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Firm Life Cycle and Cost of Debt*

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Abstract

This paper examines the relation between the corporate life cycle and lending spreads. Using a sample of 20,307 firm-loan observations spanning 5,076 publicly traded U.S. firms, we find that lending spreads follow a U-shape pattern across the life cycle phases. This pattern is in addition to the variation explained by typical controls. In a multivariate analysis, we find that firms in the introduction and decline phases pay lending spreads that are greater than firms in the mature phase (differences of 6 percent and 12 percent, respectively). We explore omitted variables bias and instrumental variable estimation in robustness testing and find that the U-shape pattern persists. Our findings are consistent with theoretical predictions regarding the relationship between the corporate life cycle and various lending risks.

Keywords: Firm life cycle; cost of debt; bank loans; risk.
JEL Classification: G32, M21

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I. INTRODUCTION

Accounting information is commonly used to assess and price lending risks. This is because accounting disclosures provide valuable information regarding business diversification, customer concentration, and the overall information environment, all of which aid lenders in assessing risks and pricing lending spreads (Franco, Urcan, and Vasvari 2016; Campello and Gao 2017; Francis, Hunter, Robinson, Robinson, and Yuan 2017). This study examines whether accounting proxies for firms' life cycles convey incremental information regarding lending risks and, ultimately, whether these risks affect lending spreads according to theoretical predictions.

Given the "common wisdom" that a firm's life cycle station is linked to external financing (Rajan and Zingales 1998), it is surprising that the nature of the relationship between a firm's life cycle station and lending risk is not well studied.[1] On one hand, life cycle measures may inform users regarding risks that are priced into lending spreads. Measures of credit risk, such as those used in predicting spreads, may not adequately capture the overall effects of firm life cycle in empirical models (Dickinson 2011). In addition to credit risk, lending spreads include compensation for systematic risk and non-diversifiable idiosyncratic risk (Amiram, Kalay, and Sadka 2017). Theory suggests that these risks vary with the corporate life cycle (Chowdhury and Chowdhury 2001; Gao 2019).

On the other hand, firm life cycle measures may fail to provide additional information that is relevant to the pricing of lending spreads. Accounting-based measures of the corporate life cycle may not provide significant information regarding lending spreads after considering standard financial controls such as size, leverage, market-to-book ratios, and profitability. Even if the corporate life cycle informs lending spreads beyond that of existing *accounting* measures, other external measures, such as credit ratings, may already capture such incremental information. Finally, prior research indicates that inefficiencies do exist in equity markets with respect to life cycle phases (Dickinson 2011; Vorst and Yohn 2018). Because lending spreads are a product of markets, it is possible that spreads fail to price risks regarding the corporate life cycle.

We conduct our analysis using a sample of 20,307 firm-loan observations. This sample includes 5,076 unique publicly traded U.S. firms and spans the period from 1988 to 2018. As plotted in Figure 1, univariate statistics indicate that loan spreads do follow a distinct U-shape

[1] We use the terms station and stage interchangeably when identifying a firm's location within its life cycle in general terms. We reserve the term phase for referencing the specific life cycle categorizes of Gort and Klepper (1982) and Dickinson (2011): introduction, growth, mature, shake-out, and decline.

pattern across life cycle phases. In Figure 2, we plot the variation in lending spreads across life cycle phases as predicted by a multivariate analysis. The U-shape pattern persists. For context regarding the economic significance of our findings, we find that firms in the introduction phase (decline phase) may expect to pay lending spreads that are 6 percent (12 percent) higher than firms in the mature phase. As a reference for economic significance, we note that Campello and Gao (2017) find that a one standard deviation increase in customer concentration is associated with a 6 percent increase in loan spreads. Ertugrul, Lei, Qiu, and Wan (2017) find that a one standard deviation increase in the natural log of 10-K file size is associated with a 9.73 percent increase in lending spreads.

Because the distribution of firm and loan characteristics may vary with life cycle, there is concern that our results may be an artifact of our sample composition. We address this concern by entropy balancing the sample between life cycle phases (Hainmueller 2012). Specifically, we divide our sample into four subsamples, each consisting of two "neighboring" life cycle phases (e.g., introduction and growth).[2] The U-shape trend of interest spreads and the overall economic significance remains comparable with the results from our non-balanced multivariate analysis.

Although a firm's life cycle station is arguably exogenous to the pricing of its debt, we recognize that the empirical design raises endogeneity concerns. To avoid simultaneity issues, we lag firm-level independent variables in all specifications. This more accurately depicts the firm characteristics observed by lenders when setting terms and prevents the lending decision *itself* from contaminating right-hand-side-variables.[3] We further address concerns of endogeneity and confounding variables in two ways. First, we calculate the impact threshold of a confounding variable (ITCV). This provides insight into how sensitive the results may be to omitted variables that we fail to consider. Second, we conduct an instrumental variable analysis using industry-level growth shocks. Results of both analyses alleviate endogeneity concerns and are consistent with our initial findings.

To further exclude alternative explanations, we conduct several additional robustness tests. First, we include industry-period fixed effects, which account for unobserved time-variant industry heterogeneity. These results are primarily dependent upon *between-firm* variations of firm life cycle. Next, we include firm fixed effects, which account for time-invariant unobserved

[2] We note that firms are not required to progress through phases sequentially (Miller and Friesen 1984). Nonetheless, we believe that these "neighbor" comparisons are informative to understanding differences across life cycle stations.
[3] The issuance of a loan has a mechanical relationship with cash from financing, and, therefore, empirical measures of firm life cycle.

firm heterogeneity. These results are dependent upon *within-firm* variation of firm life cycle. Our results are largely consistent with the primary analysis. Combined, these analyses exclude several alternative explanations that depend upon either uncontrolled changes in the macro environment or uncontrolled differences between firms.

Next, we introduce additional empirical measures that could subsume the effects of firm life cycle. The interest rate spread on private loans includes premiums to compensate for expected loan loss, systematic risk, and non-diversifiable idiosyncratic risk (Amiram et al. 2017). We introduce measures of loss given default, probability of covenant violation, and debt beta. Our results remain largely unchanged. In our final analysis, we use lending terms other than pricing (i.e., the use of collateral and loan durations) as substitute measures for lending spreads. The results provide additional evidence supporting our findings regarding the corporate life cycle.

This study contributes to a number of streams of research. There is a range of research on corporate life cycle and capital markets. Challenges and opportunities differ substantially across life cycle stations (Jawahar and McLaughlin 2001). We find that a firm's life cycle explains differences in lending spreads, a function not only of the risk of loan loss, but also of systematic and non-diversifiable idiosyncratic risk. By using the private debt market, our setting allows for more heterogeneity across our sample (Francis et al. 2017).These findings also speak to the broader literature linking accounting information with debt contracting (Ball, Robin, and Sadka 2008; Christensen, Nikolaev, and Wittenberg-Moerman 2016).

Beyond the literature on firm life cycle, our findings make specific contributions to research on private debt markets. Empirical work shows that systematic risk plays an important role in determining interest rate spreads (Iannotta, Pennacchi, and Santos 2019). Theory shows that moral hazard, which fluctuates with firm life cycle, impedes the sharing of idiosyncratic risk (Chowdhury and Chowdhury 2001; Gao 2019). Our results buttress these ideas and indicate that the corporate life cycle explains variation in spreads beyond that explained by traditional spread determinants.

The remainder of this paper is organized as follows: Section II reviews the related literature and develops our hypothesis; Section III describes our research design and our sample; Section IV presents our primary findings; Section V contains additional tests of robustness; and Section VI concludes.

II. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Literature Review

As firms age, they traverse a corporate life cycle. This life cycle may be segmented into various phases: introduction, growth, mature, shake-out, and decline (Gort and Klepper 1982). Early work indicates that a firm's strategy, structure, and environment all vary according to its life cycle station (Miller and Friesen 1984). Using survey data and field studies, Moores and Yuen (2001) show that a firm's life cycle stage has implications that extend to the configuration of its accounting systems. DeAngelo, DeAngelo, and Stulz (2010) show how the corporate life cycle can explain firms' interactions with equity markets. Despite the structural differences across life cycle stations, empirical identification can be challenging.

DeAngelo, DeAngelo, and Stulz (2006) suggest that firms with proportionately low (high) levels of retained earnings are less (more) mature and more dependent on (independent of) external financing. The authors argue that the ratio of retained earnings to total assets and the ratio of retained earnings to total equity are "logical prox(ies) for the life cycle stage at which a firm currently finds itself" (DeAngelo et al. 2006). Not only is linking external financing to the corporate life cycle intuitive, prior literature shows that the disaggregation of cash flows between its operating, financing, and investing components does provide additional information (Livnat and Zarowin 1990). Dickinson (2011) takes this one-step further by providing a parsimonious measure that maps firms to the various life cycle phases based upon their performance across the various components of the statement of cash flows.

Theory provides many empirically testable predictions regarding the consequence of a firm's life cycle station. Evidence indicates that firms' accounting information should be interpreted in light of their life cycle stations (Anthony and Ramesh 1992; Hribar and Yehuda 2015). Because a firm's life cycle phase is informative with respect to future profits, it is logical that a firm's life cycle also affects the pricing of its accruals (Cantrell and Dickinson 2020; Vorst and Yohn 2018; Dickinson 2011; Hribar and Yehuda 2015). Dickinson, Kassa, and Schaberl (2018) show that investors rely more heavily on traditional accounting measures when firms are in the introduction or decline phases and that their attention shifts more to analyst forecasts when firms are growing or mature. Research indicates that companies adjust their disclosure practices and real business activities according to their life cycle station (Chen, DeFond, and Park 2002; Cohen, Mashruwala, and Zach 2010).

Hypothesis Development

Prior literature studies the relationship between accounting information and lending. For example, high quality financial reporting may better enable lenders to assess a firm's diversification and riskiness (Franco et al. 2016; Campello and Gao 2017). Financial statement comparability may reduce information asymmetries between borrowers and lenders (Fang, Li, Xin, and Zhang 2016). The proprietary costs of information may affect the structure and demand for bank lending (Cheng 2017). A borrower's change in auditor may signify information risk that lenders ultimately price into their contracts (Francis et al. 2017).

Our interest centers on the informativeness of a firm's life cycle station with respect to lending spreads. Agarwal and Gort (2002) develop a model showing that the probability of a firm's survival is inherently linked to its life cycle station. Empirical evidence also supports the predictive abilities of firm life cycle with respect to future firm performance (Dickinson 2011; Cantrell and Dickinson 2020; Vorst and Yohn 2018). In addition, theory recognizes that debt overhang and moral hazard problems are also intertwined with firms' life cycle station (Jensen and Meckling 1976; Diamond 1989; Chowdhury and Chowdhury 2001). Managerial risk taking appears to be consistent with these predictions (Habib and Hasan 2017). If a firm's survival and the probability of loan loss are functions of a firm's life cycle, then it follows that loan spreads should reflect such risks.

