



Bank loan renegotiation and financial institutions' network

Christophe J. Godlewski^{a,*}, Bulat Sanditov^b

^a Faculty of Business and Law & EM Strasbourg Business School, University of Strasbourg, PEGE, 61 avenue de la Forêt Noire, 67000 Strasbourg, France

^b Université Paris-Saclay, Univ. Evry, IMT-BS, LITEM, 9 rue Charles Fourier, 91011 Evry Cedex, France

ARTICLE INFO

JEL classification:

G21
G24
G32
G34

Keywords:

Financial contracts
Bank loan
Renegotiation
Syndicated lending
Social network analysis
Lender network
Lender centrality

ABSTRACT

We investigate how lender's capacity of sourcing information about a borrower, proxied by its centrality in the networks of syndicated lending, influences the process of bank loan renegotiation. Using a large sample of more than 6000 loans issued in 25 European countries we find that the presence of network-central and better-informed lenders in a syndicate has a significant impact on the renegotiation process, increasing the likelihood of renegotiation, the number of renegotiation rounds, and the number of amendments to the loan agreement. Our findings survive numerous robustness checks and confirm that access to superior information encourages private debt renegotiation.

1. Introduction

One of the main advantages of private debt contracts is their inherent flexibility, as they can be renegotiated outside of financial distress (Gorton & Kahn, 2000; Smith & Warner, 1979; Zinbarg, 1975). Amendments to credit agreements are, indeed, very common and most long-term debt contracts is often renegotiated during their lifetime (Nikolaev, 2018; Roberts, 2015; Roberts & Sufi, 2009). The two leading views on renegotiation of debt contracts – the theories of complete and incomplete contracts – emphasize the key role played by lender's ability to gather private information about the borrower and the state of the world efficiently. However, as we will develop hereafter, the effect of lender's informedness on the renegotiation process considerably differ between the two views. Relying on two strands of literature: the financial contracting literature on loan renegotiation outside of distress and the emerging literature on social network analysis of credit markets and financial institutions, we investigate how lenders' capacity of sourcing relevant information influences main characteristics of a bank loan renegotiation process (decision, dynamics, and scope).

The theory offers two, somewhat opposite, perspectives on how renegotiations may affect the design and optimality of contracted relationships. The earlier literature, based on the theory of complete

contracts, sets renegotiations within the standard framework of principal-agent model, where the contract between the two parties is needed to shield principal's gains against opportunistic actions of the agent in an environment where agent's type or behavior is either unobserved or observed but non-verifiable by a third party (Dewatripont & Maskin, 1990; Fudenberg & Tirole, 1990; Hart & Tirole, 1988). The possibility to revise the terms of the original contract *ex post*, i.e. after the contract has been put in place, can modify agent's *ex ante* incentives: the sheer fact that in some states of the world the principle would agree to replace the current contract by a new one is undermining agent's commitment to the initial agreement which, in turn, reduces the overall efficiency and the value of the contract for both parties.

In this line of research, the analysis focuses on equilibria with *renegotiation-proof* contracts, where contracts are never renegotiated along the equilibrium path. Indeed, if the parties are able to foresee future contingencies, then for any non-renegotiation-proof contract, i.e. an initial contract such that under certain circumstances the parties find mutually beneficial to tear it up and write a new one, these special circumstances can already be incorporated into the current contract making it renegotiation-proof. Hart and Tirole (1988) studied efficiency of long-term contracts under adverse selection and have shown that, although in some situations a renegotiation-proof contract is better than

* Corresponding author.

E-mail addresses: godlewski@unistra.fr (C.J. Godlewski), bulat.sanditov@imt-bs.eu (B. Sanditov).

<https://doi.org/10.1016/j.irfa.2024.103409>

Received 3 June 2022; Received in revised form 26 February 2024; Accepted 7 March 2024

Available online 28 June 2024

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no contract, it still comes short of the efficiency which the contracting parties could have achieved in standard principle-agent settings with no renegotiation. Fudenberg and Tirole (1990) have shown that in a model with moral hazard renegotiations give rise to certain amount of agent's opportunistic behavior, thus, an inefficient outcome.

The alternative approach, based on the theory of incomplete contracts, departs from the assumption that the parties can anticipate and describe all possible contingencies in the initial contract (Aghion & Bolton, 1992; Grossman & Hart, 1982; Hart & Moore, 1990). In this literature, specifying all future contingencies, i.e. cataloguing all opportunistic actions of the agent, is prohibitively costly (if at all possible), therefore by mutual agreement the future contingencies are left out of the contracts. Instead, a contract lays down a set of conditions (e.g., deterioration of financial state of the borrower, success of the financed project, discovery of important private information), which may invoke (re)allocation of the decision rights. Those conditions would typically correspond to *ex post* inefficiencies of the current contract, while the matching rules for (re)allocating decision rights allow the renegotiation process to achieve *ex post* Pareto optimum.¹

The incomplete contracts perspective on lending relationships has been taken up and developed further in the financial contracting literature, both theoretically (Dessein, 2005; Garleanu & Zwiebel, 2009) and empirically (Christensen & Nikolaev, 2012; Nikolaev, 2018; Roberts, 2015; Roberts & Sufi, 2009).

For instance, Garleanu and Zwiebel (2009) examine the role of covenants in debt contracts and show that under asymmetric information, better-informed borrowers give up control rights to less-informed lenders in a form of overly tight covenants.² Such initial contracts allow high quality borrowers to signal their true type to the lenders. Upon arrival of information, the parties renegotiate the initial contract to loosen the covenants and reallocate control rights from the lender to the borrower. Strictness of the covenants in the initial contract increases with information asymmetry and decreases with the costs of renegotiations.

Roberts and Sufi (2009) and Roberts (2015) find that debt contracts are renegotiated, often early in the life of the loan, upon accrual of new information concerning financial health of the borrower, fluctuations in credit and equity markets, and the outcome of earlier renegotiations. Nikolaev (2018) examines the relationship between renegotiations and monitoring. He argues that since lenders can use renegotiations to monitor their borrowers, the frequency of renegotiations varies with the demand for monitoring. He shows that debt contracts for less transparent borrowers or borrowers with riskier projects (e.g., borrowers with high market/book ratio or investing in intangible assets) who require intensive monitoring, are more likely to be frequently renegotiated. Monitoring through renegotiation may, however, impose costs on borrowers, because of interference with the borrower's optimal investment policies: in the trade-off between lower risk vs. long-term gain, the creditor prefers safer investments which do not have to be optimal. Nikolaev (2018) finds that contracts with borrowers for whom over-monitoring is associated with particularly high costs (e.g., firms with high future growth opportunities or significant investments in intangible assets) are, other things equal, renegotiated less frequently.

In both theories, of complete contracts and of incomplete contracts, timely access to valuable private information about borrower's actions, as well as, to the information about the true state of the world, plays a key role for the renegotiation process. However, the effect of lenders

informedness on the renegotiation process drastically differs between the two theories.

On the one hand, credit agreements with better informed lenders are less likely to be renegotiated. Indeed, a lender with high quality information does better in anticipating and assessing possible contingencies and, therefore, can design a contract close to being renegotiation proof. First, better information about the borrower improves lender's ability to predict borrower's potential opportunistic actions and, consequently, have them covered in the contract, hence limiting the scope for renegotiations. Second, with better information about the current state of the world the lender can build more accurate expectations concerning its evolution, foresee corresponding risks for the contracted relationship, and cover them in the contract. Third, borrowers facing well-informed lenders are less likely to act opportunistically, which is further reducing the probability of renegotiations.

On the other hand, taking the perspective of incomplete contracts, one may argue that better informed lenders should renegotiate initial contracts more frequently. Within the theory of incomplete contracts, renegotiations are triggered by discovery of private information or arrival of new information concerning the state of the world. Other things equal, it follows that better-informed lenders, who are more likely to receive such information, should renegotiate more often than their less informed peers. Further, if not only the quantity but also the quality of information matters, then we may expect that lenders receiving information from many independent sources have higher probability to get relevant information than their less informed peers and therefore more likely to prompt renegotiations. Better access to private information is also likely to reduce lender's costs of renegotiations, thus we may expect to see that renegotiations with well-informed lenders are not only more likely, but also more frequent and larger in scope of revision of the terms of the initial contract.

Since both theoretical arguments seem a priori plausible, the relationship between lender's informedness and the likelihood, frequency, and scope of renegotiations needs to be examined empirically. Next, we explain how knowledge about the structure of networks of relationships among lenders can be used to measure lender's informedness.

Financial institutions are linked to each other in various ways (board interlocks, interbank lending, syndicated loans, etc.); the web of interconnections forms a financial network. The primary function of such a network is to support raising the necessary funding,³ however, the very same network is playing a role of an information network shaping patterns of exchange of information among financial institutions (Baum, Rowley, & Shipilov, 2004; Baum, Shipilov, & Rowley, 2003; Godlewski, Sanditov, & Burger-Helmchen, 2012; Morrison & Wilhelm Jr., 2007). The network allows lenders to tap into valuable private information produced elsewhere on the network, making screening and monitoring activities less costly and more efficient.

The theory of social networks, which during the past decade has seen a surge of interest in financial and economic literature, argues that strategic positions in a network, often in its center, may give advantage to the actors occupying such positions for several, although not independent, reasons.

First, some actors simply breed more relationships than the others, and if valuable resources, such as private information, are shared through social relationships, they are able to secure access to more resources *vis-à-vis* their peers having only a handful of connections. Second, the position of an actor having short network distances to many other actors may provide her advantage over actors located at the periphery of the network, far away from the others. Indeed, suppose that a discovery of new information (or similar type of a resource) may happen

¹ For instance, allocation of voting rights in venture capital contracts is often contingent on the financial performance of the startup, hence a failure to meet a prespecified level of earnings triggers reallocation of control from the entrepreneur to the venture capitalist, while as the startup's position improves the entrepreneur obtains more control rights (Kaplan & Strömberg, 2003).

² Effectively giving the lender the right to "call the loan" (Gorton & Kahn, 2000).

³ Morrison and Wilhelm Jr. (2007) emphasize this networking function of financial intermediaries in capital markets and argue that a primary reason for investment banks to exist is their skills in creating and maintaining relevant networks.

in any part of the network with equal probability and once being produced, the information is travelling across the network via social ties connecting actors. Transmission from an informed actor to its uninformed neighbor occurs at random and quality of information is deteriorating at each transmission. If, as it is the case of acquiring private information about borrowers, receiving information earlier than later and with least distortion is crucial for the actor's ability to make correct decisions, then the actor occupying the center of the network should do better than an actor sitting in the periphery because, on average, the information created elsewhere on the network arrives to a centrally located actor in fewer steps, hence faster and less distorted.

So far, we have assumed that all information reaching the actor is equally useful. However, in some situations diversity of information may also be important. Like many other networks, financial networks are highly clustered (Godlewski et al., 2012), implying that actor's closest neighbors share many connections among them. The information circulating in locally dense personal networks is often "redundant": the same news is being told and re-told multiple times. As a result, acquiring many connections may not guarantee access to many independent sources of information. This argument, first formulated by Granovetter (1973), has been widely discussed in the social network literature under the title of "strength of weak ties". In social networks non-redundant, and therefore more valuable, information tends to arrive through a "weak tie": a connection leading away from the circle of closest friends (to whom an individual is connected by "strong ties"). Thus, simply having many connections may not be enough to ensure good quality information, the actor's connections must also be sufficiently diverse.

Applying these notions from the social network theory to the networks of financial institutions one may conclude that central positions in these networks give actors (financial firms or individual managers) ability to access relevant information in time and at a lower cost hence, other things equal, centrally located actors, on average, are expected to attain better results than their peers from the network periphery. Recent empirical research on financial networks and the relationship between position occupied by an actor in the respective network and actor's performance confirms this intuition.

Well-connected firms have greater reach and shorter distance to the other parts of the financial network and, therefore, can timely access valuable private information located elsewhere. Screening and monitoring for such firms is cheaper and more efficient which improves firm's performance (Larcker, So, & Wang, 2013). Furthermore, being at the center of the network often implies being in-between firms occupying different ends of the network, thus central firms not only have more information channels to acquire sensitive information but they are also being exposed to more diverse, less redundant, information, which again improves the quality of their decision making (Horton, Millo, & Serafeim, 2012). Cohen, Frazzini, and Malloy (2008) find that mutual fund portfolio managers place larger bets on firms with which they are connected and perform better on these holdings (see also Cujean, 2020).⁴ On the IPO market, central underwriters are associated with more successful, greater valuation and liquidity, and larger returns offerings (Bajo, Chemmanur, Simonyan, & Tehranian, 2016). Central VC firms have better fund performance (Hochberg, Ljungqvist, & Lu, 2007),⁵ while central lenders charge lower interest rates to their borrowers (Engelberg, Gao, & Parsons, 2012; Godlewski et al., 2012), provide loans with longer maturities and impose fewer collateral requirements (Alperovych, Divakaruni, & Manigart, 2022), and provide a significant market certification effect (Godlewski & Sanditov, 2018).

⁴ See also Lin, Wang, and Wei (2021) for a social network analysis of hedge funds.

⁵ See also Aleenajitpong and Leemakdej (2021).

Our focus on the market for syndicated loans allows us to construct variables, based on bank centralities in the network of syndicated loans, which we interpret as proxies for lenders' informedness.⁶ We also control for a large set of factors including loan, lender, and borrower characteristics, along with country economic, financial, and legal characteristics. We use a sample covering more than 6000 loans issued to almost 4500 European firms from 25 countries between 1999 and 2017. The European credit market is particularly relevant because its financial system is bank-based and private debt remains the major source of external financing for firms (de Haan, Oosterloo, & Schoemaker, 2012; Gomes & Phillips, 2012), making the design of loan contracts of utmost interest. Furthermore, the European legal environment is less protective of creditors. For instance, according to Favara, Schroth, and Valta (2012), lenders' recovery rate in the US is close to 90% while it is below 70% in the European Union. Hence, the design of loan contracts becomes very important because the security level of this design may be a substitute for the country-level protection of investors (Miller & Reisel, 2012).

Our findings can be summarized as follows. We confirm that network-central, and therefore better informed, lenders have a positive influence on the entire renegotiation process. We find no support for the alternative hypothesis that central lenders can write more "complete" contracts at origination which are more renegotiation-proof. Greater ability to gather information more efficiently and at a lower cost, associated with centrality of the lender, increase likelihood of renegotiation, the number of renegotiation rounds and the number of amended terms. These results survive numerous robustness checks.

