. In contrast to these three papers, we do not investigate arm's length debt but relationship lending which is more common with private firms. Moreover, we consider two differently informed types of lenders and their interactions: relationship lenders and outside lenders.

Finally, our analysis highlights the interaction between financial reporting and relationship lending which, to the best of our knowledge, has not been explicitly analyzed in the accounting literature. Theoretical papers on relationship lending focus on other matters. Dell'Ariccia and Marquez [2004] and Dell'Ariccia, Friedman, and Marquez [1999] examine the effects of asymmetric information between relationship and outside lenders on the portfolio allocation of relationship lenders and on the market structure of the banking industry, respectively. Rajan [1992] and Bolton, Freixas, Gambacorta, and Mistrulli [2013] address firm choices between relationship lending and arm's length lending. Boot and Thakor [2000] analyze how increased competition in the banking market may affect

[4]Our paper addresses collective decision making and is thus related to Morris and Shin [2002], who show that if public information is not only used for updating beliefs but also serves a coordinating role, agents might overreact to public information and under-react to private information. In some scenarios, more precise public information induces more overreaction and reduces social welfare. In contrast to Morris and Shin, we stress the *ex ante* (in)efficiency of public information.

relationship-specific investments. Fenghua and Thakor [2007] investigate why banks finance relationship loans primarily with deposits. Parlour and Plantin [2008] address the link between relationship lending and liquidity in the loan market. None of these papers addresses the role of financial reporting.

With regard to empirical research, our model results suggest that there will be more relationship lending with less informative financial reports. We expect more relationship lending in countries with a high degree of book-tax-alignment. In countries in which SMEs have the obligation or option to select IFRS, we expect a decrease in new relationship lending, depending on the level of opacity permitted under national GAAP.

This paper is organized as follows. Section 2 contains the basic model, which shows that relationship lending requires sufficiently opaque financial reporting. Section 3 contains the equilibrium analysis. In particular, it contains our main results concerning the opacity and conservatism of financial reporting. Section 5 shows that conservative reporting is also welfare-optimal. Section 4 argues how the time inconsistency problem can be tackled. Section 6 concludes. Proofs are in appendix A. Appendix B contains an in-depth analysis of how the initial costs can be interpreted as liquidity support for the firm. Finally, appendix C contains the figures.

2 The model

Projects. Consider an economy with two types of agents: an entrepreneur with no funds and a continuum of competing outside lenders (outsiders). The entrepreneur owns and runs the firm. Agency problems inside the firm are thus ignored, and we only talk of "the firm". The opportunity rate of investment is zero, and all agents are risk neutral.

There are two stages. In $t = 0$ (the pre-contracting stage), the entrepreneur, who has access to an investment project, founds a firm. The project requires a cost c at date $t = 0$, and an investment of $I > 0$ at date $t = 1$ (the contracting stage), which generates a risky return at date $t = 2$. The return is Y with probability p (success), and zero with probability $1 - p$ (failure). The cost c is required for investment in the second stage. It might stand for the lender's cost of gathering and evaluating private information regarding the firm. These costs are a shortcut to reflect the losses that relationship lenders generally incur when initiating a relationship. Such costs may stem from adverse selection or from financing a precursor project with a negative NPV, e.g., the development of a proto-type. Relationship lenders are also known to provide liquidity support, although such funding is not financially efficient for them in the short run; in appendix B, we provide a model of

this scenario to make this cost more concrete. For the sake of exposition, we model the costs of relationship lending as simply as possible in the basic model.

There are two types of firms that are differentiated by the quality of their projects. A fraction ϕ of firms are good. Good firms (with good projects) have a high probability of success p_G, leading to a positive NPV, $p_G Y - I > 0$, even exceeding the pre-contracting cost, $p_G Y - I > c$. Bad firms (fraction $1 - \phi$) have a low probability of success $p_B < p_G$. The NPV of bad projects can be either positive or negative.

Debt contracts and lenders. We concentrate on loan contracts. At date $t = 1$ (the contracting stage), lenders can offer the firm a loan of volume I at the gross loan rate R, including redemption of the principal. The firm takes the best offer, that is, the offer with the lowest interest rate.

At date $t = 0$, the lender who incurs the cost c is called the relationship lender. This investment of c might lead to an information advantage that is explained in the next paragraph. Therefore, at the contracting stage, we call the relationship lender the *insider*, and all other potential lenders are called *outsiders*. Note that the firm is not required to accept the loan offer from the insider (his relationship lender); instead, he may choose to take the offer from an outsider if the loan rate is lower.

Information structure and financial reporting. At $t = 0$, all parameters and the sequence of events are common knowledge. However, only the firm knows the true project type at $t = 0$; lenders know only the *a priori* probability ϕ. At date $t = 1$, before lenders offer a loan to the firm, there are two simultaneous pieces of information; one *publicly* observable financial report, and a *private* signal to the insider (the relationship lender). The insider thus observes both the private signal and the financial report, whereas outsiders only observe the latter.

The insider's *private* signal cannot be communicated to the outsiders by the firm because it is soft information. The signal is noisy. It can take two values, positive or negative. The probability that a good firm emits a bad signal is α_i (type I error), where the index i stands for insider. The probability that a bad firm emits a good signal is β_i (type II error). Both α_i and β_i are between 0 and 1/2.

The *publicly* observable financial report is also noisy, and it can also be incorrect in both directions. The probability that a good firm issues a negative report—perhaps because the financial report indicates low earnings—is α_o (where the o stands for outsider, because the

report is *also* observed by the outsider). The probability that a bad firm issues a positive report (because of high earnings) is β_o. Again, both parameters are between 0 and 1/2. Figure 2 shows the potential errors of the financial report; the information structure with inside information is similar.

Figure 1 about here.

The aggregate opacity of the financial report can be measured by $\alpha_o + \beta_o$ (which is analogous for the private signal). With $\alpha_o = \beta_o = 0$, there is no bias and no opacity (full transparency). With $\alpha_o = \beta_o = \frac{1}{2}$, there is maximum opacity; the report is worthless. Another characteristic of the financial report is its conservatism (or its aggressiveness). With $\alpha_o > \beta_o$, a good firm is more likely to disclose a negative financial report than a bad firm is likely to disclose a positive report. This relates to conservatism. Consistently, $\alpha_o < \beta_o$ indicates aggressiveness.

Lenders are differently affected by α_o and β_o. With a type I error (relatively high α_o), no loan is granted to a good firm, and the lender potentially loses interest income. With a type II error (relatively high β_o), good money is paid out to a bad firm, and (potentially) neither interest nor principal are repaid. Thus, a type II error is more costly for a lender, such that there is a preference for conservatism.

Figure 2 depicts the sequence of events.

Figure 2 about here.

3 Equilibrium analysis

3.1 The second stage

We solve the model by backward induction, beginning with the second stage. Both insider and outsiders have read the financial report; the insider has also received the private signal. Both are ready to make offers to the debtor in the form of interest rates. Let R_o denote the lowest rate by any outsider, and R_i the rate offered by the inside lender. The firm will thus take the loan from the insider if $R_i < R_o$. Note that potential lenders are practically in an auction, where the interest rates correspond to the prices they would bid. The structure is a common value auction (in the end, the loan is worth the same for all lenders) with asymmetric information (the inside lender has an information advantage).