The changes in loan spreads across life cycle phases are not necessarily monotonic. Liquidation values and moral hazard problems follow a U-shape over firms' life cycles (Gort and Klepper 1982; Arikan and Stulz 2016). The debt overhang problem increases as firms face higher default risks and greater financial constraints (Cai and Zhang 2011). Asset substitution and information asymmetry problems result from uncertain and volatile cash flows.[4] Because growth and mature firms have more predictable earnings, these problems (and therefore credit spreads) are predicted to be lower in the growth and mature phases relative to the introduction, shake-out, and decline life cycle phases (Lang 1991). Growth and mature firms may also accumulate a greater analyst following, which increases monitoring and further reduces information asymmetry (Barth, Kasznik, and McNichols 2001). Given these findings, we expect the risk of loss to lenders to be relatively high in the introduction phase, to attenuate through the growth and mature phases, and to increase again in the shake-out and decline phases. Accordingly, we expect credit spreads to follow a U-shape pattern across these life cycle phases.

[4] See Jensen and Meckling (1976), Stiglitz and Weiss (1981), Myers and Majluf (1984), and Diamond (1989).

For alternative empirical measures of the corporate life cycle (e.g. DeAngelo et al. 2010), we expect lending spreads to be negatively related with debt maturity.

In addition to expected loan loss, the interest rate spread on private loans includes premiums to compensate for systematic risk and non-diversifiable idiosyncratic risk (Amiram et al. 2017). Less mature firms have higher uncertainty about future profitability and cash flow and thus experience higher idiosyncratic return volatility (Pástor and Veronesi 2003). Similarly, we expect shake-out and decline firms to have greater uncertainty as well. Because moral hazard obstructs the diversification of idiosyncratic risks, this reinforces the U-shape hypothesis discussed above (Gao 2019). Furthermore, the statistics from Dickinson (2011) provide evidence that systematic risks also follow a U-shape across the firm life cycle.[5]

Despite the predicted U-shape pattern between firm life cycle and lending spreads, it remains unclear whether such a relation would extend beyond that explained by common financial controls. Effective bankruptcy prediction models may be constructed using just a few financial measures (Beaver, McNichols, and Rhie 2005). Banks may be able to mitigate differences in moral hazard via monitoring. For example, evidence shows that bank monitoring can compensate, in part, for weaknesses in firms' information environment (Dhaliwal, Hogan, Trezevant, and Wilkins 2011). Even if uncontrolled differences in risk exist across firms' life cycles, markets may not fully account for differences between life cycle phases (Dickinson 2011; Cantrell and Dickinson 2020; Vorst and Yohn 2018). Lenders are not always compensated for differences in systematic risk (Marques and Pinto 2020). For these reasons, we state our formal hypothesis in the null form.

H1: Lending spreads are not associated with firm life cycle.

III. RESEARCH DESIGN AND SAMPLE CONSTRUCTION

Research Design

To explore the relation between a firm's cost of debt and its life cycle station, we follow prior literature in specifying the following model:[6]

$$SPREAD_{it} = f\left(LIFE\ CYCLE\ STAGE_{i,t-1}, FIRM\ CONTROLS_{i,t-1}, LOAN\ CONTROLS_{it}\right) \quad (1)$$

for all firms i and quarters t. We cluster standard errors at the firm level.

Measure of loan spread

[5] See the descriptive statistics for Dickinson's (2011) "ASSET BETA" variable in Table 2 Panel A .
[6] For examples, see Graham, Li, and Qiu (2008); Chava, Livdan, and Purnanandam (2009); Valta (2012); Fang et al. (2016); Ertugrul et al. (2017); Campello and Gao (2017); Amiram et al. (2017); and Robin, Wu, and Zhang (2017).

Our primary dependent variable is the natural logarithm of the loan spread ($SPREAD_{it}$). Following prior literature, we use loan spread over the London Interbank Offered Rate (LIBOR) at the time of loan origination as our primary measure of the cost of borrowing (Graham et al. 2008; Bharath, Dahiya, Saunders, and Srinivasan 2011; Ertugrul et al. 2017). DealScan's "all-in-drawn" spread provides the amount borrowers pay in basis points over the LIBOR for each dollar drawn down. The loan spread measure includes any annual (or facility) fees paid to the bank group. Where noted, we use the unlogged measure of loan spread in basis points (bps) for descriptive purposes.

Measures of corporate life cycle

We use two approaches to measure firms' life cycle stage. First, we identify firms' life cycle phases according to Dickinson (2011).[7] Second, we employ the use of two continuous proxies for firm life cycle (*RE/TA* and *RE/TE*) introduced by DeAngelo et al. (2006). In order to control for conditions that are observable at the time loan spreads are set, we lag measures of firms' life cycle stage by one quarter.

We follow the methodology of Dickinson (2011) in defining firms' life cycle phases. We create an indicator variable for each of the five life cycle phases (*INTRO*, *GROWTH*, *MATURE*, *SHAKEOUT*, and *DECLINE*). We assign each observation to one of the phases according to the cash flow pattern observed across three components: cash flow from operations (CFO), cash flow from investing (CFI), and cash flow from financing (CFF).[8]

Firms in the introduction phase (*INTRO*= 1) are figuring out their business plan and making investments (CFO ≤ 0 and CFI ≤ 0). These firms are dependent upon external financing (CFF > 0). Firms in the growth phase (*GROWTH*= 1) have seemingly profitable business plans (CFO > 0), but still depend on external sources to finance their growth (CFI ≤ 0 and CFF > 0). Firms in the mature phase (*MATURE*= 1) have seemingly profitable business plans (CFO > 0), and investments no longer depend on cash from external financing (CFI ≤ 0 and CFF ≤ 0). Firms in the decline phase (*DECLINE*= 1) no longer seem to have profitable business plans (CFO ≤ 0). While in decline, firms predominantly divest from their current business lines (CFI > 0). Decline firms may return funds from these divestitures to their investors, or they may raise additional funds from investors in order to fill any shortages (CFF ≤ or ≥ 0). The remaining firms are defined as being in the shake-out phase (*SHAKEOUT*= 1). These include firms that appear to be changing course by divesting from business plans that are currently

[7] When regressing on the phases, as defined in Dickinson (2011), we omit *SHAKEOUT* to avoid a dummy trap.

[8] See Dickinson (2011) for a detailed discussion on the theoretical support for the construction of these variables.

profitable (CFO > 0 and CFI > 0). The shake-out phase also includes firms that are reinventing themselves and would have identified as introduction firms (CFO ≤ 0 and CFI ≤ 0), were they not well endowed financially from their past (CFF ≤ 0)

We complement the Dickinson (2011) cash-flow-based life cycle measures with two continuous measures of firm life cycle: the ratio of retained earnings to total assets (*RE/TA*) and the ratio of retained earnings to total equity (*RE/TE*). Introduced by DeAngelo et al. (2006), these measures capture the earned/contributed capital mix and proxy for the extent to which a firm is self-financing or reliant upon external capital. The ratio climbs as firms mature with declining investment opportunities. Lower values reflect a life cycle stage similar to the introduction and decline phases, while higher values are more comparable to the mature phase. We calculate *RE/TA* and *RE/TE* using COMPUSTAT variables as described in the Appendix. If the value of total assets (total equity) is not greater than 0.00, then we consider *RE/TA* (*RE/TE*) to be undefined.

Firm controls

As with our measures of firm life cycle, we lag firm controls by one quarter to control for conditions that are observable at the time lending spreads are set. We use a number of controls frequently employed in the literature on lending spreads. These include firm size (*FIRM SIZE*); growth opportunities, as reflected by the market-to-book ratio (*MTB*); leverage (*LEV*); tangibility of assets (*TANGIBILITY*); cash flow risk, as reflected by the standard deviation of cash flows from operations (*STD CF*); bankruptcy risk, as reflected by Altman's Z-Score (*Z-SCORE*); and firm profitability, as reflected by profit margin (*PROFITABILITY*). Because analysts may reduce monitoring costs, we also control for analyst following (*ANALYST*) (Barth et al. 2001). In addition, we control for sales growth (*SALES GROWTH*).

Valta (2012) shows that firms operating in a competitive product market are associated with a higher cost of borrowing. Therefore, we control for competition (*C4-INDEX*). We control for age (*AGE*) to better identify the effects specific to firms' life cycle (Bradley, Pantzalis, and Yuan 2016). Campello and Gao (2017) provide evidence that a concentrated set of large customers negatively affects private lending. Because customer concentration may also vary with firm life cycle, we control for customer concentration (*CUST CONCN*). We control for systematic risk (*BETA*). When available, we also control for credit ratings (credit rating fixed effects). Lastly, we include industry fixed effects (FFI48), to account for any systematic differences across industries. Broadly speaking, these controls account for the differences in risk lenders face between firms. Additional detail regarding the calculation of these variables is available in the Appendix.

Loan controls

We control for loan maturity (*LOAN TERM*), loan size (*LOAN SIZE*), and whether or not the loan is secured (*SECURE*). Our model includes fixed effects that control for the various types of loans issued. We include period fixed effects (calendar year-quarter) to control for temporal differences in the macroeconomic environment when loans are issued.

Sample Construction

Our sample lies at the intersection of three databases. We obtain loan data from the Loan Pricing Corporation's (LPC) DealScan database,[9] construct financial measures using data from COMPUSTAT, and obtain stock price data from the Center for Research in Security Prices (CRSP) database. We limit our sample to U.S. firms over the years 1988 to 2018, inclusive.

We exclude financial (SIC 6000 – 6999) and utility (SIC 4900 – 4949) firms from our sample due to their regulated nature. We drop all firms without borrower ID and exclude observations missing any of our primary variables. Our final sample includes 20,307 firm-loan observations for 5,307 publicly traded firms. To mitigate the effect of extreme values, we winsorize continuous variables at the 1st and the 99th percentiles.

Sample Statistics

Table 1 Panel A presents summary statistics for our sample. The distribution of our sample across the introduction, growth, mature, shake-out, and decline life cycle phases is approximately 15 percent, 26 percent, 44 percent, 10 percent, and 4 percent, respectively. This distribution is generally consistent with that reported by Dickinson (2011). The mean (median) ratio of retained earnings to total assets (*RE/TA*) is 0.05 (0.13). Because the calculation of *RE/TE* is more restrictive in that it requires total equity to be greater than zero, the population drops slightly when calculating this variable (n= 19,342).

The loans in our sample have a mean (median) spread (*SPREAD*) of 196 bps (175 bps) over LIBOR, a mean (median) loan maturity (*LOAN TERM*) of 46 months (49 months), and a mean (median) loan size (*LOAN SIZE*) of 506 million dollars (190 million dollars). These statistics are consistent with other studies investigating the cost of borrowing (e.g. Valta 2012; Ertugrul et al. 2017).

[9] LPC data are skewed against smaller firms and do not represent a random sample of bank loans (Valta 2012). Although this is an inherent limitation of our study, we believe that the suppressed variation in firm characteristics (e.g., size) would bias against us finding an association between life cycle and credit spreads. Furthermore, although imperfect, the private debt market does allow for more heterogeneity than other settings (Francis et al. 2017).

