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Credit ratings and firm life-cycle

Magnus Blomkvist[a], Anders Löflund[b,*], Hitesh Vyas[a]

[a] Audencia Business School, Nantes, France
[b] Hanken School of Economics, Finland

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ABSTRACT

Credit ratings display an inverse U-shaped relation over the corporate life-cycle. Firms' likelihood to obtain a rating initially increases over the life-cycle as reputation increases and asymmetric information is reduced. As investment opportunities diminish during the shakeout and decline phases the benefit of having a rating decreases. The economic effect is substantial: transitioning from the introduction to the growth phase increases the rating likelihood from 6.7% to 30%.

1. Introduction

This study explores firms' access to bond markets over the corporate life-cycle. Faulkender and Petersen (2006) measure bond market access by having a credit rating[1] and highlight the advantages on capital supply.[2] Diamond (1991) argues that the barriers to enter the bond market follow a life-cycle pattern. The costs to enter the bond market depend on the level of asymmetric information and the firm's reputation. Banks reduce informational asymmetries to alleviate moral hazard through costly monitoring. Conversely, uninformed bond investors do not monitor actively, but instead transfer monitoring costs onto borrowers. For these reasons, firms with high asymmetric information and weak reputation face higher borrowing costs in the bond market and have a lower demand for a credit rating. According to the 'dynamic resource-based' view, reputation is a valuable and time-varying intangible resource (Boyd et al., 2010) linked to the firm's life-cycle. Introduction-stage firms, with low reputation and high asymmetric information levels, rely mainly on bank instead of bond market financing. As firms evolve, their quality is gradually revealed improving reputation, thereby enabling the firms to obtain a credit rating and to enter the bond market. In the later stages of the firm life-cycle, the net benefits of a credit rating are reduced due to shrinking investment opportunities, lower ability to service debt and increasing asymmetric information. Therefore, we expect an inverse u-shaped relation of having a credit rating over the firm's life-cycle.

Firm characteristics change through its life-cycle stages (Porter, 2004; Miller and Friesen, 1984). The dynamic resource-based view postulates that the transition through life-cycle stages depends on the development of heterogeneous resources and capabilities to create competitive advantages (Habim and Hasan, 2017). Early stage firms have greater investment opportunities and have less

* Corresponding author.
E-mail addresses: mblomkvist@audencia.com (M. Blomkvist), anders.loflund@hanken.fi (A. Löflund), hvyas@audencia.com (H. Vyas).

[1] Credit ratings can be viewed as a summary statistics that captures various elements affecting the firm's capital structure.
[2] Firms with a credit rating operate with 35% higher leverage ratios.

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CFO/CFI/CFF are cash flows from operations, investment activities and financing activities.

	CFO	CFI	CFF
1. Introduction	<0	<0	>0
2. Growth	>0	<0	>0
3. Mature	>0	<0	<0
4. Shake-out		Remaining firms	
5. Decline	<0	>0	<>0

Fig. 1. Life-cycle stage classification CFO/CFI/CFF are cash flows from operations, investment activities and financing activities.

Table 1
Descriptive statistics.

	Mean	Std. Dev.
Credit rating	0.223	0.416
Obtaining rating	0.015	0.121
Forgoing rating	0.005	0.071
Introduction	0.144	0.351
Growth	0.287	0.452
Mature	0.388	0.487
Shake-out	0.106	0.307
Decline	0.075	0.264
Market leverage	0.140	0.159
Size	4.305	1.949
Cash/TA	0.214	0.229
R&D/TA	0.060	0.147
M/B	2.091	1.884
EBITDA/TA	0.059	0.240
ln(1 + age)	2.321	0.880
12-month return	0.214	1.063
Proportion rated	0.209	0.177
S&P500	0.088	0.284
NYSE	0.334	0.472
Herfindahl	18.26	16.02
N	77,130	

Credit rating is an indicator variable taking value one if the firm has a long-term S&P issuer rating in year t. Obtaining rating (Forgoing rating) is indicator variables taking value one if the firm obtains (forgoes) a rating during year t. Introduction, growth, mature, shake-out and decline are indicator variables taking the value of one if the firm belongs to the respective life-cycle stage. Market leverage is measured as long-term plus short-term debt scaled by market value of assets. Market value of assets is defined as total assets minus book value of equity + market value of equity. Size is defined as the natural logarithm of market capitalization in 2017 dollars. TA is total assets. M/B is market value of assets scaled by book value of assets. Ln(1 + age) is the natural logarithm of 1 plus the number of years in COMPUSTAT. 12-month return is the last 12-months stock return. Proportion rated is the proportion of rated firms in the 3-digit SIC code. S&P500 is an indicator if the firm is a S&P500 constituent. NYSE is an indicator if the firm is listed on the New York Stock Exchange. Herfindahl is a sales based on the 3-digit SIC code.

