What drives the dynamics of bank debt renegotiation in Europe? A survival analysis approach

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Abstract

Debt renegotiation matters for the borrower-lender relationship to ensure the credit agreement is regularly amended to include new information and make it more "complete". I investigate the determinants of the dynamics of bank loan renegotiations using a sample of 1 600 amendments to private debt contracts in Europe. The median duration between loan amendments equals 1 year, although frequently renegotiated contracts are amended every 5 months. Employing a stratified Cox-type hazard model, I find that initial loan terms, banking pool features, amendments' characteristics, and the legal environment significantly influence the duration time between renegotiations. Contract complexity, informational frictions in the borrower-lender relationship, the uncertainty of the economic environment, and the legal protection of creditors also play a major role in shaping the dynamics of bank loan renegotiation in Europe.

Keywords: renegotiation process, bank loans, multiple failure-time data, Cox model, Europe.

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1 Introduction

According to the theory of complete contracts, debt renegotiation destroys the value of entering a contract, which in turn should eliminate any incentives to renegotiate (Dewatripont and Maskin, 1990; Hart, 1995). Indeed, the scope for renegotiation can have an adverse effect on ex ante incentives and contract efficiency (Hart and Moore, 1988; Fudenberg and Tirole, 1990; Dewatripont and Maskin, 1995). However, in a world with frictions, contracts are bound to be incomplete and thus not renegotiation-proof. Several theoretical studies show that the possibility of renegotiation has a profound impact on security design, incentives, and welfare (cf. Hart and Moore, 1988; Gale and Hellwig, 1989; Bester, 1994; Chemmanur and Fulghieri, 1994; Mella-Barral, 1999; Dessein, 2005; Garleanu and Zwiebel, 2009)[1]. The main conclusion regarding the incomplete contracts theory is that leaving scope for renegotiation can actually enhance the efficiency of contracts.

Surprisingly, despite rich theoretical predictions, empirical evidence regarding debt renegotiation is still at an early stage. Roberts and Sufi (2009) show that private credit agreements are renegotiated early in the life of the loan following the arrival of new information, leading to significant changes to the contract terms; on the other hand, Roberts (2012) found that most loans are renegotiated multiple times over relatively short timeframes. According to Nikolaev (2013), the scope for renegotiation is higher among companies with higher uncertainty, greater agency conflicts, lower information frictions, and tighter creditor control rights. Godlewski (2013) shows that early and less frequent renegotiations substantially increase borrowing firms' abnormal return in Europe.

In a nutshell, renegotiation matters for contracting parties wanting to ensure their debt contract is regularly amended to include new information, eventually becoming even more "efficient" or "complete".

[1] Section 2 provides an overview of the relevant literature.

However, these empirical findings raise further important questions. Why renegotiate a loan several times? Are early and less frequent loan amendments more valuable? More generally, which determinants accelerate or delay the path towards a more "complete" contract? The aim of this article is to provide empirical evidence on these issues by focusing on a large set of variables that can influence the duration between renegotiation rounds.

I use a cross-country sample of loan amendments in Europe, in which companies rely mostly on bank lending as a major external source of capital to fund their growth. For instance, in 2011, the ratios of domestic credit provided by the banking sector and total value of stocks traded to GDP were equal in the European Union to 156.5% and 58.3%, respectively (source: World Bank)[2]. In this context, the design of bank debt contracts is even more fundamental to insuring efficient capital allocation in the economy. A better understanding of bank loan renegotiation dynamics provides valuable knowledge regarding which determinants shape debt contract efficiency over the course of the borrower-lender relationship.

I consider initial loan contract, banking pool, and subsequent amendment characteristics, but also countries' legal and institutional environment. To perform my empirical investigation, I use a sample of 1 600 amendments to 759 loans to 669 firms from January 1999 until June 2011, covering a total of 28 European countries (source: Bloomberg). Due to the specific nature of the date (i.e. multiple failure-time with repeated ordered events), I employ the conditional risk set model proposed by Prentice et al. (1981). This is a stratified Cox-type model which allows taking event dependence into account to identify the effect of various covariates on duration in a multivariate setting. Hence, I explicitly take into account the relationship between durations separating subsequent renegotiations.

The closest related paper is Nikolaev (2013), who uses a large sample of loan amendments in the US to study the impact of debt contract features on the scope of

[2] For comparison, in the US these ratios equaled 232.5% and 205.1%, respectively (source: World Bank).

renegotiation, employing a Cox proportional hazard duration model. Another related paper is by Roberts (2012), who uses hand-collected data from the US to investigate not only what happens in a renegotiation, but also when it occurs. He investigates the determinants of the number of renegotiation rounds, amendments to different loan terms (such as covenants), and durations.

My paper offers complementary evidence due to the fact I focus on a different continent (Europe). Here bank lending represents a larger proportion of external financing for firms than in the US. Furthermore, the cross-country dimension of my sample allows the exploitation of legal and institutional variables that affect renegotiation dynamics. I also investigate a broader set of variables, such as loan terms, amendments characteristics, and banking pool features. Finally, I apply an econometric method which explicitly accounts for durations' dependence in a multiple failure-time data setting.

The rest of the article is structured as follows. I discuss the relevant literature and provide empirical hypotheses in sections 2 and 3, respectively. Section 4 is devoted to the methodology and data description. The results are provided and discussed in section 5. Finally, section 6 concludes the article.

2 Renegotiation of debt contracts

Debt renegotiation can occur when contracting parties are unable or unwilling to commit to the initial terms of their agreement. This is more likely to occur when unanticipated or non-contractible states of the world occur. Eventually, changing the terms of the loan can translate into a mutual gain for the borrower and the lender.

In practice, the renegotiation process usually begins with the borrower contacting the lender (although both parties can initiate it) as a consequence of the restrictiveness of the initial contract because the firm may wish to increase their capital expenditures, undertake an

acquisition, or increase dividends, etc. These activities may be explicitly restricted by the initial loan agreement due to informational frictions between the borrower and the lender, in particular through various financial and non-financial covenants. Indeed, better-informed borrowers usually yield control rights to less informed lenders (Dessein, 2005). Furthermore, Garleanu and Zwiebel (2009) show that stronger rights are granted to the lender by the borrower in the initial contract when information asymmetry is greater, when it is more costly to acquire information by the lender, and when it is less costly to renegotiate.

A positive shock to the borrower that improves credit quality should shift the bargaining power in his favor (Hart and Moore, 1998), eventually allowing them to renegotiate more advantageous terms, in particular if market conditions provide more outside options to obtain external financing for the firm. The borrower can also consider the renegotiation process as a signaling game to influence the lender's renegotiation strategy ("tough" or "soft") via the repayment offer (Gale and Hellwig, 1989). Renegotiation can also be considered by the lender as a reputation device, providing incentives to devote a larger amount of resources to information production in order to make the "right" renegotiation decision (Chemmanur and Fulghieri, 1994); for instance, the latter can avoid a soft budget constraint problem. Next to reputational concerns, the lender's renegotiation strategy may also reduce a borrower's incentives to engage in opportunistic renegotiation (Bourgeon and Dionne, forthcoming). This is a crucial element, especially when a negative shock occurs, which can lead to loan renegotiation when liquidation is ex post Pareto inefficient, in turn leading to less favorable terms. Overall, debt reorganization can even enhance the market value of debt as the process enables creditors to avoid ill-timed liquidation (Mella-Barral, 1999)[3].

[3] However, Berlin and Mester (1992) show that firms with a high ex ante credit risk find the option to renegotiate most valuable.

However, these renegotiations bear several costs in terms of a fee that varies with the size and complexity of the loan, time, and effort. Furthermore, in the case of a large (syndicated) loan with a large banking pool, the amendments must be approved by a certain percentage of lenders, usually according to three levels of approval: the required-lenders level, full vote, and supermajority[4].

Empirical evidence regarding debt renegotiation is far less developed than theoretical studies. However, although scarce and mostly focused on the US market, it provides results in line with theoretical predictions. Roberts and Sufi (2009) find that nearly all private credit agreements in their sample are renegotiated prior to maturity. These renegotiations occur early in the life of the loan, generating large changes to the terms of the initial contract. Primary determinants of renegotiation and its outcomes are the accrual of new information concerning the credit quality, investment opportunities, and the collateral of the borrower, as well as macroeconomic fluctuations in credit and equity market conditions. Furthermore, renegotiation is partially controlled by the contractual assignment of bargaining power.

Roberts (2012) focuses on the dynamics of loan renegotiation, and provides a series of interesting results. He finds that most loans are renegotiated multiple times over relatively short horizons, leading to significant changes to the contract terms. Renegotiations are initiated by borrowers in response to changing conditions in order to modify contractual constraints originally designed to mitigate informational frictions. Modifications to the initial loan contract are driven largely by borrowers' desire to alter their investment, operating, or financing policies. Lenders learn of the quality of the borrower through ex post renegotiation as new information becomes available, thereby improving the efficiency of the contract over time. In other words, leaving scope for renegotiation can enhance the efficiency of incomplete

[4] The first level is a simple majority used for the approval of nonmaterial amendments and waivers, or changes affecting one facility. A full vote (including all participants) is required to approve material changes such as RATS (rate, amortization, term, security). A supermajority – typically 70–80% of lenders – is required for certain material changes such as changes in amortization and the release of collateral.

contracts, and this can be considered a method of completing contracts as the future unfolds. Furthermore, the timing of renegotiations is governed by three main factors: the financial health of the loan parties; the uncertainty regarding the borrower's future profitability; and the outcome of the renegotiation.

Nikolaev (2013) investigates a large sample of 16 500 loan amendments from Dealscan, and focuses exclusively on the role of contracting frictions and the design of the debt contract in driving the scope for renegotiation (or the duration between loan amendments). He finds that the scope is higher among companies with higher uncertainty, greater agency conflicts, lower information frictions, and tighter creditor control rights, while syndicate size and performance pricing are associated with a lower scope for renegotiation. He also finds that strategic control allocation via the debt contract triggers renegotiation. He concludes that renegotiation has ex ante efficiency implications.

Finally, Godlewski (2013) provides empirical results on the impact of bank loan renegotiation on the wealth of shareholders at listed European firms. He finds that renegotiations occur as early as in the US, but are less frequent, leading to substantial changes in loan amounts, maturity, and covenants. He shows that early and less frequent renegotiations with amendments to financial covenants and loan amounts increased the borrower's cumulative abnormal return. He concludes that the renegotiation of financial contracts can be seen as signaling and certification devices regarding borrower's quality.

3 Empirical hypotheses

In this section I lay down empirical hypotheses regarding loan, lender, amendment, and country characteristics that are expected to have an impact on the duration between the origination date and subsequent renegotiation dates. For the sake of interpretability, a

covariate which increases (respectively decreases) the duration is found to decrease (respectively increase) the probability of future renegotiation.