Some factors as characteristics of the environments in which the financial firms operate and/or characteristics of the type of deals may attenuate the positive effect of better lenders' informedness. Our results highlight the crucial role of legal and institutional environments for private debt renegotiation: weaker legal protection of creditors decreases the role of network centrality for renegotiation. We also uncover that complex deals (with multiple tranches) make network centrality insignificant for renegotiation. Finally, we find that the benefits of being central are not concentrated with the major players on the credit market.

We contribute to a growing empirical literature on private debt renegotiation and to the literature on social network analysis of financial markets, with a focus on the largest private debt market – the syndicated loans market. We complement studies on private debt renegotiation (Godlewski, 2014, 2015, 2019, 2020; Nikolaev, 2018; Roberts, 2015; Roberts & Sufi, 2009), proposing a new approach to quantify lenders' informedness. We also extend the existing literature applying social network analysis to syndicated lending (Alperovych et al., 2022; Baum et al., 2004; Godlewski et al., 2012; Houston, Lee, & Suntheim, 2018) by investigating loan renegotiation.

The rest of the article is organized as follows. We present the empirical design in Section 2. We discuss the results in Section 3. Section 4 concludes.

2. Empirical design

In this section, we describe our data, methodology and variables.

2.1. Data

The main source of our data is the Bloomberg Professional Terminal Service (Bloomberg). We extract all loan amendments in Europe with effective dates between January 1999 and December 2017. This first data set contains description of amended terms, such as changes to amount, maturity, covenants, pricing grid, and definition (which is a

⁶ Due to limited information on borrowers, in particular, on the evolution of their state between origination and renegotiations, we cannot control for ex-post determinants of renegotiations and restrict our analysis to ex-ante factors.

non-material amendment). We extract all loans issued to European borrowers (excluding Financial and Government entities) with effective dates between January 1999 and December 2017. This second data set contains information at origination on loan agreements, such as facility amount, spread, maturity, covenants, collateral, date, type (revolver, term...), purpose (corporate, refinance, acquisition...), currency, etc. We also have information on lenders, such as the number of lenders, the retained shares of the loan, the nationalities (country of incorporation), the roles (or titles), and the identity (names). We merge both datasets (loan amendments and loan agreements at origination with lenders' information) using unique loan identifiers.⁷ Next, we use the borrower identifiers to gather firms' characteristics, including descriptive information (name, industry sector, country, identifiers...) and accounting variables and financial ratios.⁸ We also use data from the World Bank, Demirgüç-Kunt, Levine, Cihak, and Feyen (2012), Djankov, McLiesh, and Shleifer (2007), Favara et al. (2012) to obtain (borrower) country level data related to economic growth, credit and stock markets development, the rule of law, and creditors' protection in case of debt restructuring.

2.2. Methodology and variables

Broadly defined a network is a collection of nodes and the links between them. In our case, the nodes are the financial institutions operating in the market for syndicated loans, and the links represent the relationships among the lenders as explained below.⁹

As most of the interactions within a syndicate run through the lead banks (Campbell, 2013), we account for the relations only between lead and participant banks in order to reconstruct the network (Baum et al., 2003; Godlewski et al., 2012; Godlewski & Sanditov, 2018; Wu, Chang, Suardi, & Chang, 2013). Thus, two banks in our networks are directly connected if and only if within the observed period both have participated in the same lending syndicate and at least one of them was leading the deal. We identify lead banks by using lenders' titles provided by Bloomberg for each of the deals with the variable *Loan Agent*.¹⁰

The network of relationships among banks is constantly evolving as old syndicates dissolve and new syndicates form. To account for the dynamic structure of the syndication network we assume that ties between lead banks and other syndicate members do not disappear immediately but remain active for several years. Hence, in our analysis we employ overlapping moving three-year windows. For each time window, we reconstruct lenders' network considering only the syndicated loans arranged during this period.¹¹

As discussed in the introduction, the social networks theory suggests that lender's ability to tap into the network to gather valuable information efficiently and at lower cost is a function of the characteristics of

⁷ At this stage, the sample size is affected mostly by missing information on lenders, especially on their roles (or titles). This information is crucial to compute social network metrics. It is important to remind that our sample consists of non-defaulted loans, including non-defaulted renegotiation (indeed, these are so called "renegotiations outside of default").

⁸ This step reduces drastically the size of the sample with financial information on the borrowing companies.

⁹ An illustration of lender centrality is provided in the internet appendix, while a more formal definition of lender centrality is provided in appendix A.1.

¹⁰ This procedure allows to clearly identify one lead bank per syndicate but at the cost of losing observations for which such information is unavailable in Bloomberg.

¹¹ When choosing the window, one needs to balance between short-term considerations, which can lead to the problem of having networks that are too disconnected, and long-term considerations, which shortens the length of the time series (e.g., with a five-year window we miss the first four years of observations). In the robustness checks section, we consider a different definition of a network, where duration of a tie between lenders lasts until the maturity date of the syndicated loan.

the lender's position in the network, more precisely, its centrality.¹²

We employ three most common measures of centrality introduced by Freeman (1979): degree centrality, closeness centrality, and betweenness centrality (Baum et al., 2003; Godlewski et al., 2012; Godlewski & Sanditov, 2018; Houston et al., 2018). These three measures are our main explanatory variables in the subsequent regressions. A formal definition of each centrality measure is provided in the appendix but, in simple terms, degree centrality refers to the size of a lender's network; closeness centrality measures the "depth" of lender's network, or how close the lender is to all other actors on the network; and betweenness centrality measure of "diversity" of lenders connections, in other words, the degree to which the lender is "bridging" different parts of the network.

Notice that in the network of syndicated lending the lender is not a single bank but a syndicate, centrality of the individual lenders needs to be aggregated into the centrality of a syndicate and the method of aggregation depends on the underlying assumption. We assume that the main primary resources in this market are information (experience, knowledge and alike) which syndicate members share with the lead bank who then use the information to screen, write contract and monitor. Informedness of the syndicate then, is the maximum informedness of the syndicate members,¹³ and since we use network centrality as a proxy of informedness, knowledge, reputation, and trust, we shall define the centrality of a syndicate as the maximum centrality of its members. In other words, we assume that what truly matters for a syndicate capacity to access superior private information is the most network-central member.

We consider three main (explained) variables to describe a renegotiation process: renegotiation decision i.e. likelihood (*Renegotiation* equals 1 if a loan is renegotiated, 0 otherwise), renegotiation dynamics i.e. rounds (*Rounds* equals the number of times a loan was renegotiated; 0 for non-renegotiated loans up to 12 times), and renegotiation scope i.e. amended terms (*Amendments* equals the number of amended loan terms following renegotiation; 0 for non-renegotiated loans up to 6).¹⁴ By doing so, we offer three empirical perspectives on the renegotiation process: a simple binary decision to renegotiate a loan, a dynamic perspective considering that a loan can be renegotiated multiple times over time, and a scope perspective considering that a few or all terms of the loan agreement can be amended at renegotiation.

We control for a large number of variables at the loan, syndicate, borrower, and country levels. All these variables are measured at the time of loan origination and are expected to influence the renegotiation process according to the existing literature (Godlewski, 2019, 2020; Nikolaev, 2018; Saavedra, 2018). We consider main loan terms such as amount, maturity, collateral, and covenants¹⁵ and for the amount outstanding and the number of previously issued loans as well as loan origination year, purpose, and currency. Amount and maturity are related to information asymmetry and uncertainty (Berger, Espinosa-Vega, Frame, & Miller, 2005; Mosebach, 1999) while collateral and covenants are contractual mechanisms mitigating adverse selection and moral hazard problems (Besanko & Thakor, 1987; Bester, 1985). Secured loans are more prone to renegotiation (Bester, 1994) while

¹² Such a relationship between lender's informedness and centrality of its position in the network is assumed throughout our analysis. Alternative empirical designs may allow investigating validity of the assumption, however, certain limitations of our data, in particular, completeness of information on evolution of the state of borrowers between the dates of loan origination and renegotiations, does not permit us to conduct such tests.

¹³ Notice that information is a non-rival good, sharing information a lender does not diminish the amount of information it possesses.

¹⁴ The amended terms are: Amount, Covenants financial, Covenants non-financial, Maturity, Pricing, Definition

¹⁵ Including the loan spreads drastically reduces the sample size as less than half of it contains information on this variable. Therefore, we do not include it in the main regressions.

covenants renegotiation allows to rebalance the allocation of contractual control rights (Garleanu & Zwiebel, 2009). We also include main characteristics of the banking pool such as the number of lenders,¹⁶ the presence of league table lead lenders, of previous bank-borrower relationships and of lenders from the same country as the borrower. The structure and composition of the banking pool are related to informational frictions, especially regarding credit risk diversification, moral hazard, and hold-up problems (Bolton & Scharfstein, 1996; Lee & Mullineaux, 2004; Preece & Mullineaux, 1996; Sufi, 2007), while lender's reputation helps mitigating agency problems (Bushman & Wittenberg-Moerman, 2012; Johnson, 1997; McCahery & Schwienbacher, 2010; Ross, 2010). Borrower-lender proximity helps overcome information asymmetry problems (Hauswald & Marquez, 2006; Mian, 2006).

We control for borrower financial characteristics to take their bargaining power and financial health into account, by including size, leverage, liquidity, and profitability proxies.¹⁷ We include borrower rating to proxy for transparency. We consider the economic and financial development of the borrower's country because it affects the cost of external financing by acting on information asymmetry and provides outside options for refinancing (Levine, Loayza, & Beck, 2000; Rajan & Zingales, 1998). We include legal factors related to creditors protection proxies using the rule of law index, following notably Bae and Goyal (2009) and Qian and Strahan (2007), and proxies for legal renegotiation frictions faced by creditors, following Favara et al. (2012): renegotiation failure index, creditors' priority index and creditors recovery rate.¹⁸ We also control for the legal origin of the borrower's country.

We have three explained variables which are proxies of the renegotiation process: a binary variable *Renegotiation*, a number of renegotiation *Rounds*, and a counting variable of the number of *Amendments*. The nature of each explained variable determines the choice of the regression model: a logit model, an ordered logit model, and a Poisson regression, respectively. We have three main explanatory variables of interest - the proxies of the lender's network-centrality: *Betweenness*, *Closeness*, and *Degree*. We propose three different specifications with respect to control variables (under data availability constraints): one with loan and syndicate variables, one with additional borrower variables, and one with loan, syndicate, and country variables. We provide alternative specifications in the robustness checks sub-section.

3. Results

In this section, we present descriptive statistics, and we discuss univariate and regression results. We also provide several robustness checks.

3.1. Descriptive statistics and univariate results

Our sample contains 6361 loan facilities to 4805 borrowing firms from 25 European countries, involving 238 lenders.¹⁹ The sample is comparable to papers on bank loan renegotiation by Nikolaev (2018) for

¹⁶ An alternative variable is the syndicate concentration measured with the retained shares of the loan by each lender, but this information is often missing in Bloomberg.

¹⁷ All firm variables are symmetrically winsorized at 5% to minimize the influence of outliers.

¹⁸ The renegotiation failure index summarizes several characteristics of debt enforcement procedures that protect creditors from shareholders' strategic default. Priority reflects the order in which creditors' claims are served. Recovery rate is computed for secured creditors, conditional on default.

¹⁹ Depending on the specification use for regressions, this number can vary due to data availability on particular variables. Due to the method for computing lenders' centrality measures using overlapping three years windows, we "lose" the first three years of our initial sample (1999 to 2001). The final sample starts in 2002 and goes until 2017.

the US and Godlewski (2020) for Europe.

Table 1 provides descriptive statistics for main explained and explanatory variables by country. Table 2 displays descriptive statistics and *t*-tests for all variables between *Renegotiation* variable.²⁰

The UK, France, Spain, Germany, Netherlands, and Italy account for most of the loans (81% of the sample), which is consistent with the European market for syndicated loans. The sample renegotiation average rate equals 33%. Renegotiation rates are heterogenous across countries, ranging from 3% in Portugal to 85% in Luxembourg. This is also the case with respect to renegotiation rounds, ranging from 1 to almost 6 (i.e. a loan was renegotiated 6 times during the sample period), while the average (median) of *Rounds* equals 2.62 (2.00). Amendments are less heterogenous across countries, ranging from 1 to almost 4 (i.e. 4 out of a total of 6 loan terms were renegotiated). The average and median of *Amendments* equal to 2.18 and 2.00 in the sample. Network-centrality scores are relatively homogenous across countries, with sample averages close to medians for *Betweenness*, *Closeness*, and *Degree*.²¹

Betweenness, *Closeness*, and *Degree* are statistically larger for renegotiated loans. *Betweenness*, *Closeness*, and *Degree* are stable in levels across rounds and increase for very frequent renegotiations (from 10 rounds and above). *Closeness* slightly increases with amendments while *Betweenness* and *Degree* start decreasing for renegotiations involving rewriting a majority of the loan agreement terms.

A vast majority of the other variables are significantly different with respect to renegotiation likelihood. Renegotiated loans are larger, with a slightly longer maturity, and more often secured with covenants attached. They are funded by larger banking pools, with slightly less reputable leaders and lenders from the same country as the borrower, but with more frequent past borrower-lender relationships. Loan renegotiations firms are more often rated, larger, more leveraged, and less liquid. More favorable economic conditions, better financial development, and legal environments protecting creditors are positively associated with loan renegotiation.²²

Table 3 provides means and *t*-tests for all variables by Low vs High levels of *Betweenness*, *Closeness*, and *Degree*.²³ All variables exhibit significant differences in means by centrality level. However, we notice that *Maturity* and *Relationship* exhibit different behavior for high level of *Closeness* as compared to the two other centrality measures. In other words, access to superior information allows to reduce adverse selection problems and write contracts with longer maturities at origination, while the informational advantage of past relationships becomes a substitute with a greater network depth and proximity. We also observe that greater network size and involvement (*High Degree*) allows for less collateral at origination. Regarding other variables, we notice that higher centrality is associated with larger loans with covenants, funded by larger syndicates and more league table lenders. Borrowers are larger with greater leverage and lower liquidity, more often rated, have larger outstanding amounts and more previous loan issues. Borrowers from countries with less developed credit markets, but more developed stock markets, deal with more central lenders. Lower renegotiation frictions and better creditors' legal protection are also related to higher

²⁰ The correlation matrix for all explanatory variables is provided in Table A1.

²¹ For ease of interpretation, *Closeness* is multiplied by 1000 and *Degree* is divided by 1000.

²² A majority of loans are term loans (59%), denominated in EUR (67%), while USD loans represent 12% of the sample. Acquisition, general corporate, LBO, and debt refinancing loan purposes account for 15%, 18%, 16%, and 36% respectively. Borrowing firms operate in basic materials (7%), communications (10%), consumer (cyclical & non-cyclical) (41%), energy (6%), industrial (25%), technology (3%), utilities (4%), and diversified (5%). French and German legal origin represents 48% and 20% of the sample, respectively.

