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Firm Characteristics and Speed of Capital Structure Adjustment: Evidence from Iran

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ABSTRACT

Some of empirical studies, with focus on firm-specific characteristics, find that firms encounter with different adjustment costs which could be affective on their speed of adjustment toward their target leverage. This paper has examined the effect of firm-specific characteristics on speed of capital structure adjustment in the listed companies in Tehran Stock Exchange (TSE). The studied sample of the research includes 115 firms in the period of 2003-2012. We used partial adjustment model and generalized method of moments (GMM) estimator to estimating the speed of adjustment. We find that studied firms adjust relatively fast towards their target leverage and these results are consistent with trade-off theory. Also, we find that firms with low growth opportunities and small size adjust faster than those with the opposite characteristics.

Keywords: dynamic trade-off theory, adjustment costs, speeds of adjustment, target leverage.

1. INTRODUCTION

The concept of target leverage plays an important role in capital structure theory. According to the trade-off theory of capital structure, firms choose their target debt ratios by trading off tax benefits of debt financing against financial distress costs of debt (Hovakimian and Li, 2011). The dynamic version of this theory has dedicated many researches to in the recent decade, assumes that adjustments of firms capital structure is costly. Over 30 years ago, Myers (1984) noted: «If adjustment costs are large, so that some firms take extended excursions away from their targets, then we ought to give less attention to refining our static trade-off theories and relatively more to understanding what the adjustment costs are, why they are so important and how rational managers would respond to them.

In the most researches, transaction costs for security issuance are considered as adjustment costs (Leary and Roberts, 2005; Flannery and Rangan, 2006). However, Faulkender et al. (2012) believed that adjustment costs depend not

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only on explicit transaction costs but also on the firms' incentive to access to capital markets. Generally, these costs prevent constant adjustment of firms towards target leverage. Hence, firms may adjust their leverage when adjustment benefits were more than its costs (Fischer et al., 1989). Therefore, firms may deviate temporarily from optimal debt ratio. In result, dynamic trade-off theory states that rather than having a unique leverage target, the firm may have a target range within which it allows its leverage to vary (Dang et al., 2012). Empirical studies confirm this range of target. Graham and Harvey (2001), find that 71% of the CFO's in their sample responded to having a target range for their leverage ratio and another 10% indicated having a unique target leverage (Leary and Roberts, 2005). Also, Hovakimian et al. (2001), Flannery and Rangan (2006), Kayhan and Titman (2007) and Strebulaev (2007), find that the dynamic trade-off model dominates alternative models.

Overall, the speed with which firms reverse deviations from their target debt ratios depends on the cost of adjusting leverage. With zero adjustment costs, the trade-off theory implies that firms should never deviate from their optimal leverage. At the other extreme, if transaction costs are infinite, we should observe no movements toward a target (Flannery and Rangan, 2006). The estimated magnitude of the speed of adjustment has important implications for the trade-off theory. The lower adjustment speed implies that offset of current leverage deviation from target leverage last longer. If as findings of Kayhanand Titman (2007), offset of half of deviation from target leverage last seven years, then target leverage can be viewed as a secondary factor in corporate financing decisions at best. But, if such as Flannery and Rangan (2006), the average adjustment speed is on the order of 35% per year, then target leverage is of central importance (Hovakimianand Li, 2011). Indeed, if firms adjust rapidly, then historical financing decisions and stock price changes will have little effect on the observed leverage, while the contrary is true if firms adjust slowly. From another perspective, rapid adjustment to target may signify among others relative lower transaction costs (such as lower external financing costs), higher costs of deviating from target, rigid debt contractual agreements or superior financial flexibility (McMillan and Camara, 2012).

In the recent years, a large number of empirical studies have attempted to examine the validity of the trade-off theory by testing whether and how fast firms move toward target leverage. For example, Ozkan (2001), Flannery and Rangan (2006) by estimating a linear partial adjustment model find that UK and US firms move towards their target leverage with a reasonable speed. Their adjustment speeds are estimated at above 50% and 30% respectively (Dang et al., 2012). Also, Lemmon et al. (2008), Antoniou et al. (2008), Huang and Ritter (2009) have empirically tested the dynamic capital structure models where in they assume that all firms move at the same speed of adjustment towards their target leverage. Table 1 reports the estimated speed of adjustment toward target leverage per year in existing empirical studies of capital structure. However, an important limitation of these studies is that they assume that all firms move towards their target leverage with the same speed of adjustment. This homogenous speed of adjustment assumes that adjustment costs are similar in all firms, an assumption which does not support with empirical researches. In fact, they did not consider the case that firms which have different characteristics encounter with different adjustment costs that could affect their speed of adjustment. Therefore, this paper investigates the firm-specific characteristics effects on speed of capital structure adjustment.

