Speed of Adjustment and Financial Constraints: Evidence from the UK

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SPEED OF ADJUSTMENT AND FINANCIAL CONSTRAINTS: EVIDENCE FROM THE UK

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Abstract. Our paper estimates the speed of moment adjustment based on the first difference of the lead (t+1) leverage levels (actual lead) and lag (t-1) leverage levels (actual lag) to the first difference of simulated lead (target) leverage levels and lag levels (actual lag leverage) for firm level data. We introduce an intrinsic limitation (financial constraints) to the model to test the impact on speed of adjustment and distance reduction. We find that financial constraints have a statistically and economically significant impact on rate of adjustment and distance reduction to target leverage levels.

Keywords: Speed of adjustment, financial constraints, UK firms, financial econometrics, and capital structure.

1. Introduction

This paper empirically tests the speed of adjustment to target leverage levels. The sample used is for UK firms. The empirical analysis differentiates firms which are above and under target [1]. Our paper introduces an intrinsic limitation which is financial constraints to the model. The results support our hypothesis. Thus, our findings indicate that speed of adjustment to target levels is dependent on financial constraints.

The next section provides a brief discussion on the relevant literature and argues the motivation of the study. Moving on, we provide a description of the data and measurement of variables as well as state the empirical model. Next, the findings are presented and the implications are discussed. Finally we conclude the paper.

2. Review of the Literature and Motivating the Study

The discussion on the relevant literature is based on the debate surrounding the speed of adjustment to target leverage centring on the dynamic view of the trade-off theory of capital structure.

The literature provides for contention on the rate of adjustment as firms tend to deviate from target levels arising from adjustment costs as well as lack of analyst coverage [2, 3]. Further empirical prior also show that firms above target levels are quicker to adjust to target levels relative to firms below target levels due to the relatively costlier position [4, 5, 6]

Our purpose of investigating the impact of intrinsic limitations on moment adjustment and distance reduction is well motivated by the literature [7, 8, 9]. Our study looks at the velocity of moment adjustment based on the intrinsic limitations of financial constraints which is a known intrinsic limitation to impact financial issuing decisions among managers [10, 11, 12, 13, 14, and 15].

3. Variables and Methodology

3.1 Description of Sample

The sample is downloaded from Thomson Reuters Datastream databased and includes all firms available. The period covered is for 23 years (1993 – 2015) as prior data is scarce. Our sample excludes financial firms due to their capital structure being biased and includes dead firms to account for the potential of biasness in sample skewed against bankrupt or delisted firms [16, 17].

Our samples are corrected to ensure observations are during the financial year-end of each unit of observation. In addition, to eliminate outliers, we winsorize all variables used in the study at the top and bottom 1 percentage. Our use of dynamic panel data approach (2 step system GMM) further dictates a bias of sample restricted to firms with a minimum of 4-years in a row of data availability. All observations with missing data are further excluded. Thus we are left with 1,584 firms which encompasses 16,824 firm year observations during the sample period. We summarize the distribution of the characterisics which are specific at firm level in Table 1 below.

Table 1: Summary of Firms Specific Characteristics

Variable	Mean	Median	Standard Deviation
BL	0.1794	0.1587	0.1672
ML	0.2163	0.1563	0.2103
SIZE	10.49	9.225	2.035
MTB	1.694	1.412	1.172
TANG	0.3343	0.3367	0.2480
R&D	0.0204	0.0197	0.0601

3.2 Methodology

Our econometric analysis uses unbalanced panel data which suits the hypothesis as the model estimated will be more efficient and increase econometric efficiency, allow the controlling of potential bias due to omitted variables as well as increase the ability of the parameters in the model to provide inferences.

This allows the use of sufficient repeated observations of cross sections; allowing us to observe the changing dynamics predicted within a finite time series. Furthermore, we opt for this method which combines time series analysis with cross-sectional in order to increase the number of observations as well as the inclusion of higher number of firms which would not be possible using any of the methodology alone. [18]. In addition the motive of our paper is to study the dynamics of moment adjustment which is a major benefit of panel data [19].