3.1 Loan and lenders' characteristics

Initial loan terms should (at least partially) reflect information frictions at the time of the debt contract origination, and thus all the problems related to adverse selection and moral hazard. The main contract features aiming to resolve these problems are collateral and covenants: covenants restrict borrower behavior and thus moral hazard; while collateral serves as a screening device to reduce adverse selection problems. Bester (1994) shows that collateral requirements make it more likely that the initial debt contract is renegotiated. I expect the presence of collateral to reduce the duration. Covenants are also expected to reduce the duration when renegotiation is triggered by the arrival of new information that reduces frictions between contracting parties, allowing softening contractual constraints (Garleanu and Zwiebel, 2009).

The size of a loan can be considered as certifying the quality of the initial lending decision (Mosebach, 1999). Larger facilities, as well as longer maturities, should signal the lender's greater confidence in the borrower's success, as well as less uncertainty and reduced information asymmetry. Indeed, Berger et al. (2005) find that loan maturity increases when information asymmetry is reduced. Loan amount and maturity are expected to increase the duration. Loan type – particularly term loan vs. revolving credit – should also play a role in renegotiation dynamics. A term loan should be amended less quickly, following similar arguments as for longer maturity, but also due to the intrinsic reduced flexibility.

Syndicated or club deals are complex and sophisticated debt contracts involving sometimes very large pool of lenders organized within a hierarchical structure, with one or more banks acting as the syndicate leaders (agents or arrangers). Such complex loan

structures should be renegotiated more quickly, although the size of the pool and the presence of leaders could have the opposite effect. Indeed, a larger syndicate is usually associated with fewer informational frictions (Lee and Mullineaux, 2004; Sufi, 2007; Bosch and Steffen, 2011), while a large number of leaders is better suited to coping with free-riding, moral hazards, and hold-up problems in cases of borrower distress, as well as any subsequent reorganization and renegotiation (Bolton and Scharfstein, 1996; Esty and Megginson, 2003). Furthermore, frequent renegotiation could hamper leaders' reputation regarding their capacity of writing efficient contracts, restricting them from engaging too quickly in a debt renegotiation (Chemmanur and Fulghieri, 1994).

A common technique in syndicated lending is tranching, which offers a wide and flexible "menu" for investors wanting to enter the deal, and can create economic value and provide benefits for riskier borrowers (Maskara, 2010). Therefore, I expect loans with multiple tranches to be renegotiated less quickly.

Borrower-lender proximity helps overcome the adverse consequences of information asymmetry (Hauswald and Marquez, 2006). Indeed, greater cultural and geographical distance influence lending decisions (Mian, 2006) and debt contract characteristics (Giannetti and Yafeh, 2011). Thus, lenders which are geographically closer to the borrowers are expected to renegotiate less frequently because of lower informational frictions.

Firm transparency reduces uncertainty and information asymmetry within the borrower-lender relationship, which can slow down the need to renegotiate the loan. A simple measure of borrower's transparency is the presence of a credit rating by a leading agency, such as Moody's or S&P. I expect a larger duration for rated firms.

3.2 Amendment characteristics

The intensity of debt renegotiation depends crucially on the contractual allocation of control and decision rights via mechanisms such as financial covenants, borrowing base, or

performance pricing (Nikolaev, 2013). Therefore, if amendments to covenants (financial and non-financial) or pricing grids convey new information contributing to reduce frictions between the borrower and the lender, they should decrease the probability of subsequent renegotiations. In a similar vein, non-material amendments, such as definition change, should also convey new information and thus slow down the timing of renegotiations. The effect of amendments to amounts (facility, tranche, or outstanding) can be explained along similar lines.

The scope and complexity of amendments should also play a role in shaping the dynamics of renegotiation. For instance, a broad package of amendment types (e.g. amount, covenants, pricing grid, and definition) should allow the debt contract to become more efficient or "complete", thereby reducing the probability of further renegotiations. The effect of renegotiation frequency is less clear-cut. On the one hand, frequent renegotiations should allow the debt contract to become more efficient more quickly, hence increasing the duration until subsequent amendments. Also, high renegotiation intensity could have adverse effects on lenders' reputation regarding their renegotiation strategy, hence providing incentives to amend less frequently but more efficiently (Chemmanur and Fulghieri, 1994). On the other hand, more frequent but "minor" amendments could be less costly, particularly in terms of a "wrong" renegotiation strategy on behalf of the lender. In other words, the path of renegotiations could be more "soft" in terms of information transfers between the contract parties, who may prefer to interact more often with less and/or smaller amendments.

Finally, the timing of the first renegotiation should have a significant impact on the duration. On the one hand, early renegotiation should be valuable for both parties, as information revelation comes more quickly and the terms of the loan are adjusted more efficiently, thus leading to shorter durations. On the other hand, later renegotiations allow

more information to be revealed in the course of the relationship, as well as the realization of (ex ante uncertain) events, leading to a less intense path of amendments and larger durations.

3.3 Country characteristics

Financial contracts are sensitive to the legal and institutional environment of a country. This environment embeds features like the quality of creditor rights' legal protection and the enforceability of property rights protection. Both affect lenders' incentives to monitor borrowers and the costs of recontracting. Qian and Strahan (2007) show that stronger creditor protection expands loan availability by increasing loan maturity and decreasing interest rates; while Bae and Goyal (2009) show that it is the better enforceability of contracts that allows increases to loan size, the lengthening of loan maturity, and reductions in loan spread.

An important dimension of the legal and institutional environment is the level of creditors' rights protection. However, its impact on duration remains ambiguous. On the one hand, better protection can reduce incentives to renegotiate in order to acquire new information and update the contract, as lenders ultimately believe that their claims are well protected. In that case, the duration would be larger. On the other hand, better protection can also lead lenders to be more favorable to quickly transferring the control rights to the borrower, hence renegotiating the loan sooner. Furthermore, one can expect the costs of renegotiation to be lower in environments with better legal protection for creditors.

Another important dimension of the institutional environment is related to financial development. We know that broad financial development and better financial intermediation enhances economic growth, particularly by reducing the costs of external financing (Rajan and Zingales, 1998; Levine et al., 2000). The latter is usually obtained thanks to decreasing information asymmetry. Thus the development of credit, bond, and stock markets is a proxy for lower informational frictions, eventually leading to more frequent contract renegotiation

and lower duration. These markets also provide valuable outside options to borrowers looking for external financing, and can help make the renegotiation process more credible, thereby accelerating it.

4 Data and methodology

In this section, I present the data collection process and the multivariate survival analysis methodology used to investigate the dynamics of bank loan renegotiations.

4.1 Data

I started by extracting all bank loan amendments (or renegotiations) for European companies from January 1999 to June 2011 using the Bloomberg Professional Terminal Server (Bloomberg). The initial data set contains the name of the company, unique loan tranche(s) identifier(s), the announcement/declaration date of the event, undertaken amendment types (such as changes to loan facility or tranche amount, outstanding amount, maturity, covenants, or pricing grid), and, if applicable, old and new terms of the contract, which refer to any quantitative changes to an amount or a maturity.

Using this information, I computed the main variable of interest, which is the duration between loan origination date and subsequent renegotiation dates. For unique renegotiations, this duration equals the time elapsed since the loan origination date until the first (and last) amendment date. For multiple renegotiations, the duration equals the gap time between the *k-1* and *k* renegotiation dates. At each renegotiation round, a new gap time can be computed, while the elapsed time since the origination date increases incrementally by the subsequent gap times. I also computed the number of amendments by loan and borrower, and the number of different amendment types by loan and renegotiation round.

Using the unique loan tranche(s) identifier(s), I merged the amendments data set with the loan agreement characteristics at origination (also extracted from Bloomberg)[5]. This allows me to enrich the data with information such as the loan and tranche(s) amounts, spread, maturity, type of loan, loan purpose, and the existence of covenants and/or collateral. I also gathered information on main bank lending pool characteristics, such as the number of lenders, if the loan is syndicated or bilateral, the percentage of lead banks in the pool, and the nationality of the lenders. I also extracted information on borrower rating availability at the time of loan origination.

I use Schaeck et al. (2009) Global Financial Development Database (World Bank) and Djankov et al. (2007) databases to include institutional and legal environment variables by country, such as private credit to GDP, corporate bond and stock markets development, as well as legal origin and creditors' rights protection index.

I ended up with a sample containing 669 companies, which renegotiated 759 loan facilities following 1 600 amendments for a total of 2 520 observations. The timespan of my sample ranged from January 1, 1999 until June 30, 2011, and covers 28 European countries (including Moldova, Russia, Turkey, and the Ukraine).

4.2 Methodology

Multiple failure-time (or multivariate survival) data arise, whereby each study subject can potentially experience several events. The simplest way of analyzing multiple failure data is to examine the time to the first event, ignoring any additional failures. However, this approach is usually not adequate, because it wastes possibly relevant information. Furthermore, with multiple events, failure times are correlated within clusters (subject or

[5] I also use these identifiers to merge the data set with information on corporate defaults from Bloomberg in order to exclude loan amendments related to borrowers' distress. I identified a residual percentage (less than 1%) of the initial data set as corporate default renegotiations, and subsequently eliminated them.

group), violating the independence of failure-time assumptions required in traditional survival analysis.

The approaches needed to deal with repeated events fall under the heading "*variance-correction models*". The idea is that repeated events only affect the variance of estimates, not the means. The covariance matrix of the estimators is adjusted to account for the additional correlation. Essentially, variance-correction models differ along three main dimensions:

1. Risk set: the risk set defines how subjects are considered to be at risk of experiencing a given event at a particular time. If a subject cannot experience a subsequent event without having experienced a prior event, then we need to define the conditional risk set that preserves this ordering. If there is no ordering, the risk set can be "unconditional" and we can estimate a "marginal" model.
2. Clock time: essentially the difference between whether (i) the clock begins when a unit enters the observation period and ends when a subject experiences an event or is censored (elapsed time); or (ii) whether the clock restarts after each event (gap time).
3. Stratification: if the hazard rate is likely to vary across events (as when event dependence exists) then we would want a model that is able to stratify the data to allow for the estimation of a separate baseline hazard for each event. If the risk associated with all events is the same, then a single baseline hazard will work and stratification is not necessary.