²³ Low vs High with respect to the variable's median, equal to 0.10, 0.41, and 0.21 for *Betweenness*, *Closeness*, and *Degree*, respectively.

Table 1
Descriptive statistics by country.

Country	# Loans	% Renegotiation	Rounds	Amendments	Betweenness	Closeness	Degree
Austria	42	0.26	1.16	1.24	0.08	0.42	0.18
Belgium	86	0.27	1.87	2.07	0.10	0.42	0.23
Croatia	14	0.39	1.00	1.00	0.03	0.27	0.06
Czech Republic	27	0.13	1.30	1.30	0.09	0.46	0.18
Denmark	51	0.33	1.71	1.46	0.10	0.44	0.21
Finland	128	0.41	1.71	1.36	0.06	0.39	0.16
France	1109	0.26	2.16	2.09	0.12	0.47	0.24
Germany	887	0.37	2.67	2.46	0.11	0.43	0.23
Greece	25	0.08	1.00	3.00	0.09	0.46	0.19
Hungary	22	0.55	1.90	1.98	0.09	0.50	0.19
Ireland	53	0.56	2.60	2.20	0.15	0.50	0.25
Italy	536	0.27	1.52	1.54	0.09	0.41	0.21
Luxembourg	27	0.85	9.19	3.41	0.16	0.48	0.29
Netherlands	334	0.45	2.91	2.69	0.12	0.44	0.25
Norway	190	0.36	3.85	3.07	0.06	0.38	0.16
Poland	49	0.44	1.76	1.00	0.07	0.35	0.17
Portugal	24	0.03	1.00	1.00	0.07	0.34	0.18
Russian Federation	42	0.50	2.85	1.72	0.10	0.38	0.21
Slovak Republic	14	0.30	7.00	2.00	0.07	0.36	0.19
Slovenia	11	0.26	1.00	1.00	0.06	0.35	0.17
Spain	991	0.27	1.63	1.83	0.08	0.40	0.19
Sweden	171	0.36	2.20	1.84	0.08	0.43	0.19
Switzerland	145	0.39	1.97	1.50	0.12	0.43	0.24
Turkey	65	0.27	1.13	1.00	0.04	0.29	0.09
United Kingdom	1325	0.32	2.28	2.15	0.10	0.48	0.22

This table displays the number of loans, the percentage of renegotiated loans, the number of renegotiation rounds, the number of amendments, and the centrality measures (betweenness, closeness, degree) by borrower country.

Table 2
Descriptive statistics and univariate results by Renegotiation.

Variable	Mean	Median	SD	No reneq.	Reneg.	T-test
Renegotiation	0.33	0.00	0.47			
Rounds	2.62	2.00	2.51			
Amendments	2.18	2.00	1.28			
Betweenness	0.10	0.10	0.06	0.0956	0.1175	(-24.07)***
Closeness	0.44	0.41	0.14	0.4082	0.4540	(-24.49)***
Degree	0.22	0.22	0.09	0.2043	0.2459	(-35.57)***
Facility	1139.51	349.07	3000.69	878.2824	1663.5063	(-18.35)***
Maturity	6.61	6.00	3.82	6.5283	6.7796	(-5.00)***
Secured	0.43	0.00	0.50	0.3687	0.5664	(-27.95)***
Covenants	0.10	0.00	0.30	0.0587	0.1943	(-26.88)***
Outstanding amount	3.17	0.39	40.82	2.8308	3.8506	(-1.87)
Previous issues	3.75	3.00	2.89	3.4655	4.3092	(-18.83)***
# lenders	10.48	7.00	10.31	8.4409	14.5694	(-36.50)***
League	0.19	0.00	0.39	0.1967	0.1695	(4.94)***
Relationship	0.25	0.00	0.43	0.2218	0.3039	(-12.81)***
% same country	0.23	0.14	0.29	0.2469	0.2068	(9.78)***
Rating	0.10	0.00	0.30	0.0715	0.1524	(-17.08)***
Sales (log)	6.78	6.86	1.95	6.5417	7.1301	(-11.80)***
Debt / Equity	2.06	0.82	3.23	1.7183	2.5481	(-8.99)***
Current ratio	0.01	0.01	0.01	0.0140	0.0129	(6.18)***
Operating margin	0.11	0.09	0.12	0.1089	0.1215	(-3.97)***
GDP growth	0.02	0.02	0.02	0.0166	0.0195	(-10.19)***
Private credit	1.14	1.07	0.35	1.1327	1.1420	(-1.71)
Stock market	0.82	0.77	0.39	0.8002	0.8576	(-8.10)***
Rule of law	1.46	1.63	0.48	1.4393	1.5079	(-9.83)***
Renegotiation index	0.38	0.45	0.14	0.3794	0.3935	(-5.79)***
Priority	3.26	3.00	0.77	3.2056	3.3829	(-13.92)***
Recovery	0.59	0.56	0.18	0.5795	0.6173	(-12.07)***

This table displays means, medians, and standard deviations for all variables (definitions are provided in the appendix) and mean t-test statistics for explanatory variables between Renegotiation variable.

centralities. These results are overall similar to those with respect to renegotiation likelihood. In other words, a large number of explanatory variables exhibit similar behavior with respect to renegotiation and lender's centrality.

Figure 1 presents the distributions of renegotiation rounds and amendments (excluding non-renegotiated loans). Fig. 2 shows all three centrality measures by renegotiation round (from 0 to 12) and

amendments (from 0 to 6). Overall, the depth and proximity of a lender's network (*Closeness*), "diversity" of lender's connections or its potential for "bridging" (*Betweenness*) and lender's network size and involvement (*Degree*) exhibit similar patterns.

Table 3
Univariate results by centrality measures.

	Low betweenness	High betweenness	T-test	Low closeness	High closeness	T-test	Low degree	High degree	T-test
Facility	620.3886	1708.4229	(-27.16) ***	817.0697	1455.8014	(-15.80) ***	701.1571	1589.1700	(-22.07) ***
Maturity	6.8622	6.3376	(10.24)***	6.3360	6.8825	(-10.56) ***	6.8237	6.3946	(8.30)***
Secured	0.4475	0.4202	(4.07)***	0.4556	0.4137	(6.24)***	0.4053	0.4644	(-8.82)***
Covenants	0.0640	0.1473	(-19.97) ***	0.0755	0.1315	(-13.62) ***	0.0677	0.1408	(-17.73) ***
Outstanding amount	1.7240	4.7548	(-5.34)***	1.9147	4.4015	(-4.53)***	2.0393	4.3300	(-4.12)***
Previous issues	3.3637	4.1653	(-20.38) ***	3.2703	4.2130	(-24.40) ***	3.5082	3.9903	(-12.31) ***
# lenders	6.8954	14.4078	(-55.74) ***	8.6617	12.2631	(-26.28) ***	7.3815	13.6578	(-46.78) ***
League	0.1172	0.2649	(-27.98) ***	0.1345	0.2398	(-20.11) ***	0.1391	0.2375	(-18.69) ***
Relationship	0.1903	0.3135	(-21.04) ***	0.2733	0.2254	(8.18)***	0.1852	0.3146	(-22.25) ***
% same country	0.2636	0.2001	(16.14)***	0.2298	0.2368	(-1.77)	0.2611	0.2048	(14.27)***
Rating	0.0577	0.1430	(-20.93) ***	0.0942	0.1025	(-2.06)*	0.0573	0.1405	(-20.69) ***
Sales (log)	6.2474	6.9968	(-14.10) ***	6.6547	6.6038	(0.94)	6.2343	7.0622	(-15.55) ***
Debt / Equity	1.3737	1.4289	(-1.22)	1.3405	1.4603	(-2.66)**	1.3439	1.4636	(-2.66)**
Current ratio	0.0145	0.0136	(4.00)***	0.0140	0.0141	(-0.41)	0.0144	0.0137	(3.15)**
Operating margin	0.1041	0.1036	(0.13)	0.1010	0.1067	(-1.64)	0.1003	0.1075	(-2.09)*
GDP growth	0.0181	0.0170	(3.99)***	0.0131	0.0215	(-29.61) ***	0.0185	0.0166	(6.52)***
Private credit	1.1389	1.1322	(1.32)	1.1594	1.1178	(8.01)***	1.1427	1.1275	(2.99)**
Stock market	0.7699	0.8577	(-15.25) ***	0.7215	0.8772	(-27.36) ***	0.7808	0.8562	(-12.81) ***
Rule of law	1.3936	1.5373	(-22.64) ***	1.4080	1.5153	(-16.61) ***	1.4303	1.4949	(-9.99)***
Renegotiation index	0.3921	0.3746	(7.74)***	0.3930	0.3734	(8.63)***	0.4049	0.3634	(18.52)***
Priority	3.1415	3.4021	(-22.15) ***	3.2155	3.3176	(-8.56)***	3.1930	3.3312	(-11.51) ***
Recovery	0.5903	0.5933	(-1.07)	0.5944	0.5885	(2.07)*	0.5940	0.5894	(1.62)

This table displays means and mean -t-test statistics for explanatory variables by centrality measure. Low vs High with respect to the variable's median, equal to 0.10, 0.41, and 0.21 for Betweenness, Closeness, and Degree respectively.

3.2. Regression results

We provide results for our main specifications in Table 4. All three centrality measures (*Betweenness*, *Closeness*, *Degree*) are significant and positive in all regressions. This first multivariate result supports the hypothesis that access to superior information has a positive influence on the entire renegotiation process: the renegotiation likelihood, the number of renegotiation rounds and the number of amended terms. Indeed, better information translates into better screening capacities mitigates adverse selection and moral hazard problems and lower renegotiation costs.

Most of loan and syndicated control variables are also significant with coefficients signs consistent with the literature. Larger loans with longer maturities, secured and with covenants attached, funded by numerous lenders are more likely to enter a renegotiation process. Indeed, large loans with long maturities are associated with lower information asymmetry and less uncertainty Berger et al. (2005), Mosebach (1999). Secured loans are more prone to renegotiation Bester (1994) while amending restrictive covenants allows to rebalance the allocation of contractual control rights Dessein (2005), Garleanu and Zwiebel (2009). Large syndicates are associated with less informational frictions Lee and Mullineaux (2004), Preece and Mullineaux (1996), Sufi (2007). Less opaque hence more transparent rated and frequent issuers are also more likely to renegotiate their loans. The presence of league

table lenders, relationship lenders, or lenders from the same country as the borrower, is not significantly related to the renegotiation process.²⁴

Table 5 shows the results with additional borrowing firm control variables. Due to data availability, the sample size decreases dramatically, losing almost 80% of the observations. Therefore, we shall interpret these results with caution. Nevertheless, although less significant, a vast majority of the centrality measures coefficients remain positive in all regressions, except for *Closeness* in the *Renegotiation* equation. Again, these results support the idea that better ability to gather valuable information distributed over network associated with lender's centrality has a positive influence on the renegotiation process. Among the firm variables, we notice that liquidity is the most significant variable across regressions, with a negative coefficient. This result is consistent with the idea that less liquidity constrained firms are less prone to renegotiate their loans.

We include (borrower) country level characteristics to our main specifications and provide the results in Table 6.²⁵ The sample size is further reduced due to data availability when compared to results in Table 3, although the data loss is much less dramatic as with firm variables (Table 5). Due to correlation, for each renegotiation variable (*Renegotiation*, *Rounds*, *Amendments*), we propose 4 different specifications, each time including economic and financial development

²⁴ It is plausible that these features are at least in part embedded into the centrality measures.

²⁵ We analyze more in depth the influence of country variables in the robustness checks sub-section (see Tables 7 and A2).

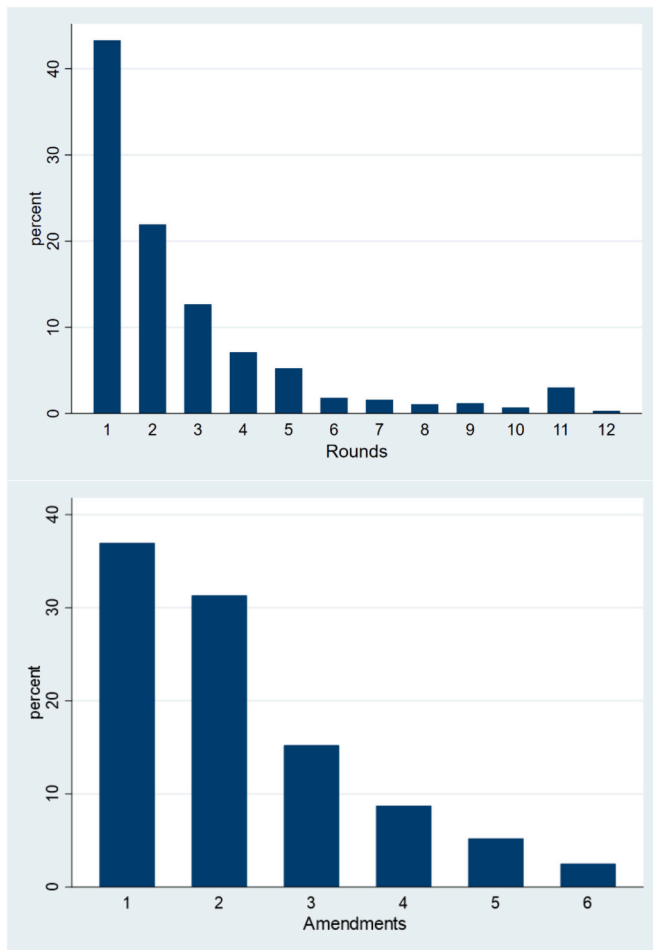


Fig. 1. Renegotiation rounds and amendments. The upper and lower figures present the distributions of renegotiation rounds and amendments excluding non-renegotiated loans.

variables, as well as different legal variables separately: *Rule of law*, *Renegotiation index*, *Priority*, and *Recovery*.²⁶ Again, a vast majority of the centrality measures coefficients remain positive in all regressions, with the notable exception of *Closeness* becoming not significant in some equations. Hence, access to superior information has a positive influence on loan renegotiation. The centrality proxy for lender’s network depth and proximity is a notable exception, suggesting that country level variables, especially legal variables, make this particular network centrality aspect less relevant for the renegotiation process.

Among all country variables, proxies for legal protection of creditors are the most significant across all specifications, followed by economic growth proxy. The latter is consistent with the idea that better economic conditions naturally facilitate renegotiation, notably due to greater bargaining power of the borrowers thanks to additional outside options for external financing. Overall quality of the legal environment (*Rule of law*) and specific proxies for creditors legal protection (*Priority* and *Recovery*) have a positive impact on the renegotiation process, while lower renegotiation legal frictions (greater *Renegotiation index* values) have the opposite effect. Better legal protection of creditors reduces the cost of renegotiation, thus enhancing the willingness of lenders to make concessions and update the loan contract through renegotiation. However, when lenders face the risk of shareholders’ strategic default, stronger debt enforcement (larger values of *Renegotiation index*) has a negative influence on the renegotiation process. This result can also be explained

²⁶ We also control for legal origin (French and German) in each regression.