Table 1 Panel B presents additional summary statistics when partitioning the sample on each of Dickinson's (2011) life cycle phases. Both the mean and the median loan spreads are greater in the introduction, shake-out and decline phases than in the growth and mature phases. Figure 1 provides a graphical representation of the U-shape trend that spreads follow across the life cycle phases. Alternatively, loan maturity and loan size are generally greater in the growth and mature phases than in the introduction, shake-out and decline phases. Additionally, firms in the growth and mature phases are less likely to be collateralized (*SECURE*).[10] As expected scaled retained earnings (*RE/TA*), increases progressively when moving from *INTRO* to *GROWTH* to *MATURE*. It then decreases in the *SHAKEOUT* phase and drops to its lowest values in the *DECLINE* phase.[11] After observing the inverse U-shape trend that *RE/TA* follows across the life cycle phases, we note that an inverse relation between *RE/TA* and *SPREAD* would be consistent with a U-shape relation between life cycle phases and lending spreads. The variation of firm size (*SIZE*), market-to-book (*MTB*), profitability (*PROFITABILITY*), and cash flow volatility (*STD CF*) across the life cycle stages is also consistent with those of prior studies (Dickinson 2011).

Table 2 reports pair-wise correlations between the variables included in the regression models. We find that the correlation of *SPREAD* with *INTRO*, *SHAKEOUT*, and *DECLINE* is positive and significant, while the correlation of *SPREAD* with *GROWTH* and *MATURE* is negative and significant. In addition, we find that the correlation between *RE/TA* and *SPREAD* is negative and significant. Supporting the overall notion that *RE/TA* proxies for maturity, we find that *RE/TA* shares similar (opposite) correlations as the *MATURE* (*INTRO* and *DECLINE*) variable(s) with several of the control variables.

Table 3 reports univariate statistical comparisons of loan spreads for each pair of Dickinson's (2011) life cycle phases. We calculate significance using both Tukey's honest significant difference (HSD) and the Tukey–Kramer (TK) method. The results indicate that the mean loan spread decreases significantly from the introduction to the growth phase. While the difference in *SPREAD* between the growth and mature phases is not statistically significant, there is a significant increase once firms enter the shake-out phase. Finally, we find that firms in decline have spreads that are significantly higher than all other phases. Both Tukey's HSD and the TK test results provide reasonable evidence that loan spreads are relatively higher in

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[10] In the subsection "Alternative Measures of Lending Terms," we analyze the use of collateral and loan maturities in a multivariate analysis.

[11] Due to differences in sample composition, statistics for *RE/TE* are not included in Panel B of Table 1. We note that the variable behaves in a similar manner across life cycle phases (untabulated).

the introduction, shake-out, and decline phases and lower in the growth and mature phases. These results indicate that the U-shape trend we observe in Figure 1 is statically significant.

IV. EMERICAL RESULTS

Main Results

Table 4 Panel A presents the results for Model (1). In Columns (1), (2), and (3), we use the life cycle phases of Dickinson (2011) as our independent variables of interest. If lending spreads follow a U-shape pattern over firms' life cycle, then loan spreads will be higher (lower) during the introduction and decline (growth and mature) phases. Specifically, in Column (1) we present the OLS regression results with only the firm life cycle proxies, and industry and period fixed effects. We find that the coefficients for the introduction phase (*INTRO)* and the decline phase (*DECLINE)* are positive and statistically significant at the 1 percent level, while those for the growth phase (*GROWTH)* and the mature phase (*MATURE)* are negative and significant at the 1 percent level.[12] These results indicate that relative to the shake-out phase, loan spreads are significantly higher (lower) in the introduction and the decline phases (growth and mature phases). In Column (2), we include all the loan and firm-level controls except for the credit rating fixed effects. We continue to find negative and statistically significant coefficients for the growth and mature phases (both at the 0.01 level), and a positive and significant coefficient for the decline phase (at the 0.05 level). Although Column (2) indicates that introduction firms do not have spreads that are significantly different from shake-out firms, an F-test indicates that they do have spreads that are significantly larger than firms in the growth phase. This is consistent with the U-shape pattern we have observed. Lastly, in Column (3) we include fixed effects for firms' credit ratings to the model. The general conclusions hold.

The magnitudes of the coefficients provided in Column (1) decline after including our financial controls. The adjusted R-squared values increase as well. This suggests that our controls do explain some of the variation in spreads observed across life cycle phases in the univariate analysis. Even so, we still find that firm life cycle measures explain variation in lending spreads. The coefficients for the control variables are in line with our expectations. For example, larger firms (*FIRM SIZE*), firms with more tangible assets (*TANGIBILITY*), and firms with greater outside monitoring (*ANALYST*) tend to pay smaller lending spreads, while firms

[12] We remind the reader that these coefficients are relative to the base case of our specification (*SHAKEOUT*= 1). At the bottom of Table 4 Panel A, F-tests provide the significance of the difference in spread between the introduction and growth phases, and the growth and mature phases. The significance of the difference between the mature (decline) and the shake-out phases is reflected by the significance of the *MATURE* (*DECLINE*) coefficient.

with greater leverage (*LEV*) and more volatile cash flows (*STD CF*) appear to pay larger lending spreads. The coefficients for *LOAN TERM*, *LOAN SIZE*, and *SECURE* are also consistent with prior literature (e.g., Valta 2012; Robin et al. 2017; Ertugrul et al. 2017).

In Columns (4) and (5) of Table 4 Panel A, we estimate Model (1) using DeAngelo et al.'s (2006) retained earnings measures as our independent variables of interest. If spreads follow a U-shape across Dickinson's (2011) life cycle phases, then we would expect the coefficients on DeAngelo et al.'s (2006) measures to be negative, indicating a negative relationship between maturity and lending spreads. The coefficients in Columns (4) and (5) indicate that both *RE/TA* and *RE/TE* are negative and significant (both at the 0.01 level).

For an economic perspective, firms in the introduction and decline phases are predicted to pay spreads that are approximately 6 percent and 12 percent greater than spreads paid by firms in the mature phase, respectively. We estimate lending spreads by life cycle phase using the parameters estimated in Column (3) of Table 4 at the sample means. Firms in the introduction, growth, mature, shake-out, and decline phases are predicted to pay lending spreads of 156 bps, 150 bps, 147 bps, 155 bps, and 164 bps, respectively. The results, plotted in Figure 2, indicate that the U-shape pattern in spreads across the life cycle phases is significant, both statistically and economically. We reject the null hypothesis and find evidence that the corporate life cycle does explain variation in lending spreads beyond that of existing financial controls.

Entropy Balancing

The distribution of firm and loan characteristics may vary with each of the life cycle phases. To account for this potential concern, we entropy balance firms in each of the adjacent life cycle phases (Hainmueller 2012) on the first and second moments (mean and variance) of all the control variables. The adjacent groups are *INTRO* and *GROWTH*, *GROWTH* and *MATURE*, *MATURE* and *SHAKEOUT*, and *SHAKEOUT* and *DECLINE*. We provide detailed summary statistics after balancing each pairing in the Internet Appendix, Table A. All groups are well balanced. In Table 4 Panel B, we present the regression results for each entropy balanced subsample. The results are consistent with the OLS results for the full sample. Spreads decline significantly going from the introduction phase to the growth phase and from the growth phase to the mature phase, as evidenced by Columns (1) and (2), respectively. Columns (3) and (4) show that this downward trend reverses as spreads increase significantly moving from the mature phase to the shake-out phase and from the shake-out phase to the decline phase, respectively.

V. Robustness Testing

Endogeneity Concerns

Omitted Variables: Impact Threshold of a Confounding Variable

There may be some concern that our results are sensitive to the omission of a confounding control variable. We assess this concern by following Frank (2000) and Larcker and Rusticus (2010) and calculate the impact threshold of a confounding variable (ITCV). The ITCV indicates how correlated an omitted variable must be with *SPREAD* and the various life cycle measures in order to overturn our results. We evaluate these thresholds relative to the partial impact of our control variables.

We evaluate the ITCV for the Dickinson (2011) life cycle phases using the specification provided in Column (3) of Table 4 Panel A. For *RE/TA* and *RE/TE,* we use Columns (4) and (5) of Table 4 Panel A, respectively. Table 5 presents the results. We find the ITCV to be greater in magnitude than the partial impacts of our sixteen control variables with a few exceptions. For *GROWTH* (*DECLINE*) the partial impact *of Z-SCORE* and *SECURE* (*Z-SCORE* and *LOAN SIZE*) are on par with the ITCV. For both *RE/TA* and *RE/TE*, the partial impact of *Z-SCORE* exceeds the ITCV. It is perhaps not surprising that bankruptcy risk and loan characteristics vary with both firm life cycle and lending spreads. Given these findings, one might argue that a variable with a similar impact as bankruptcy risk and loan characteristics exists and could overturn our results. However, we emphasize that it is unlikely that such a variable exists since our regression model includes controls such as bankruptcy risk and loan characteristics in addition to the fixed effects for credit ratings and loan type. While the inclusion of these controls reduce the magnitude of the coefficients on our variables of interest, we still find the corporate life cycle to explain lending spreads in an economically and statistically significant way. We argue that after considering our set of controls, it is unlikely that our findings are sensitive to the omission of a confounding variable.[13]

Instrumental Variable – Two Stage Least Squares

The exclusion restriction of a two-stage least squares (2SLS) instrumental variable (IV) approach requires us to identify a variable that directly affects firm life cycle. At the same time, such an IV may only have an indirect effect on lending spreads. Prior studies emphasize that the growth and riskiness within an industry can have a profound effect on the transition of corporate life cycle stages. Maksimovic and Phillips (2008) suggest that firms' investment and

[13] In the subsection, "Additional Control Variables," we include three additional controls that capture lending terms and risk: the probability of covenant violation (*PVIOL*), loss given default (*LGD*), and the beta of debt (*DEBT BETA*).

organizational form should be sensitive to industry conditions. Lumpkin and Dess (2001) argue that the environment within an industry affects firms' entrepreneurial orientation with respect to proactiveness and competitive aggressiveness.

We consider the volatility of sales growth within an industry. Firms naturally reduce capital investments in uncertain environments (Gulen and Ion 2016). In addition, firms' payout policies are also a function of the uncertainty they face. Easing simultaneity concerns, Chay and Suh (2009) show that uncertainty is a determinant of dividends that is distinct from firms' life cycle. Arguably, the effect industry uncertainty has on lending spreads is limited by its implications for each individual firm. For example, Amiram et al. (2017) attribute the relation between industry characteristics and lending spreads to how such industry characteristics affect an individual firm's environment and risk factors.[14] We argue that uncertainty in industry sales growth should only affect individual firm's lending spreads to the extent such uncertainty affects each individual firm's environment.[15]

We construct our measure of industry growth uncertainty (*IND_GRW_SHOCK*) by first calculating the standard deviation of quarterly sales growth over the last eight quarters at the individual firm level. We then calculate the value of *IND_GRW_SHOCK* for firm *i* as the industry-mean of the standard deviations, calculated after excluding firm *i*'s standard deviation. Because the maturity of a firm is interlocked with its relative stability, we expect *IND_GRW_SHOCK* to be inversely related to maturity.[16]

Columns (1) and (3) present the first-stage regressions for *RE/TA* and *RE/TE*, respectively. As predicted, we find a negative and significant coefficient for our instrumental variable in both first-stage regressions. Columns (2) and (4) of Table 6 report the second-stage regression results for the relation between our instrumented measures of firm life cycle (*RE/TA (IV)* and *RE/TE (IV)*, respectively) and lending spreads. The Kleibergen-Paap rk LM and Kleibergen-Paap Wald F statistics support our identification and instrument selection. Consistent with our main results, we find that the relation between our instrumented life cycle variables and lending spreads remains negative and significant at the 0.01 level in both cases.