In my case, events (loan renegotiations) are ordered, as a borrower cannot experience a subsequent amendment without having experienced a prior renegotiation. Furthermore, it is reasonable to assume that event dependence exists so that subsequent renegotiations for a given borrower are related. Therefore, I employ the conditional risk set model proposed by

Prentice et al. (1981) (PWP), which is the most suitable for an analysis of ordered events that contain stratification. The assumption made is that a subject is not at risk of a second event until the first event has occurred, and so on. The conditional risk set at time *t* for event *k* is made up of all subjects under observation at time *t* that have had event *k-1*. There are two variations to this approach: (1) the time to each event can be measured from entry time (elapsed time); or (2) it can be measured from the previous event (gap time). The latter approach is best suited for modeling the time between each of the recurring events, while the former approach is very useful for modeling the full course of the recurrent event process.

More formally, the PWP model is a stratified Cox-type model that allows the shape of the hazard function to depend on the number of preceding events, as well as other characteristics[6]. Let $N(t)$ be the number of events (renegotiations) a subject (loan facility or borrower) experiences by time t. Let $Z(t)$ be the covariate vectors of the subject at time t. For a subject who has K events (before being censored), let $t_0 = 0, t_k$ the k^{th} recurrence time, $k = 1, \dots, K$ and t_{K+1} the censored time. The elapsed time (1) and gap time (2) models can be written respectively as:

$$\lambda(t|F_{t-}) = \lambda_{0k}(t)e^{\beta_k' Z(t)} \quad (1)$$

$$\lambda(t|F_{t-}) = \lambda_{0k}(t - t_{k-1})e^{\beta_k' Z(t)} \quad (2)$$

where $t_{k-1} < t \leq t_k$, λ_{0k} is an arbitrary baseline intensity function, and β_k' a vector of stratum specific regression coefficients. In this setting, a subject moves to the k^{th} stratum immediately after this $(k-1)^{th}$ recurrence time, and remains there until the k^{th} recurrence occurs or until censorship takes place.

[6] A numerical illustration of the approach is provided in Appendix A.

5 Results

In this section I first discuss several descriptive statistics to provide a better insight into loan renegotiation process dynamics. Then I perform a multivariate analysis using Prentice et al. (1981) conditional risk set model to investigate the duration.

5.1 Descriptive statistics

Table 1 presents the sample composition by country of borrower. A total of 28 countries are represented, with the majority originating from Western Europe, and thus also from the European Union and the Eurozone. More than 30% of loan renegotiations are in the UK; combined with France, Germany, the Netherlands, Spain and Luxembourg, these six countries account for more than 70% of the sample. There is considerable heterogeneity in the duration time between amendments: the average duration by country ranges from 6 months in Austria to almost 5 years in Latvia. A typical loan is renegotiated between one and two times, with a maximum in Ireland, where it is renegotiated three times on average.

The distribution of loans and amendments, as well as loan renegotiation intensity and duration over time, are provided in Figure 1. Loans and amendments take off in 2005 to reach 75 loans and 150 amendments in 2008, and 350 loans and 700 amendments during a peak in 2009 and 2010. Renegotiation intensity (computed as a renegotiation counter by loan) varies between 1 and 2, meaning that a typical loan is renegotiated between one and two times. We remark that renegotiation intensity is more volatile in the early years of the sample, and increases to 1.6 during the Global Financial Crisis to 1.6. Duration between amendments (measured in months) is much more volatile, albeit with an upward trend. We observe a first peak in 2003 at 20 months, a second one in 2006 at 17 months, and a last peak in 2008 at 30 months.

Figure 2 provides the distribution of renegotiations and durations by loan renegotiation intensity. Almost 74% of the loans (733) in the sample were renegotiated only once. In comparison, Nikolaev (2013) finds that half of the loans experience one renegotiation, while Roberts (2012) reports an even smaller figure – close to 30%. The average duration for these loans (in this case, between origination and the first unique amendment) is 25 months. Loan renegotiation intensity decreases, as does duration; however, the more frequently a loan is renegotiated, the shorter the duration (i.e. frequent renegotiations are quasi-continuous in time).

The breakdown of different types of amendment[7] (which are not necessarily mutually exclusive for a given loan or borrower) in the sample can be found in Figure 3. The major type of amendment is maturity change (24.39%), followed by tranche and facility amounts (18.90% and 16.84%, respectively). The main other amendment types are definition change (11.59%), pricing grid (10.55%), and financial covenants (8.21%). For comparison, major changes in Roberts' (2012) sample are covenants, spread, maturity, and amount (34%, 26%, 24%, and 23%, respectively).

Finally, Figure 4 provides stratified survival and hazard functions for duration. Stratification is performed by loan renegotiation intensity, computed as a renegotiation counter by loan[8]. The survival function of a loan renegotiated only once is very smooth, contrary to more frequently renegotiated loans. For instance, half of the duration lasts approximately 20 months for a unique renegotiation, while it is close to 0 (i.e. quasi-instantaneous) for more frequently renegotiated loans. The hazard function for unique renegotiation is long and almost flat (with an increasing trend starting at 60 months), while it is much shorter with almost vertical jumps for more frequent renegotiations. For instance, a

[7] A brief description of amendment types is provided in Appendix B.
[8] For visual clarity, the last category of the counter has been rescaled to 4+, and aggregates all categories greater or equal to 4.

loan renegotiated four times or more has an instantaneous rate of a subsequent renegotiation close to 100% when the duration approaches 5 months.

Descriptive statistics for all variables are provided in Table 2[9]. The first part concerns renegotiations. The average (median) start and stop times of loan amendments equal 10 (0) and 30 (25) months, respectively, for a duration of 20 (12) months. In other words, the first renegotiation can already start 10 months after loan origination, while a second amendment can happen 30 months later, leading to a duration between amendments of 20 months. Roberts (2012) and Nikolaev (2013) report shorter average and median times to renegotiation of 8 and 5.5 months, respectively. The number of amendments by loan or by borrower range between 3 and 4, indicating an intense renegotiation dynamic. On average, each renegotiation involves two different actions types (for instance, changes to facility amount and maturity). We also remark that renegotiation occurs early in the life of the loan: half of them happen before half of the original maturity has elapsed. Finally, when loans' terms of maturity or amounts are amended, the resulting quantitative changes are large: +1.61 years and +13%, respectively. If we consider the average maturity and facility amount at origination as benchmarks, a typical amendment increases the stated maturity by 25%, which then reaches almost 8 years, while an amended loan increases by almost 155 million USD[10]. These figures are comparable to the findings of Roberts and Sufi (2009), who find an average change in amount and maturity of 193 million USD and 2.12 years, respectively.

This leads us to the second part of Table 2, which provides the main statistics for loan and lender variables at origination[11]. The average facility amount is close to 1.2 billion USD, although its median value is much smaller at 241 million USD for a maturity, and a spread exceeding 6 years and 200 bps, respectively. A majority of renegotiated loans are syndicated

[9] Definitions of variables can be found in Appendix C.
[10] However, let's note that the median amendment to amount translates into a reduction of 2%.
[11] The main loan purposes are general corporate (32%), debt refinancing (27%), LBO (14%), and acquisition (11%). The main loan currencies are EUR (45%), GBP (25%), and USD (22%).

and thus have multiple tranches, half of them being term loans with collateral and covenants at issuance. Bank lending pools are quite large, with almost 14 lenders on average (median at 8), of which more than half are lead banks. Regarding lenders' origin, a majority (around three out of four) of lenders come from the same region as the borrower, which also means that many lenders come from the same European Union (EU) or Eurozone (EZ) country as the borrowing firm. These figures confirm the important segmentation credit markets in Europe, where European banks provide most of the loans to European firms.

Statistics for country characteristics related to the legal and financial environment are provided in the third part of Table 2. One third of borrowers are from a French law country, with an average creditor rights index of 2.6. The latter indicates a fair level of creditors' protection, but the former implies a weak overall protection of investors. Countries are relatively well developed in terms of capital markets, with the importance of credit markets (160% of GDP on average) compared to stock markets (86% of GDP), which is a particular European characteristic.

Finally, less than 25% of the borrowers had a Moody's or S&P's credit rating which might indicate that a majority of borrowers were more opaque at the time of issuance[12].

Table 3 provides averages of main variables by duration quartiles (at 3, 12.42, and 30 months, respectively). The number of amendments (by borrower and by loan) decreases with the duration between amendments (from around five to three). The complexity of renegotiations (several different amendment types) follows a similar pattern, while the renegotiation to maturity ratio remains quite stable. We also remark that modifications to maturity and amounts exhibit a drastic change when gap time becomes large (in the 4th quartile): amended maturity increases by almost 3 years, while amounts reduce by 5%. Hence, renegotiation intensity and complexity decreases when the duration between renegotiations

[12] The main industry sectors are consumer (cyclical & non-cyclical) (27%), industrial (20%), communications (10%), and basic materials (9%). Due to data availability, I cannot obtain a reasonable sample size including the balance sheet information of the borrowers.

increases, while amendments leading to quantitative changes become more "extreme". Regarding the amendments package, the occurrence of changes to maturity, covenants, and outstanding amount are stable, while they increase with the duration of facility and tranche amounts, and decrease for pricing grid and definition change. Initial loan terms are relatively stable across durations, except for spreads and collateralization, which decrease. In other words, later renegotiations concern loans with lower spreads and which are secured less often; as such, better quality deals are associated with these two characteristics. The structure of the banking pools also remain similar, except for their size, which decreases with duration. Thus, smaller pools tend to renegotiate later, eventually because they are better structured for a tighter monitoring of the borrower.

5.2 Main regression results

Tables 4 and 5 provide the main regression results. I use a PWP stratified Cox-hazard rate estimation model with standard errors clustered at the borrower level. In Table 4, time is measured as elapsed time, which is computed from the entry time (loan origination date). Covariates influence the full duration from origination until renegotiation(s). In Table 5, time is measured as gap time, which is computed from the previous renegotiation date. Covariates influence the duration between the *(k-1)* and *k* amendments. I use four different models: (1) with initial loan terms and borrower rating only; (2) with dummies for changes in the amendments package; (3) with renegotiation intensity, complexity, and timing; and (4) with country characteristics[13].

Among initial loan terms, the most robust results are for variables related to the nature of the loan and the structure of the banking pool, notably the syndicated nature of the deal (*Syndication*) and the percentage of lead banks (*Leaders*). The latter strongly increases the

[13] I include control variables for loan purpose, borrower industry sector, and main loan currencies in every model.

duration, both in terms of elapsed and gap time, whereas the former reduces the duration. For instance, in model (1.1), a syndicated loan has a duration that is reduced by 93% (1-hazard ratio, equal to 0.07) or a quasi-instantaneous probability of renegotiation, as compared to a bilateral loan. In model (1.2), an additional leader of the syndicate multiplies the probability of renegotiation by 14. These results confirm that more complex deals are renegotiated quickly. However, the role of lead banks in mitigating free-riding, moral hazard and hold-up problems allows the postponement of amendments. Leaders' reputations regarding their capacity to write efficient contracts can also explain their reluctance to quickly renegotiate a loan (Chemmanur and Fulghieri, 1994).

