2019-1018 IJOI
http://www.ijoi-online.org/

THE IMPACT OF FINANCIAL CONSTRAINT ON FIRM GROWTH: AN ORGANIZATIONAL LIFE CYCLE PERSPECTIVE AND EVIDENCE FROM TAIWAN

Jiang-Chuan Huang
School of Business, Putian University
imjchuang@foxmail.com

Jen-Jen Tseng*
Department of Finance, Chien Hsin University of Science and Technology
*Corresponding author: jenjen@uch.edu.tw

Hueh-Chen Lin
School of Business, Putian University
imhjlin@foxmail.com

Abstract

This paper explores the relationships between cash flow, leverage and growth opportunities to ascertain whether financial constraints influence a firm's growth based on an organizational life cycle perspective. Results show that cash flow is positively related to a firm's growth across firm life cycle stages, while leverage is negatively related to a firm's growth for firms in the growth and mature stages of the firm life cycle. Moreover, the sensitivity of growth to cash flow of growth-stage firms is greater than that of firms in the mature and decline stages. However, the sensitivity of growth to leverage for the decline-stage firms is the highest among firms in all stages of the life cycle. The evidence suggests that firms in the growth and mature stages may conform to the pecking order to promote growth, while firms in the decline stage may consider to follow signaling theory to promote growth because both dominant theories are individually suitable for firms to promote growth in different stages of the firm life cycle.

Key words: organizational life cycle, financial constraints, cash flow, debt structure, capital structure.

Introduction

In the practical capital market, financial considerations significantly complicate investment opportunities. Modigliani and Miller (1963) claim that firms can increase values by debt financing, which seemingly encourages firms to debt finance unlimitedly to increase their values and ignores the existence of debt financing costs. However, a financial constraint exists when high leverage limits the capability of debt financing, which then negatively affects firm growth. Facing financial constraints, firms cannot respond to investment demands and then may lose growth opportunities (Oliveria and Fortunato, 2006). Because firms face a variety of different constraints at different stages of the life cycle, Phelps et al. (2007) argue that research on firm growth should consider the organizational life cycle theory.

Organizational life cycle theory proposes that firms pass through a series of stages throughout their life cycle, and that the resources, capabilities, structures and strategies vary significantly with stages of development (Habib et al., 2018). In order for accommodating to changes in internal and external environments at various stages, firms must develop appropriate strategies to continue growth, while maintaining or reversing the life cycle. However, strategies affect investment decisions, and financial decisions also limit the implementation of investment decisions (O'Brain, 2003). In general, when discussing the relationship between financing decisions and investment, researchers usually consider the pecking order theory and the signaling theory as two conflicting viewpoints (Barry et al., 2004; Akorsu, 2014). According to Barry et al. (2004), the signaling theory implies a positive relationship between the firm's cash flow and debt structure, while the pecking order theory suggests a negative relationship between the firm's cash flow and debt structure. Akorsu (2014) argues that from the practice of financial management in firms, the pecking order and the signaling theories are both concerned with the relationship between a firm's debt structure and cash flow under asymmetric information, moral hazard and adverse selection. These issues seem to be puzzling from the classical pecking order theory or the signaling theory point of view (Miglo, 2017). In this paper, we consider that firms in different life cycle stages should have various financing characteristics, and thus infer that these two theories (pecking order theory vs. signaling theory) can both fit into firms in different stages of the life cycle. Therefore, we attempt to examine the relationships between cash flow, leverage and growth opportunities to ascertain whether financial constraints influence a firm's growth based on an organizational life cycle perspective.

By financial constraints, most studies describe frictions in the supply of capital as being caused by information asymmetries (Myers and Majluf, 1984) and agency problems (Jensen and Meckling, 1976) that induce a wedge between a firm's internal and external costs of funds (Schauer et al., 2019). While most of the existing empirical literature that examines the effect of financial con-

straint on investment and firm growth (e.g., Hutchinson and Xavier, 2006; Oliveira and Fortunato, 2006; Miglo, 2017; Quader, 2017), there is little evidence on firm growth and financial constraint across firm life cycle stages. In particular, this paper considers the firm's financing difference in the various life cycle stages to investigate the impact of financial constraint on firm growth, expecting to provide more managerial implications.