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[14] As another example, Gaspar and Massa (2006) show that the relation between competitive marketplaces and idiosyncratic volatility is function that is dependent upon how competitive marketplaces affect individual firms.
[15] Assumptions regarding the exclusion restriction are a natural limitation of any IV design. We perform an analysis with Industry-Period fixed effects that yields results consistent with our assumptions. See the subsection entitled "Fixed Effects" for additional discussion.
[16] Here, we use *RE/TA* and *RE/TE* as our independent variables of interest. Because Dickinson's (2011) life cycle measures are discrete, they are not adequate for capturing the incremental effect of our instrumental variable.

The coefficients for our instrumented variables in Table 6 are greater in magnitude than those of the OLS coefficients reported in Table 4. One explanation is that the 2SLS regression identifies a local average treatment effect rather than the population effect. This may be due to the endogenous nature of our dependent variable. Because we only observe lending spreads when firms voluntarily take out loans, our sample is censored. This is a natural limitation of empirical work regarding lending spreads, as firms may postpone financing or find an alternative source of funds if they do not find lending spreads to be satisfactory. This limits variation in our dependent variable. As firms respond to uncertainty within their industry, their need for capital may become more urgent and our sample may become less censored.[17] The coefficients in Table 6 suggest that the importance of firm life cycle with respect to lending spreads may be even greater than that indicated by our primary OLS specification, but they are subject to criticism as in Jiang (2017).

Fixed Effects

In our main analysis, our model controls for, among other things, industry and period fixed effects. Although this is conventional practice in the literature (e.g., Valta 2012), there may be concern that our results are driven by time-variant industry effects or time-invariant cross-sectional differences between firms. In this section, we re-estimate our primary specification with industry-period fixed effects and, separately, with firm and period fixed effects.

Our results are in Table 7. In Columns (1) through (3), we estimate the model with industry-period fixed effects. Qualitatively, both the coefficients and the adjusted R-squared terms look very similar to those presented in Columns (3) through (5) of Table 4. These results show that the U-shape trend in lending spreads that we identify across firm life cycles is not the consequence of variation in industry conditions across time. In addition, a comparison of adjusted R-squared terms suggests that time-variant industry conditions do not add significantly to explaining the variation in lending spreads beyond our existing suite of controls. This is consistent with our assumptions regarding the exclusion restriction in our IV analysis.

In Columns (4) through (6) of Table 7, we present results when substituting firm fixed effects for industry fixed effects in Model (1). Such a fixed-effect structure is dependent upon *within firm* variation in firm life cycle. The results when using Dickinson's life cycle measures

[17] Supporting this notion, Table 1 Panel B shows the standard deviation of lending spreads to be greatest for firms in the introduction and decline phases and lowest for firms in the growth and mature phases.

remain unchanged qualitatively. In contrast to industry-period fixed effects, we do observe an increase in the adjusted R-squared values. This suggests that there is some heterogeneity amongst firms that explains the variation in lending spreads not captured by our primary specification. The magnitude and the significance of our results decline moderately when using the *RE/TA* measure of firm life cycle and entirely when using the *RE/TE* measure.

Additional Control Variables

Next, we consider three additional control variables that further account for expected losses and the systematic risk associated with a firm's debt: the probability of loss given default (*LGD*), the probability of covenant violation (*PVIOL*), and the systematic risk of debt (*DEBT BETA*). We follow Amiram et al. (2017) in calculating *LGD*. If lenders find it more difficult to mitigate their losses when firms are in the introduction or decline phases, then such a measure could explain our findings. We measure *PVIOL* in accordance with Demerjian and Owens (2016).[18] In addition to credit risk, lending spreads compensate lenders for systematic risks. Arguably, the systematic risk of a firm's debt may also correlate with its life cycle. We calculate debt beta (*DEBT BETA*) following Schaefer and Strebulaev (2008) and Merton (1974). Detailed variable definitions are included in the Appendix.

We present the results in Table 8. In Columns (1) through (3), we require all three new variables to be defined. Despite the drastic drop in observations, we still observe a significant U-shape trend in lending spreads across the life cycle phases. The model indicates that firms in the growth and mature phases pay significantly lower spreads than firms in the introduction, shake-out, and decline phases. Although our results hold for the *RE/TE* measure of firm life cycle, they weaken when using the *RE/TA* measure. To alleviate the loss of power due to the reduction in sample size, we allow observations where *LGD*, *PVIOL*, or *DEBT BETA* are undefined to remain in our sample and control for their differences with the inclusion of three additional indicator variables (*MISSING LGD*, *MISSING PVIOL*, and *MISSING DEBT BETA*, respectively). In Columns (4), (5), and (6), we find that our primary findings hold across all three measures of firms' life cycle stage (life cycle phases, *RE/TA*, and *RE/TE*, respectively).

Additional Analysis: Firm Life Cycle and Non-Pricing Lending Terms

Lastly, we consider the effects of firms' life cycle station on other contractual lending terms. While lenders often manage their risk through loan pricing (i.e., spreads), they may also manage their risks through other non-price terms. We consider the use of collateral

[18] We thank the authors for making this measure available on their website: https://sites.google.com/site/edowensphd/research.

(*SECURITY*) and lending durations (*LOAN TERM*) as two measures of non-pricing lending terms. Given the high (low)-levels of operating and informational riskiness in the introduction and decline (growth and mature) phases, we expect the use of collateral will be greatest (lowest) when firms are in the introduction and decline (growth and mature) phases and when firms have lower (higher) retained earnings ratios (*RE/TA* and *RE/TE*). Similarly, we expect introduction and decline (growth and mature) firms will also have shorter (longer) loan durations.

We present our results in Table B of the internet appendix. In column (1) of Panel A, an OLS probability model indicates that loans to growth and mature firms are the least likely to be collateralized. In columns (2) and (3), we find the probability of securitization declines as firms become more mature. These findings are unaffected when using a logit specification (untabulated). In Panel B of Table B, we find that firms in the mature phase and firms with greater retained earnings ratios are extended loans with longer terms. These findings are consistent with our predictions.

VI. CONCLUSION

We examine the relation between firm life cycle and lending spreads in the private debt market. We find that lending spreads follow a U-shape pattern across Dickinson's (2011) life cycle phases and are negatively related to DeAngelo et al.'s (2006) measures of maturity. This relation persists after controlling for firm and loan characteristics. We conduct an ITCV analysis, an IV research design, and test for robustness with high-dimensional fixed effects and lesser-used control variables. Combined, we find that firm life cycle explains unique variation in lending spreads.

Our findings have a number of implications for both research regarding firm life cycle and research regarding lending spreads. Theory suggests that less mature firms carry greater systematic risk and non-diversifiable risk. Our findings are consistent with these predictions. Researchers often look to lending spreads in an effort to understand how certain characteristics affect risk. Given the ubiquitous implications firm life cycle has on corporate structure, we expect many of these characteristics to also vary according to firms' life cycle. Researchers studying the relation between these other characteristics and lending spread would be well served by controlling for firms' life cycle. Given the parsimonious nature of firm life cycle measures, such controls are widely implementable across a variety of research settings.

Although an advantage of studying the private debt market is that it allows for a more heterogeneous sample (Francis et al. 2017), a limitation of our study is that we do not consider the firm's choice of debt markets. Our study therefore presents results conditional on firms obtaining a loan. Denis and Mihov (2003) find that firms with medium credit quality usually borrow from banks while firms with high credit tend to utilize public debt markets. We leave it to future research to consider the impact of life cycle stages on the choice of debt markets.

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APPENDIX

Variables	Definition and Measurement
Life cycle variables of interest	
INTRO	Indicator variable equal to one if 1) quarterly cash flows from operations (CFO) is less than or equal to zero; 2) quarterly cash flows from investing (CFI) is less than or equal to zero; and 3) quarterly cash flows from financing (CFF) is greater than zero, and zero otherwise. For observations where FQTR equals 1, we use the year-to-date (YTD) measures OANCFY, IVNCFY, and FINCFY to identify CFO, CFI, and CFF, respectively. When FQTR is greater than one, we identify quarterly cash flows by taking the YTD measure and subtracting the corresponding YTD measure from the prior quarter.
GROWTH	Indicator variable equal to one if 1) CFO is greater than zero; 2) CFI is less than or equal to zero; and 3) CFF is greater than zero, and zero otherwise.
MATURE	Indicator variable equal to one if 1) CFO is greater than zero; 2) CFI is less than or equal to zero; and 3) CFF is less than or equal to zero, and zero otherwise.
SHAKEOUT	Indicator variable equal to one if *INTRO*, *GROWTH*, *MATURE*, and *DECLINE* all equal zero, and zero otherwise.
DECLINE	Indicator variable equal to one if 1) CFO is less than or equal to zero; and 2) CFI is greater than zero, and zero otherwise.
RE/TA	Retained earnings (REQ) divided by total assets (ATQ).
RE/TE	Retained earnings (REQ) divided by total equity (CEQQ).
Loan characteristics	
SPREAD	The natural logarithm of the "all-in-drawn" lending spread (bps) as reported in the DealScan database. Where specifically noted, we report this variable unlogged in terms of basis points (bps) for descriptive purposes. Source: DealScan.
LOAN TERM	The natural logarithm of loan maturity measured in months. Where specifically noted, we report this variable in terms of months for descriptive purposes. Source: DealScan.
LOAN SIZE	Natural logarithm of the amount of a loan in millions of dollars.
SECURE	Indicator variable equal to one if a loan is collateralized, and zero otherwise. Source: DealScan.
LOAN TYPE	The type of lending facility (LOANTYPE). Source: DealScan.
PVIOL	The predicted probability of covenant violation as defined and measured by Demerjian and Owens (2016). Source: https://sites.google.com/site/edowensphd/research.
MISSING PVIOL	Indicator variable equal to one if *PVIOL* is undefined, and zero otherwise.