debt (Faff et al., 2016), but are opaque (Hasan and Habib, 2017)[3] and invest in riskier projects (Coad et al., 2016) relative to mature firms. As firms decline, investment opportunities decrease (Faff et al., 2016) and information asymmetries increase (Hasan and Habib, 2017). Hence, several factors correlated with the demand and barriers to bond market financing vary over the firm life-cycle.

In a sample of 77,130 U.S. firm-years over the January 1st, 1989 – December 31st, 2015 period, we find an inverse U-shaped relation between credit rating likelihood and the life-cycle. In line with our hypothesis, we report that the credit rating likelihood increases from 6.7% to 25.9% when firms transition from the introduction to the growth phase. In the decline-stage the credit rating likelihood drops to 5%. Our novel finding is that firms in the early stages of their life-cycle, and firms in a declining phase, are significantly less likely to have a credit rating than predicted by standard credit rating determinants.

[3] Hasan and Habib (2017) study the effect of the life-cycle on idiosyncratic volatility, e.g. Ivashina (2009) links idiosyncratic volatility to asymmetric information.

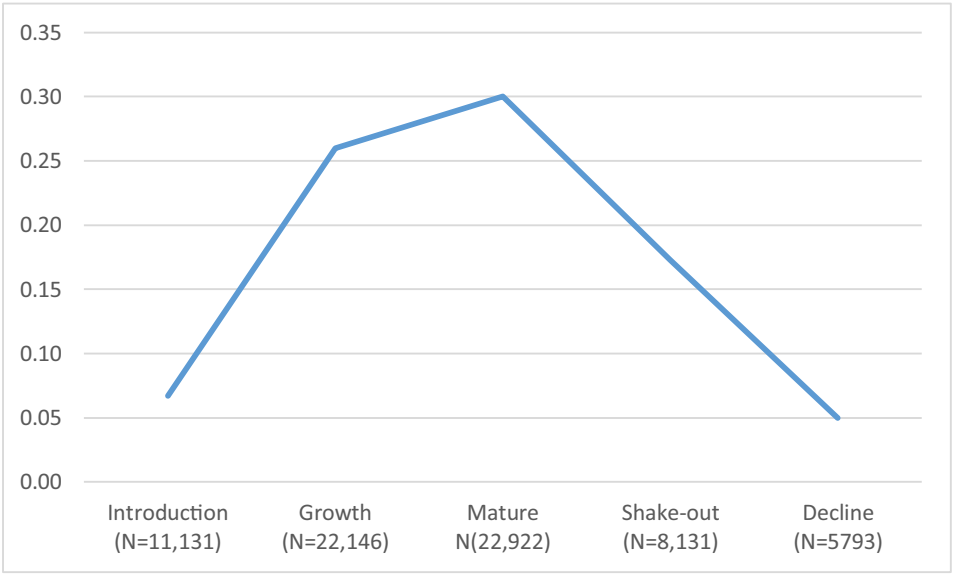

Fig. 2. Likelihood of having a credit rating.

Studying the impact of the life-cycle on the rating decision remains unexplored and is of importance to two strands of literature. First, we contribute to the understanding about the credit rating decision, e.g. Cantillo and Wright (2000). Second, we add to the literature on the life-cycle effects on corporate decisions (e.g. DeAngelo et al., 2006; Faff et al., 2016).

2. Data and method

We use the COMPUSTAT and CRSP sample of U.S. firms between January 1st, 1989 and December 31st, 2014. We exclude firms with negative book equity, total assets below $10 million, financial firms and utilities. We gather annual credit rating data from COMPUSTAT covering firms with an S&P long-term issuer rating between January 1st, 1990 and December 31st, 2015.

We then categorize firms into their life-cycle stages according to the commonly used Dickinson (2011)[4] methodology, based on the firms' cash flow patterns.[5] Firms are classified into five stages: Introduction, Growth, Mature, Shake-out and Decline, according to the cash flow signs from operations, investment and financing activity (see, Fig. 1).