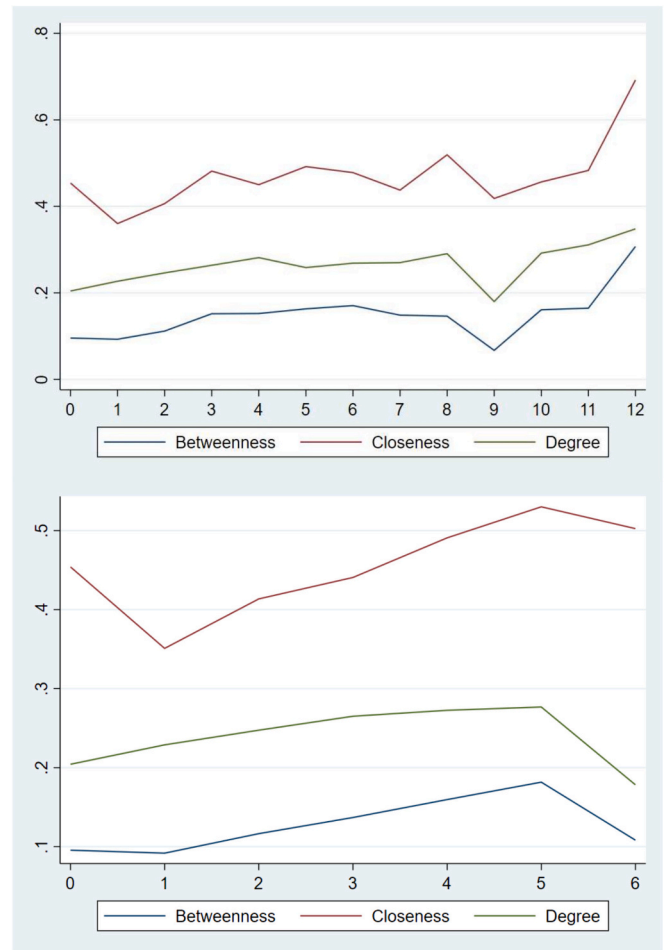


Fig. 2. Network-centrality metrics across renegotiation rounds and amendments. This figure displays the betweenness, closeness, and degree centrality measures across renegotiation rounds and amendments (0 to 12 and 0 to 6 respectively).

by the fact that borrowers are less willing to renegotiate their debt in environments with stronger debt enforcement favoring creditors.

To summarize our findings, we confirm the hypothesis that central, better informed, lenders have a positive influence on the entire renegotiation process. Thus, our findings lay support to the argument following from the theory of incomplete contracts. We do not validate the alternative hypothesis that central lenders are able to write more “complete” contracts at origination which are more renegotiation-proof. The information value of centrality enhances screening capacities, helping to mitigate adverse selection problems in renegotiations, and helps improve deal structuring capacities, signal a better deal, mitigate moral hazard, and lower renegotiation costs. In a nutshell, better information increases renegotiation likelihood, the number of renegotiation rounds and of amended terms.

3.3. Robustness checks

We conducted a comprehensive set of robustness checks to validate our main findings.²⁷ Table 7 presents the results of the first battery of robustness checks at both the micro-level and macro-level. In panel A, we analyze specific renegotiations, loan, and syndicate characteristics, while in panel B we examine country and time specific characteristics.

²⁷ We are grateful to the anonymous referees for suggesting the additional robustness checks.

Table 4
Regression results – main specification.

	Renegotiation			Rounds			Amendments		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Betweenness	4.6453*** (1.2480)			3.6738*** (0.8605)			5.3348*** (1.5580)		
Closeness		4.5991** (2.1232)			2.1199** (0.9278)			4.0179* (2.2157)	
Degree			3.5572*** (0.9301)			3.5910*** (0.7589)			3.4743*** (1.1761)
Facility (log)	0.3870*** (0.0707)	0.3926*** (0.0728)	0.3839*** (0.0716)	0.2603*** (0.0524)	0.2682*** (0.0539)	0.2467*** (0.0526)	0.2890*** (0.0780)	0.2980*** (0.0803)	0.2843*** (0.0797)
Maturity	0.0503*** (0.0143)	0.0510*** (0.0145)	0.0510*** (0.0142)	0.0577*** (0.0116)	0.0591*** (0.0116)	0.0572*** (0.0113)	0.0629*** (0.0159)	0.0627*** (0.0162)	0.0633*** (0.0160)
Secured	0.5634*** (0.0984)	0.5441*** (0.0972)	0.5639*** (0.0974)	0.5453*** (0.0801)	0.5364*** (0.0796)	0.5576*** (0.0791)	0.6159*** (0.1086)	0.5893*** (0.1066)	0.6147*** (0.1076)
Covenants	1.5645*** (0.1860)	1.5623*** (0.1855)	1.5986*** (0.1852)	0.6921*** (0.1199)	0.6995*** (0.1184)	0.6976*** (0.1193)	1.4792*** (0.2186)	1.4780*** (0.2161)	1.5066*** (0.2187)
Outstanding (log)	-0.2595*** (0.0636)	-0.2493*** (0.0658)	-0.2628*** (0.0649)	-0.1010*** (0.0371)	-0.0838** (0.0395)	-0.1020*** (0.0374)	-0.2122*** (0.0627)	-0.1963*** (0.0650)	-0.2100*** (0.0642)
Previous issues	0.1004*** (0.0232)	0.1002*** (0.0235)	0.1026*** (0.0233)	0.0362*** (0.0130)	0.0357*** (0.0131)	0.0380*** (0.0133)	0.0979*** (0.0247)	0.1000*** (0.0252)	0.1002*** (0.0249)
# lenders	0.0245*** (0.0098)	0.0312*** (0.0099)	0.0261*** (0.0098)	0.0149*** (0.0038)	0.0188*** (0.0034)	0.0156*** (0.0038)	0.0420*** (0.0106)	0.0494*** (0.0105)	0.0450*** (0.0107)
League	0.1821 (0.1352)	0.2180 (0.1333)	0.1540 (0.1383)	-0.0479 (0.1025)	-0.0260 (0.1038)	-0.0725 (0.1037)	0.0487 (0.1474)	0.0927 (0.1465)	0.0361 (0.1490)
Relationship	-0.0269 (0.1114)	-0.0327 (0.1131)	-0.0335 (0.1109)	0.0531 (0.0733)	0.0428 (0.0754)	0.0492 (0.0718)	0.0209 (0.1293)	0.0142 (0.1311)	0.0169 (0.1284)
% same country	-0.0235 (0.1351)	-0.0139 (0.1377)	-0.0160 (0.1366)	0.0715 (0.1340)	0.0561 (0.1317)	0.0736 (0.1328)	0.0814 (0.1878)	0.0833 (0.1917)	0.0827 (0.1904)
Rating	0.2631** (0.1331)	0.2636* (0.1380)	0.2508* (0.1336)	0.2011*** (0.0705)	0.1860*** (0.0720)	0.2094*** (0.0696)	0.1783 (0.1294)	0.1751 (0.1323)	0.1780 (0.1293)
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loans	6361	6361	6361	6361	6361	6361	6361	6361	6361
Chi2	754.35	757.25	788.99	8787.18	8238.17	7808.44	1233.91	1331.37	1314.75
Log.L.	-10,107.22	-10,165.95	-10,110.21	-21,935.87	-22,146.28	-21,867.01	-19,839.43	-19,941.85	-19,878.77
PseudoR2	0.27	0.26	0.27	0.40	0.39	0.40	0.18	0.18	0.18

This table presents estimated coefficients and standard errors, clustered at the loan facility level (in parentheses), from logit, ordered logit, and poisson regressions respectively. Renegotiation = 1 if a loan is renegotiated (0 otherwise); Rounds = 0 (no renegotiation) to 12 renegotiation rounds; Amendments = 0 (no renegotiation) to 6 amended loan terms. Betweenness, Closeness, Degree are lender's network-centrality measures and our main explanatory variables. All variables are described in the appendix. All regressions include control variables for main loan currencies (USD and EUR), loan type (term), loan purposes (acquisition, general corporate, LBO, debt refinancing). *, **, and *** indicate a statistically significant coefficient at the 10%, 5%, and 1% confidence level.

Table 8 displays the results for our main specifications (see Table 4) with alternative measures for relationship intensity/strength based on loan amount and loan numbers (following notably Bharath, Dahiya, Saunders, & Srinivasan, 2011; Prilmeier, 2017; Schenone, 2010). This approach allows us to further scrutinize the influence of relationships on our centrality results. To address potential endogenous matching issues between borrowers and lenders, we employ nearest neighbor matching (NNM) method, which results are presented in Table 9.

We begin with the discussion of the general robustness checks in Table 7. In panel A, we initially question the hypothesis of using a 3-year overlapping moving window to calculate centrality measures. Although such approach with moving time windows of exogenously predefined width have been often used in previous studies (e.g. Baum et al., 2003; Godlewski et al., 2012), lenders networks may also be constructed differently employing the information on loans maturities. Let us assume that at each point in time, only the connections corresponding to the loans which have not yet matured remain active. The active connections constitute a network that is dynamically changing as some loans reach their maturity becoming inactive and emerging new connections due to origination of new loans. Our results remain robust, with most centrality coefficients showing significant positivity. Furthermore, following notably Roberts and Sufi (2009), we exclude non-material amendments (i.e. amendments to 'Definition') from the analysis. Additionally, we introduce an *Early Renegotiation* variable in our regressions, which equals one if renegotiation occurs before half of the contractual maturity at origination. Our main findings remain robust. It is worth noting that

earlier renegotiation significantly and positively affects renegotiation rounds and amendments.

We also consider unique renegotiations and loans, and first loans. Unique renegotiations correspond to loans that entered renegotiation only once, eventually signaling more complete initial contracts and/or more efficient amendments as the loans did not re-enter subsequent renegotiations. In such circumstances, the role of lender network-centrality is expected to play a lesser role. On the contrary, unique, or first-time loans should be much more sensitive to lender network-centrality as they are more prone to adverse selection and moral hazard problems due to the lack of information. Our results remain robust, with most of the centralities' coefficients being significantly positive.

Next, we examine small loans (less than 419 US\$mil.), short maturity loans (less than 6 years), loans without collateral or covenants, deals with many tranches (more than 3), and few past loan issues (less than 3). Smaller loans and shorter maturities are associated with greater information asymmetry and uncertainty problems, making lender centrality more important. The absence of collateral may signal less risk in the initial contract, while the absence of covenants may signal less information asymmetry between the borrower and the lender at loan origination. In both cases lender centrality should play a less important role. Complex deals including multiple tranches are expected to be more difficult to renegotiate hence giving more importance to lender centrality. Fewer loan issues are associated with a less known and thus less transparent borrower on the credit market, enhancing the value of lender's centrality.

Table 5
Regression results – borrower variables included.

	Renegotiation			Rounds			Amendments		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Betweenness	3.3558* (2.0006)			5.5416*** (1.0760)			4.7026** (2.0162)		
Closeness		5.1454 (3.9666)			9.5490*** (1.8529)			7.4431* (4.1233)	
Degree			3.4753** (1.4822)			5.3410*** (0.8741)			3.9579** (1.6230)
Sales (log)	-0.1010* (0.0604)	-0.1019* (0.0603)	-0.1054* (0.0607)	-0.0550* (0.0300)	-0.0563* (0.0292)	-0.0539* (0.0292)	0.0414 (0.0542)	0.0413 (0.0537)	0.0389 (0.0543)
Debt / Equity	-0.0872 (0.0607)	-0.0911 (0.0611)	-0.0866 (0.0603)	-0.0642* (0.0374)	-0.0705* (0.0386)	-0.0646* (0.0349)	-0.1044* (0.0618)	-0.1106* (0.0628)	-0.1075* (0.0619)
Current ratio	-16.5111 (12.3083)	-17.8861 (12.3745)	-16.2642 (12.3412)	-30.0841*** (8.8278)	-32.7744*** (9.0076)	-29.6345*** (8.8549)	-33.4554*** (11.9433)	-34.9854*** (12.0154)	-33.5055*** (11.8535)
Operating margin	0.0420 (0.8930)	0.0316 (0.8851)	0.0484 (0.8970)	0.1395 (0.5353)	0.1492 (0.5319)	0.0918 (0.5361)	1.4263* (0.8162)	1.3739* (0.8102)	1.4175* (0.8142)
Loan & Syndicate & Rating	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loans	1405	1405	1405	1423	1423	1423	1420	1420	1420
Chi2	236.88	234.30	238.13	3340.26	3278.36	3419.25	2741.85	2669.47	2675.91
Log.L.	-2335.47	-2338.31	-2328.14	-4944.57	-4969.89	-4900.29	-4673.23	-4680.15	-4667.85
PseudoR2	0.28	0.28	0.29	0.30	0.29	0.30	0.18	0.18	0.18

This table presents estimated coefficients and standard errors, clustered at the loan facility level (in parentheses), from logit, ordered logit, and poisson regressions respectively. Renegotiation = 1 if a loan is renegotiated (0 otherwise); Rounds = 0 (no renegotiation) to 12 renegotiation rounds; Amendments = 0 (no renegotiation) to 6 amended loan terms. Betweenness, Closeness, Degree are lender's network-centrality measures and our main explanatory variables. All variables are described in the appendix. Loan and Syndicate variables and borrower Rating included but not shown. All regressions include control variables for main loan currencies (USD and EUR), loan type (term), loan purposes (acquisition, general corporate, LBO, debt refinancing). *, **, and *** indicate a statistically significant coefficient at the 10%, 5%, and 1% confidence level.

Again, most of our results remain robust with the notable exception of complex deals. In the case of multiple tranches, lender centralities become all non-significant for the renegotiation process. This result suggests that lender network centrality cannot compensate for more complex loans such as those involving multiple tranches when considering a renegotiation process.

We also consider small syndicates (less than 7 members), syndicates without league table lenders, without relationship lenders, un-rated borrowers, adding bank fixed effects,²⁸ and excluding specific lenders. Concentrated syndicates are generally better at mitigating moral hazard and coordination problems, however, may signal more problematic deals with larger informational frictions. The absence of reputable lenders according to league table means much less reputation to signal the quality of the deal and to reduce moral hazard problems. The absence of past relationships between the lenders and the borrower means less (private) information available and more room for adverse selection problems. Borrowers without rating are considered as less transparent and thus more informationally problematic. In such circumstances, lender centrality is expected to play a more important role. Adding bank fixed effects aims at controlling for lenders individual characteristics.