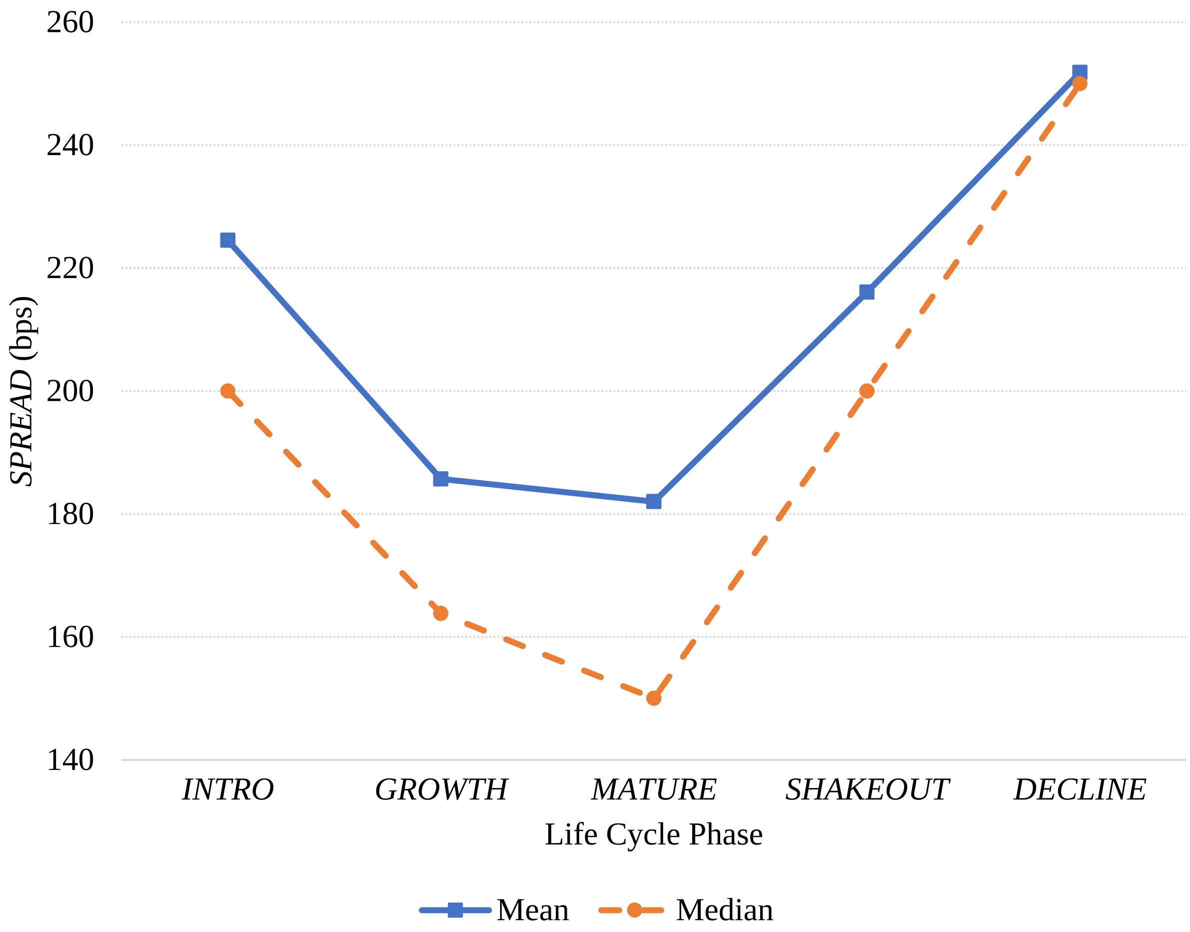
Firm characteristics

FIRM SIZE	The natural logarithm of total assets (ATQ). Where specifically noted, we report this variable in millions for descriptive purposes.
MTB	The market value of equity (PRCC_Q×CSHOQ) scaled by book value of equity (CEQQ).
LEV	Total long-term debt (DLTTQ) scaled by total assets (ATQ).
TANGIBILITY	Net property, plant, and equipment (PPENTQ) divided by total assets (ATQ).
STD CF	The standard deviation of the cash flow from operation (OANCFQ) scaled by total assets (ATQ) over the past eight quarters.
Z-SCORE	Calculated as 1.2×((ACTQ-LCTQ)/ATQ) + 1.4×(REQ/ATQ) + 3.3×(PIQ/ATQ) + 0.6×((PRCCQ*CSHOQ)/LTQ) + 0.999×(SALEQ/ATQ).
PROFITABILITY	The ratio of operating income before depreciation (OIBDPQ) scaled by sales (SALEQ) (Chava et al. 2009).
ANALYST	The number of unique analysts that issuing a forecast for the relevant period per the I\B\E\S database. Source: I\B\E\S.
SALES GROWTH	Sales growth, measures as ($SALEQ_t$ – $SALEQ_{t-1}$)/$SALEQ_{t-1}$
C4-INDEX	The aggregate market share, measured in sales (SALESQ), of the four largest firms in an industry (2 digit SIC). Calculated at the calendar quarter level.
AGE	The natural logarithm of one plus the number of years since the firm was first covered by the CRSP database ((DATADATE – BEGPRC)/365). Where specifically noted, we report this variable in terms of years for descriptive purposes. Source: Center for Research in Securities Prices (CRSP)
CUST CONCN	The aggregate percentage sales coming from the customers that represent at least 10% of total sales (see Campello and Gao (2017)).
BETA	Factor obtained from regressing monthly security returns on market returns (VWRETD) using a min (max) est. window of 36 (12) months. Source: Center for Research in Securities Prices (CRSP)
CREDIT RATING	The firm's S&P credit rating (SPLTICRM).
IND-GROW-SHOCK	The average standard deviation in sales across all firms within an industry (calculated while excluding firm *i* from the SIC2 industry average). Standard deviations are calculated using eight quarters of data.
LGD	Calculated per Amiram et al. (2017): 0.292 + 0.063×*FIRM SIZE* + 0.018×STTOLDEBT + 0.003×(INTANQ/PPENTQ) - 0.005×((ATQ - LTQ)/CSHOQ) - 0.907×(IBQ/ATQ)).
DEBT BETA	Equity beta adjusted by estimated hedge ratio (*BETA*×HEDGE RATIO). The value of HEDGE RATIO is obtained using the parameters estimated by Schaefer and Strebulaev (2008) in Panel A of Table 8.
MISSING DEBT BETA	Indicator variable equal to one if *DEBT BETA* is undefined, and zero otherwise.
MISSING LGD	Indicator variable equal to one if *LGD* is undefined, and zero otherwise.

All data sourced from Compustat unless otherwise noted.

FIGURE 1

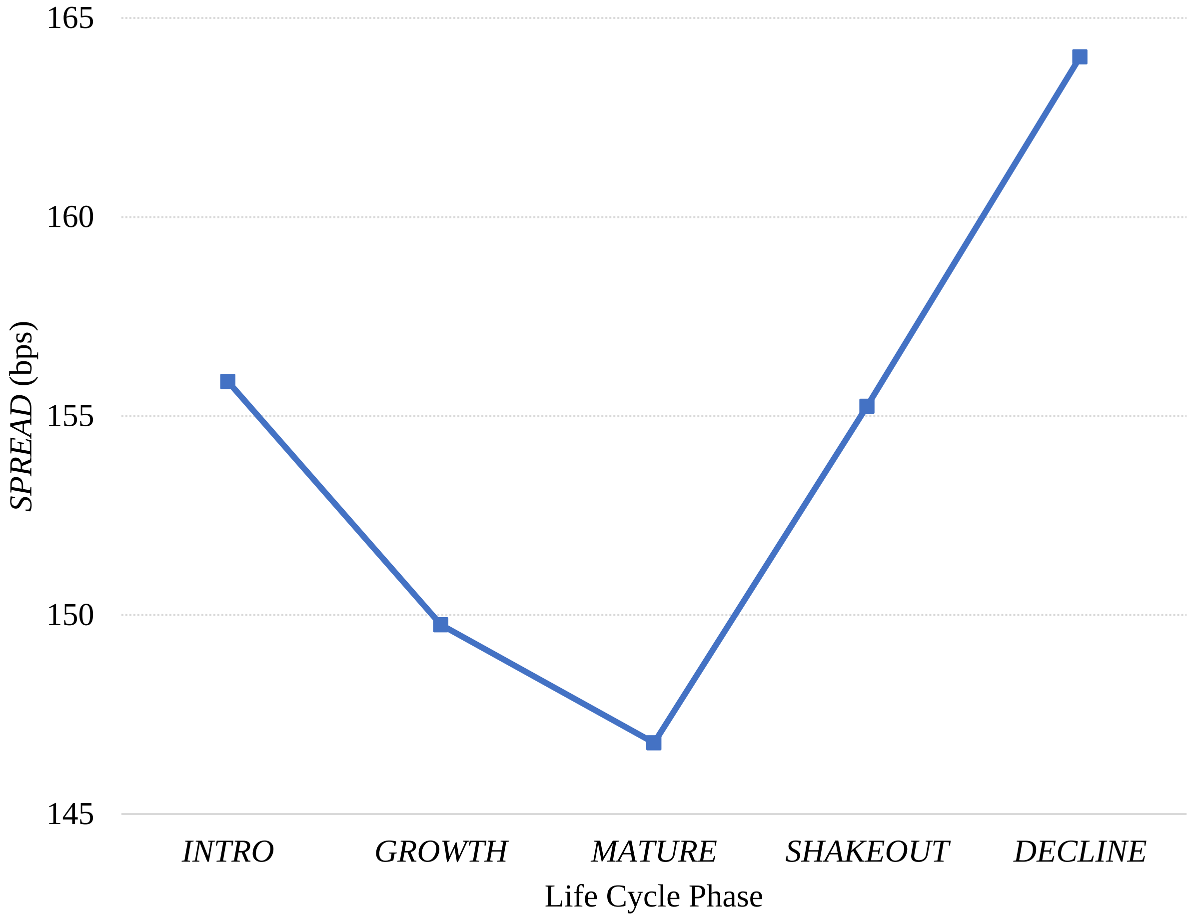
Univariate Analysis: Loan Spread and Firms' Life Cycle Stages



This figure shows the mean and median loan spreads (*SPREAD*) in basis points (bps) for each of the five life cycle phases, as defined by Dickinson (2011). See the Appendix for detailed variable definitions. The sample population includes 20,307 loans from fiscal years 1988 through 2018 that were made to 5,076 distinct publicly traded U.S. firms. Loan data come from the Loan Pricing Corporation's (LPC) DealScan database. Financial (SIC 6000 – 6999) and utility (SIC 4900 – 4949) firms are excluded from the sample.

FIGURE 2

Multivariate Analysis: Loan Spread and Firms' Life Cycle Stages



This figure shows predicted loan spread (*SPREAD*) in basis points (bps) for each of the five life cycle phases, as defined by Dickinson (2011). See the Appendix for detailed variable definitions. Predictions are calculated using the parameters estimated in Table 4, Panel A, Column (2) at the sample mean. The sample population includes 20,307 loans from fiscal years 1988 through 2018 that were made to 5,076 distinct publicly traded U.S. firms. Loan data come from the Loan Pricing Corporation's (LPC) DealScan database. Financial (SIC 6000 – 6999) and utility (SIC 4900 – 4949) firms are excluded from the sample.