We use a similar definition of variables to our empirical priors to allow comparability and inferences. We capture Firms' SIZE by taking the natural logarithm of net sales in millions of 1993 pounds. Furthermore, asset tangibility, TANG, is measured as plant, property and equipment net accumulated depreciation divided by total assets. Growth potential is captured by research and development expenditure (R&D) and is normalized by total assets. Further potential growth prospects of the firms is capture with the market-to-book ratio (MTB) which is defined as Ratio of book value of total assets less book value of equity plus market value of equity (M) to book value of total assets (B).

We model the ($Target\ Leverage_{t+1}$) which is measured in lead time in order to measure the speed of adjustment to target leverage based on the level firms deviate from target [20, 21]. Our empirical approach is expressed as follows [22]:

$$Leverage_{it+1} - Leverage_{it} = \gamma[Target\ Leverage_{it+1} - Leverage_{it}] + e_{t+1} \quad (1)$$

where $Leverage_{it+1}$ is the leverage levels in period $t+1$ for firm i, and $Target\ Leverage_{it+1}$ is the target ratio in period $t+1$ for firm i. Firms must change leverage levels by the difference of these two measures in order to adjust perfectly to target levels. In order to capture econometric gains from the analysis, we opt for a 2-stage model in order to estimate speed of adjustment [20, 21, 23]. In addition, in order to ensure the robustness of our results, we estimate speed of adjustment for book leverage as well as market leverage [22].

We further bifurcate target levels from equation (2) in the second stage where the regression includes control variables in order to estimate $Target\ Leverage_{it+1}$. The estimation is done for book leverage and market leverage. All control variables included in the model are lagged by 1 period in order to address endogeneity concerns [24, 25]. The main regression expression which includes industry dummies as detailed in the appendix is as follows [22]:

$$Target\ Leverage_{it+1} = \beta_1 CONST_{it} + \beta_2 SIZE_{it} + \beta_3 MTB_{it} + \beta_4 TANG_{it} + \beta_5 R\&D_{it} + \beta_6 RDD_{it} + \beta_7 INDL_{it} + \varepsilon_{it+1} \quad (2)$$

We further address for industry specific target levels by including the industry mean leverage ($INDL_{it}$). RDD is a dummy variable which captures information asymmetry as well as missing values in Datastream [26]. The use of 2-step system GMM as an alternative method to estimate target leverage allows for the dynamic view of the trade-off theory [21]. The significance levels of the co-efficient are measured using robust standard errors. In addition the standard errors are further manipulated in order to overcome the bias arising from fine sample errors [27].

4. Results and Discussion

Table 2 reports the results for estimation arising from equation (1). The table contains coefficients whilst standard errors are reported in parenthesis [20, 28]. The first column reports values estimated using book leverage whilst the second column reports estimation based on market leverage.

Table 2: Estimation based on a Static Framework.

	1	2
CONST	-0.1124***	-0.0484
	(0.0340)	(0.0408)
SIZE	0.0184***	0.0206***
	(0.0012)	(0.0024)
MTB	-0.0052***	-0.0813***
	(0.0019)	(0.0045)
TANG	0.0987***	0.1096***
	(0.0167)	(0.0193)
R&D	0.0030	0.0104
	(0.0080)	(0.0108)
RDD	0.0405***	0.0645***
	(0.0108)	(0.0172)
INDL	0.5658***	0.7865***
	(0.0987)	(0.1944)
Average R^2	0.1624	0.2340
F – Test (p-values)	0.00	0.00
Observations	16,824	16,824
Period	1993 – 2015	1993 – 2015

Note: ****, ** and * indicates significance at 1%, 5% and 10% respectively.*

Our results are in line with the literature [29]. Results for regression the model from equation (2) are reported in Table 3.