We control for factors predicting the existence of a credit rating in line with e.g. Faulkender and Petersen (2006) and Harford and Uysal (2014). In addition, our controls capture standard life-cycle determinants such as cash flow, firm size and age. Our firm-specific variables include Market leverage, Size, Cash/TA, M/B, EBITDA/TA, ln(1 + age), R&D/TA, 12-month return, NYSE listing and S&P500 membership. We further control for industry concentration and for the proportion of credit rated firms in the industry, and account for year fixed effects. All control variables are summarized in Table 1. After excluding firms with missing data, we end up with a sample consisting of 77,130 firm-years.

Under the null hypothesis, life-cycle variables do not capture any incremental variation in the credit rating likelihood. Our alternative hypothesis is that the credit rating likelihood is affected by the life-cycle stage of the firms beyond firm and industry-specific determinants. To test our hypothesis, we estimate the following Logit model:

$$CR_{i,t} = \beta' L_{i,t-1} + \gamma' X_{i,t-1} + \varepsilon_{i,t}, \quad (1)$$

with $CR_{i,t}$ = a credit rating indicator with 1 for existence of a credit rating for firm i in year t and 0 otherwise, $L_{i,t-1}$ = vector of four life-cycle indicator variables for firm i in year t-1 and

$X_{i,t-1}$ = firm and industry-specific control variables. $\varepsilon_{i,t}$ is an error distributed by the standard logistic distribution. We cluster the standard errors on firm and year in all specifications. In additional tests, we study the decision to obtain a rating during year t given that the firm did not have a rating during year t-1. We also test for the decision to forgo a rating during year t given that the firm is rated during year t-1. We expect the firm's willingness to obtain its first credit rating, and the decision to forgo an existing rating, to depend on the firm's life-cycle.

Fig. 2 illustrates the credit rating likelihood over the life-cycle. An inverse U-shaped relation between life-cycle stages and the proportion of rated firms: firms in the mature stage (30.4%) have roughly three times greater likelihood of having a rating relative to firms in the introduction (6.7%) and decline (4.9%) stages.

[4] E.g. Hasan and Cheung (2018) and Faff et al. (2016).

[5] Using firm age does not yield a good classification since life-cycle length differs between industries (Dickinson, 2011).

Table 2
Regression results.

	(1) Credit Rating	(2)	(3) Obtaining Rating	(4)	(5) Forgoing Rating	(6)
Intro	−1.0670***	−0.5398***	−0.0782	−0.0744	0.2691	0.0052
	(−10.658)	(−4.852)	(−0.391)	(−0.370)	(1.046)	(0.017)
Growth	0.5209***	0.1181**	0.9321***	0.3317**	−0.5606***	−0.4467**
	(8.911)	(2.001)	(6.287)	(2.033)	(−2.924)	(−2.575)
Mature	0.7216***	0.0057	0.5112***	0.0162	−0.4486**	−0.0691
	(12.438)	(0.106)	(3.677)	(0.104)	(−2.211)	(−0.379)
Decline	−1.3863***	−0.0070	−0.8989***	0.1142	1.1525***	0.7515***
	(−13.443)	(−0.060)	(−3.348)	(0.449)	(6.470)	(3.606)
Market leverage		5.1302***		4.3796***		−3.7665***
		(19.310)		(13.403)		(−5.541)
Size		0.8003***		0.4923***		−0.3988***
		(25.115)		(12.757)		(−9.628)
Cash/TA		−2.7891***		−1.4415***		2.5778***
		(−9.423)		(−5.271)		(8.942)
RD/AT		0.2220		0.1383		−0.4098
		(1.300)		(1.253)		(−0.500)
M/B		0.0676***		0.0944***		−0.1275**
		(3.420)		(8.491)		(−2.555)
EBITDA/TA		−0.1187		1.4945***		0.4813
		(−0.442)		(5.591)		(0.665)
ln(1 + age)		0.0947**		−0.2471***		0.0420
		(2.273)		(−6.943)		(0.648)
12-month return		0.1393***		0.1215*		0.0109
		(4.990)		(1.896)		(0.109)
Proportion rated		3.2375***		0.1585		−1.6108***
		(16.201)		(0.675)		(−4.405)
S&P 500		1.6634***		0.8750***		−1.5540***
		(16.099)		(6.012)		(−6.587)
NYSE		0.9927***		0.8265***		−0.6493***
		(12.369)		(9.328)		(−6.025)
Herfindahl		−0.0101***		−0.0088***		0.0051
		(−4.179)		(−2.768)		(1.557)
Constant	−1.5678***	−7.7312***	−4.4138***	−7.3982***	−3.3810***	−0.3621
	(−23.117)	(−35.161)	(−29.982)	(−26.697)	(−18.361)	(−0.759)
Observations	77,130	77,130	60,712	60,712	16,418	16,418
R-Squared	0.0564	0.5129	0.0208	0.2029	0.0160	0.1816
Year FE	No	Yes	No	Yes	No	Yes