Table 1: Estimates of the Speed of Adjustment in Empirical Studies of Capital Structure

Article	**Book Leverage**		**Market Leverage**	
	Speed	**Half-Life**	**Speed**	**Half-Life**
Fama and French (2002)	10%*	6.6 years	7%*	9.6 years
	18%**	3.5 years	15%**	4.3 years
Flannery and Rangan (2006)	34.2%	1.7 years	35.5%	1.6 years
Kayhan and Titman (2007)	10%	6.6 years	8.3%	8.0 years
Antoniou, Guney and Paudyal (2008)	NA	NA	32.2%	1.8 years
Lemmon, Roberts and Zender (2008)	25%	2.4 years	NA	NA
Huang and Ritter (2009)	17%	3.7 years	23.2%	2.6 years
Nasirzadeh and Mostaqiman(2010)	53.9%	0.9 years	NA	NA
Setayesh and Kargarfard (2011)	44.6%	1.17years	NA	NA

Note. Half-life is the number of years that the speed of adjustment implies for a firm to move halfway toward its target capital structure, $\ln(0.5) / \ln(1-\lambda)$.
* Dividend-paying firms.
**Firms that do not pay dividends.
NA is not available.

1.1 Determinants of the Adjustment Speed

It is assumed that the speed of adjustment towards the target leverage depends on firm characteristics. In this research, we consider two firm-specific variables that affect the capital structure adjustment speed, namely growth opportunities and firm size.

1.1.1 Growth Opportunities

High-growth firms are likely to be young and adopt a low-leverage policy to control the under-investment problem. They may also have low profitability and limited internal funds and rely heavily on external (equity) financing to fund growth opportunities. Through frequent visits to the external capital markets, these firms can adjust leverage more easily by appropriately altering the mix of debt and equity (Drobetz and Wanzenried, 2006). Low-growth firms, on the other hand, tend to rely more on internal finance, so any capital structure changes are likely to take the form of internal adjustment, the scope and magnitude of which is limited by the size of internal funds. Hence, the speed of adjustment is expected to be relatively faster for high-growth firms than for their low-growth counterparts. However, an opposite prediction can be made. Many low-growth firms are mature, cash-rich and highly profitable, so that they may maintain a high-leverage policy to mitigate the free cash flow problem. Therefore, low-growth firms with typically high leverage may find it more beneficial to quickly revert to target leverage in order to avoid potentially high financial distress and bankruptcy costs (Dang *et al*, 2012).

1.1.2 Firm Size

If changing the capital structure involves substantial fixed costs, these costs are relatively larger for small firms. Therefore, large firms should be able to correct deviations from the target capital structure at a relatively lower cost. In addition, due to better analyst coverage, more information is publicly available about large firms, implying better access to capital markets and lower anticipated costs arising from information asymmetries upon announcement of debt or equity issues. Hence, the cost of external financing is smaller for large firms, suggesting a quicker speed of adjustment for them (Drobetz and Wanzenried, 2006). On the other hand, large firms tend to use public debt that is more expensive to adjust, while they have less cash flow volatility, lower financial distress costs and fewer debt covenants. Thus, they have less incentive and external pressure to adjust capital structure, implying a slower adjustment speed for large firms (Flannery and Rangan, 2006).

2. LITERATURE REVIEW

Drobetz and Wanzenried (2006) have investigated the effects of firm-specific characteristics and macroeconomic variables on speed of capital structure adjustment. They studying data related to 90 Swiss firms in the period of 1991-2001, concluded that firms with higher growth and those that have high deviation from optimal capital structure, have higher speed of adjustment. Also, results of this research indicate that there is a positive relation between good economic condition and adjustment speed.

Drobetz et al. (2006) studying 706 European firms in the period of 1983-2002, concluded that firms with higher growth and bigger size move faster towards their target capital structure. Also, they showed that more deviation from target leverage leads to faster adjustment.