Finally, we exclude specific lenders: the first lender in terms of loans (9.65% of the sample): BNP Paribas and the first three lenders in terms of loans (21% of the sample): BNP Paribas, Royal Bank of Scotland, Uni-Credit. By excluding these major players from the network, we test the resilience of the remaining players and our regression results. Again, all results remain robust with significant and positive coefficients for all centrality measures. These robust checks also confirm that the credit market network and the benefits of central lenders are not due to the presence of major players on the market.

²⁸ Due to convergence problems, regression results for *Amendments* are incomplete.

In Panel B we consider country and time characteristics. We start with specific legal environments, with weak general rule of law (*Rule of law* below 1.65), weak protection of creditors against shareholders in case of default (*Renegotiation index* below 0.45) and low creditors recovery (below 0.56).²⁹ We expect lender centrality to play a greater role in such more “difficult” legal environments for creditors. We also consider different subsamples with respect to geographical composition such as excluding UK as it corresponds to the largest portion of the sample and because its legal origin and environment is different from most of the Continental Europe, more protective of investors and of creditors in particular. We also focus on the historical core Eurozone members³⁰ and on GIIPS,³¹ to verify if our results hold for these specific areas. Finally, we consider post crisis periods, one following the US Crisis (after September 15th, 2008), and one following the EZ Crisis (after December 1st, 2009). Such episodes of deep and large disruptions in the functioning of capital markets with greater uncertainty and informational frictions offer an excellent laboratory to test the robustness of the lender centrality effects. Furthermore, the September 15th, 2008 marks the bankruptcy of Lehman Brothers and a direct shock to the lenders' network.

The results for weaker rule of law and protection of creditors in case of default are similar to our main results, except for *Closeness* becoming not significant. The value of network depth and network center proximity of a lender becomes less important for renegotiation in legal environments that are more “adverse” towards creditors. In other words, weak legal protection of creditors renders lender informedness much less valuable with respect to bank loan renegotiation. It is even more

²⁹ Due to convergence problems, regressions results are partially incomplete.

³⁰ Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Spain, Portugal.

³¹ Greece, Ireland, Italy, Spain, Portugal. Due to convergence problems, regression results for *Rounds* are not available.

Table 6
Regression results – country variables included.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
<i>Renegotiation</i>												
Betweenness	4.2531*** (1.3421)			4.8009*** (1.4619)			5.0460*** (1.4560)			5.1316*** (1.4821)		
Closeness		2.8650 (2.4473)			4.6931* (2.6046)			5.6744** (2.5433)			5.4111** (2.5719)	
Degree			4.3555*** (1.1407)			4.6990*** (1.2180)			4.9269*** (1.2117)			4.9997*** (1.2306)
GDP growth	7.6367 (4.8386)	7.6626 (5.0041)	8.8629* (5.0367)	17.0808*** (5.1230)	17.8533*** (5.2754)	17.5052*** (5.2152)	12.7417*** (4.9354)	13.2917** (5.2505)	14.2976*** (5.1076)	9.5923** (4.8683)	10.0365** (5.0999)	10.4950** (5.0277)
Private credit	-0.2625 (0.2657)	-0.2788 (0.2637)	-0.2304 (0.2680)	0.1117 (0.3155)	0.0708 (0.3133)	0.1773 (0.3156)	0.1315 (0.3053)	0.0781 (0.3106)	0.2122 (0.3100)	-0.4021 (0.2895)	-0.4557 (0.2924)	-0.3038 (0.2911)
Stock market	-0.0634 (0.2357)	-0.0989 (0.2396)	-0.1111 (0.2425)	0.2310 (0.2205)	0.2274 (0.2235)	0.1473 (0.2223)	-0.0343 (0.2210)	-0.0440 (0.2278)	-0.1202 (0.2265)	0.1580 (0.2234)	0.1459 (0.2261)	0.0765 (0.2251)
Rule of law	0.4155*** (0.1437)	0.4494*** (0.1479)	0.3771*** (0.1452)									
Renegotiation index				-2.2799*** (0.6653)	-2.4110*** (0.6680)	-2.1142*** (0.6729)						
Priority							0.2353** (0.1140)	0.2402** (0.1132)	0.2223** (0.1126)			
Recovery										1.3653*** (0.3674)	1.3555*** (0.3720)	1.3072*** (0.3686)
Loan & Syndicate & Rating	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Legal origin	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loans	4843	4843	4843	3972	3972	3972	3972	3972	3972	3972	3972	3972
Chi2	482.40	485.53	500.69	430.93	434.49	442.40	423.47	425.40	440.92	428.72	433.66	441.93
Log.L.	-7307.67	-7360.88	-7281.22	-5796.88	-5839.81	-5778.26	-5868.45	-5912.82	-5846.61	-5799.33	-5847.16	-5778.00
PseudoR2	0.26	0.25	0.26	0.27	0.26	0.27	0.26	0.25	0.26	0.27	0.26	0.27
<i>Rounds</i>												
Betweenness	3.3194*** (0.9594)			3.6981*** (1.0163)			3.8391*** (1.0700)			3.8109*** (1.0723)		
Closeness		1.7222 (1.3280)			2.3336 (1.5346)			2.6955* (1.5808)			2.3417 (1.5819)	
Degree			4.0840*** (1.0457)			4.6917*** (0.9158)			4.8217*** (0.9817)			4.8781*** (0.9677)
GDP growth	-0.1700 (5.3960)	0.8930 (5.2287)	0.5291 (5.5714)	8.1449 (5.3215)	8.9834* (5.2378)	8.4464 (5.3445)	3.8098 (4.4872)	4.0652 (4.4407)	4.8544 (4.5550)	2.0081 (4.9116)	2.6222 (4.8307)	2.5500 (4.9236)
Private credit	-0.4121* (0.2408)	-0.3584 (0.2393)	-0.3989* (0.2387)	-0.0291 (0.3033)	0.0100 (0.2955)	0.0004 (0.2962)	-0.1085 (0.2551)	-0.0863 (0.2561)	-0.0567 (0.2482)	-0.4891* (0.2576)	-0.4555* (0.2503)	-0.4348* (0.2503)
Stock market	-0.0483 (0.2183)	-0.1069 (0.2174)	-0.0748 (0.2251)	0.0339 (0.1923)	0.0087 (0.1885)	-0.0144 (0.1903)	-0.1444 (0.1945)	-0.1584 (0.1933)	-0.2004 (0.1935)	-0.0403 (0.2079)	-0.0685 (0.2004)	-0.0913 (0.2068)
Rule of law	0.4041*** (0.1509)	0.4266*** (0.1563)	0.3848** (0.1522)									
Renegotiation index				-2.1910*** (0.6315)	-2.2762*** (0.6158)	-2.0772*** (0.6394)						
Priority							0.2380*** (0.0859)	0.2351*** (0.0866)	0.2316*** (0.0822)			
Recovery										1.0990*** (0.2595)	1.1132*** (0.2659)	1.0892*** (0.2484)

(continued on next page)

Table 6 (continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Loan & Syndicate & Rating	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Legal origin	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loans	4843	4843	4843	3972	3972	3972	3972	3972	3972	3972	3972	3972
Chi2	1509.41	1533.76	1449.51	1820.83	1958.88	1747.31	1485.22	1670.98	1407.71	1579.98	1699.18	1455.82
Log.L.	-16,081.14	-16,245.77	-15,955.03	-12,495.71	-12,625.44	-12,359.10	-12,653.62	-12,787.50	-12,511.81	-12,523.15	-12,662.62	-12,372.15
PseudoR2	0.34	0.33	0.34	0.37	0.36	0.37	0.36	0.35	0.37	0.36	0.36	0.37
<i>Amendments</i>												
Betweenness	4.5650*** (1.5688)			5.6351*** (1.5988)			5.9390*** (1.5869)			5.9594*** (1.6042)		
Closeness		3.7932 (2.7691)			6.4948** (2.7267)			7.4184*** (2.6789)			7.0546** (2.7486)	
Degree			4.4516*** (1.4448)			5.2834*** (1.3598)			5.5534*** (1.3492)			5.5595*** (1.3725)
GDP growth	4.3022 (5.4497)	4.5744 (5.4907)	5.5212 (5.7168)	12.6327** (5.6450)	13.7267** (5.6168)	13.2117** (5.6986)	8.5000* (5.0108)	9.4410* (5.0276)	10.1284** (5.0876)	5.1634 (5.2834)	5.9907 (5.2797)	6.0733 (5.4134)
Private credit	-0.3926 (0.2773)	-0.4068 (0.2759)	-0.3618 (0.2810)	0.0527 (0.3491)	0.0178 (0.3473)	0.1089 (0.3518)	-0.0403 (0.3186)	-0.0899 (0.3262)	0.0407 (0.3260)	-0.5722* (0.3147)	-0.6133* (0.3184)	-0.4818 (0.3165)
Stock market	-0.1488 (0.2792)	-0.1731 (0.2818)	-0.1978 (0.2918)	-0.0098 (0.2329)	-0.0212 (0.2342)	-0.0874 (0.2341)	-0.1821 (0.2264)	-0.1961 (0.2317)	-0.2710 (0.2318)	-0.0521 (0.2361)	-0.0698 (0.2371)	-0.1312 (0.2378)
Rule of law	0.5096*** (0.1511)	0.5260*** (0.1544)	0.4803*** (0.1497)									
Renegotiation index				-2.2607*** (0.7321)	-2.3691*** (0.7346)	-2.1115*** (0.7429)						
Priority							0.2264** (0.1130)	0.2274** (0.1126)	0.2217** (0.1109)			
Recovery										1.6461*** (0.3842)	1.6177*** (0.3982)	1.5860*** (0.3776)
Loan & Syndicate & Rating	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Legal origin	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loans	4843	4843	4843	3972	3972	3972	3972	3972	3972	3972	3972	3972
Chi2	694.44	696.32	713.76	615.00	633.25	628.80	570.06	582.37	584.37	568.08	582.58	588.68
Log.L.	-13,871.64	-13,939.85	-13,852.02	-11,064.90	-11,125.93	-11,047.95	-11,118.22	-11,181.34	-11,098.28	-11,042.70	-11,110.55	-11,024.60
PseudoR2	0.18	0.18	0.18	0.19	0.19	0.20	0.19	0.19	0.19	0.20	0.19	0.20

This table presents estimated coefficients and standard errors, clustered at the loan facility level (in parentheses), from logit, ordered logit, and poisson regressions respectively. Renegotiation = 1 if a loan is renegotiated (0 otherwise); Rounds = 0 (no renegotiation) to 12 renegotiation rounds; Amendments = 0 (no renegotiation) to 6 amended loan terms. Betweenness, Closeness, Degree are lender's network-centrality measures and our main explanatory variables. All variables are described in the appendix. Loan and Syndicate variables and borrower Rating included but not shown. All regressions include control variables for main loan currencies (USD and EUR), loan type (term), loan purposes (acquisition, general corporate, LBO, debt refinancing). *, **, and *** indicate a statistically significant coefficient at the 10%, 5%, and 1% confidence level.

Table 7
Regression results – general robustness checks.

Panel A									
	Renegotiation			Rounds			Amendments		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<i>Centrality measured in networks based on contractual maturities</i>									
Betweenness	2.5405*			1.6730***			2.2703		
	(1.5055)			(0.6261)			(1.4898)		
Closeness		2.7370			1.4873*			2.5252	
		(2.3373)			(0.8810)			(2.3807)	
Degree			1.5064**			1.3396***			1.3426*
			(0.5954)			(0.3863)			(0.6884)
<i>Excluding amendments to definition</i>									
Betweenness	4.0541***			3.8050***			5.1471***		
	(1.2207)			(0.8827)			(1.4954)		
Closeness		4.0182*			2.1192*			4.0794*	
		(2.2139)			(1.1180)			(2.2544)	
Degree			2.9556***			3.4629***			3.0673***
			(0.8959)			(0.7721)			(1.0901)
<i>Including early renegotiation dummy</i>									
Betweenness				2.9226***			3.7619**		
				(0.6938)			(1.5218)		
Closeness					2.5585***			4.2624**	
					(0.7428)			(2.1712)	
Degree						2.6561***			2.5056**
						(0.5959)			(1.1573)
Early renegotiation				1.4414***	1.4672***	1.4381***	3.9610***	3.9929***	3.9744***
				(0.0939)	(0.0961)	(0.0939)	(0.1570)	(0.1564)	(0.1565)
<i>Unique renegotiation</i>									
Betweenness	3.0692**						3.1361**		
	(1.2339)						(1.2809)		
Closeness		3.0240						3.6579*	
		(1.9648)						(1.8914)	
Degree			1.9674**						2.0296**
			(0.7935)						(0.8087)
<i>Unique loan</i>									
Betweenness	2.7345			2.9826**			3.3494		
	(1.9215)			(1.4414)			(2.0483)		
Closeness		5.4009			8.5555***			7.9124*	
		(3.5386)			(2.7746)			(4.0572)	
Degree			2.4730**			2.8370***			2.8428**
			(1.1797)			(0.9970)			(1.2278)
<i>First loan</i>									
Betweenness	3.5770***			2.9221***			3.7033**		
	(1.3531)			(0.8614)			(1.8757)		
Closeness		6.6811**			5.5732***			4.4040	
		(3.0630)			(1.9177)			(4.4816)	
Degree			2.5929**			2.9588***			2.1299
			(1.0341)			(0.7663)			(1.5767)
<i>Small loan</i>									
Betweenness	4.2851**			3.7392***			4.6834**		
	(1.7155)			(1.3068)			(2.0699)		
Closeness		7.6951***			3.6680			8.5164***	
		(2.7102)			(2.2937)			(3.0393)	
Degree			1.7864*			1.9809**			1.7952*
			(1.0219)			(0.8714)			(1.0379)
<i>Short maturity</i>									
Betweenness	6.2218***			6.8728***			7.5220***		
	(1.4035)			(0.9232)			(1.5707)		
Closeness		11.0423***			6.3490***			9.9574***	
		(2.4331)			(0.7769)			(2.0405)	
Degree			3.3709***			3.9740***			3.8264***
			(0.9228)			(0.6275)			(1.0075)
<i>Not secured</i>									

(continued on next page)

Table 7 (continued)