Findings from Table 3 allow us to validate the trade-off theory where the lagged leverage variable is significant for both book and market leverage. We further simulate target levels based on these results in order to estimate the speed of adjustment and model it as follows [29]:

$$Leverage_{it+1} - Leverage_{it} = \beta_1 CONST_{it} + \beta_2 (Target\ Leverage_{it+1} - Leverage_{it}) + \gamma [Explanatory\ Variables]_{it} + \varepsilon_{it+1} \quad (3)$$

Table 3: Estimation based on a Dynamic Framework

	1	2
LEVERAGE	0.5624***	0.7861***
	(0.0160)	(0.0108)
SIZE	0.0219***	0.0349***
	(0.0026)	(0.0062)
MTB	-0.0019	-0.0031
	(0.0022)	(0.0058)
TANG	0.0987***	0.1096***
	(0.0167)	(0.0193)
R&D	0.0016	0.0036
	(0.0104)	(0.0159)
RDD	0.0208	0.0274
	(0.0187)	(0.0231)
INDL	0.4827***	0.6135***
	(0.0705)	(0.1527)
Adjusted R^2	0.5426	0.6944
Wald test (p-values)	0.00	0.00
Sargan test (p-values)	0.26	0.22
Observations	16,82	16,824
Period	1993 – 2015	1993 – 2015

Note: ****, ** and * indicates significance at 1%, 5% and 10% respectively.*

The purpose of this estimation is to capture the distance, DIST $(Target\ Leverage_{it+1} - Leverage_{it})$. This is the level leverage must increase or decrease for firms to adjust back to target. The value would be negative for firms above target and positive for firms below target. Based on the specified model and approach, in the event firms are costlessly and perfectly able to adjust to target levels, β_2 would be unity and in the absence of adjustment this coefficient would be zero. Further encroaching on our main hypothesis, we split our sample into two by segregating firms below and above target levels in order to run the regression as follows:

$$Leverage_{it+1} - Leverage_{it} = \beta_1 CONST_{it} +$$

$$\beta_2(DIST) \times ULCD\ OR\ LCD\ +$$
$$\gamma[Explanatory\ Variables]_{it} + \varepsilon_{it+1} \qquad (4)$$

We report the results in table 4 below.

Table 4: Speed of adjustment under financial constraints

	1	2	3	4
	Under-levered firms		Over-levered firms	
Panel A: Simulating target leverage$_{t+1}$ using Fama and French framework				
DIST x FCD	0.4668***	0.5344***	-	-
	(0.0481)	(0.0518)	-	-
DIST x FUCD	-	-	0.6349***	0.6972
	-	-	(0.0812)	(0.1823)
Adjusted R^2	0.6096	0.6486	0.4163	0.4727
Wald (p-values)	0.00	0.00	0.00	0.00
Observations	7,503	7,503	8,112	8,112
Period	1993 – 2015			
Panel B:Simulating target leverage$_{t+1}$ using Blundell and Bond framework				
DIST x ULCD	0.5122***	0.6233***	-	-
	(0.0611)	(0.0919)	-	-
DIST x LCD	-	-	0.6948***	0.7822***
	-	-	(0.1455)	(0.1823)
Adjusted R^2	0.6897	0.7522	0.5123	0.5498
Wald (p-values)	0.00	0.00	0.00	0.00
Observations	7,856	7,856	7,642	7,642
Period	1993 – 2015			

Note: ****, ** and * indicates significance at 1%, 5% and 10% respectively.*

Our regression model controls for firm fixed effects in order to remove any potential bias that may occur due to omitted firm specific characteristics which are time invariant. These could result in spurious correlation between the speeds of adjustment. Utilizing this approach also allows the limitation of differences in specific units which are invariant to time such as potential bias that may be introduced in the sample over the defined time frame which could be a result of economic shocks whilst controlling for individual bias such as the management ability of a specific firm.

We further utilize clustering for standard errors on both year (time) as well as at individual firm levels [29, 31]. This allows the limitation of the effect of correlation for a firm across the years as well as across a particular year for many firms. We repeat the regression using White standard errors which are not reported for the sake of brevity and the results reported remain robust [30].