TABLE 1

Summary Statistics

Panel A: Descriptive Statistics of Pooled Sample

Variable	N	Mean	St.Dev	P25	P50	P75
INTRO	20,307	0.15	0.36	0.00	0.00	0.00
GROWTH	20,307	0.26	0.44	0.00	0.00	1.00
MATURE	20,307	0.44	0.50	0.00	0.00	1.00
SHAKEOUT	20,307	0.10	0.31	0.00	0.00	0.00
DECLINE	20,307	0.04	0.19	0.00	0.00	0.00
RE/TA	20,307	0.05	0.51	-0.04	0.13	0.30
RE/TE	19,342	-0.01	2.24	-0.04	0.36	0.73
SPREAD (bps)	20,307	195.62	129.23	100.00	175.00	273.13
LOAN TERM (mo)	20,307	46.31	21.80	31.83	49.26	60.00
LOAN SIZE (mil)	20,307	506.02	851.65	50.00	190.00	530.00
SECURE	20307	0.53	0.50	0.00	1.00	1.00
FIRM SIZE (mil)	20,307	4,980	11,835	246	934	3,520
MTB	20,307	2.86	4.59	1.27	2.09	3.47
LEV	20,307	0.27	0.20	0.12	0.25	0.39
TANGIBILITY	20,307	0.31	0.24	0.12	0.24	0.45
STD CF	20,307	0.03	0.03	0.01	0.02	0.04
Z-SCORE	20,307	2.20	2.52	0.90	1.63	2.73
PROFITABILITY	20,307	0.14	0.22	0.07	0.13	0.21
ANALYST	20,307	7.44	7.14	2.00	5.00	11.00
SALES GROWTH	20,307	0.07	0.24	-0.04	0.03	0.13
C4-INDEX	20,307	0.41	0.15	0.30	0.39	0.48
AGE (yrs)	20,307	20.21	19.19	6.23	13.41	27.56
CUST CONCN	20,307	0.26	0.38	0.00	0.03	0.42
BETA	20,307	1.21	0.91	0.66	1.12	1.65

Panel B: Descriptive Statistics by Life Cycle Phase

	INTRO (n = 3,072)			*GROWTH* (n = 5,348)			*MATURE* (n = 8,999)			*SHAKEOUT* (n = 2,115)			*DECLINE* (n = 773)		
Variable	Mean	P50	S.D.	Mean	P50	S.D.	Mean	P50	S.D.	Mean	P50	S.D.	Mean	P50	S.D.
RE/TA	-0.10	0.07	0.63	0.08	0.12	0.40	0.13	0.17	0.43	0.00	0.10	0.59	-0.34	-0.03	0.86
SPREAD (bps)	224.51	200.00	132.69	185.70	163.82	122.16	182.01	150.00	124.71	216.07	200.00	140.70	251.82	250.00	141.13
LOAN TERM (mo)	42.33	37.00	21.78	47.32	52.36	22.10	48.09	59.00	21.17	44.89	48.00	22.07	38.26	36.00	22.21
LOAN SIZE (mil)	271.11	77.75	548.56	512.65	200.00	878.67	598.60	250.00	904.43	515.73	165.00	893.59	289.34	50.00	667.52
SECURE	0.64	1.00	0.48	0.52	1.00	0.50	0.47	0.00	0.50	0.57	1.00	0.50	0.67	1.00	0.47
FIRM SIZE (mil)	1,785	328	4,842	5,078	978	12,305	6,224	1,374	13,327	4,971	889	11,429	2,545	291	7,067
MTB	2.74	1.92	4.59	3.00	2.27	4.28	2.90	2.13	4.74	2.57	1.88	4.53	2.52	1.60	5.02
LEV	0.26	0.23	0.21	0.29	0.28	0.20	0.27	0.25	0.20	0.25	0.22	0.22	0.22	0.19	0.21
TANGIBILITY	0.25	0.20	0.19	0.37	0.29	0.28	0.32	0.26	0.24	0.28	0.21	0.22	0.23	0.17	0.18
STD CF	0.05	0.04	0.04	0.03	0.02	0.02	0.03	0.02	0.02	0.03	0.02	0.03	0.04	0.03	0.03
Z-SCORE	1.91	1.51	2.49	2.42	1.63	2.88	2.22	1.73	2.16	2.13	1.53	2.71	1.77	1.23	3.15
PROFITABILITY	0.02	0.07	0.25	0.19	0.16	0.21	0.17	0.15	0.16	0.11	0.11	0.21	-0.06	0.04	0.35
ANALYST	4.44	3.00	5.21	8.07	6.00	7.22	8.39	7.00	7.36	7.20	5.00	7.40	4.55	3.00	5.82
SALES GROWTH	0.09	0.04	0.31	0.09	0.05	0.24	0.05	0.03	0.20	0.05	0.02	0.24	0.05	0.01	0.30
C4-INDEX	0.42	0.39	0.16	0.41	0.38	0.15	0.42	0.39	0.16	0.42	0.38	0.16	0.41	0.38	0.15
AGE (yrs)	15.48	9.73	15.60	18.44	11.81	18.19	22.88	16.31	20.35	21.36	14.40	19.91	17.05	10.23	17.61
CUST CONCN	0.21	0.01	0.34	0.25	0.03	0.37	0.28	0.03	0.39	0.27	0.03	0.38	0.24	0.03	0.36
BETA	1.30	1.21	1.06	1.23	1.14	0.88	1.14	1.05	0.81	1.30	1.20	1.00	1.44	1.28	1.16

This table provides summary statistics for our sample. The sample population includes 20,307 loans from fiscal years 1988 through 2018 that were made to 5,076 distinct publicly traded U.S. firms. Financial (SIC 6000 – 6999) and utility (SIC 4900-4949) firms are excluded from the sample. Panel A provides descriptive statistics for the pooled sample. We provide detailed variable definitions in the Appendix. Other than loan specific measures (*SPREAD*, *LOAN TERM*, *LOAN SIZE*, and *SECURE*), variables are measured in the quarter immediately preceding loan issuance (*t*-1). We present *SPREAD*, *LOAN TERM*, *LOAN SIZE*, *FIRM SIZE*, and *AGE* unlogged in terms of basis points (bps), months, millions of dollars, millions of dollars, and years, respectively, for descriptive purposes. Panel B provides descriptive statistics while conditioning on the various life cycle phases as defined by Dickinson (2011).

TABLE 2
Correlation Matrix

Panel A: Variable Correlations with *INTRO* through *MTB*

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1)INTRO	1.00											
(2)GROWTH	-0.25	1.00										
(3)MATURE	-0.38*	-0.54*	1.00									
(4)SHAKEOUT	-0.14*	-0.20*	-0.30*	1.00								
(5)DECLINE	-0.08*	-0.12*	-0.17*	-0.07*	1.00							
(6)RE/TA	-0.13*	0.01*	0.15*	-0.03*	-0.15*	1.00						
(7)*SPREAD* (ln)	0.10*	-0.02*	-0.10*	0.04*	0.07*	-0.37*	1.00					
(8)*LOAN TERM* (ln)	-0.07*	0.02*	0.07*	-0.02*	-0.07*	0.08*	0.07*	1.00				
(9)*LOAN SIZE* (ln)	-0.18*	0.02*	0.17*	-0.02*	-0.11*	0.28*	-0.35*	0.29*	1.00			
(10)SECURE	0.10*	0.00	-0.10*	0.03*	0.06*	-0.30*	0.53*	0.12*	-0.25*	1.00		
(11)*FIRM SIZE* (ln)	-0.20*	0.02*	0.17*	-0.01	-0.10*	0.30*	-0.41*	0.14*	0.85*	-0.36*	1.00	
(12)*MTB*	-0.01*	0.01	0.02*	-0.02*	-0.01	-0.11*	-0.06*	0.02*	0.10*	-0.04*	0.08*	1.00
(13)*LEV*	-0.04*	0.09*	0.00	-0.05*	-0.06*	-0.10*	0.18*	0.24*	0.27*	0.14*	0.19*	0.16*
(14)*TANGIBILITY*	-0.12*	0.15*	0.02*	-0.05*	-0.07*	0.03*	-0.04*	0.06*	0.05*	-0.01*	0.07*	-0.07*
(15)*STD CF*	0.25*	-0.10*	-0.14*	0.03*	0.09*	-0.12*	0.11*	-0.17*	-0.33*	0.12*	-0.39*	0.04*
(16)*Z-SCORE*	-0.04*	0.05*	0.00	0.00	-0.02*	0.32*	-0.20*	-0.08*	-0.14*	-0.15*	-0.11*	0.19*
(17)*PROFITABILITY*	-0.24*	0.15*	0.14*	-0.05*	-0.19*	0.29*	-0.14*	0.10*	0.26*	-0.11*	0.26*	0.03*
(18)*ANALYST*	-0.18*	0.05*	0.12*	-0.01	-0.08*	0.21*	-0.37*	0.05*	0.58*	-0.32*	0.70*	0.15*
(19)*SALES GROWTH*	0.04*	0.06*	-0.06*	-0.02*	-0.02*	-0.05*	0.08*	-0.01*	-0.05*	0.08*	-0.08*	0.00
(20)*C4-INDEX*	0.03*	-0.02*	0.00	0.00	-0.01*	0.06*	0.03*	0.00	-0.04*	0.03*	-0.06*	-0.07*
(21)*AGE* (ln)	-0.12*	-0.06*	0.14*	0.02*	-0.04*	0.29*	-0.30*	0.01	0.35*	-0.29*	0.44*	-0.01
(22)*CUST CONCN*	-0.05*	-0.01	0.04*	0.02*	-0.01*	-0.01	0.09*	0.07*	0.12*	0.02*	0.11*	0.02*
(23)*BETA*	0.04*	0.01	-0.08*	0.03*	0.05*	-0.19*	0.16*	0.04*	-0.01*	0.12*	0.00	0.03*

Panel B: Variable Correlations with *LEV* through *BETA*

Variables	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)
(13)*LEV*	1.00										
(14)*TANGIBILITY*	0.24*	1.00									
(15)*STD CF*	-0.26*	-0.19*	1.00								
(16)*Z-SCORE*	-0.46*	-0.16*	0.12*	1.00							
(17)*PROFITABILITY*	0.17*	0.28*	-0.25*	0.09*	1.00						
(18)*ANALYST*	0.00	0.09*	-0.25*	0.12*	0.24*	1.00					
(19)*SALES GROWTH*	0.05*	-0.02*	0.09*	0.02*	0.11*	-0.08*	1.00				
(20)*C4-INDEX*	-0.02*	0.12*	0.09*	-0.04*	-0.06*	-0.08*	-0.01	1.00			
(21)*AGE* (ln)	-0.05*	-0.01*	-0.16*	-0.04*	0.09*	0.28*	-0.11*	-0.02*	1.00		
(22)*CUST CONCN*	-0.02*	-0.13*	-0.08*	0.02*	0.03*	0.10*	-0.02*	-0.06*	0.06*	1.00	
(23)*BETA*	0.00	-0.04*	0.01*	0.00	-0.10*	0.02*	-0.02*	-0.03*	-0.08*	0.07*	1.00

This table presents the correlations between variables. * indicates significance at the 5 percent level. The sample population includes 20,307 loans from fiscal years 1988 through 2018 that were made to 5,076 distinct publicly traded U.S. firms. Financial (SIC 6000 – 6999) and utility (SIC 4900-4949) firms are excluded from the sample. The correlations for *SPREAD*, *LOAN TERM*, *LOAN SIZE*, *FIRM SIZE*, and *AGE* are expressed after taking the natural log. See the Appendix for detailed variable definitions.