Panel A									
	Renegotiation			Rounds			Amendments		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<i>Betweenness</i>	5.3513*** (1.2605)			5.1577*** (1.0555)			6.2128*** (1.4995)		
<i>Closeness</i>		7.8971*** (2.6681)			5.6879*** (1.2848)			9.7034*** (2.8262)	
<i>Degree</i>			3.3280*** (0.9792)			4.0860*** (0.8645)			3.2417*** (1.0571)
<i>No covenants</i>									
<i>Betweenness</i>	5.3473*** (1.2682)			4.4379*** (1.0112)			5.2376*** (1.6332)		
<i>Closeness</i>		6.4961*** (2.0933)			3.0356*** (1.1279)			4.7035* (2.4964)	
<i>Degree</i>			3.6764*** (0.8965)			3.6714*** (0.7730)			3.0900*** (1.1552)
<i>Many tranches</i>									
<i>Betweenness</i>	-0.1381 (3.0313)			1.7072 (1.0972)			1.8430 (2.9258)		
<i>Closeness</i>		8.7428** (3.6305)			1.1967 (1.0698)			4.9794 (3.4291)	
<i>Degree</i>			0.6559 (2.2987)			1.3853 (1.0481)			1.0507 (2.3366)
<i>Few issues</i>									
<i>Betweenness</i>	2.9122** (1.2339)			3.2182*** (0.9231)			3.0700** (1.4169)		
<i>Closeness</i>		7.0940*** (2.2626)			4.1035*** (1.0365)			6.4034*** (2.1255)	
<i>Degree</i>			1.9236** (0.9232)			3.2473*** (0.7178)			2.0755* (1.1289)
<i>Small syndicate</i>									
<i>Betweenness</i>	3.4632* (1.9725)			3.1959** (1.5217)			3.8812* (2.2357)		
<i>Closeness</i>		4.2043 (2.8141)			2.9503** (1.3399)			5.0093* (2.8585)	
<i>Degree</i>			2.2963* (1.2340)			2.4348** (1.1059)			2.4586* (1.4244)
<i>No league</i>									
<i>Betweenness</i>	6.1858*** (1.3121)			4.2771*** (0.9194)			6.7266*** (1.6673)		
<i>Closeness</i>		5.8355*** (2.1866)			2.2129** (1.0084)			5.0573** (2.4563)	
<i>Degree</i>			4.5376*** (0.9522)			4.1132*** (0.8080)			4.3687*** (1.2730)
<i>No relationship</i>									
<i>Betweenness</i>	5.1952*** (1.3914)			4.2786*** (0.9064)			6.4280*** (1.8934)		
<i>Closeness</i>		6.4779** (2.9742)			4.3688** (1.7915)			6.8124* (3.7779)	
<i>Degree</i>			3.5657*** (1.0222)			4.1327*** (0.8084)			3.7945*** (1.4412)
<i>No rating</i>									
<i>Betweenness</i>	4.8823*** (1.3083)			3.5378*** (0.9165)			5.2391*** (1.6452)		
<i>Closeness</i>		6.7776*** (2.0111)			3.9823*** (0.9712)			5.3663** (2.1787)	
<i>Degree</i>			3.4861*** (0.9522)			3.2697*** (0.8205)			3.0037** (1.2104)
<i>Bank fixed effect</i>									
<i>Betweenness</i>	5.0331*** (1.2266)			4.1154*** (0.8216)					
<i>Closeness</i>		4.6553** (2.2284)			2.5102*** (0.7121)				

(continued on next page)

Table 7 (continued)

Panel A									
	Renegotiation			Rounds			Amendments		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Degree			4.3995*** (0.9516)			4.2872*** (0.6466)			4.3451*** (1.0790)
<i>no BNP</i>									
Betweenness	5.6735*** (1.2603)			4.1711*** (0.8868)			6.4384*** (1.5751)		
Closeness		5.7104*** (2.1372)			2.3367** (0.9582)			5.0818** (2.2492)	
Degree			4.1780*** (0.9259)			3.9144*** (0.7885)			4.1465*** (1.1899)
<i>no BNP RBS UCG</i>									
Betweenness	6.3359*** (1.4603)			5.0404*** (1.0253)			6.6596*** (1.8320)		
Closeness		7.2246*** (2.2484)			3.6984*** (1.0939)			5.6410** (2.6257)	
Degree			4.3015*** (1.0277)			4.0942*** (0.7775)			4.0754*** (1.3572)
Panel B									
	Renegotiation			Rounds			Amendments		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<i>Low rule of law</i>									
Betweenness	3.7858** (1.5283)			3.5831*** (0.9926)			4.5632*** (1.7569)		
Closeness		2.4858 (2.7328)						4.3293 (2.8498)	
Degree			3.1321** (1.4578)			4.5416*** (1.1144)			3.6895** (1.6045)
<i>Low renegotiation index</i>									
Betweenness	5.3628*** (1.9000)						6.8895*** (2.0911)		
Closeness		0.1867 (3.6352)						4.2751 (3.1623)	
Degree			5.5399*** (1.8591)						6.7566*** (2.1876)
<i>Low recovery</i>									
Betweenness	2.9935 (2.2810)			2.4432* (1.3328)			2.5948 (2.5063)		
Closeness		1.8723 (3.5455)						1.5520 (3.2658)	
Degree			1.5176 (2.3026)						1.2714 (2.5700)
<i>No UK</i>									
Betweenness	5.4461*** (1.3532)			4.4323*** (0.8730)			6.7649*** (1.6096)		
Closeness		6.4656*** (2.2864)			2.5371** (1.0333)			5.7237*** (2.1880)	
Degree			3.8591*** (0.9547)			4.2899*** (0.6742)			4.2082*** (1.1160)
<i>Core EZ</i>									
Betweenness	5.9179*** (1.3947)			3.9685*** (0.8717)			7.5212*** (1.7192)		
Closeness		6.7587** (2.8118)			2.0246** (0.9630)			5.6143** (2.5291)	
Degree			4.3023*** (1.1185)			3.8351*** (0.8362)			4.8068*** (1.3141)
<i>GIIPS</i>									
Betweenness	4.4338* (2.4022)						7.5928** (3.2527)		

(continued on next page)

Table 7 (continued)

Panel B									
	Renegotiation			Rounds			Amendments		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Closeness		2.8705 (5.1959)						5.6523 (5.3676)	
Degree			3.3115** (1.6243)						3.1417* (1.7059)
<i>Post US Crisis</i>									
Betweenness	6.9396*** (1.5152)			4.6455*** (1.0000)			6.4271*** (1.5121)		
Closeness		12.2316*** (2.3529)			3.4564*** (0.6121)			8.6225*** (1.8625)	
Degree			3.1949*** (0.8323)			2.9240*** (0.5794)			2.9458*** (0.8589)
<i>Post EZ Crisis</i>									
Betweenness	7.1373*** (1.4833)			4.9962*** (0.9150)			6.5532*** (1.4472)		
Closeness		12.7509*** (2.5337)			3.6675*** (0.6673)			9.7353*** (1.9759)	
Degree			3.3727*** (0.8015)			3.3736*** (0.5028)			3.0805*** (0.8117)

This table presents estimated coefficients and standard errors, clustered at the loan facility level (in parentheses), from logit, ordered logit, and poisson regressions respectively. Renegotiation = 1 if a loan is renegotiated (0 otherwise); Rounds = 0 (no renegotiation) to 12 renegotiation rounds; Amendments = 0 (no renegotiation) to 6 amended loan terms. Betweenness, Closeness, Degree are lender's network-centrality measures and our main explanatory variables. All variables are described in the appendix.

Panel A shows robustness checks for micro-level variables. Centrality measured in networks based on contractual maturities = centrality measures computed on networks constructed employing the information on the contractual loan maturities. Excluding amendments to definition = amendments to "Definition" excluded from the sample. Including early renegotiation dummy = Early renegotiation equals to 1 if the time from loan origination to renegotiation is lower than lower than half of the contractual maturity at origination. Unique renegotiation = loans renegotiated only once in the sample. Unique loan = borrowers with only one loan issue in the sample. First loan = only first loan issues according to the sample. Small loan = loan amount lower than 419 (sample median). Short maturity = loan maturity lower than 6.00. Not secured = loans without collateral. No covenants = loans without covenants attached. Small outstanding = loans with amount outstanding lower than 0.44 (sample median). Few issues = borrower with less than 3 previous loan issues (sample median). Small syndicate = syndicates with less than 7 members (sample median). No league = syndicates without league table lenders. No relationship = syndicates without previous borrower-lender relationship. No rating = borrower without any rating. Many tranches = loans with more than 3 tranches (sample median). Bank fixed effect = regressions including lender fixed effects. No NBP = loans involving BNP Paribas excluded. No BNP RBS UCG = loans involving BNP Paribas or Royal Bank of Scotland or UniCredit excluded. All regressions include loan and syndicate variables, borrower rating and dummy variables for loan year, borrower industry, borrower country, loan currency, loan type and loan purpose.

Panel B shows robustness checks for country-level variables and for country or time dimensions. Low rule of law = Rule of law below 1.65 (sample median). Low renegotiation index = Renegotiation index below 0.45 (sample median). Low recovery = Recovery below 0.56 (sample median). All regressions include loan and syndicate variables, borrower rating and dummy variables for loan year, borrower industry, loan currency, loan type, loan purpose and borrower country legal origin. No UK = loans to UK borrowers excluded. Core EZ = Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Spain, Portugal only. GIIPS = Greece, Ireland, Italy, Spain, Portugal only. Post US Crisis = loans originated after September 15th 2008. Post EZ Crisis = loans originated after December 1st 2009. All regressions include loan and syndicate variables, borrower rating and dummy variables for loan year, borrower industry, loan currency, loan type, loan purpose and borrower country.

*, **, and *** indicate a statistically significant coefficient at the 10%, 5%, and 1% confidence level.

straightforward in the case of lower creditors recovery – all centrality measures become insignificant. Lender's superior ability to collect information does not matter for the renegotiation process when creditors recovery is lower. These results point to the importance of the legal and institutional environment for financial contracting and to the imperfect substitute of private arrangements, such as individual informational network building, to compensate for weaker legal protection of creditors.³²

³² We conduct further robustness checks for country-level legal variables, as presented in Table A2. In addition to the sub-sample regression results shown in Table 7, Panel B, we extend our analysis to the full sample by introducing interaction variables between each centrality measure and dummy variables equal to 1 when the *Rule of law*, *Renegotiation index*, *Recovery*, and *Priority* variables are below their respective sample medians. Our main findings regarding the centrality variables remain unchanged, while the interaction variables are largely non-significant. However, we observe significant results for the interaction of *Rule of law* with *Closeness* and *Degree*, respectively. The negative coefficients indicate that in weaker legal environments, the impact of centrality on renegotiation is diminished.

The geographic composition of the borrower countries does not seem to affect our main results, as most of the coefficients of centrality measures remain significant and positive when excluding the UK or focusing on core Eurozone members. However, *Closeness* becomes insignificant when considering GIIPS area, meaning that the specificities of these countries reduce the effect of network depth and proximity on the renegotiation process. Considering post crisis periods lead to similar results as well, meaning that lender centrality remains important for renegotiation even in periods of greater uncertainty, informational frictions, and disruptions on the credit market network.

Table 8 presents the results using alternative measures of relationship intensity/strength based on loan amount and loan numbers. Indeed, the dummy variable for prior relationships between the lender and the borrower which we use in the main specification of the model may not capture the whole extent of the effect of pre-existing lending relationships on renegotiation process. To address this concern, we compute additional alternative relationship measures following the approaches of

Table 8
Regression results – robustness checks for alternative relationship strength measures.

	Renegotiation			Rounds			Amendments		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Betweenness	4.2460*** (1.1420)			3.7763*** (0.9355)			4.6152*** (1.2911)		
Closeness		1.5045 (2.3571)			1.2105 (1.3669)			1.4466 (2.5681)	
Degree			2.8500*** (0.8801)			3.3813*** (0.7877)			2.8457*** (0.9656)
mean Relationship (amount)	0.0123 (0.0469)	0.0175 (0.0488)	0.0142 (0.0471)	-0.0222 (0.0437)	-0.0157 (0.0351)	-0.0218 (0.0413)	0.0084 (0.0418)	0.0142 (0.0420)	0.0105 (0.0412)
Betweenness	4.2255*** (1.1433)			3.7522*** (0.9352)			4.5909*** (1.2913)		
Closeness		1.4773 (2.3571)			1.2120 (1.3678)			1.4262 (2.5677)	
Degree			2.8311*** (0.8809)			3.3572*** (0.7870)			2.8222*** (0.9652)
mean Relationship (#loans)	0.1164** (0.0479)	0.1209** (0.0509)	0.1172** (0.0478)	0.0396 (0.0272)	0.0444* (0.0238)	0.0379 (0.0273)	0.0876*** (0.0239)	0.0911*** (0.0237)	0.0881*** (0.0235)
Betweenness	4.2439*** (1.1445)			3.7770*** (0.9370)			4.6126*** (1.2945)		
Closeness		1.4974 (2.3580)			1.2110 (1.3677)			1.4405 (2.5684)	
Degree			2.8473*** (0.8800)			3.3820*** (0.7886)			2.8423*** (0.9669)
max. Relationship (amount)	0.0075 (0.0362)	0.0131 (0.0367)	0.0096 (0.0357)	-0.0132 (0.0293)	-0.0083 (0.0246)	-0.0131 (0.0277)	0.0057 (0.0339)	0.0120 (0.0330)	0.0080 (0.0327)
Betweenness	4.2258*** (1.1436)			3.7523*** (0.9351)			4.5939*** (1.2914)		
Closeness		1.4892 (2.3549)			1.2174 (1.3672)			1.4423 (2.5661)	
Degree			2.8308*** (0.8808)			3.3570*** (0.7869)			2.8240*** (0.9651)
max. Relationship (#loans)	0.0936** (0.0390)	0.0979** (0.0425)	0.0945** (0.0391)	0.0328* (0.0176)	0.0360** (0.0153)	0.0315* (0.0175)	0.0671*** (0.0164)	0.0696*** (0.0164)	0.0674*** (0.0161)

This table presents estimated coefficients and standard errors, clustered at the loan facility level (in parentheses), from logit, ordered logit, and poisson regressions respectively. Renegotiation = 1 if a loan is renegotiated (0 otherwise); Rounds = 0 (no renegotiation) to 12 renegotiation rounds; Amendments = 0 (no renegotiation) to 6 amended loan terms. Betweenness, Closeness, Degree are lender's network-centrality measures and our main explanatory variables. All variables are described in the appendix. All regressions include loan and syndicate variables, borrower rating and dummy variables for loan year, borrower industry, loan currency, loan type, loan purpose and borrower country. *, **, and *** indicate a statistically significant coefficient at the 10%, 5%, and 1% confidence level.