Standard theory thus applies. For example, as shown in Broecker [1990], there is no equilibrium in pure strategies. Nonetheless, the interest rates that lenders will offer the debtor and the expected profits of lenders can be calculated.

Proposition 1 *For a high enough net present value of the debtor's project (conditions given in the proof, see appendix), an outsider's expected profit from competing for the firm is zero. The insider's expected profit is*

$$\Pi_i = \frac{(p_G - p_B)(1-\alpha_i-\beta_i)(1-\phi)\phi}{(1-\alpha_o)\phi p_G + \beta_o(1-\phi)p_B} \cdot \frac{\alpha_o(1-\alpha_o)\phi p_G + \beta_o(1-\beta_o)(1-\phi)p_B}{\alpha_o\phi p_G + (1-\beta_o)(1-\phi)p_B} \cdot I. \quad (1)$$

We are primarily interested in how the profit Π_i depends on the financial report, i.e., α_o and β_o. To get an indication of such relationship, we plot the profit as a function of α_o and β_o. For the numerical example, we use the parameters $p_G = 2/3$, $p_B = 1/3$, $\phi = 1/2$ and $I = 1$, furthermore $\alpha_i = 1/4$ and $\beta_i = 1/4$.

Figure 3 about here.

There are a number of intuitive properties. First, if both $\alpha_o = 0$ and $\beta_o = 0$, the financial report will already perfectly reveal the debtor's type. Even with additional information, the insider cannot gain an information advantage compared with the outsider. Therefore, his expected profits vanish, $\Pi_i = 0$. Second, the insider's profits increase both in the probability of a type I error (α_o) or a type II error (β_o), that is, it increases with the opacity of the financial report. Thus, if the financial report is more informative, there is less to be learned from inside information for the insider, and his profits will decrease. This property is important; we stress it in a remark (proof in the Appendix).

Remark 1 *The insider's expected profit increases in both α_o and β_o; $d\Pi_i/d\alpha_o > 0$ and $d\Pi_i/d\beta_o > 0$.*

Another property is interesting, but not immediately visible from the picture. The numerical example is symmetrical in the two types of errors. However, the profit function Π_i is not completely symmetrical in α_o and β_o. This emerges when calculating Π_i for $\alpha_o = 1/2$ and $\beta_o = 0$, which is $\Pi_i(\alpha_o = 1/2, \beta_o = 0) = 0.0625$, whereas $\Pi_i(\alpha_o = 0, \beta_o = 1/2) = 0.05$. Given that the profit varies only between 0 and 0.0833, this difference is not negligible. It suggests that, all else equal, an increase in α_o benefits the insider more than a comparable increase in β_o. Thus, for a given level of transparency, a conservative report leads to higher profits for the insider than an aggressive report. This property holds in general.

Remark 2 *Keeping the level of transparency constant ($\alpha_o + \beta_o$ constant), a marginal increase in conservatism (larger α_o) benefits the insider more than a marginal increase in aggressiveness (larger β_o) if and only if*

$$\phi \geq \frac{(1 - 2\,\beta_o)\,p_B}{(1 - 2\,\alpha_o)\,p_G + (1 - 2\,\beta_o)\,p_B}. \tag{2}$$

Figure 4 illustrates that the insider's expected profit increases more with a type I error (α_o) than with a type II error (β_o).

Figure 4 about here.

It may not be obvious that Remark 2 implies an asymmetry between conservative and aggressive reporting. Assume that the initial situation is symmetric, that is, there are as many good as bad loans ($\phi = 1/2$), and the accounting system is not biased toward or against conservatism ($\beta_o = \alpha_o$). Then, the condition for Remark 2 (see (2)) holds, because $p_B/(p_B + p_G)$ is smaller than $1/2$.

Where does the different role of α_o and β_o stem from? The intuition is that the inside lender earns a higher expected information rent with a type I error (α_o) where good debtors disclose a "bad" financial report and outside lenders offer unfavorable terms.

Although the bias structure of the financial report plays a role regarding the insider's profits, the bias structure of the insider's private signal does not, which becomes clear from looking at the expected profit Π_i, where the private signal enters only in the factor $(1 - \alpha_i - \beta_i)$ (see (1)). Furthermore, the value of the private signal increases with the difference in success probabilities of good and bad debtors ($p_G - p_B$); it increases in p_G and decreases in p_B.

The insider's profit is linear in $(1 - \alpha_i - \beta_i)\,I$ and thus perfectly symmetrical in α_i and β_i. The profit Π_i is concave in ϕ, and vanishes for the extremes $\phi = 0$ and $\phi = 1$. This is intuitive: for the extreme cases, the project type is already known; thus, neither the financial report nor the private signal can contain any additional information. There is no asymmetry between insider and outsider, and the insider's profit thus vanishes.

3.2 The first stage

After having discussed the second stage, the first stage analysis is straightforward. Each potential lender expects to make a profit of Π_i in the second stage. In the first stage, there

is a participation constraint. A lender will only be willing to become the insider if future expected information rents compensate (or over-compensate) for the investment, c. For example, figure 4 shows the insider's expected profits in the second stage, in which the red dashed curve is one iso-profit curve. Thus, if costs c equal the profits on this curve, then relationship lending is possible to the upper-right of this curve.

Remark 3 *If $\Pi_i < c$, then no lender will become an insider in $t = 0$. Consequently, good projects with a positive net present value will not be financed (underinvestment).*

The important message is that informative financial reports are not efficient in our setting. Because the inside lender is then unable to earn a sufficiently large information rent in the second stage, he will be unwilling to enter in the first stage, although it would be efficient to do so.

Because the profit function Π_i is increasing in both α_o and β_o, the two are substitutes. A reporting system that consists of a combination of α_o and β_o, can be viable if either $\alpha_o = 0$ and β_o is large enough (aggressive reporting), or if $\beta_o = 0$ and α_o is large enough (conservative reporting), or a combination of the two.

4 Requirements for a Perfect Bayesian Equilibrium

If debtors do not know the quality of their projects, there is no incentive to deviate from opacity ex post in $t = 1$. However, when debtors know that they have a good project, they have an incentive to increase transparency. If they could, they would reveal their type. The remaining debtors are then inferred to be bad. Consequently, there would be perfect Bertrand competition, with zero profits for insider and outsider, and relationship lending would break down, which would mean that the project would not be financed in the first place (in the pre-contracting stage).

In the above model, relationship lending requires that the firm is able to credibly commit to a disclosure policy in $t = 0$. There are several mechanisms to ensure commitment, including the following: (1) high costs of increasing transparency, (2) financial reporting regulation, (3) contracting for transparency, (4) uncertain disclosure incentives and (5) incentives for the firm to maintain the lending relationship. We will now address these mechanisms in more detail.