The objectives of this paper are to empirically test whether financial constraints influence the firm growth based on an organizational life cycle perspective. First, we explore the relationship between cash flow and firm growth to ascertain whether the relationship is positive to determinate the existence of liquidity constraints as well as financial constraints across life cycle stages. Second, we also examine the relationship between leverage and firm growth to ascertain whether the relationship is negative to test the existence of financial constraints across life cycle stages. And then, we estimate the interactive effects of cash flow (and leverage) and a life cycle dummy variable with pairwise comparisons to determine whether the pecking order and the signaling theories can both conform to firms for promoting firm growth at different stages of the firm life cycle.

Our empirical results show that cash flow has a significantly positive effect on firm growth across firm life cycle stages, while there is a significantly negative relationship between leverage and firm growth for firms in the growth and mature stages. This evidence suggests that firms in the growth and mature stages may conform to the pecking order to promote growth. In addition, the sensitivity of growth to cash flow for growth-stage firms is greater than that of mature- and decline-stage firms because firms' growth is hampered by liquidity constraints for firms in the growth stage. However, the sensitivity of growth to leverage for decline-stage firms is the highest because the leverage effect and sensitivity become weaker for firms in the growth and mature stages. The evidence suggests that firms in the decline-stage of the life cycle may consider to follow the signaling theory to promote growth. Consequently, our findings suggest that although the pecking order and the signaling theories are both concerned with the relationship between a firm's cash flow and debt structure to growth, they are individually suitable for firms to promote growth in different stages of the firm's life cycle.

The remainder of the paper is organized as follows. Section 2 discusses the sample selection and the methodology. Section 3 presents our empirical results. Section 4 is our conclusion.

Data and Methodology

Sample Selection and Data

Taiwan's authorities have made every effort to cultivate the high-tech industry, which is in need of huge investment. In recent years, Taiwan has already played a crucial role in the global IT manufacturing system with the help from the central government. Par-

ticularly, Taiwan has become the third-largest IC and PC manufacturing center after the United States and Japan, and also won the title of "chip kingdom". Therefore, it is important to understand how firms in the high-tech industry access internal and external capital to promote growth. We collected a sample of 569 Taiwanese listed IC firms over the period 2014-2017, and explored the impact of financial constraints on firm growth across firm life cycle stages. The financial statements for sample firms were obtained from the *Taiwan Economic Journal* (TEJ) database.

Empirical Model and Variables

This study aims to examine the relationship between cash flow (and leverage) and firm growth to ascertain whether financial constraints affect firm growth across firm life cycle stages and determine whether the pecking order and the signaling theories can both fit into firms' planning to promote growth at different stages of the life cycle. The empirical models are as follows:

$$Growth_{i,t} = \beta_0 + \beta_1 CF_{i,t} + \beta_2 LEV_{i,t} + \sum \gamma_j CTRL_{t,jt} + \varepsilon_{i,t} \quad (1)$$

$$Growth_{i,t} = \beta_0 + \beta_1 CF_{i,t} + \beta_2 LEV_{i,t} + \beta_3 (CF_{i,t} \times LC\_DUM_{i,t}) + \beta_4 (LEV_{i,t} \times LC\_DUM_{i,t}) + \sum \gamma_j CTRL_{t,jt} + \varepsilon_{i,t} \quad (2)$$

where the following apply:

Dependent variables

$Growth_{i,t}$: We employ market-book ratio (*M/B*) and Tobin's Q (*TQ*) as proxy variables of growth opportunity as well as firm growth to be the dependent variables.

$M/B_{i,t}$: The total market value of outstanding common and preferred shares, divided by total equity for firm *i* at time *t*.

$TQ_{i,t}$: The total market value of outstanding common and preferred shares plus total liabilities, and then divided by total asset for firm *i* at time *t*.

Independent variables

$CF_{i,t}$: A proxy variable of cash flow is the net cash from operations plus the accumulated depreciation for firm *i* at time *t*. By examining the relationship between cash flow and growth opportunities, we will be able to determine the existence of liquidity constraints as well as financial constraints.

$LEV_{i,t}$: The leverage is the ratio of total liabilities and total assets for firm *i* at time *t*. The leverage ratio is usually used as a proxy indicator for the borrowing capability of firms, or a proxy indicator of financial constraints (Honjo and Harada, 2006).