TABLE 3
Pairwise Analyses

	(1)*INTRO*	(2)*GROWTH*	(3)*MATURE*	(4)*SHAKEOUT*	(5)*DECLINE*	Difference-in-means	HSD-test	TK-test
Group means								
SPREAD (bps)	224.51	185.70	182.01	216.07	251.82			
Analyses of sequential pairs								
(1) vs. (2)	224.51	185.70				38.80	13.90***	18.98***
(2) vs. (3)		185.70	182.01			3.69	1.32	2.37
(3) vs. (4)			182.01	216.07		-34.06	12.20***	15.61***
(4) vs. (5)				216.07	251.82	-35.74	12.80***	9.42***
Remaining analyses								
(1) vs. (3)	224.51		182.01			42.49	15.22***	22.52***
(1) vs. (4)	224.51			216.07		8.43	3.02	3.31
(1) vs. (5)	224.51				251.82	-27.31	9.78***	7.52***
(2) vs. (4)		185.70		216.07		-30.37	10.88***	13.10***
(2) vs. (5)		185.70			251.82	-66.11	23.68***	19.03***
(3) vs. (5)			182.01		251.82	-69.80	25.00***	20.63***

This table examines the differences in mean loan spreads (bps) between each of Dickinson's (2011) life cycle phases. Our sample includes U.S. publicly traded firms from 1988 to 2018. We exclude financial (SIC 6000 – 6999) and utility (SIC 4900 – 4949) firms from the sample. Tests of the difference-in-means are conducted using the Tukey honest significant difference test (HSD-test) and the Tukey-Kramer test (TK-test). *, **, and *** denote significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

TABLE 4
Firm Life Cycle and Loan Spread
Panel A: Firm Life Cycle and Loan Spread: Pooled Sample

	Dependent Variable= *SPREAD*				
Variable	(1)	(2)	(3)	(4)	(5)
INTRO	0.169***	-0.002	0.005		
	(6.74)	(-0.10)	(0.32)		
GROWTH	-0.129***	-0.041***	-0.036***		
	(-5.76)	(-2.90)	(-2.68)		
MATURE	-0.213***	-0.083***	-0.056***		
	(-9.88)	(-6.23)	(-4.52)		
DECLINE	0.278***	0.056**	0.055**		
	(8.10)	(2.38)	(2.48)		
RE/TA				-0.096***	
				(-8.50)	
RE/TE					-0.014***
					(-5.92)
FIRM SIZE		-0.059***	-0.033***	-0.025***	-0.035***
		(-8.20)	(-3.98)	(-3.08)	(-4.09)
MTB		-0.002*	0.001	0.000	-0.005***
		(-1.72)	(0.80)	(0.29)	(-3.98)
LEV		0.445***	0.234***	0.205***	0.352***
		(13.40)	(7.28)	(6.39)	(9.45)
TANGIBILITY		-0.134***	-0.120***	-0.122***	-0.138***
		(-4.09)	(-4.21)	(-4.29)	(-4.72)
STD CF		0.638***	0.615***	0.631***	0.906***
		(3.12)	(3.22)	(3.25)	(4.63)
Z-SCORE		-0.035***	-0.034***	-0.027***	-0.026***
		(-14.10)	(-14.74)	(-11.55)	(-10.89)
PROFITABILITY		-0.024	-0.024	-0.008	-0.051**
		(-0.88)	(-0.96)	(-0.33)	(-1.98)
ANALYST		-0.012***	-0.006***	-0.007***	-0.005***
		(-10.31)	(-6.15)	(-6.95)	(-5.34)
SALES GROWTH		0.073***	0.069***	0.066***	0.078***
		(4.39)	(4.36)	(4.23)	(4.93)
C4-INDEX		0.009	0.003	0.003	0.013
		(0.18)	(0.06)	(0.07)	(0.29)
AGE		-0.066***	-0.031***	-0.025***	-0.029***
		(-10.38)	(-5.48)	(-4.45)	(-5.19)
CUST CONCN		0.026*	0.021*	0.020	0.016
		(1.87)	(1.75)	(1.61)	(1.32)
BETA		0.045***	0.024***	0.019***	0.021***
		(8.70)	(5.34)	(4.25)	(4.44)
LOAN TERM		-0.060***	-0.065***	-0.063***	-0.067***
		(-5.06)	(-5.58)	(-5.39)	(-5.73)
LOAN SIZE		-0.118***	-0.119***	-0.117***	-0.121***

		(-16.57)	(-15.30)	(-14.99)	(-14.88)
SECURE		0.369***	0.330***	0.326***	0.328***
		(32.47)	(29.34)	(29.11)	(28.96)
Credit Rating FE	No	No	Yes	Yes	Yes
Loan Type FE	No	Yes	Yes	Yes	Yes
Industry FE (FFI48)	Yes	Yes	Yes	Yes	Yes
Period FE (calendar quarter)	Yes	Yes	Yes	Yes	Yes
Observations	20,307	20,307	20,307	20,307	19,342
Adj. R-squared	0.16	0.62	0.66	0.66	0.67
Test of Coefficients (F-Statistic)					
INTRO = GROWTH	212.68***	9.30***	10.47***		
GROWTH = MATURE	28.78***	19.12***	5.07**		

Panel B: Firm Life Cycle and Loan Spread: Entropy Balanced Samples

	Dependent Variable= *SPREAD*			
Variable	(1)	(2)	(3)	(4)
[NEXT PHASE]	-0.063***	-0.024***	0.051***	0.039*
	(-4.87)	(-2.64)	(4.09)	(1.68)
BASE PHASE	*INTRO*	*GROWTH*	*MATURE*	*SHAKEOUT*
NEXT PHASE	*GROWTH*	*MATURE*	*SHAKEOUT*	*DECLINE*
Controls	Yes	Yes	Yes	Yes
Credit Rating FE	Yes	Yes	Yes	Yes
Loan Type FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Period FE	Yes	Yes	Yes	Yes
Observations	8,420	14,347	11,114	2,888
Adj. R-squared	0.62	0.68	0.70	0.63

This table presents the results of regressing loan spreads on life cycle measures and control variables. The sample population includes 21,307 loans from fiscal years 1988 through 2018 that were made to 5,076 distinct publicly traded U.S. firms. Financial (SIC 6000 – 6999) and utility (SIC 4900-4949) firms are excluded from the sample. The specifications in Panel A follow Equation (1). Columns (1) through (3) utilize the five life cycle phases, as defined by Dickinson (2011). Columns (4) and (5) utilize two continuous measures of firm life cycle (*RE/TA* and *RE/TE*, respectively), as defined by DeAngelo et al. (2006). The regression analysis uses the logged version of the *SPREAD*, *FIRM SIZE*, *AGE*, *LOAN TERM*, and *LOAN SIZE* variables. Fixed effects for firm credit rating, loan type, industry (FFI48) and period are included as indicated. See the Appendix for detailed variable definitions. Panel B provides the results when estimating Column (3) of Panel A with a sample that is entropy balanced according to Dickinson's Dickinson (2011) life cycle phases. For each column in Panel B, the sample is limited to observations belonging to either the base phase or the next phase, as indicated. Summary statistics for the entropy balanced samples are provided in the Internet Appendix Table A. The indicator variables corresponding to the subsequent phase is included in the regression analysis. In both Panel A and Panel B, we cluster standard errors at the firm level. t-statistics are reported in parentheses. *, **, and *** denote significance at the 10 percent, 5 percent, and 1 percent levels, respectively (two-tailed).

TABLE 5
Firm Life Cycle and Loan Spread: ITCV

	Life Cycle Phases				*RE/TA*	*RE/TE*
Variables	(1)	(2)	(3)	(4)	(5)	(6)
Impact threshold of a confounding variable						
INTRO	-0.011					
GROWTH		-0.005				
MATURE			-0.018			
DECLINE				0.004		
RE/TA					-0.047	
RE/TE						-0.029
Partial impact of other life cycle measures						
INTRO		-0.012	-0.021	0.003		
GROWTH	0.017		-0.006	0.013		
MATURE	0.030	0.022		0.020		
DECLINE	-0.008	-0.012	-0.016			
Partial impact of control variables						
FIRM SIZE	0.001	0.000	0.001	0.000	-0.007	-0.003
MTB	0.000	0.000	0.000	0.000	0.000	0.007
LEV	0.003	0.003	0.001	0.000	-0.008	0.003
TANGIBILITY	0.000	-0.002	-0.001	0.000	-0.001	0.000
STD CF	0.002	-0.002	-0.001	0.000	-0.002	0.000
Z-SCORE	0.004	-0.006	-0.002	0.004	-0.052	-0.040
PROFITABILITY	0.001	-0.001	-0.001	0.001	-0.004	-0.003
ANALYST	0.000	0.000	0.000	0.000	0.006	0.002
SALES GROWTH	0.001	0.001	0.000	0.000	-0.001	0.000
C4-INDEX	0.000	0.000	0.000	0.000	0.000	0.000
AGE	0.001	0.002	0.001	0.000	-0.006	-0.004
CUST CONCN	0.000	0.000	0.000	0.000	0.000	0.000
BETA	0.001	0.000	-0.001	0.001	-0.007	-0.004
LOAN TERM	0.000	-0.001	-0.002	0.000	-0.003	-0.001
LOAN SIZE	-0.001	0.000	-0.004	0.004	-0.013	-0.012
SECURE	0.000	-0.006	-0.009	0.003	-0.021	-0.013

This table presents the impact threshold of a confounding variable (ITCV). Specifically, following Frank (2000) and Larcker and Rusticus (2010), the ITCV presents the correlation an omitted variable must have with our life cycle variables of interest in order to upend our primary findings. We present the partial impacts of the other life cycle measures and control variables as a benchmark for assessing the magnitude required in order to upend our primary findings. Columns (1) through (4) follow the specification provided in Column (3) of Table 4 Panel A. Columns (5) and (6) follow the specifications provided in Column (4) and Column (5) of Table 4 Panel A, respectively. This analysis uses the logged version of the *SPREAD*, *FIRM SIZE*, *AGE*, *LOAN TERM*, and *LOAN SIZE* variables. See the Appendix for detailed variable definitions.