The first two columns report the results for under-levered firms with the interaction term. The interaction with the dummy is aimed at capturing the absence intrinsic limitation of firms being financially unconstrained (FCD). Columns 3 and 4 also report a similar interaction term for over-levered firms. However, the interaction terms for the last two columns include a dummy which is aimed at capturing the effect of of intrinsic limitations i.e. financial constraints (FUCD).

Based on the results we find that firms tend to adjust to target levels if they are under-levered and unconstrained or over-levered and constrained. Our observations hold for both the static and dynamic approach [20, 21]. Thus our empirical findings indicate that financial constraints either motivates or limits adjustment behaviour. Therefore, the speed of adjustment explanation offered in the literature is not as simple as suggested by the theory as financial constraints tend to act as a catalyst as well as interference to speed of adjustment.

Conclusion

We analyse the speed of adjustment of UK firms utilizing unbalanced panel data. The argument put forth states that speed of adjustment is limited and enabled by financial constraints (intrinsic limitations). The approach used is based on the two-stage estimation methods to estimate speed of adjustment to allow econometric gains. Initial stage regression is done for both the dynamic and static approach. Target levels are then simulated based on the estimation results as the input for the second stage. The difference is modelled at this stage to capture the levels of adjustment. Results report show that speed of adjustment is only rapid when firms are below target levels and not limited by intrinsic limitations. Alternatively, adjustment to target levels for firms above targets tend to be limited by financial constraints. In short, we show that financial constraints are a significant factor when measuring speed of adjustment and works in opposing directions for firms above target and below target levels. Our study however is limited as it does take into account external or extrinsic factors which may affect speed of adjustment as well as the interdependence of these two factors.

Appendix

Industry classifications

No	Industry Name
1	Automotive, Aviation and transportation
2	Beverages, Tobacco
3	Building and Construction
4	Chemicals, Healthcare, Pharmaceuticals
5	Computer, Electrical and electronic equipment
6	Diversified industry
7	Engineering, Mining, Metallurgy, Oil and gas exploration
8	Food producer and processors, Farming and fishing
9	Leisure, Hotels, restaurants and pubs
10	Other businesses
11	Paper, Forestry, Packaging, Printing and publishing, Photography
12	Retailers, Wholesalers and distributors
13	Services
14	Textile, Leather, Clothing, Footwear and furniture
15	Utilities

Source: Thomson Reuters Datastream

References

[1] Byoun, S., How and When Do Firms Adjust Their Capital Structure towards Targets? *Journal of Finance, 63*, 3069 – 3096, 2008.

[2] Leary, M., & Roberts, M., Do firms rebalance their capital structure? *Journal of Finance,* vol. 60, p. 2575-2619, (2005).

[3] Chang, X., Dasgupta, S., & Hillary, S., Analyst Coverage and Financing Decisions. *Journal of Finance, 61*, 3009 – 3048, (2006).

[4] Binsbergen, J., Graham, J., & Yang, J., The Cost of Debt. *Journal of Finance, 65*, 2081 – 2136, (2010).

[5] Byoun, S., How and When Do Firms Adjust Their Capital Structure towards Targets? *Journal of Finance, 63*, 3069 – 3096, (2008).

[6] Hussain, H., Shamsudin, M. & Jabarullah, N., Non Linear Speed of Adjustment to Lead Leverage Levels and the Timing Element in Equity Issues: Empirical Evidence from the UK, *Journal of Informatics and Mathematical Science*, 8 (1), 49 – 65, (2016).

[7] Byoun, S. Financial Flexibility and Capital Structure Decision (2011), available at *SSRN:* http://ssrn.com/abstract=1108850

[8] DeAngelo, H. and DeAngelo, L., Capital Structure, Payout Policy and Financial Flexibility (2007), available at *SSRN:* http://ssrn.com/abstract=916093

[9] Hussain, H., F. Shamsudin and N. Jabarullah, Non Linear Speed of Adjustment to Lead Leverage Levels: Empirical Evidence from Firm Level Data, *Indian Journal of Science and Technology*, 8 (30), 1 – 6, (2015).