Initial maturity is significant, but only with negative coefficients in models (3) and (4), although the impact of this covariate on the duration is different in Tables 4 and 5. In the latter, larger maturities decrease the hazard rate by half, while the reduction is larger in the former (approximately 80%). Hence, the impact of maturity is stronger with respect to the duration since origination than since last amendment. In other words, as renegotiation intensity increases, the effect of maturity becomes weaker. This result does not validate the argument that larger maturities are associated with less information asymmetry. Rather it supports the idea that the contractual incompleteness, complexity, and costs of long-term contracts are less desirable than a series of short-term contractual arrangements (Nikolaev, 2013). Hence, loans with longer maturities are renegotiated faster. Additionally, we remark that *term loan* is significant and positive in Table 5, meaning that such loan types, although less flexible than revolving credit, slow down the renegotiation duration (or doubles the probability of subsequent amendment) when measured by gap time.

Interestingly, the proxy for borrower transparency (*borrower rating*) is not significant, and thus does not impact the renegotiation duration. Other main contract features, such as *covenants* or *secured*, are also not significant, except for covenants in models (3.1) and (3.2).

These results provide some empirical confirmation for the theoretical predictions that restrictive contractual features which aim to mitigate adverse selection and moral hazard problems are renegotiated more quickly (Bester, 1994; Garleanu and Zwiebel, 2009). We can therefore state that different amendment types have different effects on the durations. When considering elapsed time, four characteristics are significant: (1) changes to the facility amount; (2) financial covenants; (3) the outstanding amount; and (4) the definition – the latter being the most robust across specifications. All respective covariates are positive, meaning that these amendment characteristics increase the durations and therefore reduce the probability of renegotiation. We can argue that these particular types of amendments are best suited to achieve a more "complete" contract, thus reducing the need to renegotiate further. Only a change to maturity bears a significant and negative coefficient in Table 5 when duration is measured as gap time. This result is consistent with the coefficient for initial maturity, and indicates that an amendment to this loan characteristic allows a reduction in renegotiation duration. Furthermore, it means that maturity amendment remains an important driver of renegotiation dynamics, as it increases the probability of subsequent amendments by 70–80%.

Other amendment characteristics are all significant and robust across specifications, both in the elapsed and gap time specifications. Renegotiation complexity – as measured by *amendment types by loan* – strongly increases the duration because amending a broad package of loan terms allows the contract to become more "complete", reducing the need to renegotiate quickly again. Renegotiation frequency (*amendments by borrower*) has the opposite effect, reducing the probability of renegotiation by 10–20%. This result supports the idea that a more intense renegotiation path could be more "soft" in terms of information transfers between contracting parties who could prefer to interact more often, but renegotiate fewer loan terms. Also, it means that the renegotiation dynamics are amplified by frequent

amendments. *Renegotiation/maturity* almost halts the duration, meaning that later renegotiations could be more valuable as they allow more information to be revealed in the course of the relationship. Such renegotiation timing leaves more time for the realization of various events leading to a greater accumulation of information. Overall, it appears that a loan contract should be deeply renegotiated (i.e. the maximum number of amended terms) and late (in the course of the relationship) in order to reduce the probability of further renegotiations.

Finally, among the country characteristics related to the institutional, legal, and financial development, only the *French legal origin* is significant and positive, increasing the probability of renegotiation by a factor of 11 compared to a common law country. Investors in civil law countries are usually less well protected than in common law jurisdictions. Hence, a weaker legal protection increases the duration and increases the probability of renegotiation. Indeed, weaker protection of lenders' claims can provide them with stronger incentives to renegotiate quickly in order to acquire new information and update the contract earlier. Variables related to better financial development and reduced information asymmetries, as well as outside options in terms of external financing, do not play a significant role in the renegotiation dynamics.

5.3 Economic uncertainty and lender proximity

As an important number of renegotiations occur in 2009 and 2010, it might be the case that this particular shock drives the previous results. Furthermore, borrower-lender proximity influences information asymmetry and could affect the renegotiation duration. Hence, Tables 6 and 7 provide regression results with a particular focus on the effect of the Global Financial Crisis and lenders' origins on the duration.

Proxies for borrower-lender proximity are based on the percentage of lenders in the banking pool from the same region and EU or EZ country as the borrower. *Crisis* is a dummy

variable equal to 1 if renegotiation occurs after September 2008 (i.e. Lehmann Brothers' bankruptcy). The most complete model is retained for all regressions (i.e. (4) with all covariates), but including *crisis* and subsequently *same region*, *same EU member* and *same EZ member* variables, respectively.

We can see that *crisis* is significant and negative across all specifications, particularly in Table 6, where duration is measured as elapsed time. Bank debt contracts are renegotiated more quickly during a period of accrued uncertainty and informational frictions. This is a natural consequence of a crisis in credit markets, when an exogenous shock adversely affects information asymmetry in the borrower-lender relationship, triggering quicker loan renegotiations. However, the crisis effect is weaker when considering the gap time duration.

Next we remark that two out of the three proxies for borrower-lender proximity are significant and positive. With the exception of cases within EZ proximity, shorter geographical distance allows an increase in duration and a reduction in the intensity of renegotiation because it reduces adverse consequences of information asymmetry (Hauswald and Marquez, 2006). However, this effect is economically weak, with a positive impact of 2–4% on the probability of renegotiation. Although not significant, the coefficient for *same EZ member* is negative, meaning that this type of proximity increases the probability of renegotiation. This result could be related to the subsequent problems of EZ banks that appeared after the Credit Crisis of 2007–2009.

Regarding other variables, we remark that coefficients for initial loan terms remain similar when compared to regressions (4.1) and (4.2) in Tables 4 and 5. Regarding amendment type dummies, we observe that changes to maturity becomes weakly significant in regressions (4.1b) and (4.1c), while changes to facility and outstanding amounts are now significant in Table 7. Results for renegotiation dynamic variables are very similar to the ones previously obtained in Tables 4 and 5. Finally, while there are no changes to legal protection

proxies, we notice that variables accounting for financial development become significant and mostly positive. This last result could indicate that renegotiations are postponed when borrowers have access to more outside options for external (re)financing, especially during a credit crisis.

6 Conclusion

In an incomplete contracts framework, numerous theoretical studies show that leaving scope for debt renegotiation can enhance the efficiency of private financial contracts. Intermittent existing empirical results show that loan renegotiations occur early and frequently, mostly driven by the consequences of informational frictions between the contracting parties (Roberts and Sufi, 2009; Roberts, 2012; Nikolaev, 2013).

I investigated the determinants of debt contract renegotiation dynamics using a sample of bank loan amendments in Europe. The design and efficiency of loan contracts is of utmost importance for European companies because more complete contracts can enhance domestic private credit allocation, which is the major external source of capital in Europe. I applied an econometric technique adapted to multiple failure-time data with repeated and ordered events, which is the conditional risk-set model proposed by Prentice et al. (1981).

I found that multiple renegotiations occur for one in four loans, leading to large changes in initial contract terms. For instance, the average amended maturity increases by 25% to reach 8 years, while a typical loan facility amount gains 13%, or 155 million USD. The average and median durations between renegotiation rounds equal 20 and 12 months, respectively. However, 5 months after an amendment, a loan renegotiated four times or more has an instantaneous hazard ratio of a subsequent renegotiation close to 100%.

Multivariate regressions show that various factors influence the renegotiation dynamic, such as initial loan terms, banking pool, and amendments' characteristics, as well as

the legal and institutional environment. The complexity of the initial contract increases the duration between amendments, while a larger agent section of a syndicate slows down the renegotiation process. Also, greater borrower-lender proximity, which mitigates adverse consequences of information asymmetry at loan origination, reduces the intensity of renegotiation. Amendment types have different impacts on the duration. Changes to facility and outstanding amounts, financial covenants, and definitions increase the duration. Furthermore, amendments to loan maturity are an important driver of renegotiation dynamics as they increase the probability of subsequent amendment by 70–80%. However, complex renegotiations which involve multiple amendments to various loan terms decrease the renegotiation intensity, while more frequent amendments have naturally the opposite effect. Weak legal protection of creditors' rights increases the probability of renegotiation, as lenders have stronger incentives to acquire new information faster. Finally, bank debt contracts are renegotiated more quickly during a period of accrued uncertainty and informational frictions such as during the Global Financial Crisis.

Overall, empirical evidence from Europe shows that bank loans experience multiple renegotiation rounds, thus leading to substantial amendments to main loan terms. Frequently amended debt contracts exhibit very short durations between renegotiation rounds. Initial loan terms, banking pool features, amendment characteristics, and country legal environment have a significant impact on the renegotiation dynamic, while contract complexity, information frictions, uncertainty, and legislation play a major role in shaping bank loan contracts over time.

Appendix

Appendix A: Numerical illustration of the PWP model

To illustrate this approach, let suppose all subjects (for instance loans) have at most three observed events (amendments). *Loan* represents the identification number of a loan. *Counter* represent a renegotiation counter by loan. This counter serves for stratification purposes in the multivariate regressions. *T start* represents the $(k-1)^{th}$ recurrence time or 0 if $k = 1$. In the latter case, it corresponds to the time of issuance of the loan. *T stop* represents the k^{th} recurrence time or the time of censoring if $k = K + 1$. *Duration* represents the difference between *T stop* and *T start*. All time values are in months. The data for the three loans in the input data set are as follows:

Loan	*Counter*	*T start*	*T stop*	*Duration*
LN1	1	0	9.8	9.8
LN2	1	0	7.3	7.3
LN2	2	7.3	12.4	5.1
LN3	1	0	13.8	13.8
LN3	2	13.8	29.6	15.8
LN3	3	29.6	33.9	4.3

Loan LN1 has been renegotiated once after 9.8 months since the time of origination (entry time). Thus *Counter* for *LN1* equals 1. Here, *Duration* is equal to the duration from loan issuance until first (and last) amendment. In other words gap time and elapsed time are equal. *Loan LN2* has been renegotiated twice hence *Counter* for *LN2* equals 1 then 2. The first renegotiation occurred after 7.3 months from issuance. The second amendment occurred 5.1 months after the first one (measured by *Duration*) or 12.4 months since origination. In that case, total elapsed time equals 12.4 months, which is the sum of the durations: 7.3 and 5.1. Finally, *Loan LN3* has been amended three times. In that case *Counter* goes from 1 to 3. The first renegotiation occurred after 13.8 months since issuance, the second 15.8 months later (or 29.6 months since issuance) and the third and last one 4.3 months later (or 33.9 months since issuance). In this last case, we have three events hence three different gap and elapsed times.