$LC\_DUM_{i,t}$: A dummy variable for the firm's life cycle stages. We follow an abbreviated life cycle measure proposed by Aivazian et al. (2005) and Arcelus et al. (2005), who develop a composite indicator to determinate the firm's life cycle stages by using four variables such as dividend payout ratio, sales growth rate, capital expenditure ratio and firm age as the basis to group firms into three life cycle stages, such as "growth", "mature" and "decline". The classifications are based on the patterns of these four variables as shown in Table 1.

Table 1. The classification of firm life cycle stages

Life cycle stages	Dividend payout ratio	Sales growth rate	Capital expenditure ratio	Firm age
Growth stage	Low	High	High	Low
Mature stage	Medium	Medium	Medium	Medium
Decline stage	High	Low	Low	High

In addition, we assign the growth stage a score of 0, the mature stage a score of 1 and the decline stage a score of 2. The composite indicator is scored by the intersection of the variables and the life cycle stages. The firms with a score of 0-2 are grouped into the growth-stage firms, those with a score of 3-5 are grouped into the mature-stage firms and those with a score of 6-8 are grouped into the decline-stage firms. For example, according to the classifications of life cycle stages and the patterns of variables in Table 1, a firm *i* with a low dividend payout ratio falling in the growth stage is scored 0, medium sales growth rate falling in the mature stage is scored 1, high capital expenditure ratio falling in the growth stage is scored 0 and medium firm age falling in the mature stage is scored 1. The composite indicator is totally scored 2 for firm *i*, and then we group firm *i* into the growth-stage firms.

$CF_{i,t}$ x $LC\_DUM_{i,t}$: The interactive variable to measure the cross interactions between cash flow and firm's life cycle to firm growth.

$LEV_{i,t}$ x $LC\_DUM_{i,t}$: The interactive variable to measure the cross interactions between leverage and firm's life cycle to firm growth.

Control variables

$SIZE_{i,t}$: The natural log of total assets for firm *i* at time *t*.

YR_t: A vector of year control variables containing the period 2014-2017.
$\varepsilon_{i,t}$: The random error term.

Empirical Results

Table 2 shows the descriptive statistics of all variables. The final effective sample size is 569 Taiwanese listed IC firms over the period 2014-2017 excluding missing or incomplete data. The mean of two dependent variables, Tobin's Q and market-book ratio is 1.491 and 2.591, respectively, and the standard deviation (S.D.) is 1.245 and 2.236, respectively. For the key independent variables, the mean of cash flow for the entire sample is 0.100 and the S.D. is 0.175, which shows a greater variation of cash flow for each sample firm. Considerable variation in leverage can be seen between the minimum (0.030) and maximum (0.870). The remaining four variables (i.e., dividend payout, sales growth, capital expenditure and age) are composed as a dummy variable to proxy the firm life cycle stages.

Table 2. Descriptive Statistics of Variables

Variable		Size	Min.	Max.	Mean	S.D.
Tobin's Q	*TQ*	569	0.060	10.990	1.494	1.245
Market-Book	*MB*	569	0.230	16.120	2.591	2.236
Dividend payout	*DIV*	569	0.000	16.290	2.390	2.665
Sales growth	*SG*	569	-.850	7.430	0.192	0.478
Capital expenditure	*CE*	569	-1.315	3.769	0.025	0.251
Firm age	*AGE*	569	1.000	46.000	12.719	7.060
Cash flow	*CF*	569	-1.120	0.590	0.100	0.175
Leverage	*LEV*	569	0.030	0.870	0.333	0.167
Firm size	*SIZE*	569	11.170	21.280	15.219	1.785

Table 3 reports the regression analysis for the impact of cash flow and leverage on firm growth across all firm life cycle stages. In Panels A and B of Table 3, the evidence shows that cash flow (*CF*) displays significantly positive effects on the firm growth as the results show in Models (1) - (4). It implies that the more cash flow firms have, the greater likely they will present growth, which means that cash flow from operations can promote growth in every organizational life cycle stage. However, when firms do not have plenty of cash flow to support their investment projects, they may face liquidity constraints and are inclined toward slow growth (Oliveria and Fortunato, 2006). In contrast with the cash flow, as the results in Panels A and B show, the coefficients on the leverage are significantly negative as reported in Models (1) - (3), except the insignificantly negative results for decline-stage firms as shown in Model (4). This result indicates that there is a negative relationship between leverage and firm growth, implying that firms with higher leverage in the growth and mature stages of the

firm life cycle will have limited external borrowing capability which will hamper the firm's growth due to the existence of financial constraints. Consequently, this evidence suggests that firms in the growth and mature stages may consider to follow the pecking order theory to promote their growth.