Dang et al. (2011) have studied the asymmetric adjustment speed for firms of France, Germany, Japan, UK and US in the period of 1980-2007. Their results indicate that firms that have financial deficit and are over-levered move faster towards their target leverage. They also find that firms that tend to adjust more quickly towards their target leverage have lower profitability and growth opportunities, fewer tangible assets and are smaller in size.

Faulkender et al. (2012) examined cash flows effects and financial constraints and market timing variables on capital structure adjustments in the period of 1965-2006. Their results show that firms' cash flow features affect not only the target leverage, but also effect on adjustment speed towards the target. They also find that financial constraints and market timing variables affect the speed of adjustment toward target leverage.

Dang et al. (2012) performed a research on asymmetric adjustment of capital structure using an unbalanced panel of UK firms over the period 1996–2003. They find that firms with large financing imbalance, large investment or low earnings volatility adjust faster than those with the opposite characteristics. Also, they showed that firms with higher growth opportunities, higher profitability and smaller size have higher adjustment speed.

3. METHOD AND DATA

3.1 Regression Models

The conventional econometric specification to model firms' adjustment toward target leverage takes the form of a partial adjustment process (e.g., Flannery and Rangan, 2006):

$$LEV_{it} - LEV_{it-1} = \lambda(LEV_{it}^{*} - LEV_{it-1}) + \mu_{i} + e_{it} \qquad (1)$$

where LEV_{it} is firm i's actual (observed) leverage in period *t*, LEV_{it}^{*} is firm i's target leverage, μ_{i} represents time-invariant unobservable variable (firm fixed effect) and e_{it} is the error term. λ is the speed of adjustment that measures how fast firms move toward their target leverage; $0 \le \lambda \le 1$. If $\lambda = 0$, the speed of adjustment is zero, that is there is no adjustment toward target leverage at all. If $\lambda = 1$ the speed of adjustment is infinitely high, that is the debt ratio is always at its target value.

Since the target leverage is unobservable, it is not possible to directly test the dynamic trade-off model in Eq. (1). There are two approaches to dealing with the unobserved target leverage in (1). First, target leverage can be proxied by the mean or the moving average of the actual (observed) leverage. The drawback of this approach lies in the difficulty to justify why target leverage should remain constant over time or only depend on past leverage decisions (Shyam-Sunder and Myers, 1999). Second, target leverage can be considered as a unique ratio determined by firms' characteristics as follows (Dang et al., 2012):

$$LEV_{it}^{*} = \beta' X_{it} \tag{2}$$

Where X_{it} is a vector of the determining factors of leverage and β is a vector of coefficients such that the trade-off hypothesis implies that $\beta \neq 0$. Following the literature (Ozkan, 2001; Flannery and Rangan, 2006; Lemmon et al., 2008; Dang et al., 2012), the five most commonly-used determinants of leverage, such as tangibility, growth opportunities, non-debt tax shields, profitability and firm size were employed.

In estimating Eq. (1) together with Eq. (2), there are two approaches available. The first is a two-stage procedure (Shyam-Sunder and Myers, 1999; Fama and French, 2002; Byoun, 2008), in which one regresses actual leverage on the firm-specific characteristics in Eq. (2), obtains the fitted values $\widehat{LEV}_{it}^{*} = \hat{\beta}' X_{it}$ and then uses this proxy for target leverage, LEV_{it}^{*}, in Eq. (1). Evaluating the two-stage estimation procedure that is commonly used in the literature, Flannery and Rangan (2006) show that the partial adjustment speed reflected by the coefficient on target leverage from first stage regressions is abnormally smaller than theory would predict and that the long-term elasticity of the observed leverage relative to its target is significantly different from unity. For this reason, following Flannery and Rangan (2006), in this research employed the one-stage procedure in which Eq. (2) is substituted into Eq. (1) to yield:

$$LEV_{it} = (1 - \lambda) LEV_{it-1} + (\lambda\beta) X_{it} + \mu_i + e_{it} \tag{3}$$

Eq. (3) says that managers take ‘action’ to close the gap between where they are (LEV_{it-1}) and where they wish to be (βX_{it}). The specification further implies that;

1) The firm’s actual leverage eventually converges to its target leverage, βX_{it}.
2) The long-run impact of X_{it} on the leverage is given by its estimated coefficient, divided by λ.

3) All firms have the same adjustment speed (λ) (Flannery and Rangan, 2006).