(1) Costs of increasing transparency. Increasing transparency comes with additional reporting and verification costs. In this instance, we must discuss how much information a firm can credibly reveal to lenders, which is ultimately an empirical question. The answer surely depends on how informative mandatory information is in the financial reporting standards. If the reporting standard features a relatively low level of transparency, there is more need to provide precise voluntary information. The literature suggests that the transparency level of financial reporting standards also depends on the degree of book-tax alignment (Burgstahler, Hail, and Leuz [2006]). When there are single accounts for tax and financial reporting—such as in Austria, Germany and Switzerland, for example—increasing transparency may require a separate financial reporting statement and that might imply considerable additional costs. A separate statement induces a fixed cost that is independent of the precision level.[5]

Moreover, important pieces of information might be hard to verify, such as management skills and the prospects of the business idea. This information is soft and thus difficult to put into a financial statement in a credible way because any firm would likely choose the most positive report. Thus, there is an upper limit on the precision of financial reporting. Some (but not all) information might be soft originally, but could become hard in the hands of an intermediary such as a rating agency or an auditor. However, this hardening also comes with an additional cost, particularly when there is no audit requirement (as with smaller private firms in some countries, such as Germany or Switzerland). Information intermediaries are likely to charge a fixed fee and a variable component, depending on factors like firm size. Thus, smaller firms are most likely less able to bear the fixed cost component than bigger firms.

We can thus assume that the cost of transparency $T(\alpha_o)$ has a fixed component and increases with higher reporting precision beyond the initial level, $T'(\alpha_o) < 0$ and $T''(\alpha_o) > 0$. Remember that a higher α_o implies *less* transparency. If the marginal costs of transparency exceed the marginal benefits from better contract terms in the second stage for any transparency level, the firm can credibly commit to an opaque financial reporting system in $t = 0$.

(2) Financial reporting standards. The financial reporting standard defines certain minimal and maximal $\alpha_{\min}$ and $\alpha_{\max}$ for the type I error α_o, and certain minimal and maximal $\beta_{\min}$ and $\beta_{\max}$ for the type II error β_o.

[5]The empirical literature suggests that switching to a more informative financial reporting system might result in substantial cost (e.g., from local GAAP to IFRS, see Daske, Hail, Leuz, and Verdi [2013]).

The principles of current financial reporting standards would generally ascribe different lower bounds to the type I error α_o, and the type II error β_o. The prudence principles suggest a minimum $\alpha_{\min} > 0$ in most GAAP. Under US GAAP and German GAAP, this minimum $\alpha_{\min}$ might be larger than under IFRS. With regard to type II error β_o, the minimum $\beta_{\min}$ might be close to zero, because both the reliability principle and the prudence principle work against type II error. Consequently, in the following we assume $\beta_{\min} = 0$ and $\alpha_{\min} > 0$. If financial reporting standards require a sufficiently large type I error by $\alpha_{\min}$, the firm can credibly commit to a disclosure policy at $t = 0$.

(3) Contracting for transparency. Although it might be hard to imagine that firm and inside lender contract directly on α_o, there is some evidence that they might do so indirectly. The evidence is on adjustments to local GAAP. Leftwich [1983] finds provisions that require non-current assets to be measured at historical costs, as opposed to current costs. El-Gazzar and Pastena [1990] show that tailored GAAP generally correct for unrealized gains. Goodwill and other intangible assets—such as brands—are excluded from equity (El-Gazzar and Pastena [1990], Leuz, Deller, and Stubenrath [1998]). All these adjustments tend to increase the type I error α_o, such that a good project might appear to be bad.

Remark 4 summarizes the findings on the first three mechanisms, which ensure time-consistency.

Remark 4 *In $t = 1$, given that $\beta_{\min} = 0$ and $\alpha_{\min} > 0$, a firm with a good project will choose sufficiently opaque financial reporting if forced to do so by mandatory GAAP, i.e., if the minimum α-error necessary to make relationship lending work does not exceed the minimum α-error required by GAAP,*

$$\alpha_o^* \leq \alpha_{\min}. \tag{3}$$

If $\alpha_{\min} < \alpha_o^* \leq \alpha_{\max}$, time-consistency is ensured if (a) the marginal disclosure costs of more transparent financial reporting exceed its marginal benefits, that is,

$$T(\alpha_o) - T(\alpha_o^*) \geq \Pi_i(\alpha_o^*) - \Pi_i(\alpha_o) \quad \text{for all} \quad \alpha_o \in [\alpha_{\min}, \alpha_o^*], \tag{4}$$

or if (b) firm and inside lender contract upon increasing α_o up to α_o^*.

(4) Uncertain disclosure incentives. Outsiders will consider the disclosure of low (high) earnings in $t = 1$ as a signal of a bad (good) project quality if the firm wants to maximize firm value, which outsiders know is the firm's objective (Beyer, Cohen, Lys, and Walther [2010]). However, with a high degree of book-tax-alignment, in particular, the firm may also have incentives to disclose low earnings to save tax payments. As a result, outsiders might be uncertain about the firm's reporting incentives. This impairs the informativeness of the financial report in $t = 1$ (Beyer, Cohen, Lys, and Walther [2010]). When the financial statement serves both informational and tax-saving goals, the marginal benefits of greater precision are lower because of outsiders' uncertainty and the marginal costs are supposedly higher due toreduced tax savings—compared to a situation with separate financial and tax accountings. This in turn will make it easier for the firm to credibly commit to a disclosure policy in $t = 0$.

Overall, the arguments sketched out above imply and predict that relationship lending will be facilitated in countries with less informative financial reporting standards and/or a high degree of book-tax-alignment. This result is related to the principles of "mechanism design", which imply here that the regulator is able to affect the equilibrium of a game by designing the game form, in particular, by designing the legal environment. For instance, GAAP are considered relatively opaque and conservative in Austria, Germany, Italy or Japan (Burgstahler, Hail, and Leuz [2006], Peek, Cuijpers, and Buijink [2010]).

(5) Debtor's incentives to maintain the lending relationship. There is evidence that firms may benefit from lending relationships in other ways. Relationship lenders are more likely than other lenders to provide liquidity support. Moreover, relationship lending allows firms to avoid revealing proprietary information, e.g., to competitors in the product market or to labor unions. As long as these future benefits of keeping up the relationship exceed the benefits of violating the (implicit) contract, the firm will adhere to the initial reporting system. In appendix B, we show that reporting opacity also facilitates liquidity support by a relationship lender.

Summing up, firms with good projects in particular have an incentive to reveal their true type, i.e., to reduce α_o and β_o as much as possible. However, this incentive can be problematic, if they cannot commit to the opacity level of their financial report. We discussed five reasons why a deviation from a chosen level of transparency may be costly and perhaps not even feasible.

5 Welfare analysis

Thus far, we have addressed the questions of how the reporting system affects insider's expected profits, and which reporting system enables relationship lending. Now we want to ask: Which reporting system maximizes social welfare?

There are certain important preliminaries. *First*, if financial reporting disincentivizes and disables relationship lending, there will be no lending at all. Consequently, in the welfare optimum, reporting must be vague enough not to deter relationship lenders. *Second*, if all projects (good and bad) have a positive NPV, then all firms get a loan (either by the insider or the outsider). Because welfare is defined as the weighted sum of the NPVs of realized projects, welfare is constant. As a consequence, the answer to the welfare question would then be simple (and too simple for any policy discussion): as long as relationship lending is not deterred, the reporting system is irrelevant for welfare.