Appendix B: Brief description of amendment types

Borrow amount = change to borrowed amount

Borrowing base amount = change to borrowing base amount which is the value assigned to a collection of a borrower's assets (such as accounts receivable or inventory), used by lenders to determine the initial and/or ongoing loan amount, and/or compliance with one or more debt covenants

Financial covenants = change to financial covenants which enforce minimum financial performance against the borrower (such as coverage, leverage, current ratio, tangible net worth and maximum capital expenditures)

Non-financial covenants = change to non-financial covenants which can be affirmative (state what action the borrower must take to comply with the loan) and negative (limit the borrower's activities)

Definition change = change to definition of key terms in loan agreement (for instance the definition of an accounting ratio used as a benchmark for a financial covenant, such as the equity to assets ratio)

Facility amount = change to facility amount

LOC amount = change to line of credit amount which acts as a guarantee provided by lenders to pay off debt or obligations if the borrower cannot

Loan fee = change to loan fees (such as upfront fee, commitment fee, facility fee, etc.)

Maturity change = change to loan maturity

Outstanding amount = change to loan outstanding amount

Prepay amount = change to prepay amount

Pricing grid = change to pricing grid such as altering the level of applicable margin contingent on borrower's leverage (for instance when borrower's average leverage is greater than 1.75 then the applicable margin equals Libor + 2.00 + Prime rate + 0.25 + Commitment fee + 0.50 whereas when its average leverage drops below 1.00 then the applicable margin becomes Libor + 1.25 + Prime rate + Commitment fee + 0.25)

Tranche amount = change to tranche amount

Appendix C: Variables definitions

T start = Start time (in months): (k-1)th recurrence time or 0 if k=1 (k = number of renegotiations)

T stop = Stop time (in months): kth recurrence time

Duration = Time b/w T stop and T start (in months)

Amendments by borrower = Number of amendments by borrower

Amendments by loan = Number of amendments by loan facility

Amendment types by renegotiation = Number of different amendment types by renegotiation

Amendment types by loan = Number of different amendment types by loan facility

Renegotiation / maturity = Time until first renegotiation / Loan maturity

Difference in maturity = Maturity difference after renegotiation (in years)

Difference in amounts = Difference in loan amounts after renegotiation (in %)

Facility amount = Loan facility amount (in MLN USD)

Tranche amount= Loan tranche amount (in MLN USD)

Maturity = Loan maturity (in years)

Spread = Loan spread (in bps)

Tranches = 1 if loan has multiple tranches

Syndication = 1 if loan is a syndicated or a club deal

Term loan = 1 if loan is a term loan

Secured = 1 if loan is secured

Covenants =1 if loan has covenants

Lenders = Number of lenders in the pool

Leaders = Percentage of leaders among the lenders in the pool (leaders include banks which titles include the following terms: agent, arranger, book runner, manager, and underwriter).

Same region = Percentage of lenders in the pool who are from the same region as the borrower

Same EU member = Percentage of lenders in the pool who are from the same EU country as the borrower

Same EZ member = Percentage of lenders in the pool who are from the same EZ country as the borrower

French legal origin =1 if the borrower's country has French legal origin

Creditor rights = Average creditor rights index

Corporate bonds = Corporate bonds to total bonds (%)

Private credit = Private credit to GDP (%)

Stock market = Stock market capitalization to GDP (%)

Borrower rating =1 if the borrower had a Moody's or a S&P's rating when the loan was issued (I consider LT Local Issuer Credit or Senior Unsecured Debt ratings by S&P’s or Moody’s).

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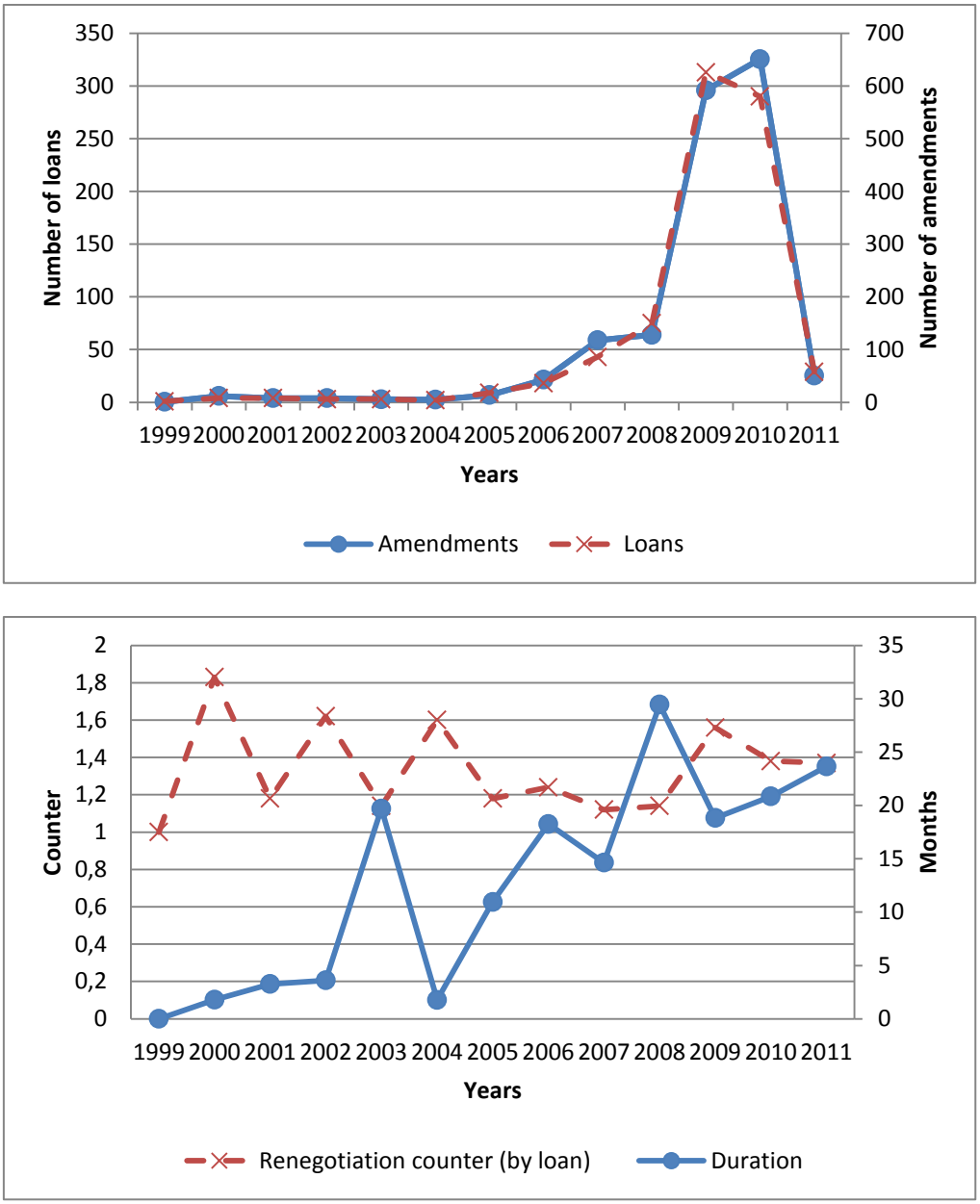

Figure 1 Loans, renegotiations, loan renegotiation intensity and duration over time
The upper figure displays the number of loans (red dashed line; left hand scale) and the number of amendments (blue plain line; right hand scale) by year (for 2011: January to June). The lower figure displays the renegotiation counter (by loan) (red dashed line; left hand scale) and the average duration between amendments (in months) (blue plain line; right hand scale) by year (for 2011: January to June).

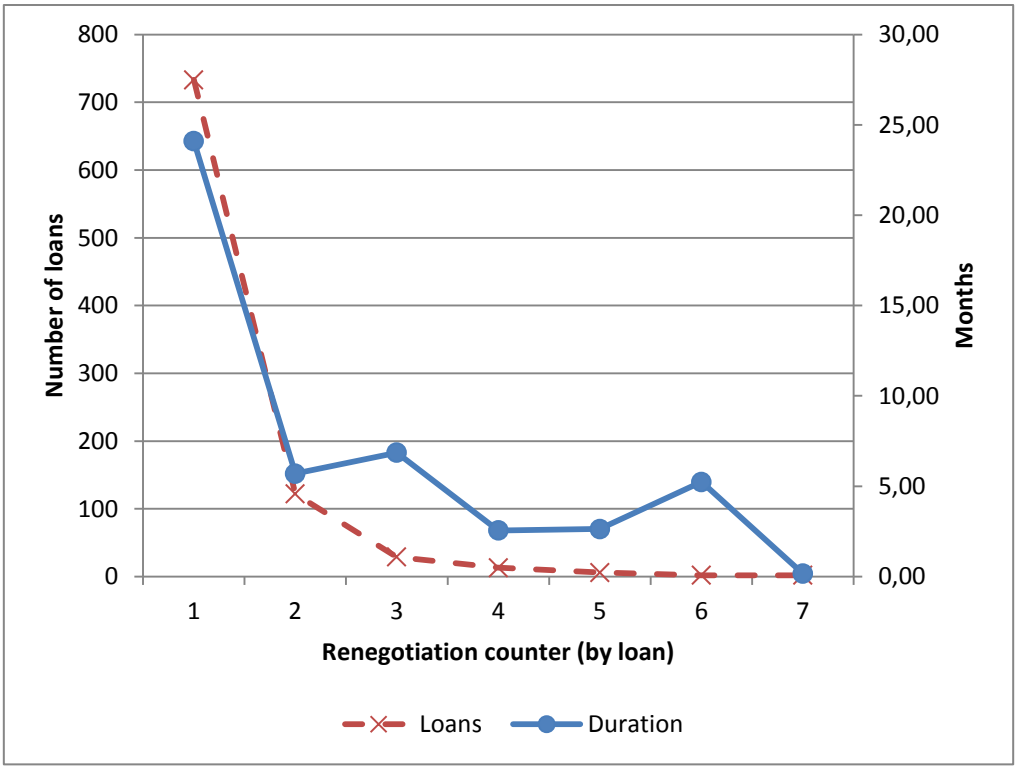

Figure 2 Loan and duration by renegotiation intensity

This figure displays the number of loans (red dashed line; left hand scale) and the average duration between amendments (blue plain line; right hand scale) by a renegotiation counter computed by loan.