The table reports Logit models. All variables are defined as in Table 1. Robust t-stats clustered on firm and year are reported in parentheses. ***, **, * denotes significance on 1%, 5% and 10% level respectively.

The descriptive statistics in Table 1 reports that 22.3% of all firms have a credit rating. The maturity stage (38.8%) is the most common life-cycle stage, whereas decline is the least common (7.5%).

3. Results

Column (1) in Table 2 reports the relation between life-cycle stages and the credit rating likelihood. Our panel Logit model captures the graphical pattern in Fig. 2. Firms in the introduction and decline stage have a lower probability of having a rating relative to the shakeout stage. Conversely, firms in the mature and growth stage have a higher probability of being rated. The economic effect is large: the probability of being rated increases from 6.4% to 28.7% by moving from the introduction to the growth phase.[6] In column (2), we control for important economic determinants of bond market access and year fixed effects. We find that life-cycle effects are still incrementally relevant. Firms in the introduction stage exhibit a lower, and firms in the growth stage, a higher likelihood of being rated. The economic effect is non-trivial: moving from the introduction to the growth phase increases the probability of being rated from 18.4% to 22.8%. The signs of the control variables are in line with prior studies, e.g. Faulkender and Petersen (2006) and Harford and Uysal (2014). In unreported results including firm-level fixed and random effects, we report life-cycle effects in line with the results in column (2). In columns (3)-(4), we study the likelihood of obtaining an initial credit rating. In column (3), the likelihood of obtaining a rating is positive in the growth and mature phases, and negative in the decline phase. When adding controls in column (4), firms predominately obtain a credit rating in the growth stage of the life-cycle. In columns (5) and (6),

[6] We obtain the economic significance from the marginal effects (−0.134 for introduction and 0.088 for growth) relative to average rating probability (19.8%) in the shake-out phase (our tables report the odds ratio and not marginal effects).

we study the likelihood of forgoing an existing credit rating. We report that firms in the decline stage are more likely, and firms in the growth stage less likely, to forgo their credit rating in both specifications.

In line with our hypothesis, the credit rating likelihood exhibits an inverse U-shape over the life-cycle. We document an incremental life-cycle effect after controlling for standard determinants of credit rating status. Some of these determinants such as age, EBITDA/TA and size are also correlated with the life-cycle. Hence, after controlling for observable factors affecting the credit rating decision, we argue that the remaining life-cycle variation affecting the credit rating decision is likely to capture unobservable factors such as information and reputation. Thus, we attribute our findings to how resources and capabilities evolve over the life-cycle affecting the credit rating decision.

4. Conclusions

We examine how the credit rating likelihood changes over the corporate life-cycle. Specifically we find that, introduction and decline stage firms are less likely, and growth and mature stage firms more likely to have a credit rating. Hence, bond market access becomes more important in the middle stages, creating an inverse u-shaped relation of credit rating likelihood. The life-cycle effects persist even after controlling for firm and industry-wide factors determining credit rating likelihoods. We confirm the effect splitting the credit rating variable into firms obtaining their first credit rating, and to firms that forgo their rating. Firms in the introduction and growth stages have strong demand for an initial rating, whereas mature and declining stage firms do not.

CRediT authorship contribution statement

Magnus Blomkvist: Conceptualization, Methodology, Data curation, Visualization, Investigation, Validation, Writing - review & editing. **Anders Löflund:** Conceptualization, Methodology, Data curation, Visualization, Investigation, Validation, Writing - review & editing. **Hitesh Vyas:** Conceptualization, Methodology, Data curation, Visualization, Investigation, Validation, Writing - review & editing.

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