Therefore, let us now assume that bad projects have a negative NPV in the second stage. What changes if the bad project has a negative NPV?[6] When the bad project has a negative NPV with a bad private signal, there are many different cases, depending on the quality of the public and private information. For example, if both pieces of information are relatively vague (case 1), insider and outsider may always offer a loan, no matter whether the information is positive or negative. If the insider's private signal is relatively precise (case 2), then the insider may make an offer only if this information is positive. If the public report is relatively more precise than the private signal (case 3), then both insider and outsider will make an offer only if the public report is positive, otherwise not. In this case, the insider's private signal will influence the pricing of the loan, but not whether insider and outsider make an offer at all. Which of the cases applies depends in particular on the (endogenous) quality of the public report, i.e., α_o and β_o. Here, the fact that the reporting system is endogenous comes in handy. If the insider's first stage losses are not large, then the profits it must recoup in the second stage are also small. Hence, endogenously, the firm's reporting will be relatively transparent, and α_o and β_o will be small. This implies that the public report is relatively precise. Let us therefore make a consistent choice for the *second case* and assume that the public financial report is precise, and that the insider's private signal is even more precise. In this manner, outsiders will be deterred from making a bid if the report is negative. The insider, however, may yet bid if his private signal is positive. In this case, welfare is not a constant; projects are turned down with positive probability. Still, the insider's private signal is valuable, even

[6] For a detailed discussion of the consequences on bidding behavior, see the discussion at the end of step 1, proof of proposition 1 in appendix A.

if the public report is negative. As a consequence, no one will make an offer to a firm with a negative report. With a positive report, the firm will get a loan with certainty. The welfare function is then

$$\begin{aligned} W = {} & \phi \left[(1-\alpha_o) + \alpha_o (1-\alpha_i) \right] (p_G Y - I) \\ & + (1-\phi) \left[\beta_o + (1-\beta_o) \beta_i \right] (p_B Y - I) - c. \end{aligned} \tag{5}$$

Each good project (fraction ϕ) has a positive NPV of $(p_G Y - I)$, but gets financed only if the public report is positive (probability $1 - \alpha_o$) or if the report is negative but the insider's private signal is positive (probability $\alpha_o (1 - \alpha_i)$). Each bad project (fraction $1 - \phi$) has a negative NPV of $(p_B Y - I)$, but gets financed only if the public report is positive (probability β_o) or if the report is negative but the private signal is positive (probability $(1 - \beta_o) \alpha_i$). The c stems from the insider's investment in the first stage. Welfare is linear and decreasing in both α_o and β_o. The welfare-optimal reporting bias maximizes welfare under the constraint that relationship lending is not deterred,

$$\max_{\alpha_o, \beta_o} W \quad \text{s.t.} \quad \Pi_i \geq c. \tag{6}$$

In the appendix, we provide more analysis to prove the following proposition.

Proposition 2 *Conservative reporting is welfare-optimal.*

The analysis suggests that, from a welfare perspective, conservative opacity is preferable to aggressive opacity. Although sufficient opacity is required to enable relationship lending and investing in good projects, it might have the negative side effect that investments are not always efficient. For instance, with more opacity there is a higher probability of investing in bad projects. Thus, there is also a need to keep the level of opacity small. From remark 2 we know that the insider benefits more from an increase in conservatism than from an increase in aggressiveness. Therefore, for a "given level of opacity", a lower level of conservatism is required than of aggressiveness to make relationship lending work. Consequently, the side effects are smaller with conservatism.

6 Conclusion

Many private firms rely on relationship lending in which the lender obtains inside information over the course of the lending relationship. This paper shows that relationship lending requires sufficiently *uninformative* (opaque) financial reporting. Opacity ensures

that the inside lender earns an information rent that compensates for losses or costs in the firm's early years, such as losses due to adverse selection problems or losses due to legal interest rate ceilings or transaction costs. Thus, excessively transparent financial reporting may be undesirable for young and small private firms if they have to rely on relationship lending. Here, we can also differentiate between conservative and aggressive financial reporting systems. A conservative system tries to be on the safe side, a good project firm may thus appear bad (type I error, or α-error). An aggressive system makes a bad project firm appear good (type II error, or β-error).

Our model shows that conservative opacity benefits the relationship (or inside) lender relatively more. From a welfare perspective, opacity may have the side effect of financing non-viable projects. Thus, the optimum level of opacity is the minimum level that guarantees relationship lending. Conservative opacity is thus welfare-optimal because conservative reporting generates higher information rents than aggressive reporting at a given level of opacity.

Ex post, "good" firms prefer informative financial reporting. Ex ante, a good firm can credibly commit itself to opacity (a) if sufficient financial reporting opacity is required by mandatory GAAP,(b) if sufficient opacity can be contracted upon, (c) if more informative reporting implies high marginal costs (such as setting up separate accounts for financial and tax accounting) or (d) by implicit contracting. The analysis suggests that such a commitment is easier in countries with a high degree of book-tax-alignment.

Given the model results, the efforts of the IASB [2009] to make financial reporting by small and medium-sized firms (SMEs) more informative may induce an undesirable side effect if SMEs are considerably reliant on relationship lending. More informative reporting tends to match the information needs involved in arm's length financing. Future research might empirically test the results of our analysis. We expect a higher proportion of relationship lending and a greater likelihood of liquidity support with sufficiently opaque financial reporting standards. In countries in which SMEs have the obligation or option to select IFRS, we thus expect a decrease in new lending relationships, dependent on the level of opacity of national GAAP.

A Proofs

Proof of proposition 1. We prove the proposition in three steps. In the first step, we take the financial report as given and calculate the insider's expected profit in the bidding process. In the second step, we show how the choice of α_o and β_o influence the probabilities of getting a positive or negative report and how that influences the insider's aggregate expected profits.

Step 1. First, consider a situation in which the insider has received a positive private signal about the firm with probability μ and a negative private signal with probability $1-\mu$. The success probability of the debtor's project is q_H after a "positive" financial report and q_L after a "negative" financial report. The variables (μ, q_H and q_L) are not from our model but will be substituted by our model variables in step 2.

From the outsiders' perspective, the success probability is $\mu\, q_H + (1-\mu)\, q_L$. Now R_i denotes the gross interest rate that the insider offers (including repayment of the principal), and R_o represented by the outsider's offer. Under certain conditions, insider and/or outsider might neither make an offer at all; we will derive such conditions below. For now, let us start with discussing the case in which both insider and outsider make an offer. Note that these offers cannot be deterministic because the insider and outsiders will always want to slightly undercut one another. Thus, let $F_i(R_i)$ denote the probability distribution of the insider's offer, and $F_o(R_o)$ that of the best offer from an outsider.