Testing trade-off models using Eq. (3) assumes that firms undertake capital structure adjustments in a symmetric fashion. In the presence of costly adjustment, however, this assumption is no longer valid because leverage changes are infrequent and tend to occur at 'restructuring points'. Firms adjust at different rates according to the position of their actual leverage relative to targets as well as the costs of their adjustment (Dang et al., 2012). Hence, to capture this dynamic trade-off behavior, we use the sample-splitting approach. In this approach, we classify firms into the low (high) group when the value of the firm-specific variables (growth opportunities and size) is less than or equal to (greater than) the mean value.

Applying the OLS estimator to Eq. (3) produces biased estimates because the lagged dependent variable is correlated with the firm fixed effects μ_i. One of the existed solutions for this problem is using instrumental variable estimators and more importantly, generalized method of moment (GMM). This method which suggested by Arellano and Bond (1991), could be considered as a powerful estimator for heteroscedasticity and auto correlation condition because of selecting correct instrumental variables and applying a weighting matrix. As suggested by Arellano and Bond (1991), we use their two-step GMM estimator for inference on coefficients. Validity of GMM estimator results measured by two tests of AR (2) and Sargan. AR (2) test is a test for second-order serial correlation and is asymptotically distributed as N(0,1) under the null of no serial correlation. Sargan test is a test for the validity of instruments and is asymptotically distributed as χ^2 under the null of valid instruments.

3.2 Data

The research has been performed via balanced panel data for a sample of 115 selected companies listed on the Tehran Stock Exchange during 2003 to 2012. Total 1150 observations are adopted for each variable considered. For selecting this sample, applied a number of standard data restrictions as follow:

1. End of fiscal year is to end of March.
2. The firm should not change its fiscal during study (2003 to 2012).
3. Financial information of the firm should be available during study.
4. The firm should not be in the financial and investment sector.

The definitions and summary statistics for the variables under consideration are provided in Tables 2 and 3 respectively.

Table 2: Variable Definitions

Variable	Definition
Dependent variable	
MLEV *(Market Leverage)*	Book value of debt/Market value of assets (book value of debt plus market value of equity)
Independent variables	
TANG *(Tangibility)*	Fixed assets/Total assets
NDTS *(Non-debt Tax Shields)*	Depreciation expense/Total assets
PROF *(Profitability)*	Earnings before interest and depreciation / Total assets
GROW*(Growth Opportunities)*	Market value of assets/Total assets
SIZE *(Size)*	Natural logarithm of total assets

Table 3: Descriptive Statistics

Variables	Num	Mean	Med	Max	Min	Std. Dev.	Skew	Kurt
MLEV	1150	0.5302	0.5463	0.9694	0.0467	0.2159	-0.1874	2.2373
TANG	1150	0.2529	0.2204	0.8888	0.0025	0.1762	0.9772	3.7083
NDTS	1150	0.0228	0.0184	0.1177	0.0002	0.0175	1.4416	5.4635
PROF	1150	0.1629	0.1427	0.6183	-0.2958	0.1246	0.6893	4.3607
GROW	1150	1.5296	1.2240	10.4134	0.5416	1.0534	4.3611	27.8914
SIZE	1150	13.1819	13.0170	18.4376	9.7973	1.3897	0.7271	3.9415

4. RESULT

4.1 Partial Adjustment Model

Table 4 reports the results of the partial adjustment model. This model estimates same speed for all firms.

Table 4: Speed of Adjustment toward Target Leverage

Variables	
LEV ($t-1$)	0.469 (0.107)*
TANG	0.226 (0.044)*
NDTS	-0.367 (0.210)***
PROF	-0.126 (0.052)**
GROW	-0.031 (0.012)**
SIZE	0.037 (0.020)***
Speed of Adjustment (λ)	**53%**
Half-Life	0.92
AR(2)	-1.19 [0.234]
Sargan	40.17 [0.252]

Note: Figures in () are the standard errors of the coefficients and those in [] are the p-values of the test statistics.
* Statistical significance at 1%.
** Statistical significance at 5%.
*** Statistical significance at 10%.