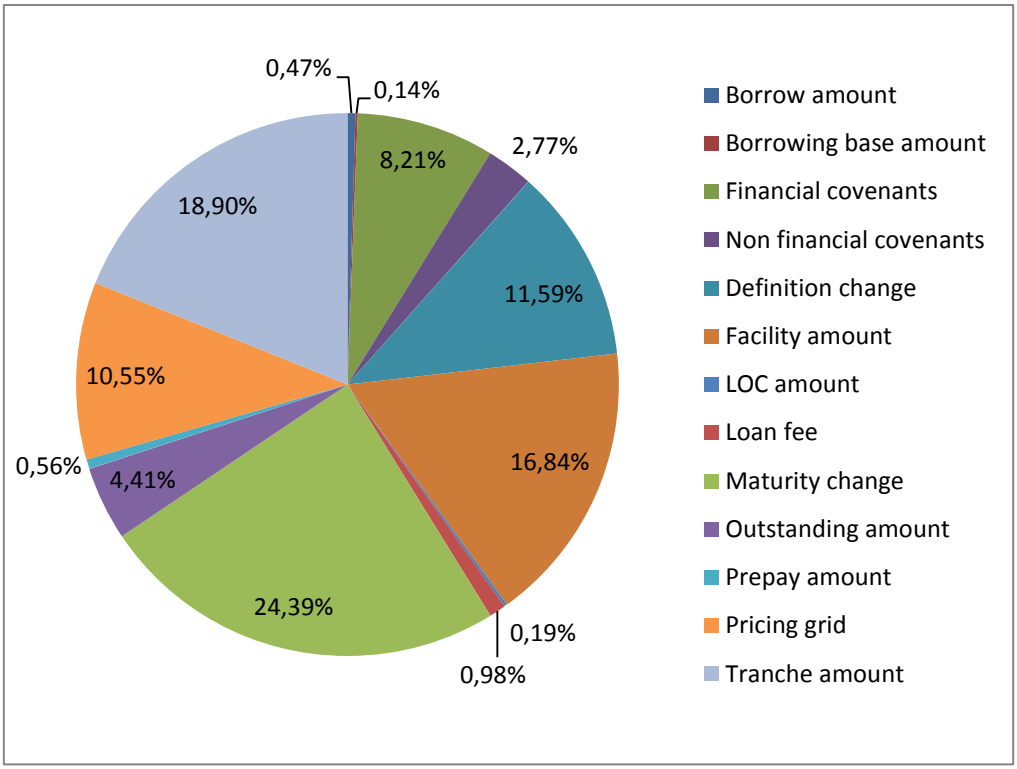

Figure 3 Breakdown of loan amendment types

This figure displays the breakdown of amendment types for all loan renegotiations. A brief description of all amendments can be found in Appendix B.

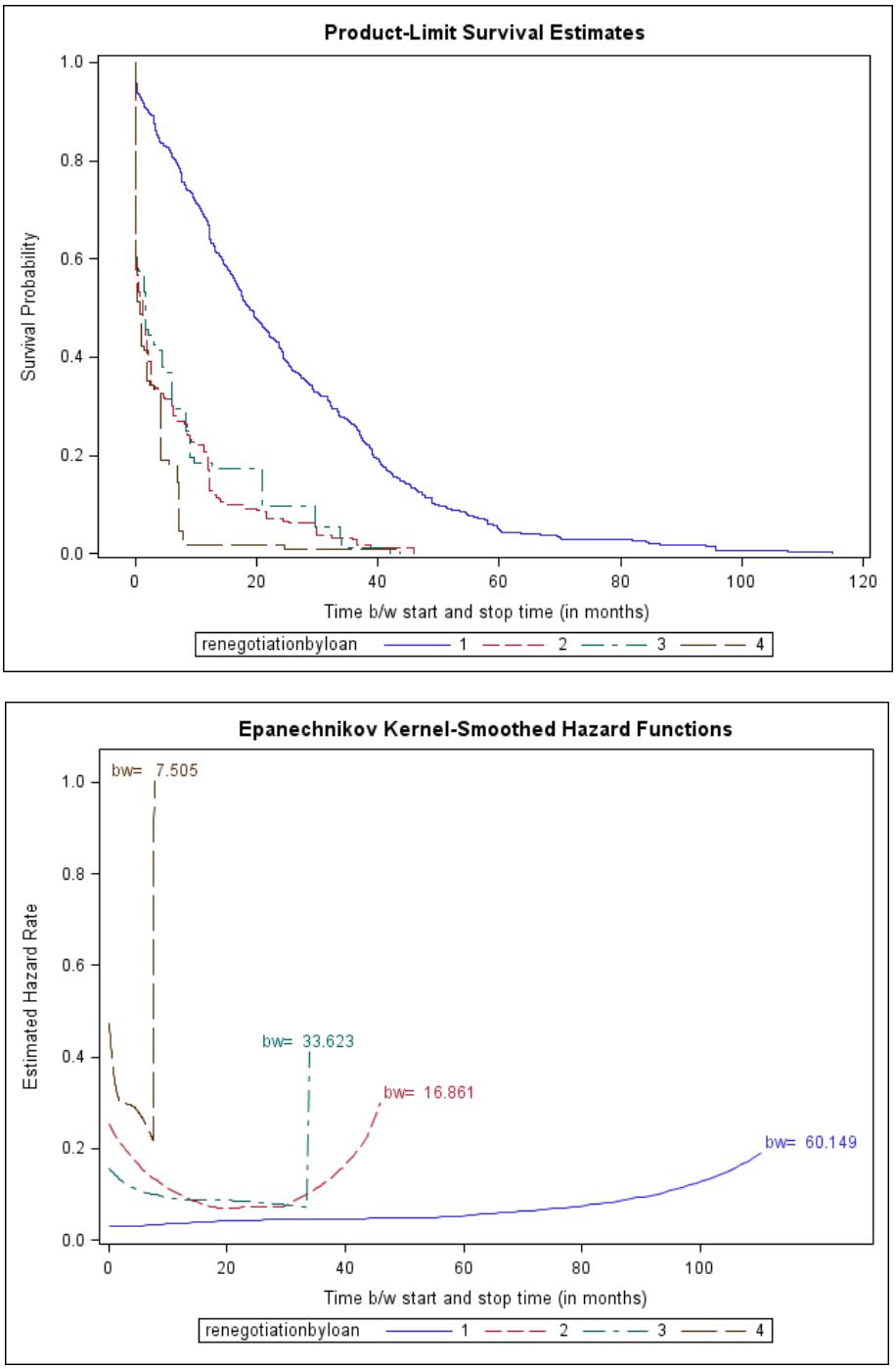

Figure 4 Survival and hazard functions for duration (in months) by strata (renegotiation counter by borrower)

This figure displays the survival (top) and hazard (bottom) functions stratified by loan renegotiation intensity (for clarity, the categories greater or equal to 4 of the initial renegotiation counter by loan have been aggregated into a single category equal to 4). Survival probability and hazard ratio are plotted against duration between amendments (in months).

Table 1 Sample composition by borrower country

This table presents the list of borrower countries in the sample and the number of firms, loans and amendments respectively. The fifth column provides the average duration between amendments in months. The last column provides the average renegotiation counter (by loan).

Country	Percentage	Number of firms	Number of loans	Number of amendments	Duration	Renegotiation counter
Austria	0.79	7	5	12	6.18	1.70
Belgium	1.55	16	16	27	34.37	1.10
Switzerland	3.02	21	26	53	22.23	1.05
Cyprus	0.36	4	4	7	14.33	1.00
Czech Republic	0.87	5	4	16	22.69	1.00
Germany	8.65	51	56	146	17.78	1.34
Danemark	0.28	4	4	5	42.15	1.00
Estonia	0.20	2	2	3	22.64	1.40
Spain	7.74	34	43	97	13.41	1.90
Finland	1.11	11	12	20	23.16	1.00
France	10.28	60	68	162	21.18	1.30
United Kingdom	33.61	237	255	557	17.82	1.29
Hungary	0.99	7	6	13	43.13	1.48
Ireland	1.98	13	15	35	25.62	2.90
Italy	3.33	26	33	58	28.37	1.23
Luxembourg	5.16	20	22	52	12.85	1.62
Latvia	0.28	3	3	5	56.63	1.14
Moldavia	0.24	1	1	3	42.46	1.00
Malta	0.16	2	2	3	20.95	1.00
Netherlands	7.82	51	58	113	18.85	1.98
Norway	2.58	18	23	41	14.46	1.81
Poland	1.47	12	19	29	22.09	1.05
Romania	0.16	2	2	3	37.44	1.00
Russia	4.64	34	52	88	16.53	1.08
Sweden	1.94	18	18	37	26.98	1.08
Slovenia	0.08	2	2	2	18.61	1.00
Turkey	0.52	5	5	8	17.71	1.23
Ukraine	0.20	3	3	5	28.43	1.00

Table 2 Descriptive statistics

This table provides descriptive statistics for all variables. Definitions are provided in Appendix C. All variables come from Bloomberg except country characteristics which come from Djankov et al. (2007) and Schaeck et al. (2012) Global Financial Development Database (World Bank).

Variable	N	Mean	Std. Dev.	Median
T start	2520	10.29	17.59	0.00
T stop	2520	29.48	20.61	25.46
Duration	2520	19.19	20.14	12.38
Amendments by borrower	2520	4.15	3.34	3.00
Amendments by loan	2520	3.37	2.71	2.00
Amendment types by renegotiation	2520	1.88	1.30	1.00
Amendment types by loan	2520	2.53	1.42	2.00
Renegotiation / maturity	2518	0.41	0.39	0.38
Difference in maturity	603	1.61	4.17	1.11
Difference in amounts	937	0.13	2.66	-0.02
Facility amount	2520	1 191.82	3 010.56	241.35
Tranche amount	2520	351.91	989.13	28.62
Maturity	2520	6.36	3.34	6.00
Spread	1260	223.59	182.72	200.00
Tranches	2520	0.74	0.44	1.00
Syndication	1946	0.83	0.38	1.00
Term loan	2520	0.45	0.50	0.00
Secured	2520	0.60	0.49	1.00
Covenants	2520	0.40	0.49	0.00
Lenders	2520	13.78	17.30	8.00
Leaders	2520	0.50	0.38	0.50
Same region	2295	0.80	0.23	0.83
Same EU member	2253	0.74	0.25	0.77
Same EZ member	2233	0.70	0.26	0.66
French legal origin	2312	0.34	0.47	0.00
Creditor rights	2312	2.58	1.37	3.00
Corporate bonds	2204	0.31	0.27	0.34
Private credit	2152	1.59	0.55	1.62
Stock market	2312	0.86	0.44	0.79
Borrower rating	2520	0.23	0.42	0.00

Table 3 Variables by duration quartiles

This table provides the means of variables by duration quartiles (respectively at 3, 12.42, and 30 months). Δ denotes amendment for a specific loan term. All variables are described in Appendix C.