TABLE 6
Firm Life Cycle and Loan Spread: Instrumental Variables Model

	Dependent Variables			
	First-stage *RE/TA*	Second-stage *SPREAD*	First-stage *RE/TE*	Second-stage *SPREAD*
Variables	(1)	(2)	(3)	(4)
IND-GRW-SHOCK	-0.411***		-1.498***	
	(-4.01)		(-3.09)	
RE/TA (IV)		-1.408***		
		(-3.43)		
RE/TE (IV)				-0.390***
				(-2.81)
FIRM SIZE	0.072***	0.070**	0.144***	0.020
	(11.10)	(2.18)	(3.91)	(0.80)
MTB	-0.005***	-0.006**	-0.185***	-0.075***
	(-4.19)	(-2.32)	(-8.34)	(-2.67)
LEV	-0.294***	-0.181	0.559**	0.561***
	(-7.16)	(-1.30)	(2.57)	(4.53)
TANGIBILITY	0.060*	-0.032	-0.116	-0.169***
	(1.83)	(-0.54)	(-0.75)	(-2.63)
STD CF	-0.969***	-0.729	0.831	1.123**
	(-4.62)	(-1.33)	(0.79)	(2.44)
Z-SCORE	0.074***	0.070**	0.308***	0.089**
	(21.09)	(2.28)	(17.88)	(2.06)
PROFITABILITY	0.445***	0.573***	1.235***	0.412**
	(13.85)	(3.03)	(8.24)	(2.30)
ANALYST	-0.009***	-0.019***	-0.017***	-0.012***
	(-8.57)	(-4.62)	(-2.95)	(-3.73)
SALES GROWTH	-0.050***	-0.003	-0.071	0.048
	(-3.33)	(-0.09)	(-0.98)	(1.47)
C4-INDEX	0.044	0.063	0.011	0.018
	(1.21)	(0.94)	(0.06)	(0.22)
AGE	0.057***	0.052**	0.167***	0.036
	(10.14)	(2.03)	(5.58)	(1.30)
CUST CONCN	-0.019	-0.007	-0.172**	-0.049
	(-1.30)	(-0.28)	(-2.10)	(-1.21)
BETA	-0.070***	-0.075**	-0.225***	-0.067**
	(-11.15)	(-2.44)	(-8.03)	(-2.01)
LOAN TERM	0.049***	0.003	0.103***	-0.026
	(5.45)	(0.11)	(2.73)	(-1.12)
LOAN SIZE	0.032***	-0.076***	0.138***	-0.070***
	(7.51)	(-4.81)	(5.92)	(-3.02)
SECURE	-0.072***	0.230***	-0.221***	0.243***
	(-9.13)	(6.93)	(-5.97)	(6.83)
Credit Rating FE	Yes	Yes	Yes	Yes
Loan Type FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

Period FE	Yes	Yes	Yes	Yes
Observations	20,307	20,307	19,342	19,342
Kleibergen-Paap rk LM statistic		16.18		9.73
Kleibergen-Paap (p-value)		0.00		0.00
Kleibergen-Paap Wald F statistic		16.05		9.53

This table presents results from estimating Model (1) after instrumenting *RE/TA* and *RE/TE*. We use a 2SLS estimation for our IV approach. Columns (1) and (3) provide the first stage estimations of *RE/TA* and *RE/TE*, respectively. Columns (2) and (4) use the instrumented variables from the first stage estimations (*RE/TA (IV)* and *RE/TE (IV)*, respectively) and otherwise follow the specification provided in Columns (4) and (5) of Table 4 Panel A, respectively. Our instrumental variable, *IND-GROW-SHOCK*, is the average standard deviation in sales growth for an industry, excluding the observation firm. This analysis uses the logged version of the *SPREAD*, *FIRM SIZE*, *AGE*, *LOAN TERM*, and *LOAN SIZE* variables. Detailed definitions are provided in Appendix A. Standard errors are clustered by firm. t-statistics are reported in parentheses. *, **, and *** denote significance at the 10 percent, 5 percent, and 1 percent levels, respectively (two-tailed).

TABLE 7
Alternative Regression Specifications: Firm and High Dimensional Fixed Effects

	Dependent Variable= *SPREAD*					
Variable	(1)	(2)	(3)	(4)	(5)	(6)
INTRO	-0.004			-0.017		
	(-0.22)			(-1.07)		
GROWTH	-0.048***			-0.043***		
	(-3.12)			(-3.14)		
MATURE	-0.069***			-0.041***		
	(-4.96)			(-3.20)		
DECLINE	0.050**			0.057**		
	(2.04)			(2.34)		
RE/TA		-0.104***			-0.045**	
		(-8.68)			(-2.09)	
RE/TE			-0.014***			-0.005
			(-6.14)			(-1.50)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Credit Rating FE	Yes	Yes	Yes	Yes	Yes	Yes
Loan Type FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry × Period FE	Yes	Yes	Yes			
Firm FE				Yes	Yes	Yes
Period FE				Yes	Yes	Yes
Observations	20,307	20,307	19,342	20,307	20,307	19,342
Adj. R-squared	0.67	0.67	0.67	0.73	0.73	0.73
Test of Coefficients (F-Statistic)						
INTRO = GROWTH	9.31***			4.02**		
GROWTH = MATURE	4.24**			0.08		

This table presents the results of regressing loan spreads on life cycle measures and control variables. Control variables include *FIRM SIZE*, *MTB*, *LEV*, *TANGIBILITY*, *STD CF*, *Z-SCORE*, *PROFITABILITY*, *ANALYST*, *SALES GROWTH*, *C4-INDEX*, *AGE*, *CUST CONCN*, *BETA*, *LOAN TERM*, *LOAN SIZE*, and *SECURE*. The table uses the logged measures for *SPREAD*, *FIRM SIZE*, *AGE*, *LOAN TERM*, and *LOAN SIZE*. Columns (1) through (3) utilize Industry × Period fixed effects, while Columns (4) through (6) utilize both firm fixed effects and period fixed effects. In Columns (1) and (4), F-statistics are provided testing the equality of the coefficients for the introduction and growth phases and the growth and mature phases, respectively. We cluster standard errors at the firm level. t-statistics are reported in parentheses. *, **, and *** denote significance at the 10 percent, 5 percent, and 1 percent levels, respectively (two-tailed).

TABLE 8
Additional Control Variables

	Dependent Variable= *SPREAD*					
Variable	(1)	(2)	(3)	(4)	(5)	(6)
INTRO	0.014			0.003		
	(0.46)			(0.20)		
GROWTH	-0.091***			-0.035**		
	(-3.34)			(-2.50)		
MATURE	-0.134***			-0.074***		
	(-5.39)			(-5.61)		
DECLINE	0.089			0.056**		
	(1.64)			(2.43)		
RE/TA		-0.024			-0.094***	
		(-0.53)			(-7.37)	
RE/TE			-0.015***			-0.016***
			(-2.95)			(-5.97)
DEBT BETA	1.052***	0.995***	1.000***	0.951***	0.954***	1.011***
	(4.83)	(4.47)	(4.41)	(9.40)	(9.37)	(9.31)
PVIOL	0.158***	0.166***	0.161***	0.175***	0.176***	0.173***
	(6.53)	(6.78)	(6.42)	(11.73)	(11.75)	(11.40)
LGD	-0.022	-0.012	0.072	0.123***	0.102***	0.137***
	(-0.12)	(-0.07)	(0.42)	(4.10)	(3.70)	(4.09)
MISSING DEBT BETA				0.060***	0.065***	0.058***
				(3.57)	(3.85)	(3.37)
MISSING PVIOL				0.063***	0.061***	0.060***
				(4.80)	(4.64)	(4.54)
MISSING LGD				0.226***	0.181***	0.234***
				(5.38)	(4.38)	(5.28)
FIRM SIZE	-0.045***	-0.044**	-0.065***	-0.061***	-0.053***	-0.066***
	(-2.62)	(-2.52)	(-3.81)	(-7.80)	(-6.77)	(-8.20)
MTB	-0.003*	-0.003*	-0.015***	-0.002*	-0.002**	-0.011***
	(-1.95)	(-1.84)	(-5.80)	(-1.84)	(-2.24)	(-7.23)
LEV	0.229***	0.212***	0.479***	0.391***	0.361***	0.583***
	(3.29)	(3.02)	(5.64)	(11.44)	(10.54)	(14.88)
TANGIBILITY	-0.088	-0.098	-0.071	-0.125***	-0.129***	-0.148***
	(-1.36)	(-1.50)	(-1.08)	(-3.84)	(-3.97)	(-4.43)
STD CF	0.537	0.986**	1.381***	0.553***	0.604***	0.972***
	(1.20)	(2.14)	(3.00)	(2.73)	(2.95)	(4.75)
Z-SCORE	-0.080***	-0.081***	-0.066***	-0.033***	-0.027***	-0.024***
	(-6.10)	(-4.99)	(-4.67)	(-13.74)	(-10.65)	(-9.17)
PROFITABILITY	0.013	-0.029	-0.037	-0.005	0.004	-0.036
	(0.20)	(-0.44)	(-0.54)	(-0.18)	(0.15)	(-1.31)
ANALYST	-0.007***	-0.008***	-0.007***	-0.011***	-0.012***	-0.010***
	(-3.50)	(-3.52)	(-3.07)	(-9.84)	(-10.47)	(-8.51)
SALES GROWTH	0.107***	0.109***	0.114***	0.071***	0.069***	0.080***
	(2.94)	(2.97)	(3.14)	(4.31)	(4.24)	(4.89)
C4-INDEX	0.206**	0.206**	0.243**	0.014	0.013	0.031
	(2.01)	(2.02)	(2.35)	(0.28)	(0.25)	(0.61)

AGE	-0.063***	-0.060***	-0.057***	-0.063***	-0.059***	-0.061***
	(-5.10)	(-4.77)	(-4.66)	(-10.15)	(-9.33)	(-9.79)
CUST CONCN	0.015	0.019	0.015	0.026*	0.025*	0.020
	(0.56)	(0.69)	(0.51)	(1.90)	(1.79)	(1.46)
BETA	-0.049**	-0.042*	-0.036	0.017***	0.013***	0.014***
	(-2.26)	(-1.91)	(-1.60)	(3.42)	(2.67)	(2.63)
LOAN TERM	-0.023	-0.032	-0.027	-0.055***	-0.054***	-0.057***
	(-0.81)	(-1.12)	(-0.95)	(-4.60)	(-4.55)	(-4.83)
LOAN SIZE	-0.065***	-0.065***	-0.055***	-0.114***	-0.113***	-0.115***
	(-4.44)	(-4.46)	(-3.79)	(-15.72)	(-15.40)	(-15.08)
SECURE	0.495***	0.503***	0.472***	0.349***	0.347***	0.342***
	(18.37)	(18.54)	(17.87)	(31.02)	(30.93)	(30.40)
Loan Type FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Period FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,798	3,798	3,601	20,307	20,307	19,342
Adj. R-squared	0.72	0.71	0.72	0.63	0.63	0.63
Test of Coefficients (F-Statistic)						
INTRO = GROWTH	13.26***			8.92***		
GROWTH = MATURE	4.99**			16.99***		

This table presents the results of regressing loan spreads on life cycle measures and control variables. In addition to the primary controls in Model (1), specifications in this table include controls for *DEBT BETA*, *PVIOL*, and *LGD*. In Columns (1) through (3) the sample is limited to observations where these variables are defined. In Columns (4) through (6) we replace undefined values of *DEBT BETA*, *PVIOL*, and *LGD* with zero and include indicator variables to account for such change (*MISSING DEBT BETA*, *MISSING PVIOL*, and *MISSING LGD*, respectively). In Columns (1) and (4), F-statistics are provided testing the equality of the coefficients for the introduction and growth phases and the growth and mature phases, respectively. We cluster standard errors at the firm level. t-statistics are reported in parentheses. *, **, and *** denote significance at the 10 percent, 5 percent, and 1 percent levels, respectively (two-tailed).

Abstrakt

Tento článek zkoumá vztah mezi podnikovým životním cyklem a úrokovým rozpětím. Na vzorku 20 307 pozorovaných firemních půjček celkem 5 076 veřejně obchodovaných amerických firem jsme zjistili, že úroková rozpětí napříč fázemi životního cyklu vykazují vzorec tvaru U. Ve vícerozměrné analýze jsme zjistili, že firmy v introduction a decline fázi platí vyšší úroky než firmy ve fázi mature (relativní rozdíly 6%, respektive 12%). V testování odolnosti zkoumáme vliv vynechaných proměných (včetně vysokorozměrných fixních efektů) a odhad instrumentální proměnné. Vzor ve tvaru písmene U přetrvává. Kromě úvěrového rizika jsou naše zjištění v souladu se systematickými a nediverzifikovatelnými idiosynkratickými riziky, která se liší v životním cyklu společnosti.

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