In addition, the results in all of models show that firm size delivers significant positive effects on the firm growth, implying that large firms may have the comparative advantage in internal reallocation and capability in external capital markets. The results also present that firms had better growth in years 2016 and 2017 than those of other years. Since a firm's growth is measured by market values and since Taiwan's stock market was bullish during those two years, which caused the empirical results to be consistent with the situation of the capital market.

Table 3. Regression analysis on financial constraint and firm growth across various life cycle stages

Panel A: Dependent variable: Tobin's Q				
Variables	Model (1) ALL firms	Model (2) Growth firms	Model (3) Mature firms	Model (4) Decline firms
Intercept	-1.062**	-4.431***	-0.632	-0.706
	(0.470)	(1.611)	(0.455)	(0.811)
CF	1.364***	3.129***	0.671***	1.907**
	(0.298)	(1.399)	(0.254)	(0.740)
LEV	-1.205***	-3.881***	-1.369***	-0.462
	(0.275)	(0.879)	(0.273)	(0.482)
SIZE	0.176***	0.443***	0.155***	0.114**
	(0.029)	(0.112)	(0.028)	(0.050)
YR2014	-0.296*	-0.010	-0.300*	-0.164
	(0.162)	(0.444)	(0.155)	(0.347)
YR2015	0.001	0.628	-0.124	0.052
	(0.159)	(0.437)	(0.152)	(0.339)
YR2016	0.449***	1.121***	0.308**	0.293
	(0.156)	(0.406)	(0.153)	(0.328)
YR2017	0.381**	1.280***	0.316**	0.014
	(0.151)	(0.413)	(0.145)	(0.334)
F Statistic	28.746***	13.127***	23.020***	4.709***
R Square	0.264	0.442	0.325	0.260
Adj. R Square	0.255	0.408	0.311	0.204
N	569	124	343	102
Panel B: Dependent variable: Market-Book Ratio				
Variables	Model 1 ALL firms	Model 2 Growth firms	Model 3 Mature firms	Model 4 Decline firms
Intercept	-0.634	-5.566*	-0.302	0.217
	(0.887)	(3.148)	(0.782)	(1.664)
CF	3.131***	6.699**	1.767***	2.730*
	(0.562)	(2.734)	(0.437)	(1.519)
LEV	-1.392**	-4.456**	-1.147**	1.298
	(0.519)	(1.718)	(0.470)	(0.990)
SIZE	0.192***	0.623***	0.176***	0.168*
	(0.055)	(0.219)	(0.047)	(0.103)
YR2014	-0.769**	-1.033	-0.498*	-0.574
	(0.306)	(0.867)	(0.267)	(0.713)
YR2015	-0.063	0.576	-0.017	-0.225
	(0.299)	(0.854)	(0.261)	(0.696)
YR2016	0.614**	1.274	0.591**	0.281
	(0.294)	(0.793)	(0.262)	(0.672)
YR2017	0.568**	1.751**	0.490**	0.410
	(0.286)	(0.806)	(0.249)	(0.686)
F Statistic	18.661***	8.962***	15.517***	1.946***
R Square	0.189	0.351	0.245	0.127

Adj. R Square	0.179	0.312	0.229	0.062
N	569	124	343	102

Notes: The coefficients of variables are listed in each column, with standard errors reported in the parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively.

Table 4. Comparison of responses of internal and external capital to firm growth with different life stages.