	Duration (quartiles)			
Variable	**1**	**2**	**3**	**4**
Amendments by borrower	5.73	4.23	3.45	3.20
Amendments by loan	4.54	3.01	3.05	2.86
Amendment types by renegotiation	2.40	1.72	1.66	1.73
Amendment types by loan	3.21	2.35	2.28	2.27
Renegotiation / maturity	0.43	0.33	0.35	0.52
Difference in maturity	1.47	1.50	0.56	2.84
Difference in amounts	0.46	0.17	0.02	-0.05
Δ Facility amount	0.12	0.17	0.17	0.17
Δ Tranche amount	0.16	0.19	0.21	0.18
Δ Maturity	0.23	0.22	0.25	0.26
Δ Financial covenants	0.11	0.05	0.09	0.10
Δ Non financial covenants	0.06	0.02	0.01	0.03
Δ Outstanding amount	0.02	0.07	0.04	0.04
Δ Pricing grid	0.14	0.12	0.09	0.10
Δ Definition	0.14	0.15	0.11	0.09
Facility amount	1 308.90	1 300.30	1 367.10	791.04
Tranche amount	307.94	403.03	431.61	264.97
Spread	238.50	237.44	220.54	194.15
Maturity	6.13	5.56	5.97	7.81
Tranches	0.84	0.70	0.74	0.68
Syndication	0.81	0.81	0.83	0.85
Term loan	0.56	0.40	0.45	0.40
Secured	0.73	0.53	0.59	0.55
Covenants	0.48	0.43	0.30	0.39
Lenders	17.03	15.42	10.00	12.68
Leaders	0.48	0.48	0.54	0.52
Same region	0.74	0.80	0.81	0.83
Same EU member	0.70	0.74	0.74	0.78
Same EZ member	0.62	0.71	0.74	0.71
Borrower rating	0.32	0.31	0.19	0.12

Table 4 Multivariate results for PWP stratified Cox hazard rate model (elapsed time specification)
Main regressions

This table provides regression results from a PWP conditional risk set model where time is measured since loan origination date with clusters at the borrower level. Coef.: regression coefficient, HR: hazard ratio, Chi²: chi-square statistic. A positive (resp. negative) coefficient indicates that a covariate increases (resp. decreases) duration between origination and subsequent amendment dates. A hazard ratio greater (resp. lower) than 1 indicates that a covariate decreases (respectively increases) the instantaneous probability of a loan renegotiation. ***, **, and * denotes coefficients that are statistically significant at the 1%, 5%, and 10% level. Δ denotes amendment for a specific loan term. All variables are described in Appendix C. N. obs.: number of observations, LL: log likelihood, AIC: Akaike information criteria. Sample size varies due to data availability for specific covariates. Control variables for loan purpose, borrower industry sector and main loan currencies included but not reported.

	(1.1)			**(2.1)**			**(3.1)**			**(4.1)**		
Variable	**Coef.**	**HR**	**Chi²**	**Coef.**	**HR**	**Chi²**	**Coef.**	**HR**	**Chi²**	**Coef.**	**HR**	**Chi²**
Facility amount	-0.075	0.93	1.24	-0.086	0.92	1.65	-0.028	0.97	0,27	-0,103	0,90	1,20
Maturity	-0.155	0.86	1.84	-0.145	0.87	1.31	-1.490	0.23	17.79***	-1.733	0.18	18.88***
Secured	0.418	1.52	1.12	0.196	1.22	0.31	1.241	3.46	2.91*	0.559	1.75	0.66
Covenants	-0.491	0.61	0.84	-0.652	0.52	1.77	-1.931	0.15	7.96***	-1.205	0.30	2.12
Term loan	0.555	1.74	1.25	0.469	1.60	0.96	0.580	1.79	1.26	0.958	2.61	1.94
Syndication	-2.638	0.07	6.78***	-2.965	0.05	8.35***	-3.434	0.03	4.89**	-3.099	0.05	2.85*
Tranches	0.603	1.83	0.86	0.692	2.00	1.26	-1.105	0.33	2.27	-1.893	0.15	2.24
Lenders	0.014	1.01	0.84	0.006	1.01	0.19	0.014	1.01	0.60	-0.009	0.99	0.28
Leaders	3.166	23.72	8.32***	3.082	21.80	7.88***	2.784	16.19	2.78*	3.099	22.17	1.73
Borrower rating	1.218	3.38	1.97	1.166	3.21	1.44	0.733	2.08	0.22	2.169	8.75	0.87
Δ Facility amount				2.003	7.41	4.27**	2.365	10.64	4.84**	0.271	1.31	0.07
Δ Tranche amount				0.244	1.28	0.11	0.296	1.35	0.41	0.732	2.08	2.59
Δ Maturity				-0.179	0.84	0.08	-0.232	0.79	0.19	-0.166	0.85	0.20
Δ Financial covenants				0.873	2.40	1.72	0.887	2.43	2.83*	0.551	1.74	1.57
Δ Non financial covenants				0.617	1.85	0.74	-0.534	0.59	0.06	0.975	2.65	1.46
Δ Outstanding amount				0.420	1.52	0.31	2.006	7.43	10.12***	1.775	5.90	4.29**
Δ Pricing grid				0.714	2.04	1.48	0.275	1.32	0.52	0.426	1.53	1.04
Δ Definition				1.225	3.41	3.83*	1.128	3.09	4.51**	1.001	2.72	2.96*

Table 5 Continued

Amendment types by loan			0.980	2.67	14.69***	1.084	2.96	11.44***
Amendments by borrower			-0.199	0.82	2.76*	-0.177	0.84	1.34
Renegotiation / Maturity			-17.175	0.00	16.39***	-21.876	0.00	21.59***
Creditor rights						0.744	2.11	1.33
French legal origin						2.402	11.05	3.64*
Private credit						0.001	1.00	0.04
Corporate bonds						0.023	1.02	2.27
Stock market						0.000	1.00	0.00
N. obs.	1960	1959		1958			1641	
LL	-523.30	-512.34		-441.51			-357.11	
AIC	1146.61	1140.69		1005.02			818.23	

Table 5 Multivariate results for PWP stratified Cox hazard rate model (gap time specification)
Main regressions

This table provides regression results from a PWP conditional risk set model where time is measured since previous renegotiation date with clusters at the borrower level. Coef.: regression coefficient, HR: hazard ratio, Chi²: chi-square statistic. A positive (resp. negative) coefficient indicates that a covariate increases (resp. decreases) duration between subsequent amendment dates. A hazard ratio greater (resp. lower) than 1 indicates that a covariate decreases (respectively increases) the instantaneous probability of a loan renegotiation. ***, **, and * denotes coefficients that are statistically significant at the 1%, 5%, and 10% level. Δ denotes amendment for a specific loan term such as Facility amount or Financial covenants. All variables are described in Appendix C. N. obs.: number of observations, LL: log likelihood, AIC: Akaike information criteria. Sample size varies due to data availability for specific covariates. Control variables for loan purpose, borrower industry sector and main loan currencies included but not reported.

	(1.2)			(2.2)			(3.2)			(4.2)		
Variable	**Coef.**	**HR**	**Chi²**	**Coef.**	**HR**	**Chi²**	**Coef.**	**HR**	**Chi²**	**Coef.**	**HR**	**Chi²**
Facility amount	-0.214	0.81	12.56***	-0.205	0.82	11.34***	-0.111	0.90	1.62	-0.091	0.91	1.21
Maturity	-0.161	0.85	2.53	-0.142	0.87	2.12	-0.642	0.53	4.37**	-0.808	0.45	4.69**
Secured	0.459	1.58	0.78	0.315	1.37	0.40	0.830	2.29	0.99	1.660	5.26	2.01
Covenants	-0.175	0.84	0.08	-0.349	0.71	0.33	-1.052	0.35	2.26	-1.302	0.27	1.74
Term loan	0.671	1.96	2.51	0.740	2.10	2.74*	0.768	2.16	3.36*	1.205	3.34	4.68**
Syndication	-2.391	0.09	10.82***	-3.085	0.05	19.31***	-3.590	0.03	14.49***	-3.313	0.04	2.09
Tranches	1.091	2.98	3.35*	1.123	3.07	2.93*	0.306	1.36	0.38	0.326	1.39	0.18
Lenders	0.012	1.01	0.38	0.010	1.01	0.39	0.005	1.01	0.09	0.009	1.01	0.17
Leaders	2.630	13.88	7.45***	3.036	20.81	9.15***	1.932	6.90	2.65	3.355	28.64	1.71
Borrower rating	0.692	2.00	1.05	0.414	1.51	0.34	-0.168	0.85	0.05	0.823	2.28	0.25
Δ Facility amount				0.441	1.56	0.15	0.992	2.70	0.84	-1.082	0.34	1.13
Δ Tranche amount				-1.084	0.34	2.17	-1.084	0.34	1.83	-0.895	0.41	1.45
Δ Maturity				-1.217	0.30	5.93**	-1.668	0.19	6.53**	-1.385	0.25	5.31**
Δ Financial covenants				-0.453	0.64	0.35	-0.628	0.53	0.43	-0.745	0.48	0.63
Δ Non financial covenants				-0.906	0.40	1.25	-1.480	0.23	1.69	-0.785	0.46	0.70
Δ Outstanding amount				-1.165	0.31	1.65	-0.376	0.69	0.07	-1.212	0.30	1.69
Δ Pricing grid				-0.017	0.98	0.00	-0.324	0.72	0.14	-0.313	0.73	0.21
Δ Definition				0.064	1.07	0.01	-0.126	0.88	0.03	0.029	1.03	0.00

Table 5 Continued

Amendment types by loan			1.054	2.87	8.51***	0.946	2.58	4.71**
Amendments by borrower			-0.236	0.79	3.87**	-0.074	0.93	0.22
Renegotiation / Maturity			-6.368	0.00	3.92**	-7.537	0.00	3.27*
Creditor rights						0.186	1.20	0.27
French legal origin						2.405	11.08	4.58**
Private credit						0.004	1.00	0.49
Corporate bonds						-0.011	0.99	0.27
Stock market						-0.006	0.99	0.59
N. obs.	1960	1959		1958			1641	
LL	-720.36	-707.07		-669.68			-567.55	
AIC	1540.73	1530.14		1461.37			1239.10	

Table 6 Multivariate results for PWP stratified Cox hazard rate model (elapsed time specification)
Crisis and lenders' origin effects

This table provides regression results from a PWP conditional risk set model where time is measured since loan origination date with clusters at the borrower level. Coef.: regression coefficient, HR: hazard ratio, Chi²: chi-square statistic. A positive (resp. negative) coefficient indicates that a covariate increases (resp. decreases) duration between origination and subsequent amendment dates. A hazard ratio greater (resp. lower) than 1 indicates that a covariate decreases (respectively increases) the instantaneous probability of a loan renegotiation. ***, **, and * denotes coefficients that are statistically significant at the 1%, 5%, and 10% level. Δ denotes amendment for a specific loan. All variables are described in Appendix C. Crisis is a dummy equal to 1 if the renegotiation occurs after September 2008. N. obs.: number of observations, LL: log likelihood, AIC: Akaike information criteria. Sample size varies due to data availability for specific covariates. Control variables for loan purpose, borrower industry sector and main loan currencies included but not reported.