The results in Table 4 show that the estimated coefficients for LEV_{it-1} are significant at the 1% level. Therefore, in the studied firms, there is target leverage and the speed of adjustment toward target leverage for these firms is 53% (1-0.469). These results indicate that studied firms can close more than a half of their deviation from target leverage within a year. In the other words and using concept of half-life, this shows that these firms only need 0.92 year to halve their deviation from target leverage. This finding is consistent with estimated speeds for Iranian firms (Nasirzadeh and Mostaqiman, 2010; Setayeshand Kargarfard, 2011). Also, this estimated speed is consistent with the reported results for UK firms (Ozkan, 2001; Dang, 2011; Dang et al., 2012), but faster than the speeds estimated for US firms (Flannery and Rangan, 2006; Lemmon et al., 2008; Huang and Ritter, 2009). This finding provides strong evidence for the trade-off theory.

Also, the results of AR(2) and Sargan tests shows that null hypothesis in both tests are not rejected. Hence, GMM regression results are reasonable and confirmed.

4.2 Determinants of the Speed of Adjustment

Table 5 shows the impact of firm-specific variables on the speed of adjustment.

Table 5: Determinants of the Speed of Adjustment

Variables	Growth Opportunities		Size	
	Low	**High**	**Low**	**High**
LEV ($t-1$)	0.505 (0.080)*	0.625 (0.088)*	0.505 (0.131)*	0.563 (0.077)*
TANG	0.207 (0.054)*	0.204 (0.071)*	0.201 (0.054)*	0.171 (0.058)*
NDTS	-0.256 (0.285)	-0.319 (0.319)	-0.238 (0.243)	-0.126 (0.354)
PROF	-0.193 (0.060)*	-0.110 (0.062)***	-0.100 (0.059)***	-0.235 (0.081)*
GROW	-0.165 (0.042)*	-0.036 (0.011)*	-0.040 (0.014)*	-0.057 (0.020)*
SIZE	0.036 (0.014)**	0.001 (0.014)	0.029 (0.019)	0.033 (0.018)***
Speed of Adjustment (λ)	**49.5%**	**37.5%**	**49.5%**	**43.7%**
AR(2)	-1.38 [0.167]		-1.07 [0.284]	
Sargan	73.45 [0.365]		78.64 [0.224]	

Note: Figures in () are the standard errors of the coefficients and those in [] are the p-values of the test statistics.
* Statistical significance at 1%.
** Statistical significance at 5%.
*** Statistical significance at 10%.

4.2.1 Growth Opportunities

The results show that the speeds of adjustment for low-growth and high-growth firms are respectively 49.5% and 37.5%. It is consistent with the argument that due to having high leverage, low-growth firms may find it more beneficial to quickly revert to target leverage in order to avoid potentially high financial distress and bankruptcy costs (Dang et al., 2012). This result is in line with Dang et al. (2011), but in consistent with Drobetz and Wanzenried (2006), Drobetz et al. (2006) and Dang et al. (2012).

4.2.2 Firm Size

The results show that small and large firms adjust toward their target leverage at the rates of 49.5% and 43.7% respectively. The magnitude of these speeds appears to be consistent with the argument that due to facing lower cash flow volatility and financial distress costs as well as fewer debt covenants, large firms have less incentive and external pressure to adjust capital structures, implying a slower speed of adjustment (Dang et al., 2012). This finding is consistent with recent research (Dang et al., 2011; Faulkenderet al., 2012; Dang et al., 2012), but inconsistent with Drobetz et al. (2006).

5. CONCLUSION

Dynamic trade-off theory posits that firms adjust their leverage ratio when adjustment benefits were more that its costs. Some papers have empirically tested the dynamic capital structure models where in they assume that all firms move at the same speed of adjustment (Ozkan, 2001; Flannery and Rangan, 2006; Lemmon et al., 2008; Antoniou et al., 2008; Huang and Ritter, 2009). But, firms which have different characteristics encounter with different adjustment costs that could affect their speed of adjustment. Hence, other papers estimated different adjustment speeds while focusing on firm-specific characteristics (Fama and French, 2002; Drobetz et al., 2006; Drobetz and Wanzenried, 2006; Dang et al., 2011; Faulkenderet et al., 2012; Dang et al., 2012). So, in this paper we focused on two firm variables, namely growth opportunities and size.

We find that firms with low growth opportunities and small size adjust faster than those with the opposite characteristics. These results suggest that above mentioned firms have higher incentive for adjusting their capital structure because of encountering higher financial distress costs or lower costs of adjustment. Generally, the research results indicate that studies firms move with different speeds towards different leverage targets.

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