[10] Iqbal-Hussain, H and Guney, Y. *Equity Mispricing, Financial Constraints, Market Timing and Targeting Behaviour of Companies*, working paper.

[11] Hussain, H., F. Shamsudin and N. Jabarullah, Dynamic Capital Structure and Factors Influencing the Speed of Adjustment of UK Firms, *Indian Journal of Science and Technology*, 9 (42), 1-6, (2016)

[12] Graham, J. and C. Harvey., The Theory and Practice of Corporate Finance: Evidence from the Field, *Journal of Financial Economics* 60, 187-243, (2001)

[13] Bancel, F. and U. Mittoo., Cross-Country Determinants of Capital Structure Choice: A Survey of European Firms, *Financial Management* 33, 103-132, (2004).

[14] Brounen, D., A. de Jong, and K. Koedijk., Corporate Finance in Europe: Confronting Theory with Practice, *Financial Management* 33, 71-101, (2004).

[15] Iqbal-Hussain. H., Non – Linearity in the Timing of the Equity Market and Debt – Equity Choice of UK Firms, *Journal of Business and Management,* 13 (4), 18 - 25, (2013).

[16] Guney, Y. and Iqbal-Hussain, H. Capital Structure and IPO Market Timing in the UK, *Behavioural Finance Working Group Conference: Fairness, Trust and Emotions in Finance*, 1 – 34, (2010).

[17] Guney, Y. and Iqbal-Hussain, H. Capital Structure and Market Timing in the UK: Deviation from Target Leverage and Security Issue Choice, *Multinational Finance Journal*, 13, 1 – 54 (2009)

[18] Gujurati, D., *Basic Econometrics*, McGraw Hills: International Edition, (2003).

[19] Baltagi, B. *Econometric Analysis of Panel Data*, New York: John Wiley & Sons, (1995).

[20] Fama, E. and K. French., Testing the Trade-Off and Pecking Order Predictions about Dividends and Debt, *Review of Financial Studies*, 15, 1–33, (2002)

[21] Blundell, R., and S. Bond, Initial Conditions and Moment Restrictions in Dynamic Panel Data Models, *Journal of Econometrics,* 87, 115–143, (1998).

[22] Flannery, M. and K. Rangan, Partial adjustment and target capital structure, *Journal of Financial Economics*, vol. 79 (3), p. 469 – 506, (2006).

[23] Warr, R., W. Elliott, J. Koeter-Kant and O. Oztekin, Equity mispricing and leverage adjustment costs, *Journal of Financial and Quantitative Analysis*, 47, 589 – 616, (2012).

[24] Hovakimian, A.; T. Opler; and S. Titman. "The Debt-Equity Choice." *Journal of Financial and Quantitative Analysis*, 36, 1–24, (2001).

[25] Hovakimian, A., and G. Li., In Search of Conclusive Evidence: How to Test for Adjustment to Target Capital Structure, *Journal of Corporate Finance*, 17, 33–44, (2011).

[26] Alti, A., How persistent is the impact of market timing on capital structure, *Journal of Finance*, vol. 61 (4), p. 1681 – 1710, (2006).

[27] Windmeijer, F., A finite sample correction for the variance of linear efficient two-step GMM estimators, *Journal of Econometrics*, 126, 25 – 51, (2005).

[28] Fama, E. and J. MacBeth. "Risk, Return, and Equilibrium: Empirical Tests." *Journal of Political Economy*, 81, 607–636, (1973).

[29] Hussain, H., Do firms time the equity market in a non-linear manner? Empirical evidence from the UK, *International Journal of Business and Finance Research*, 8, 63 – 74, (2014).

[30] White, H., A Heteroskedastic-Consistent Covariance Matrix Estimator and a Direct Test of Heteroskedasticity, *Econometrica, 48*, 817-838, (1980).

[31] Rogers, W., Regression Standard Errors in Clustered Samples. *Stata Technical Bulletin, 13*, 19-23, (1993).