Begin by taking the insider's perspective. If he gets the negative private signal, the loan has an NPV of $q_L\, R_i - I$. The insider has no incentive to choose $R_i > I/q_L$, which would be equivalent to simply leaving the firm to the outsider. Additionally, he will not choose $R_i < I/q_L$, which indicates he would only lose money. Consequently, $R_i = I/q_L$ in the case of a negative private signal. If the private signal is positive, the insider will offer a more aggressive R_i. If the outsider offers a lower $R_o < R_i$, he will attract the firm. From the insider's perspective—who only anticipates the outsider's distribution function—this result occurs with probability $F_o(R_i)$. The insider gets the loan with probability $1 - F_o(R_i)$. The insider's expected profit is thus $(1 - F_o(R_i))\,(q_H\, Ri - I)$. In a mixed-strategy equilibrium, the insider must be indifferent among different offers, thus

$$(1 - F_o(R_i))\,(q_H\, R_i - I) = \text{constant}, \tag{7}$$

which implies that $F_o(R_i) = 1 - \text{constant}/(q_H\, R_i - I)$, or after a change of variables, $F_o(R_o) = 1 - \text{constant}/(q_H\, R_o - I)$. We will derive the constant below.

Now take the outsider's perspective. With probability $1-\mu$, the insider has the negative private signal and will set a prohibitive $R_i = I/q_L$, such that the outsider will end up with the loan and earn (or rather lose) an expected $q_L\, R_o - I$. With probability μ, the insider has positive information. In this case, the outsider will be able to attract the firm if $R_o < R_i$, and with probability $1-F_i(R_o)$. In a mixed strategy equilibrium, the expected profit must not depend on R_o. Because of competition, it will vanish. Therefore,

$$(1-\mu)\,(q_L\, R_o - I) + \mu(1-F_H(R_o))(q_H\, R_o - I) = 0. \tag{8}$$

The index H indicates the insider's distribution function when he has positive inside information. Consequently,

$$F_H(R_i) = \frac{(1-\mu)\, q_L\, R_i + \mu\, q_H\, R_i - I}{\mu\,(q_H\, R_i - I)}. \tag{9}$$

This term becomes zero (there is no offer) for $R_i = \frac{I}{(1-\mu)\, q_L + \mu\, q_H}$, and it becomes 1 (there definitely is an offer) for $R_i = I/q_L$. For a specific parameter choice, it appears as in the following figure (left chart, with parameters $q_L = 1/2$, $q_H = 3/4$, $\mu = 2/3$, and $I = 1$).

Figure 5 about here.

We can now come back to the determination of the constant. The outsider will not want to offer a rate lower than the lowest possible offer by the insider. Therefore, $F_o(R_o)$ must vanish at the minimum R_i, hence the constant must be

$$\text{constant} = \frac{(q_H - q_L)\,(1-\mu)}{(1-\mu)\, q_L + \mu\, q_H} \cdot I. \tag{10}$$

In Figure 5, the ensuing function $F_o(R_o)$ also begins at $R_o = 1.5$, but does not reach 1 at $R_o = 2.0$. However, the outsider will never want to offer a loan rate above 2.0, which would be prohibitive in any event. Therefore, he bids this 2.0 with positive probability (mass point).

Finally, let us determine the insider's expected profit. With probability $1-\mu$, he receives the negative private signal and places a conservative bid, leaving zero profits. With probability μ, he receives the positive signal, yielding a profit equal to the above constant. Consequently, the expected profit is

$$\Pi_i = \mu \cdot \text{constant} = \frac{(q_H - q_L)\,\mu\,(1-\mu)}{(1-\mu)\, q_L + \mu\, q_H} \cdot I. \tag{11}$$

Now we know what the bidding in equilibrium looks like. The insider makes the worst possible offer if he gets the negative private signal, and he randomizes over more aggressive

offers if he gets the positive private signal. The outsider does not get any private signal, but nevertheless makes the worst possible offer with some positive probability (mass point). Otherwise, he also randomizes over the same interval of offers as the insider.

The above analysis was performed under the premise that insider and outsider both make offers to the firm. However, do they? With a negative private signal, the insider will only bid if the NPV is still positive, i.e., if $q_L\,Y \geq I$. The insider's strategy will thus be: bid (stochastically) if the information is positive, otherwise do not bid. We will show that, as a reply, the outsider will also refrain from bidding with positive probability. Assume that the outsider makes a bid only with probability λ_o. Begin with the perspective of an outsider who makes a bid. In perfect analogy to (8), his expected profit must vanish,

$$(1-\mu)\,(q_L\,R_o - I) + \mu(1-F_H(R_o))(q_H\,R_o - I) = 0. \tag{12}$$

Hence, (9) still applies, for $R_i \leq Y$. Now turn to the insider. In analogy to (7), the insider must still be indifferent between offers,

$$\big((1-\lambda_o) + \lambda_o\,(1-F_o(R_i))\big)\,(q_H\,R_i - I) = \text{constant}. \tag{13}$$

Again, taking into account that the support of F_o must be identical to that of F_H, we arrive at two conditions and can solve for the two variables λ_o and constant, regardless.

$$\begin{aligned} \text{constant} &= \frac{(q_H - q_L)\,(1-\mu)}{(1-\mu)\,q_L + \mu\,q_H}\cdot I, \\ \lambda_o &= q_H\,\frac{\mu\,q_H\,Y - I + (1-\mu)\,q_L\,Y}{(q_H\,Y - I)\,((1-\mu)\,q_L + \mu\,q_H)}. \end{aligned} \tag{14}$$

The constant is exactly the same as above. Consequently, the insider's expected profit is also exactly the same as above, $\Pi_i = \mu \cdot \text{constant}$. We are particularly interested in a condition for when the outsider entirely stops to bid. This is the case for $\lambda_o = 0$, i.e.,

$$Y = \frac{I}{(1-\mu)\,q_L + \mu\,q_H}. \tag{15}$$

Thus, if the average NPV of the debtor's project turns negative, the outsider becomes too cautious to make a bid. This implies that the insider turns into a monopolist. He can then set the maximum loan rate, $R_H = Y$, making an expected profit of $q_H\,Y - I$, equal to the NPV of a project with positive information. If this NPV turns negative for very low Y, then there will be no bidding at all.

To sum up the results of this first step, we have four cases. (i) For $q_L\,Y \geq I$, both insider and outsider will always bid, even under negative information. The insider's expected profit is Π_i as in (11). (ii) For $q_L\,Y < I \leq \big((1-\mu)\,q_L + \mu\,q_H\big)\,Y$, the insider will bid only

if his private signal is positive, and the outsider will bid with positive probability. The insider's expected profit remains Π_i as in (11). (iii) For $\big((1-\mu)\,q_L+\mu\,q_H\big)\,Y < I \leq q_H\,Y$, outsiders will not bid at all, and the insider will bid only with positive information. The insider's expected profits are $q_H\,Y - I$. (iv) Finally, for $q_H\,Y < I$, there is no bidding at all. In the following, we first concentrate on case (i).