Panel A: Dependent variable: Tobin's Q

Variables	Model (1) Growth vs. Mature (Mature=1)	Model (2) Growth vs. Decline (Decline=1)	Model (3) Mature vs. Decline (Decline=1)
Intercept	-1.565*** (0.514)	-1.398 (0954)	-0.888** (0.394)
CF	1.133*** (0.141)	0.746*** (0.144)	0.133*** (0.047)
LEV	-0.441*** (0.100)	-0.452*** (0.136)	-0.236*** (0.048)
CF×LC_DUM	-1.021*** (0.147)	-0.515*** (0.183)	0.112 (0.120)
LEV×LC_DUM	0.241** (0.116)	0.477*** (0.184)	0.194** (0.090)
SIZE	0.187*** (0.032)	0.181*** (0.060)	0.144*** (0.024)
YR2014	-0.270 (0.169)	-0.257 (0.318)	-0.300** (0.144)
YR2015	0.043 (0.166)	0.190 (0.312)	-0.11(0.140)
YR2016	0.547*** (0.164)	0.639** (0.296)	0.266* (0.139)
YR2017	0.553*** (0.158)	0.630** (0.302)	0.245* (0.135)
F Statistic	29.992***	11.866***	19.932***
R Square	0.371	0.331	0.292
Adj. R Square	0.359	0.303	0.277
N	467	226	445

Panel B: Dependent variable: Market-Book Ratio

Variables	Model (1) Growth vs. Mature (Mature=1)	Model (2) Growth vs. Decline (Decline=1)	Model (3) Mature vs. Decline (Decline=1)
Intercept	-0.853 (0.962)	0.361 (1.870)	-0.119 (0.706)
CF	2.314*** (0.264)	1.485*** (0.281)	0.348*** (0.085)

LEV	-0.360*	-0.388*	-0.194**
	(0.187)	(0.206)	(0.086)
CF×LC_DUM	-1.986***	-1.125***	0.001
	(0.275)	(0.358)	(0.216)
LEV×LC_DUM	0.216*	0.815**	0.447***
	(0.115)	(0.360)	(0.162)
SIZE	0.212***	0.170	0.147***
	(0.060)	(0.118)	(0.044)
YR2014	-0.760**	-1.221*	-0.548**
	(0.317)	(0.623)	(0.257)
YR2015	0.044	-0.210	-0.096
	(0.310)	(0.611)	(0.251)
YR2016	0.784**	0.542	0.467*
	(0.306)	(0.580)	(0.249)
YR2017	0.748**	0.923	0.459*
	(0.296)	(0.593)	(0.242)
F Statistic	22.542***	8.469***	12.300***
R Square	0.307	0.261	0.203
Adj. R Square	0.294	0.230	0.186
N	467	226	445

Notes: "*LC_DUM*" is a dummy variable for life stages. In Model (1), it takes a value of one if a firm is in the mature stage of the life cycle. In Models (2) and (3), it takes a value of one if a firm is in the decline stage of the life cycle.
The coefficients of variables are listed in each column, with standard errors reported in the parentheses.
***, ** and * indicate significance at the 1% , 5% and 10% level, respectively.

In order to compare the sensitivity of financial constraint on firm growth in different stages of the firm life cycle, we set up a dummy variable (*LC_DUM*) to proxy the firm's life cycle stage and measure the effects of the interactions between cash flow (and leverage) and this life cycle stage dummy variable. Table 4 presents the results of pairwise comparisons. In both Panel A and Panel B, the interaction variable, *CF* x *LC_DUM*, has a negative and significant effect on firm growth as shown in Model (1) and (2) except for the insignificant results of decline-stage firms as reported in Model (3). It implies that compared to growth-stage firms, mature- and decline-stage firms tend to offset the positive effect of cash flow on the firm's growth, which means that the cash flow of firms in the mature and decline stages to firms' growth is less sensitive than that of growth-stage firms. Thus, we suggest that growth-stage firms are more easily constrained by liquidity which affects their growth.

Additionally, all of the models in Panels A and B show that the coefficients on the interaction variable (*LEV* x *LC_DUM*) are positive and significant, implying that firms in the mature and decline stages are more likely to offset the negative effects of leverage on firm growth than that of growth-stage firms. The evidence reveals that the sensitivity of leverage to firm growth is the highest

in decline-stage firms, followed by mature-stage firms and lowest in growth-stage firms significantly. Hence, our findings suggest that firms in the decline stage of the life cycle may consider to follow signaling theory to promote firms' growth because high leverage can work as financing signal for these firms, and these firms will have a higher leverage level which is connected with contemporaneous investments (Akorsu, 2014).

Moreover, in order to test the basic hypotheses in the regression models, we conduct the Durbin-Watson (DW) test and Variance Inflation Factors (VIF) analysis. Accordingly, the results identify that auto-correlation does not exist in the residual terms and the problem of multicollinearity is negligible.