	(4.1a)			(4.1b)			(4.1c)			(4.1d)		
Variable	**Coef.**	**HR**	**Chi²**	**Coef.**	**HR**	**Chi²**	**Coef.**	**HR**	**Chi²**	**Coef.**	**HR**	**Chi²**
Facility amount	-0.188	0.83	2.36	-0.112	0.89	0.90	-0.114	0.89	1.00	-0.364	0.70	1.55
Maturity	-1.376	0.25	18.17***	-1.430	0.24	17.70***	-1.408	0.25	14.86***	-1.461	0.23	18.41***
Secured	0.734	2.08	1.54	1.175	3.24	2.73*	1.103	3.01	2.46	0.866	2.38	2.04
Covenants	-1.159	0.31	0.64	-1.009	0.37	0.97	-0.941	0.39	0.94	-3.764	0.02	4.53**
Term loan	0.559	1.75	0.67	1.027	2.79	2.45	1.011	2.75	2.31	-0.099	0.91	0.05
Syndication	-2.449	0.09	5.37**	-2.452	0.09	3.04*	-2.249	0.11	1.78	-2.143	0.12	0.40
Tranches	0.464	1.59	0.33	-0.216	0.81	0.09	-0.187	0.83	0.05	0.767	2.15	0.47
Lenders	0.016	1.02	0.99	0.020	1.02	1.06	0.020	1.02	1.04	0.021	1.02	0.49
Leaders	2.871	17.65	3.77*	3.867	47.80	4.69**	3.810	45.15	3.41*	1.013	2.75	0.25
Crisis	-3.853	0.02	11.22***	-5.180	0.01	6.27**	-5.035	0.01	4.74**	-3.946	0.02	4.83**
Same region				0.021	1.02	3.26*						
Same EU member							0.021	1.02	2.71*			
Same EZ member										-0.038	0.96	1.48
Borrower rating	0.338	1.40	0.02	0.653	1.92	0.15	0.652	1.92	0.15	1.240	3.45	0.59
Δ Facility amount	0.637	1.89	1.31	-0.921	0.40	0.72	-0.787	0.46	0.58	1.565	4.78	5.92**
Δ Tranche amount	0.373	1.45	0.70	0.115	1.12	0.08	0.167	1.18	0.17	0.884	2.42	4.49**
Δ Maturity	-0.061	0.94	0.02	-0.452	0.64	3.51*	-0.434	0.65	2.98*	-0.207	0.81	0.60
Δ Financial covenants	0.368	1.45	0.79	0.026	1.03	0.02	0.032	1.03	0.02	0.090	1.09	0.13
Δ Non financial covenants	0.663	1.94	1.02	0.959	2.61	1.53	1.011	2.75	1.62	0.808	2.24	1.03
Δ Outstanding amount	2.209	9.11	3.64*	1.659	5.25	3.25*	1.720	5.58	4.01**	4.867	129.96	16.63***

Table 6 Continued

Δ Pricing grid	0.023	1.02	0.00	-0.289	0.75	0.77	-0.216	0.81	0.46	0.211	1.24	0.39
Δ Definition	0.850	2.34	2.41	0.656	1.93	1.78	0.715	2.04	2.11	0.760	2.14	2.73*
Amendment types by loan	0.792	2.21	11.56***	0.783	2.19	11.28***	0.735	2.09	9.73***	0.853	2.35	3.17*
Amendments by borrower	-0.092	0.91	0.18	-0.140	0.87	0.80	-0.152	0.86	0.96	-0.185	0.83	0.73
Renegotiation / Maturity	-16.184	0.00	12.42***	-16.313	0.00	13.64***	-16.073	0.00	12.49***	-18.640	0.00	11.82***
Creditor rights	-0.171	0.84	0.22	0.175	1.19	0.16	0.197	1.22	0.21	-0.814	0.44	1.94
French legal origin	1.524	4.59	2.84*	2.497	12.15	5.11**	2.537	12.64	5.42**	3.510	33.44	2.80*
Private credit	0.007	1.01	2.72*	0.007	1.01	4.56**	0.007	1.01	4.13**	0.020	1.02	12.56***
Corporate bonds	0.007	1.01	0.24	0.026	1.03	2.99*	0.024	1.03	2.56	-0.034	0.97	1.72
Stock market	0.010	1.01	2.66	0.024	1.02	6.70***	0.024	1.02	7.43***	0.027	1.03	6.93***
N. obs.		1639			1523			1505			1462	
LL		-370.38			-338.55			-336.85			-298.98	
AIC		830.77			769.10			765.71			689.97	

Table 7 Multivariate results for PWP stratified Cox hazard rate model (gap time specification)
Crisis and lenders' origin effects

This table provides regression results from a PWP conditional risk set model where time is measured since previous renegotiation date with clusters at the borrower level. Coef.: regression coefficient, HR: hazard ratio, Chi²: chi-square statistic. A positive (resp. negative) coefficient indicates that a covariate increases (resp. decreases) duration between subsequent amendment dates. A hazard ratio greater (resp. lower) than 1 indicates that a covariate decreases (respectively increases) the instantaneous probability of a loan renegotiation. ***, **, and * denotes coefficients that are statistically significant at the 1%, 5%, and 10% level. Δ denotes amendment for a specific loan term. All variables are described in Appendix C. Crisis is a dummy equal to 1 if the renegotiation occurs after September 2008. N. obs.: number of observations, LL: log likelihood, AIC: Akaike information criteria. Sample size varies due to data availability for specific covariates. Control variables for loan purpose, borrower industry sector and main loan currencies included but not reported.

	(4.2a)			(4.2b)			(4.2c)			(4.2d)		
Variable	**Coef.**	**HR**	**Chi²**	**Coef.**	**HR**	**Chi²**	**Coef.**	**HR**	**Chi²**	**Coef.**	**HR**	**Chi²**
Facility amount	-0.198	0.82	2.37	-0.197	0.82	1.80	-0.213	0.81	6.37**	-0.265	0.77	2.42
Maturity	-0.647	0.52	9.52***	-0.613	0.54	8.65***	-0.519	0.60	6.43**	-0.650	0.52	5.18**
Secured	1.002	2.73	2.49	0.986	2.68	1.81	0.512	1.67	1.00	1.072	2.92	2.57
Covenants	-0.818	0.44	1.33	-0.713	0.49	1.00	-1.106	0.33	2.97*	-3.041	0.05	5.65**
Term loan	1.251	3.49	5.48**	2.152	8.60	17.54***	2.432	11.38	12.08***	0.992	2.70	1.08
Syndication	-2.265	0.10	2.08	-2.700	0.07	4.78**	-1.339	0.26	1.25	-3.883	0.02	3.33*
Tranches	0.512	1.67	0.45	0.520	1.68	0.35	1.466	4.33	3.42*	0.698	2.01	0.42
Lenders	0.019	1.02	1.35	0.033	1.03	3.28*	0.032	1.03	3.20*	0.017	1.02	0.18
Leaders	2.653	14.19	2.31	2.567	13.03	3.35*	0.978	2.66	0.85	0.483	1.62	0.11
Crisis	-2.962	0.05	6.10**	-2.512	0.08	2.58	-1.666	0.19	1.84	-3.274	0.04	2.82*
Same region				0.038	1.04	7.91***						
Same EU member							0.020	1.02	3.00*			
Same EZ member										-0.034	0.97	0.82
Borrower rating	0.275	1.32	0.04	0.203	1.23	0.03	0.423	1.53	0.13	2.187	8.91	1.77
Δ Facility amount	-2.126	0.12	9.15***	-3.196	0.04	9.36***	-2.247	0.11	7.34***	-1.573	0.21	1.70
Δ Tranche amount	-1.020	0.36	2.35	-1.661	0.19	2.85*	-1.114	0.33	1.71	-1.329	0.27	1.13
Δ Maturity	-1.605	0.20	6.34**	-1.824	0.16	3.97**	-1.438	0.24	4.45**	-1.711	0.18	2.60
Δ Financial covenants	-0.963	0.38	1.24	-1.220	0.30	1.58	-1.182	0.31	1.94	-1.706	0.18	1.71
Δ Non financial covenants	-1.000	0.37	1.25	-0.734	0.48	0.43	-0.557	0.57	0.30	-1.594	0.20	1.02

Table 7 Continued

Δ Outstanding amount	-1.222	0.30	1.82	-2.290	0.10	3.78*	-2.169	0.11	4.32**	-1.649	0.19	1.07
Δ Pricing grid	-0.429	0.65	0.50	-0.797	0.45	0.81	-0.357	0.70	0.25	-0.676	0.51	0.30
Δ Definition	-0.029	0.97	0.00	-0.066	0.94	0.01	0.148	1.16	0.04	-0.613	0.54	0.20
Amendment types by loan	0.555	1.74	6.17**	0.589	1.80	4.52**	0.552	1.74	4.51**	0.827	2.29	2.04
Amendments by borrower	-0.172	0.84	1.30	-0.244	0.78	2.62	-0.290	0.75	4.18**	-0.442	0.64	3.92**
Renegotiation / Maturity	-6.104	0.00	9.11***	-5.964	0.00	7.23***	-6.416	0.00	8.70***	-10.001	0.00	7.24***
Creditor rights	0.014	1.02	0.00	-0.027	0.97	0.01	0.180	1.20	0.79	-0.056	0.95	0.01
French legal origin	2.316	10.13	4.10**	2.904	18.25	5.45**	3.969	52.93	6.33**	6.655	776.38	11.61***
Private credit	0.009	1.01	3.22*	0.012	1.01	6.46**	0.008	1.01	3.60*	0.017	1.02	8.77***
Corporate bonds	-0.031	0.97	3.34*	-0.029	0.97	2.52	-0.032	0.97	1.25	-0.091	0.91	12.35***
Stock market	-0.005	1.00	0.41	0.004	1.00	0.34	0.007	1.01	1.08	0.009	1.01	0.51
N. obs.		1639			1523			1505			1462	
LL		-576.51			-521.02			-501.70			-422.36	
AIC		1243.01			1134.03			1095.40			936.72	