Step 2. Now we turn to the second step: we calculate the parameters μ, q_H and q_L, using Bayes' rule. We must differentiate between two different cases: with a positive financial report, and with a negative financial report. The initial probability of a good project firm is ϕ. Now the public information becomes available. If the report is positive, both insider and outsider will update their priors to

$$\phi_H = \frac{\phi\,(1-\alpha_o)}{\phi\,(1-\alpha_o)+(1-\phi)\,\beta_o}. \tag{16}$$

For a negative report, the updated priors will be

$$\phi_L = \frac{\phi\,\alpha_o}{\phi\,\alpha_o+(1-\phi)\,(1-\beta_o)}. \tag{17}$$

Now the probability that the insider gets another positive private signal is $\phi_H\,(1-\alpha_i)+(1-\phi_H)\,\beta_i$. The insider then updates his belief that the firm's project is good to the probability

$$\phi_{H,H} = \frac{\phi\,(1-\alpha_o)\,(1-\alpha_i)}{\phi\,(1-\alpha_o)\,(1-\alpha_i)+(1-\phi)\,\beta_o\,\beta_i}. \tag{18}$$

The first index in $\phi_{H,H}$ stands for the positive report, the second index for the positive insider information. From the insider's perspective, the expected probability of success after the positive information is then $\phi_{H,H}\,p_G+(1-\phi_{H,H})\,p_B$.

If the insider gets a negative private signal, he updates

$$\phi_{H,L} = \frac{\phi\,(1-\alpha_o)\,\alpha_i}{\phi\,(1-\alpha_o)\,\alpha_i+(1-\phi)\,\beta_o\,(1-\beta_i)}, \tag{19}$$

and the updated probability of success becomes $\phi_{H,L}\,p_G+(1-\phi_{H,L})\,p_B$. Analogously,

$$\begin{aligned}\phi_{L,H} &= \frac{\phi\,\alpha_o\,(1-\alpha_i)}{\phi\,\alpha_o\,(1-\alpha_i)+(1-\phi)\,(1-\beta_o)\,\beta_i} \quad \text{and}\\ \phi_{L,L} &= \frac{\phi\,\alpha_o\,\alpha_i}{\phi\,\alpha_o\,\alpha_i+(1-\phi)\,(1-\beta_o)\,(1-\beta_i)}.\end{aligned} \tag{20}$$

We can now compute the aggregated expected profit of the insider. The public information from the financial report is *positive* with probability $\phi\,(1-\alpha_o)+(1-\phi)\,\beta_o$. The insider

expects the above profit after substituting $\mu = \phi_H\,(1-\alpha_i) + (1-\phi_H)\,\beta_i$, $q_H = \phi_{H,H}\,p_G + (1-\phi_{H,H})\,p_B$, and accordingly $q_L = \phi_{H,L}\,p_G + (1-\phi_{H,L})\,p_B$. Analogous definitions apply when the public information is negative. Substituting all and simplifying yields the expected profit,

$$\begin{aligned}\Pi_i = {} & (p_G - p_B)\,\phi\,(1-\phi)\,(1-\alpha_i-\beta_i)\,I \cdot \frac{(1-\alpha_o)\,\beta_o}{\phi\,(1-\alpha_o)\,p_G + (1-\phi)\,\beta_o\,p_B} \\ & + (p_G - p_B)\,\phi\,(1-\phi)\,(1-\alpha_i-\beta_i)\,I \cdot \frac{\alpha_o\,(1-\beta_o)}{\phi\,\alpha_o\,p_G + (1-\phi)\,(1-\beta_o)\,p_B}. \end{aligned} \tag{21}$$

This equals Π_i from equation (1) in proposition 1. In (21), the first row is the insider's expected profit in the bidding process when the public report is positive. The second addend stems from the case of a negative report. To conclude, consider the different cases discussed at the end of step 1 in this proof. Thus, the second line of (21) remains unchanged as long as outsiders bid with positive probability (cases (i) and (ii)). If outsiders never bid, one must replace the second line by the NPV of a project with a negative report. If even the insider does not bid, the line must be replaced by a zero. The same holds for the first line if outsiders stop bidding for projects with a positive report. Consequently, to give one example, consider the case in which the public report is relatively precise, and the bad project's NPV is negative, such that both insider and outsider bid with a positive report, but neither bids with a negative report. The insider's aggregate expected profit is then only the first line of (21),

$$\Pi_i = (p_G - p_B)\,\phi\,(1-\phi)\,(1-\alpha_i-\beta_i)\,I \cdot \frac{(1-\alpha_o)\,\beta_o}{\phi\,(1-\alpha_o)\,p_G + (1-\phi)\,\beta_o\,p_B}. \tag{22}$$

The proof is complete, and we have provided the conditions under which (1) holds. ■

Proof of remark 1. Calculate the derivative $d\Pi_i/d\beta_o$, which is negative only between $\beta_o = 1-\alpha_o$ and

$$\beta_o = (1-\alpha_o)\,\frac{p_B\,(1-\phi) + 2\,p_G\,\alpha_o\,\phi}{p_B\,(1-2\,\alpha_o)\,(1-\phi)}. \tag{23}$$

This second border is larger than the first border for admissible parameters. The larger second border implies that the derivative can never be negative because the first interval border can never be reached, as a result of $\alpha_o < 1/2$ and $\beta_o < 1/2$. The proof for the derivative $d\Pi_i/d\alpha_o$ can be led along the same procedure. ■

Proof of remark 2. We first take the two derivatives $d\Pi_i/d\alpha_o$ and $d\Pi_i/d\beta_o$, and take the fraction of the two derivatives, which yields

$$\frac{d\Pi_i/d\alpha_o}{d\Pi_i/d\beta_o} = \frac{\phi\,(1-\beta_o-\alpha_o\,(1-2\,\beta_o))\,p_G + 2\,(1-\phi)\,\beta_o\,(1-\beta_o)\,p_B}{2\,\phi\,\alpha_o\,(1-\alpha_o)\,p_G + (1-\phi)\,(1-\beta_o-\alpha_o\,(1-2\,\beta_o))\,p_B}. \tag{24}$$

Some algebra shows that this fraction is lower than 1 only under the condition from the remark. ■

Proof of remark 3: From remark 1, we know that the insider's expected profit increases monotonically in both α_o and β_o: $d\Pi_i/d\alpha_o > 0$ and $d\Pi_i/d\beta_o > 0$. Thus, there must be a threshold level α_o^* (or β_o^*) that ensures an information rent that retrieves the losses from the first stage. ■

Proof of proposition 2: The proof proceeds in two steps. *First*, we establish the profit function Π_i. If the public report is negative, the outsiders refrain from bidding: the insider enjoys an information monopoly and the algebraic structure of Π_i changes accordingly. Because of the assumption that the report is relatively precise, we can use a linearized version of Π_i around the point $(\alpha_o = 0, \beta_o = 0)$. *Second*, we use standard optimization theory to show that the optimum always has $\alpha_o > 0$ but $\beta_o = 0$, which indicates that the welfare-optimal report is fully conservative.