Conclusion

In this study, we used 569 Taiwanese listed IC firms over the period 2014-2017 to test whether financial constraints affected firm growth among firms facing different stages of the organizational life cycle. Additionally, under the presence of capital market imperfections, the pecking order and the signaling theories are both concerned with the relationship between a firm's cash flow and debt structure to growth under asymmetric information, moral hazard and adverse selection. These recognitions have led to these two dominant theoretical models which this study sought to test against firms in different stages of the life cycle.

To the best of our knowledge, this is the first study that examines the impact of financial constraints on the growth based on a firm's various stages of the life cycle. Our empirical results can make up for the gap of relevant literature on optimal capital structure, financial constraint, investment and financing policies. Consequently, we find that cash flow has a significantly positive effect on firm growth across all life cycle stages, while there is a significantly negative relationship between leverage and firm growth in the growth- and mature-stage firms. This evidence suggests that firms in the growth and mature stages of the life cycle may conform to the pecking order to promote growth. Further, the sensitivity of growth to cash flow of firms in the growth stage is greater than that of firms in the mature and decline stages because firms' growth is hampered by liquidity constraints for growth-stage firms. However, the sensitivity of growth to leverage for decline-stage firms is the highest because of the leverage effect, and the sensitivity becomes much weaker for the firms in growth and mature stages. These findings suggest that decline-stage firms may consider to follow the signaling theory to promote firm growth. On these bases, we conclude that although the pecking order and the signaling theories are both concerned with the relationship between a firm's cash flow and debt structure, they are individually suitable for firms to promote growth in different stages of a firm's life cycle.

References

Aivazian, V.A., Ge, Y., & Qiu, J. (2005). Debt maturity structure and firm investment. *Financial Management*, 34(4), 107-119.

Akorsu, P.K. (2014). Testing the pecking order and signaling theories for financial institutions in Ghana. *Research Journal of Finance and Accounting*, 5(16), 77-83.

Arcelus, F.J., Mitra, D., & Srinivasan, G. (2005). On the incidence of deferred taxes, intangibles and nonlinearities in the relationship between Tobin's Q and ROI. *Journal of Economics and Business*, 57(2),165-185.

Barry, P.J., Katchova, A.L. & Zhao, J. (2004). Testing the pecking order theory and the signaling theory for

farm businesses. *Paper prepared for presentation at the American Agricultural Economics* Association Annual Meeting, Denver, Colorado, July 1-4, 2004.

Habib, A., Bhuiyan, Md. B.U. & Hasan, M.M. (2018). Firm life cycle and advisory directors. *Australian Journal of Management*, 43(4), 575-592.

Honjo, J., & Harada, A. (2006). SME policy, financial structure and firm growth: evidence from Japan. *Small Business Economics*, 27(4), 289-300.

Hutchinson, J., & Xavier, A. (2006). Comparing the impact of credit constraints on the growth of SMEs in a transition country with an established market economy. *Small Business Economics*, 27, 169-179.

Jensen, M.C., & Meckling, W.H. (1976). Theory of the firm: managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, 3(4), 305-360.

Miglo, A. (2017). Timing of earnings and capital structure. *North American Journal of* E*conomics and finance*, 40, 1-15.

Modigliani, F., & Miller, M.H. (1963). Taxes, and the cost of capital: a correction. *American Economic Review*, 53(3), 433-443.

Myers, S.C., & Majluf, N.S. (1984). Corporate financing and investment decision when firms have information that investors do not have. *Journal of Financial Economics*, 13(2), 187-221.

O'Brien, J.P. (2003). The capital structure implications of pursuing a strategy of innovation. *Strategic Management Journal*, 24(5), 415-431.

Oliveira, B., & Fortunato, A. (2006). Firm growth and liquidity constraints: a dynamic analysis. *Small Business Economic*, 27(2), 139-156.

Phelps, R., Adams, R., & Bessant, J. (2007). Life cycles of growing organizations: a review with implications for knowledge and learning. *International Journal of Management Reviews*, 9(1), 1-30.

Quader, S.M. (2017). Differential effect of liquidity constraints on firm growth. *Review of Financial Economics*, 32, 20-29.

Schauer, C., Elsas, R. & Breitkopf, N. (2019). A new measure of financial constraints applicable to private and public firms. *Journal of Banking and Finance*, 101, 270-295.