Bharath et al. (2011), Prilmeier (2017), and Schenone (2010). We consider two measures of relationship intensity/strength³³: *Relationship (amount)*, equal to the amount of loans by lender *l* to borrower *b* in the last 3 years / Total amount of loans received by borrower *b* in the last 3 years, and *Relationship (#loans)*, equal to the number of loans by lender *l* to borrower *b* in the last 3 years / Total number of loans received by borrower *b* in the last 3 years. In the regressions, we use the mean and maximum variants of these measures at the loan facility level.³⁴ The results indicate that all centrality measures remain significantly positive, except for *Closeness*, which coefficient becomes non-significant but remains positive. Therefore, our main findings remain robust when considering alternative relationship intensity/strength measures. The variables based on *Relationship (amount)* are non-significant in all regressions, while *Relationship (#loans)* is overall significant and positive, suggesting that the accumulation of relationship loans facilitates the renegotiation process.

Another potential issue is endogenous matching between borrowers and lenders.³⁵ For example, more central lenders may selectively choose

certain borrowers, or borrowers more prone to renegotiation may select specific lenders. To address this concern, we opt for a matching analysis using nearest neighbor matching (NNM) method.³⁶ In our case, we model the treatment, lender centrality, using dummy variables indicating whether the centrality measure is greater than or equal to its sample median (see Table 2). We perform one-to-one matching per observation using the Mahalanobis distance measure, focusing on loan variables that yield the smallest standardized differences in the matched sample.³⁷

Table 9 presents the results of our analysis. In Panel A we replicate the regressions from Table 4 but using dummies for centrality measures (Benchmark) and the ATET (average treatment effect on the treated) derived from the NNM procedure. The ATET quantifies the average impact of higher centrality on those who received it, while excluding the effects on the untreated group. It measures the difference in the outcome variables (renegotiation process) between the treated and the untreated groups, assuming that the untreated group would have the same outcome if they had received the treatment. Importantly, all ATET coefficients are significantly positive, consistent with the findings from the Benchmark regressions. In Panel B, we assess the quality of the matching by comparing summary statistics for matched and unmatched samples.

³⁶ This method involves matching treated individuals with control individuals based on matching covariates. The approach aims to identify the most similar control individuals for each treated individual, thereby creating comparable groups.

³⁷ We use Abadie and Imbens (2006, 2011) procedure to adjust for bias from matching on more than one continuous covariate.

³³ These measures are computed for each lender in a syndicate.

³⁴ The sample averages of these variables are as follows: *mean Relationship (amount)*: 0.13, *mean Relationship (#loans)*: 0.13, *max. Relationship (amount)*: 0.18, *max. Relationship (#loans)*: 0.14.

³⁵ Endogenous matching refers to a situation where the selection of treated individuals (in this case, more network central lenders) and untreated individuals (in this case, less network central lenders) is based on unobserved characteristics that are correlated with both the assignment of treatment and the outcome of interest (in this case, the renegotiation process).

Table 9
Regression results – robustness checks for borrower-lender endogenous matching.

Panel A									
	Renegotiation			Rounds			Amendments		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
<i>Benchmark</i>									
D.Betweenness	0.4972*** (0.1178)			0.4613*** (0.0954)			0.4674*** (0.1217)		
D.Closeness		0.8386*** (0.2172)			0.6781*** (0.0996)			0.7616*** (0.2316)	
D.Degree			0.2273* (0.1302)			0.2808** (0.1162)			0.1512 (0.1809)
<i>NNM</i>									
D.Betweenness	0.1437*** (0.0078)			0.8066*** (0.0273)			0.5477*** (0.0202)		
D.Closeness		0.0226*** (0.0084)			0.3756*** (0.0280)			0.2347*** (0.0202)	
D.Degree			0.1695*** (0.0093)			0.7208*** (0.0426)			0.4748*** (0.0187)
Panel B									
Loan variables	D.Betweenness		D.Closeness		D.Degree				
	Standardized differences		Standardized differences		Standardized differences				
	Raw	Matched	Raw	Matched	Raw	Matched			
Facility (log)	0.7602	0.0964	0.3737	0.0273	0.5884	0.0718			
Maturity	-0.1378	0.0235	0.1428	0.0712	-0.1119	-0.0087			
Secured	-0.0544	-0.0012	-0.0857	-0.0009	0.1204	0.0007			
Covenants	0.2746	0.0003	0.1836	0.0014	0.2410	0.0000			
Outstanding (log)	0.5508	0.0576	0.2822	0.0082	0.4241	0.0496			
Previous issues	0.2781	0.0296	0.3320	0.0585	0.1661	0.0326			

Panel A presents the estimated coefficients for the base regressions (as in Table 4) but using dummy variables (D.) equal to 1 if Betweenness, Closeness, and Degree are greater or equal to their respective sample medians (Benchmark) and the estimated average treatment effect on the treated (ATET) (with standard errors clustered at the loan facility level in parentheses) following nearest neighbor matching (NNM) method. The matching is performed on loan variables. Renegotiation = 1 if a loan is renegotiated (0 otherwise); Rounds = 0 (no renegotiation) to 12 renegotiation rounds; Amendments = 0 (no renegotiation) to 6 amended loan terms. All variables are described in the appendix. *, **, and *** indicate a statistically significant coefficient at the 10%, 5%, and 1% confidence level.

Panel B displays the standardized differences for matching variables between treated and untreated (raw) and between treated and weighted untreated (weighted) following the nearest neighbor matching (NNM) method.

We evaluate comparability using standardized differences. The summary statistics appear to indicate a good balance as matching has significantly diminished systematic differences in means. Thus, our main findings remain robust to endogenous matching issues.

Thus, our main results survive numerous robustness checks with respect to specific conditions related to renegotiation, loan, syndicate, country, and time characteristics. Network-central lenders have a positive influence on the entire renegotiation. Furthermore, we notice some additional interesting results. Centrality becomes non-significant for renegotiation of complex deals with multiple tranches. Legal and institutional environments with weaker protection of creditors make the value of informedness less relevant for renegotiation. Finally, our main results are robust to alternative measures of borrower-lender relationship intensity based on loans' amount and number and to potential borrower-lender endogenous matching issues.

4. Conclusion

We provide an empirical link between the social network analysis of credit markets and the design of loan contracts by showing that the influence of lenders' financial network at loan origination is crucial for private debt renegotiation. Using a large sample of more than 6000 loans issued in 25 European countries we find that lender's network-centrality, measured by common social network metrics has a significant and positive influence on the loan renegotiation process: the likelihood of renegotiation, the number of renegotiation rounds, and the number of amendments to the initial loan. Our findings confirm that

lender's capacity to access valuable private information encourages renegotiation. These results survive multiple robustness checks with respect to specific renegotiation, loan, syndicate, country, and time characteristics. The findings are also robust to alternative measures of borrower-lender relationship intensity and to potential endogenous matching issues.

By confirming that better informed network-central lenders have a positive influence on the entire renegotiation process, we provide empirical support for the incomplete contracts' perspective. Better-informed lenders, who are more likely to timely receive better information from diverse sources tend to renegotiate loans more frequently than their less informed peers.

As have been noticed in Section 2, we have assumed, but did not test, the relationship between lenders' network position and their ability to gather relevant information distributed over the network. Although this assumption is well rooted in the theory of social network (e.g. Freeman, 1979; Granovetter, 1973) and finds support in recent studies on financial networks (e.g. Hochberg et al., 2007; Horton et al., 2012; Larcker et al., 2013), it does not necessarily mean that the central lenders always use the associated advantage to monitor their loans. One may envisage a more vigorous empirical design that test such an assumption in the first place. The theory of incomplete financial contracts suggests that the starting point of renegotiations of a loan is accrual of information by lenders (e.g. Garleanu & Zwiebel, 2009). Controlling for evolution of the state of a borrower between the time of origination of the contract and time of renegotiation, as well as incorporating the detailed information on the amendments to the original contract, may help to verify if the

central lenders are, in fact, being better informed. A research along this line, while being a promising direction for future investigation, requires higher quality and more complete information than the information from the data sources employed in this study.

We also show that lender's informedness is less relevant for the renegotiation of complex deals, while the benefits of network-centrality are not concentrated with the major financial institutions on the credit market. Finally, we find that legal and institutional environments that are less protective of the creditors render the value of financial networks insignificant for private debt renegotiation. This last result point to the crucial important of efficient legal protection of investors for better design of financial contracts.

Appendix A. Appendix

A.1. Centrality measures

A.1.1. Betweenness centrality

The betweenness centrality of lender i is defined as the number of the shortest paths between all pairs of lenders in a network, which pass through the lender i , deflated by the number of alternative shortest paths (normalized by the number of all pairs of lenders):

$$B = \frac{2}{(n-1)(n-2)} \sum_{j < k} \frac{g_i(j, k)}{g(j, k)}$$

where $g_i(j, k)$ is the total number of the shortest paths between lenders j and k , and $g(j, k)$ is the total number of the shortest paths between lenders j and k . The betweenness centrality score of a vertex is a measure of how well the vertex is positioned on the shortest paths connecting other vertices or, in other words, "in between" how many vertices is our vertex sitting and how unique is the position of the vertex with respect to those paths.

A.1.2. Closeness centrality

Closeness centrality is the inverse to the sum of the distances to all other vertices:

$$C = \frac{1}{\sum_j d(i, j)}$$

The closer is the vertex to all other vertices in the network, the higher is its closeness centrality.

A.1.3. Degree centrality

The degree centrality of a vertex is equal to the number of connections the vertex breeds. The more connections a lender has, the greater is its degree centrality.

A.2. Definitions of variables

A.2.1. Dependent variables

Renegotiation = 1 if a loan is renegotiated (0 otherwise).

Rounds = number of renegotiation rounds (0: no renegotiation – 12 renegotiation rounds).

Amendments = number of renegotiation amendments (0: no renegotiation – 6 amendments, i.e. all contract terms were amended).

A.2.2. Main explanatory variables

Betweenness = lenders' betweenness centrality measure (syndicate maximum).

Closeness = lenders' closeness centrality measure (syndicate maximum).

Degree = lenders' degree centrality measure (syndicate maximum).

A.2.3. Control variables

Loan variables (source: Bloomberg).

Amount = Loan facility amount at origination (in MLN USD).

Maturity = Loan maturity at origination (in years).

Covenants = 1, if loan has covenants.

Secured = 1, if loan is secured.

Outstanding amount = amount outstanding on all loans.

Previous issues = Number of loans previously issued by a firm.

Lender variables (source: Bloomberg).

lenders = Number of lenders in the syndicate.

Data availability

The authors do not have permission to share data.

Acknowledgements

This work has benefited from support by the initiative of excellence IDEX-Unistra (ANR-10-IDEX-0002-02) from the French national program "Investments for the future". We are grateful to the anonymous referees for the insightful suggestions which helped to improve the manuscript.

League = 1, if the loan agent was listed among the top 3 of the Bloomberg European league table.

Relationship = 1, if a lender syndicated a loan for the same borrower during the last 3 years before the origination year.

Relationship (amount) = Amount of loans by lender l to borrower b in the last 3 years / Total amount of loans received by borrower b in the last 3 years.

Relationship (#loans) = Number of loans by lender l to borrower b in the last 3 years / Total number of loans received by borrower b in the last 3 years.

% same country = Percentage of lenders in the pool which are from the same country as the borrower.

A.2.4. Firm variables (source: Bloomberg)

Rating = 1, if a firm has a rating (Moody's or S&P, Senior Unsecured Debt or LT Issuer Credit).

Sales = Net sales or revenue of the firm (in MLN USD).

Debt / Equity = Total debt to equity.

Current ratio = Current assets to current liabilities.

Operating margin = Operating income to net sales.

Country variables (sources: World Bank, Demirgüç-Kunt et al. (2012), Djankov et al. (2007), and Favara et al. (2012)).

GDP growth = GDP growth (% annual).

Private credit = Financial resources provided to the private sector by domestic money banks as a share of GDP.

Stock market = Total value of all listed shares in a stock market as a percentage of GDP.

Rule of law = Perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.

Renegotiation index = Measures the probability that shareholders fail to force a renegotiation of debt with creditors.

The index is the average of the following binary (0 if no, 1 if yes) indicators: 1) secured creditors may seize and sell their collateral without court approval, 2) secured creditors may enforce their security either in or out of court, 3) the entire firm's assets can be pledged as collateral, 4) an insolvency or liquidation order cannot be appealed at all, 5) an insolvency case is suspended until the resolution of the appeal, 6) the firm may enter liquidation without attempting reorganization, 7) secured creditors may enforce their security upon commencement of the insolvency proceedings, 8) a defaulting firm must cease operations upon commencement of insolvency proceedings, 9) management does not remain in control of decisions during insolvency proceedings, 10) secured creditors have the right to approve the appointment of the insolvency administrator, 11) secured creditors may dismiss the insolvency administrator, 12) secured creditors vote directly on the reorganization plan.

Priority = Equals 0, 1, 2, 3, or 4 to reflect the order in which creditors' claims are served. A value of 4 indicates that creditors' claims are always served first.

Creditors' recovery = Recovery rate for secured creditors, conditional on default.