Step 1. If the public report is positive, both insider and outsider will bid, and the insider's expected profit equals the first line of (21). If the report is negative, only the insider will bid, and only if his private signal is positive. The insider is then able to reap the complete NPV, which is (in expected terms),

$$\phi\,\alpha_o\,(1-\alpha_i)\,(p_G\,Y - I) + (1-\phi)\,(1-\beta_o)\,\beta_i\,(p_B\,Y - I). \tag{25}$$

This term is already linear in α_o and β_o. The first part of (21) can be linearized to

$$(p_G - p_B)\,(1-\alpha_i-\beta_i)\,\beta_o\,(1-\phi)\,I/p_G. \tag{26}$$

The insider's aggregate profit equals the sum of (25) and (26).

Step 2. Welfare is defined by (5) and is also linear in α_o and β_o. Therefore, problem (6) turns into a linear program. The solution is in the corner with $\alpha_o > 0$ and $\beta_o = 0$ if

$$\frac{dW/d\alpha_o}{d\Pi_i/d\alpha_o} > \frac{dW/d\beta_o}{d\Pi_i/d\beta_o}, \tag{27}$$

otherwise the solution has $\alpha_o = 0$ and $\beta_o > 0$. Some algebra shows that (27) is equivalent to

$$\Big(\frac{\alpha_i}{p_G} + \frac{1-\alpha_i}{p_B}\Big)^{-1} Y < I. \tag{28}$$

Interestingly, the factor before the Y is the weighted harmonic mean between the good and the bad probability of success. We have assumed that the private signal is relatively precise, i.e., $\alpha_i \approx 0$. Then, the weight on the p_G is zero, and (28) turns into $p_B\, Y < I$, which is true (the NPV of a bad project is negative). The solution must thus be in the corner with $\beta_o = 0$, which implies maximally conservative reporting. ■

Proof of remark 4: The proof is already in the text before the remark. ■

B Extension: liquidity support by the relationship lender

Model assumptions. We assume the identical agents as in the basic model, but introduce a two-stage investment project in which there are costs to the inside lender in the first stage. We maintain the second-stage investment projects with different success probabilities for the good and the bad project type; however, for simplicity, we assume that the second stage investment has a positive NPV regardless of the project quality, that is, $I < p_B\, Y < p_G\, Y$. Further, we add a first stage project.

Let us assume that in $t = 0$, an initial investment of I_0 is necessary to start the project. Independent of firm type, this project generates a risky non-monetary and non-verifiable outcome in $t = 1$, which is X in case of success (with probability p_1) and 0 in the event of failure. For instance, the non-verifiable outcome might be the progress in improving product quality or marketing. The outcome X will turn into cash at $t = 2$. We assume that lending pays in $t = 0$,

$$p_1\, X > I_0. \tag{29}$$

Since it might be possible that the two projects are financed by different lenders, let us assume that the lender of the first stage (the insider) has a senior claim in $t = 2$ limited to X. Before the bad state of nature is realized in $t = 1$, the firm suffers from a publicly observable liquidity shock in $t = 0.5$. If the firm receives no additional funds I_S in $t = 0.5$ in the bad state of nature, the outcome in $t = 1$ will be zero and the project will then be stopped.

If the firm receives additional funding I_S in $t = 0.5$, the non-verifiable outcome in $t = 1$ will be X_S for a good project firm virtually guaranteed and X_S for a bad project firm with probability q (with $0 < q < 1$), and zero otherwise. Let us assume that in case of a

liquidity shock it never pays for an inside lender to support the firm in financial distress in the short run:

$$q\,X_S < X_S < I_S. \tag{30}$$

To make the problem interesting, let us assume in $t = 0.5$ that it is socially desirable to provide liquidity support for good projects and when the project type is unknown, but not for a bad type:

$$p_G\,Y - I > I_S - X_S, \tag{31}$$

$$[\phi\,p_G + (1-\phi)\,p_B]\,Y - I > I_S - [(1-\phi)\,q + \phi]\,X_S, \quad \text{and}$$

$$p_B\,Y - I < I_S - q\,X_S. \tag{32}$$

The insider observes the liquidity shock in $t = 0.5$ and the project type in $t = 1$. The outside lender only observes the liquidity shock. Figure 6 depicts the sequence of events.

Figure 6 about here.

Equilibrium. We focus on the more interesting case in which a liquidity shock occurs in $t = 0.5$. We begin with the second stage in which the analysis is the same as with the basic model.

Remark 5 *The inside lender will provide financial support during the firm's financial distress in* $t = 0.5$ *if the following conditions hold cumulatively: (a) the inside lender finances the first stage and therefore has private information in the second stage, and (b) the financial report is sufficiently opaque in* $t = 1$ *with*

$$\alpha_o \geq \alpha_o^{**} \quad or \quad \beta_o \geq \beta_o^{**} \tag{33}$$

$$with \quad \Pi_i(\alpha_o^{**}) = \Pi_i(\beta_o^{**}) = \Pi_{\min} = I_S - [(1-\phi)q + \phi]\,X_S.$$

Proof of remark 5: The proof is analogous to that of remark 3. ■

Otherwise, the inside lender will not provide liquidity support in $t = 0.5$ and the project will be stopped in $t = 1$. The outside lender never provides liquidity support. In $t = 0$, the first stage project is realized.[7]

[7]The project of the first stage is realized because it pays off (see (29)). In $t = 0$, lenders will compete for a possible information rent net of the expected loss from liquidity support. The bigger the net information

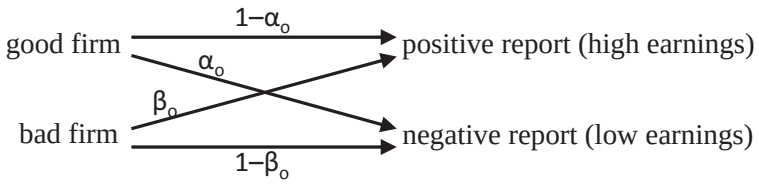
The economic intuition is straightforward. The expected future benefits from informed relationship lending encourage the inside lender to incur losses during the liquidity shock.[8] These benefits only exist if the inside lender's information advantage remains sufficiently large, which implies that the firm provides a sufficiently opaque financial report.

rent, the lower the face value of debt in $t = 0$. Even if (33) does not hold and there is thus no liquidity support and no second stage investment, the first stage will be financed due to (29). The third equilibrium path is characterized by the realization of the good state of nature in $t = 1$ (where there is no liquidity support). Because the investments yield a positive net present value in either stage, the project will be financed.

[8]Models regarding accounting conservatism often look at efficient continuation decisions with arm's length debt where accounting conservatism provides useful information (Gigler, Kanodia, Sapra, and Venugopalan [2009], Beyer [2012], Li [2013]). In our model, we stress conservative opacity instead to provide sufficient incentives to the inside lender (but not information).

C Figures

Figure 1: Noise within the financial reporting system



α_o: type I error with the financial report; β_o: type II error with the financial report. If both α_o and β_o are low, the report is transparent. If β_o is low in relation to α_o, the report is conservative.

Figure 2: Sequence of events

$t = 0$ *Pre-contracting stage:* The financial reporting system (i.e., α_o and β_o) is established

- The firm gets access to a good project (success probability p_G, fraction ϕ) or to a bad project (success probability p_B, fraction $1 - \phi$)
- Lenders can choose to become relationship lender (insider) by spending c on the project. Without spending c, an investment in $t = 1$ is not possible.

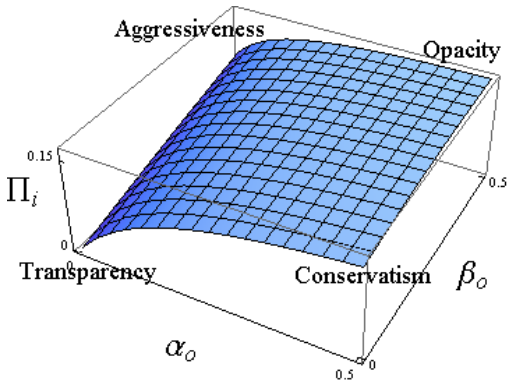
$t = 1$ *Contracting stage:* the firm discloses a financial report (publicly) observable by all lenders; the inside lender additionally receives a private signal

  - (public) financial report and private signal have type I error (α) and type II error (β)
  - α_o: probability that firm with a good project issues a bad financial report (e.g., low earnings)
  - β_o: probability that firm with a bad project issues a good financial report (high earnings)
  - α_i: probability that firm with a good project emits a bad private signal
  - β_i: probability that firm with a bad project emits a good private signal

- inside and outside lender bid for the loan, announcing loan rates
- the firm chooses one lender (not necessarily the insider)
- investment I

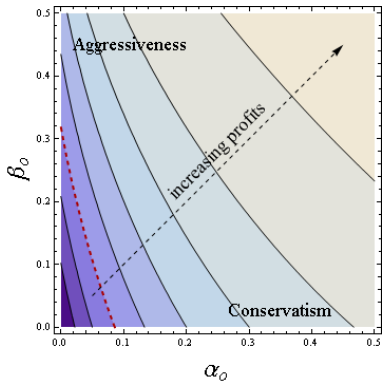
$t = 2$ payout: Y in the good state, zero in the bad state; debt is repaid

Figure 3: Inside lender's expected profit depending on α_o and β_o



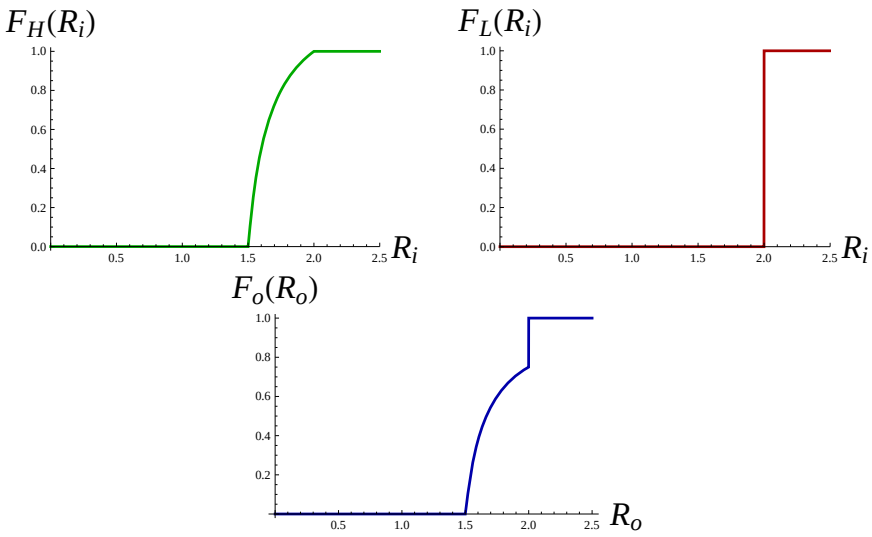
Π_i: inside lender's expected profit. α_o, β_o: type I error and type II error with the financial report, respectively. The figure already suggests our main results. Opacity increases the inside lender's expected profits. Ceteris paribus, the profits are higher with conservative than with aggressive reporting.

Figure 4: Inside lender's expected profit: Indifference curves



Π_i: Inside lender's expected profit. α_o, β_o: Type I error and type II error, respectively, with the financial report. $\alpha_o > \beta_o$ indicates conservatism, $\alpha_o < \beta_o$ indicates aggressiveness. The curves in the graph each indicate a certain insider's profit level (iso-profit curves). Toward the north-east, insider profit increases. The insider's expected profit responds more strongly to type I error (α_o) than to type II error (β_o) of the financial report. The red, dashed curve holds one specific profit level constant (in this case, $\Pi_i = 0.06$). Hence, if the inside lender's initial losses are $c = 0.06$, then insider can recoup these losses only if the report has α_o and β_o to the north-east of the red dashed curve. To the south-west, no lender will be willing to spend the cost and become an insider. The project will not get started.

Figure 5: Cumulative probability distributions of the insider's and outsider's offer



$F_H(R_i)$ (green): Cumulative distribution of the insider's bid (gross interest rate) R_i when he receives a positive private signal. $F_L(R_i)$ (red): Cumulative distribution of the insider's bid (gross interest rate) R_i when he receives negative private signal. $F_o(R_o)$ (blue): Cumulative distribution of the outsider's bid (gross interest rate) R_o.

In words, if the insider gets a negative signal, he offers the firm a loan at the rate $R_i = 2.0$ (red curve). If the insider gets a positive signal, he randomizes his loan rate offer between $R_i = 1.5$ and $R_i = 2.0$ (green curve). The outsider does not have this information: there is only one (blue) curve. He offers a loan at $R_o = 2.0$ with strictly positive probability (mass point). Otherwise, he also randomizes between $R_o = 1.5$ and $R_o = 2.0$.

Note that this numerical example takes the content of the public report as given. In the model, all parameters q_H, q_L and μ will depend on the precision and outcome of the report.

Figure 6: Sequence of events, modified model on liquidity support
Changes in comparison to figure 2 are in **bold face**.

$t = 0$ The financial reporting system (i.e., α_o and β_o) is established

- **The firm gets access to a short-term positive-NPV investment project of size I_0 with return X (probability p_1)**
- Lenders can choose to become relationship lenders (insiders) **by granting a loan for the short-term project**

$t = 0.5$ **Liquidity shock in the bad state of nature**

- The firm disappears if relationship lender does not provide additional funds I_S (with negative net present value in the short run)
- If there is no liquidity shock or if there is liquidity support, the firm gets access to a good project (success probability p_G, fraction ϕ) or to a bad project (success probability p_B, fraction $1 - \phi$)

$t = 1$ the firm discloses a financial report (publicly) observable by all lenders, and the inside lender receives an additional private signal

  - both (public) financial report and private signal have type I error (α) and type II error (β)
  - α_o: probability that a firm with a good project issues a bad financial report (e.g., low earnings)
  - β_o: probability that a firm with a bad project issues a good financial report (high earnings)
  - α_i: probability that a firm with a good project emits a bad private signal
  - β_i: probability that a firm with a bad project emits a good private signal

- inside and outside lender bid for the loan, announcing loan rates
- the firm chooses one lender (not necessarily the insider)
- investment I

$t = 2$ payout: $X + Y$ ($X_S + Y$) in the good state, X (X_S) in the bad state; debt is repaid

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