Table A2 Regression results – country variables interactions included

	Renegotiation			Rounds			Amendments		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Betweenness	10.2457*** (1.3985)	9.1069*** (1.2091)	11.8565*** (1.8713)						
Closeness				15.2276*** (2.6306)	8.9510*** (1.4979)	15.9520*** (2.9627)			
Degree							8.9640*** (1.1885)	9.4252*** (1.4428)	9.8075*** (1.4617)
Betweenness x D.Rule of law	-1.6457 (1.4249)	-1.5512 (0.9584)	-2.6203 (1.7344)						
Closeness x D.Rule of law				-0.7611 (0.4847)	-0.9515** (0.4221)	-0.9293* (0.5402)			
Degree x D.Rule of law							-1.4208* (0.7955)	-1.4532** (0.7037)	-1.7424** (0.8877)
Rule of law	0.4558*** (0.1560)	0.5366** (0.2108)	0.4562*** (0.1530)	0.4009** (0.1796)	0.4387* (0.2425)	0.3923** (0.1782)	0.3277** (0.1671)	0.4287** (0.2174)	0.3486** (0.1613)
Betweenness	9.6166*** (1.4810)	8.1477*** (1.4613)	10.9276*** (1.9081)						
Closeness				18.1202*** (2.9614)	9.9041*** (2.0644)	18.8429*** (3.4194)			
Degree							8.7602*** (1.1835)	8.5486*** (1.2555)	9.4801*** (1.3567)
Betweenness x D.Reneg. index	1.7683 (2.1748)	2.3923* (1.3829)	1.8925 (3.0478)						
Closeness x D.Reneg. index				0.0835 (0.8274)	-0.0753 (0.8038)	-0.0275 (1.0660)			
Degree x D.Reneg. index							0.9920 (1.3544)	2.6850** (1.0593)	1.3037 (1.5440)
Renegotiation index	-1.3001 (0.9338)	-1.8496 (1.1629)	-1.4016 (1.1680)	-1.7683 (1.1731)	-3.0026** (1.2889)	-2.0574 (1.3364)	-1.0528 (1.0958)	-0.7529 (1.2542)	-1.0140 (1.2165)
Betweenness	9.9853*** (1.3903)	8.8698*** (1.3815)	11.1115*** (1.6060)						
Closeness				18.1483*** (2.8804)	9.4838*** (2.0739)	19.1527*** (3.4039)			
Degree							8.9734*** (1.2685)	9.6193*** (1.4040)	9.8208*** (1.4558)
Betweenness x D.Priority	2.0540	2.5619	4.5464						

(continued on next page)

(continued)

	Renegotiation			Rounds			Amendments		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Closeness x D.Priority	(2.1848)	(1.8656)	(2.7728)	0.6710 (0.8530)	0.6530 (1.1383)	1.2989 (1.0939)			
Degree x D.Priority							1.2346 (1.3848)	1.5141 (1.6357)	1.8705 (1.5253)
Priority	0.4249*** (0.1520)	0.6045*** (0.1772)	0.6235*** (0.1702)	0.4744** (0.1959)	0.5669** (0.2495)	0.6460*** (0.2292)	0.4298** (0.1775)	0.6065*** (0.2235)	0.5790*** (0.1954)
Betweenness	10.0927*** (1.4098)	8.7805*** (1.3486)	12.1959*** (1.8716)						
Closeness				18.0434*** (3.0016)	9.3479*** (2.0919)	19.2910*** (3.6353)			
Degree							9.2291*** (1.2418)	9.4753*** (1.3536)	10.4325*** (1.5136)
Betweenness x D.Recovery	1.0127 (2.0356)	2.0923 (1.7500)	-0.7620 (2.4674)						
Closeness x D.Recovery				0.7602 (0.6541)	0.7145 (0.7078)	0.3557 (0.7958)			
Degree x D.Recovery							0.0210 (1.1720)	1.5579 (1.4484)	-0.4486 (1.3200)
Recovery	2.0867*** (0.5243)	2.3165*** (0.4920)	2.0761*** (0.6031)	2.4162*** (0.6059)	2.2777*** (0.6392)	2.3726*** (0.7233)	1.8630*** (0.5940)	2.5317*** (0.6205)	1.9883*** (0.6724)

This table presents estimated coefficients and standard errors, clustered at the loan facility level (in parentheses), from logit, ordered logit, and poisson regressions respectively, including interaction variables between centrality measures and (discretized) country level variables. Renegotiation = 1 if a loan is renegotiated (0 otherwise); Rounds = 0 (no renegotiation) to 12 renegotiation rounds; Amendments = 0 (no renegotiation) to 6 amended loan terms. Betweenness, Closeness, Degree are lender's network-centrality measures and our main explanatory variables. D. denotes dummy variables equal to 1 if Rule of law, Renegotiation index, Priority, and Recovery are lower than their respective sample medians. All variables are described in the appendix. All regressions include loan and syndicate variables, borrower rating and dummy variables for loan year, borrower industry, loan currency, loan type, loan purpose and borrower country. *, **, and *** indicate a statistically significant coefficient at the 10%, 5%, and 1% confidence level.

Appendix. Supplementary data

Internet appendix to this article can be found online at <https://doi.org/10.1016/j.irfa.2024.103409>.

References

- Abadie, A., & Imbens, G. W. (2006). Large sample properties of matching estimators for average treatment effects. *Econometrica*, 74, 235–267.
- Abadie, A., & Imbens, G. W. (2011). Bias-corrected matching estimators for average treatment effects. *Journal of Business & Economic Statistics*, 29, 1–11.
- Aghion, P., & Bolton, P. (1992). An incomplete contracts approach to financial contracting. *Review of Economic Studies*, 59, 473–494.
- Aleenajitpong, N., & Leemakdej, A. (2021). Venture capital networks in Southeast Asia: Network characteristics and cohesive subgroups. *International Review of Financial Analysis*, 76, Article 101752.
- Alperovych, Y., Divakaruni, A., & Manigart, S. (2022). Lending when relationships are scarce: The role of information spread via bank networks. *Journal of Corporate Finance*, 73, Article 102181.
- Bae, K., & Goyal, V. K. (2009). Creditor rights, enforcement, and bank loans. *Journal of Finance*, 64, 823–860.
- Bajo, E., Chemmanur, T. J., Simonyan, K., & Tehrani, H. (2016). Underwriter networks, investor attention, and initial public offerings. *Journal of Financial Economics*, 122, 376–408.
- Baum, J., Rowley, T. J., & Shipilov, A. V. (2004). The small world of Canadian capital markets: Statistical mechanics of investment Bank syndicate networks. *Canadian Journal of Administrative Sciences/Revue Canadienne des Sciences de l'Administration*, 21, 307–325.
- Baum, J., Shipilov, A. V., & Rowley, T. J. (2003). Where do small worlds come from? *Industrial and Corporate Change*, 12, 697–725.
- Berger, A. N., Espinosa-Vega, M. A., Frame, W. S., & Miller, N. H. (2005). Debt maturity, risk, and asymmetric information. *Journal of Finance*, 60, 2895–2923.
- Besanko, D., & Thakor, A. V. (1987). Collateral and rationing sorting equilibria in monopolistic and competitive credit markets. *International Economic Review*, 28, 671.
- Bester, H. (1985). Screening vs. rationing in credit markets with imperfect information. *American Economic Review*, 75, 850–855.
- Bester, H. (1994). The role of collateral in a model of debt renegotiation. *Journal of Money, Credit and Banking*, 26, 72.
- Bharath, S. T., Dahiya, S., Saunders, A., & Srinivasan, A. (2011). Lending relationships and loan contract terms. *Review of Financial Studies*, 24, 1141–1203.
- Bolton, P., & Scharfstein, D. S. (1996). Optimal debt structure and the number of creditors. *Journal of Political Economy*, 104, 1–25.
- Bushman, R. M., & Wittenberg-Moerman, R. (2012). The role of Bank reputation in “certifying” future performance implications of Borrowers’ accounting numbers. *Journal of Accounting Research*, 50, 883–930.
- Campbell, M. (2013). *Syndicated lending, practice and documentation 6th edition*, 6th (edition. ed.). London: Euromoney Institutional Investor.
- Christensen, H. B., & Nikolaev, V. V. (2012). Capital versus performance covenants in debt contracts. *Journal of Accounting Research*, 50, 75–116.
- Cohen, L., Frazzini, A., & Malloy, C. (2008). The small world of investing: Board connections and mutual fund returns. *Journal of Political Economy*, 116, 951–979.
- Cujean, J. (2020). Idea sharing and the performance of mutual funds. *Journal of Financial Economics*, 135, 88–119.
- Demirgüç-Kunt, A., Levine, R., Cihak, M., & Feyen, E. (2012). *Benchmarking financial systems around the world (No. WPS6175)*. The World Bank.
- Dessein, W. (2005). Information and control in ventures and alliances. *Journal of Finance*, 60, 2513–2549.
- Dewatripont, M., & Eric Maskin. (1990). Contract renegotiation in models of asymmetric information. *European Economic Review*, 34, 311–321.
- Djankov, S., McLiesh, C., & Shleifer, A. (2007). Private credit in 129 countries. *Journal of Financial Economics*, 84, 299–329.
- Engelberg, J., Gao, P., & Parsons, C. A. (2012). Friends with money. *Journal of Financial Economics*, 103, 169–188.
- Favara, G., Schroth, E., & Valta, P. (2012). Strategic default and equity risk across countries. *Journal of Finance*, 67, 2051–2095.
- Freeman, L. C. (1979). Centrality in social networks conceptual clarification. *Social Networks*, 1, 215–239.
- Fudenberg, D., & Tirole, J. (1990). Moral Hazard and renegotiation in agency contracts. *Econometrica*, 58, 1279–1319.
- Garleanu, N., & Zwiebel, J. (2009). Design and renegotiation of debt covenants. *Review of Financial Studies*, 22, 749–781.
- Godlewski, C. J. (2014). The determinants of multiple bank loan renegotiations in Europe. *International Review of Financial Analysis*, 34, 275–286.
- Godlewski, C. J. (2015). The certification value of private debt renegotiation and the design of financial contracts: Empirical evidence from Europe. *Journal of Banking & Finance*, 53, 1–17.
- Godlewski, C. J. (2019). Debt renegotiation and the Design of Financial Contracts. *Journal of Financial Services Research*, 55, 191–215.
- Godlewski, C. J. (2020). How legal and institutional environments shape the private debt renegotiation process? *Journal of Corporate Finance*, 62, 101555. <https://doi.org/10.1016/j.jcorpfin.2019.101555>
- Godlewski, C. J., & Sanditov, B. (2018). Financial institutions network and the certification value of Bank loans. *Financial Management*, 47, 253–283.
- Godlewski, C. J., Sanditov, B., & Burger-Helmchen, T. (2012). Bank lending networks, experience, reputation, and borrowing costs: Empirical evidence from the French syndicated lending market. *Journal of Business Finance & Accounting*, 39, 113–140.

- Gomes, A., & Phillips, G. (2012). Why do public firms issue private and public securities? *Journal of Financial Intermediation*, 21, 619–658.
- Gorton, G., & Kahn, J. (2000). The design of bank loan contracts. *Review of Financial Studies*, 13, 331–364.
- Granovetter, M. (1973). The strength of weak ties. *American Journal of Sociology*, 78, 1360–1380.
- Grossman, S. J., & Hart, O. D. (1982). *Corporate financial structure and managerial incentives (NBER chapters)*. National Bureau of Economic Research, Inc.
- de Haan, J., Oosterloo, S., & Schoenmaker, D. (2012). *Financial markets and institutions: A European perspective* (2nd ed.). Cambridge University Press.
- Hart, O., & Moore, J. (1990). Property rights and the nature of the firm. *Journal of Political Economy*, 98, 1119–1158.
- Hart, O., & Tirole, J. (1988). Contract renegotiation and Coasian dynamics. *Review of Economic Studies*, 55, 509–540.
- Hauswald, R., & Marquez, R. (2006). Competition and strategic information Acquisition in Credit Markets. *Review of Financial Studies*, 19, 967–1000.
- Hochberg, Y. V., Ljungqvist, A., & Lu, Y. (2007). Whom you know matters: Venture capital networks and investment performance. *Journal of Finance*, 62, 251–301.
- Horton, J., Millo, Y., & Serafeim, G. (2012). Resources or power? Implications of social networks on compensation and firm performance. *Journal of Business Finance & Accounting*, 39, 399–426.
- Houston, J. F., Lee, J., & Sunthim, F. (2018). Social networks in the global banking sector. *Journal of Accounting and Economics*, 65, 237–269.
- Johnson, S. A. (1997). The effect of Bank reputation on the value of Bank loan agreements. *Journal of Accounting, Auditing and Finance*, 12, 83–100.
- Kaplan, S. N., & Strömberg, P. (2003). Financial contracting theory meets the real world: An empirical analysis of venture capital contracts. *The Review of Economic Studies*, 70, 281–315.
- Larcker, D. F., So, E. C., & Wang, C. C. Y. (2013). Boardroom centrality and firm performance. *Journal of Accounting and Economics*, 55, 225–250.
- Lee, S. W., & Mullineaux, D. J. (2004). Monitoring, financial distress, and the structure of commercial lending syndicates. *Financial Management*, 33, 107–130.
- Levine, R., Loayza, N., & Beck, T. (2000). Financial intermediation and growth: Causality and causes. *Journal of Monetary Economics*, 46, 31–77.
- Lin, J., Wang, F., & Wei, L. (2021). Alumni social networks and hedge fund performance: Evidence from China. *International Review of Financial Analysis*, 78, Article 101931.
- McCahery, J., & Schwienbacher, A. (2010). Bank reputation in the private debt market. *Journal of Corporate Finance*, 16, 498–515.
- Mian, A. (2006). Distance constraints: The limits of foreign lending in poor economies. *Journal of Finance*, 61, 1465–1505.
- Miller, D. P., & Reisel, N. (2012). Do country-level investor protections affect security-level contract design? Evidence from foreign bond covenants. *Review of Financial Studies*, 25, 408–438.
- Morrison, A. D., & Wilhelm, W. J., Jr. (2007). *Investment banking: Institutions, politics, and law*. USA: Oxford University Press.
- Mosebach, M. (1999). Market response to banks granting lines of credit. *Journal of Banking & Finance*, 23, 1707–1723.
- Nikolaev, V. V. (2018). Scope for renegotiation in private debt contracts. *Journal of Accounting and Economics*, 65, 270–301.
- Preece, D., & Mullineaux, D. J. (1996). Monitoring, loan renegotiability, and firm value: The role of lending syndicates. *Journal of Banking & Finance*, 20, 577–593.
- Prilmeier, R. (2017). Why do loans contain covenants? Evidence from lending relationships. *Journal of Financial Economics*, 123, 558–579.
- Qian, J., & Strahan, P. E. (2007). How laws and institutions shape financial contracts: The case of bank loans. *Journal of Finance*, 62, 2803–2834.
- Rajan, R. G., & Zingales, L. (1998). Financial dependence and growth. *American Economic Review*, 88, 559–586.
- Roberts, M. R. (2015). The role of dynamic renegotiation and asymmetric information in financial contracting. *Journal of Financial Economics*, 116, 61–81.
- Roberts, M. R., & Sufi, A. (2009). Renegotiation of financial contracts: Evidence from private credit agreements. *Journal of Financial Economics*, 93, 159–184.
- Ross, D. G. (2010). The “dominant Bank effect:” how high lender reputation affects the information content and terms of Bank loans. *Review of Financial Studies*, 23, 2730–2756.
- Saavedra, D. (2018). Syndicate size and the choice of covenants in debt contracts. *The Accounting Review*, 93, 301–329.
- Schenone, C. (2010). Lending relationships and information rents: Do banks exploit their information advantages? *Review of Financial Studies*, 23, 1149–1199.
- Smith, C. W., & Warner, J. B. (1979). On financial contracting. *Journal of Financial Economics*, 7, 117–161.
- Sufi, A. (2007). Information asymmetry and financing arrangements: Evidence from syndicated loans. *Journal of Finance*, 62, 629–668.
- Wu, W.-S., Chang, H.-H., Suardi, S., & Chang, Y. (2013). The Cascade effect on lending conditions: Evidence from the syndicated loan market. *Journal of Business Finance & Accounting*, 40, 1247–1275.
- Zinbarg, E. D. (1975). The private placement loan agreement. *Financial Analysts Journal*, 31, 33–52.