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Testing capital structure theories using error correction models: Evidence from China, India, and South Africa

M. Kannadhasan[1]*, Bhanu Pratap Singh Thakur[1], C.P. Gupta[2] and Parikshit Charan[1]

*Corresponding author: M. Kannadhasan, Indian Institute of Management Raipur, GEC Campus, Old Dhamtari Road, Sejbahar, Raipur, Chhattisgarh, India
E-mail: mkdhasan@iimraipur.ac.in

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Abstract: The objective of this study is to empirically examine the capital structure theories that can explain the capital structure choice made by the firms that are operating in China, India, and South Africa. The study tests the capital structure theories as a stand-alone basis as well as an integrated framework of nested models using advanced dynamic panel data methods with a data-set of 1,183 firms with 12,187 firm-year observations spanning the period 1999–2016. Findings suggest that the firms adjust toward target leverage very quickly and trade-off theory explains the firms' capital structure choice better than pecking order theory in the stand-alone model as well as the model nesting these two theories. This study contributes to the empirical literature of capital structure in the following way. First, this study uses error correction framework as a general specification of the widely used partial adjustment model. Second, the study uses advanced panel data estimators to estimate partial adjustment model and error correction model. Finally, the different specifications are tested using a large data-set of firms in China, India, and South Africa that has not been done so far.

ABOUT THE AUTHORS

M. Kannadhasan is working as the associate professor of Finance at Indian Institute of Management, Raipur, India. His area of interest includes corporate finance, emerging stock market, and behavioral finance. He has published papers in international and national journals of repute.

Bhanu Pratap Singh Thakur is a research scholar at Indian Institute of Management, Raipur, India. He is interested in Fixed Income Securities, Valuation, and Corporate Finance. His published work includes in the area of Fixed Income Securities and Valuation.

C.P. Gupta, is a professor at the Department of Financial Studies, University of Delhi, Delhi, India. His areas of research, teaching, and consultancy include Investment Decisions, Risk Analysis, Project Appraisal, Security Analysis, Fuzzy Decision-Making, and Financial Modeling.

Parikshit Charan is a faculty in the Operations Management area at IIM Raipur. His area of research includes operations strategy, sustainable operations, and supply chain management. He has published papers in international and national journals of repute.

PUBLIC INTEREST STATEMENT

Over the past several years, many theories have been developed and tested to explain the capital structure decisions taken by the firms. The main theories in the forefront are the trade-off theory and the pecking order theory. These theories have been empirically tested across various countries using different methodologies. Yet, there is no consensus that which theory better explain the financing decisions made by the firms. Using advanced dynamic panel data methods, we tests these capital structure theories as a stand-alone basis as well as an integrated framework of nested models in Chinese, Indian, and South African firms. The results suggest the presence of high adjustment speed toward the target leverage in firms and better ability of the trade-off theory in explaining capital structure choices when compared to pecking order theory.

Subjects: Quantitative Finance; International Finance; Corporate Finance

Keywords: capital structure; error correction model; trade-off theory; pecking order theory; dynamic panel data; partial adjustment

JEL classifications: G15; G30; G32; G35

1. Introduction

Modigliani and Miller published their pioneering work on the capital structure in 1958. In their article, they demonstrate that, in a frictionless world where the capital markets are perfect and there are no corporate taxes, the value of a firm is unaffected by its capital structure. In other words, capital structure is irrelevant (Modigliani & Miller, 1958). Since then, researchers have attempted to establish the relevance of corporate capital structure in the presence of capital market frictions and imperfections such as gains from leverage-induced tax shields (Modigliani & Miller, 1963), bankruptcy costs (Bradley, Jarrell, & Kim, 1984; Kraus & Litzenberger, 1973), agency cost (Jensen & Meckling, 1976), and information asymmetry (Myers & Majluf, 1984). Over the past six decades, a number of theories have been developed such as trade-off theory (TOT), pecking order theory (POT), and free cash flow theory to explain the variation in debt ratios across companies, and across countries by relaxing the perfect market assumptions systematically.

According to the TOT, every company seeks to find a judicious mix of debt–equity in the capital structure of a firm, i.e. an optimum capital structure that strikes a balance between possible costs of financial distress and benefits of tax advantages associated with additional debt capital (Myers & Majluf, 1984; Warner, 1977). Myers (1984) and Myers and Majluf (1984) found inconsistencies in the TOT which lead them to propose a theory called POT. According to this theory, firms use external financing only when internal funds are insufficient to finance their investments. When faced with the external financing choice, firms prefer debt to equity because of asymmetric information and signaling problems that increase the cost of external equity (Myers, 1984).

The free cash flow theory posits that despite the threat of financial distress associated with the high level of debt, a firm uses a high level of debt when its operating cash flow exceeds its profitable opportunities (Myers, 2001). In addition to the market imperfections, floatation costs (Marsh, 1982) and adjustment costs and constraints may prevent a firm from maintaining its target/optimal debt ratio (Jalilvand & Harris, 1984). However, every firm tries to adjust toward the optimal ratio.

Existing studies (e.g. Antoniou, Guney, & Paudyal, 2008; Byoun, 2008; Dang, 2013; Flannery & Rangan, 2006; Huang & Ritter, 2009; Naveed, Ramakrishnan, Ahmad Anuar, & Mirzaei, 2015; Ozkan, 2001; Shyam-Sunder & Myers, 1999) have focused on the dynamic behavior of the adjustment process using partial adjustment model. This model captures the actual change in capital structure as a part of required change toward the target leverage of a firm. These studies found that the speed of adjustment varies from country to country, and period to period. As pointed out earlier, POT considers the problem of information asymmetry. The problem of information asymmetry arises when managers have better knowledge about the value of their firm than the rest of the market does.

In such a situation, potential investors are unable to differentiate between high-quality firms and low quality firms. As a result, potential investors price the shares of high-quality firms at a discount to protect themselves against making a worthless investment. Firms issue securities that carry the smallest adverse selection cost, i.e. they issue securities that are less risky and less responsive to valuation mistakes and subsequently least likely to be mispriced by imperfectly informed outside investors. In other words, firms issue securities that are least likely to be priced at a discount by investors. These issues lead a firm to prefer internal funds to external funds, and debt financing to equity.

The extant literature exhibits an inconclusive support to the POT (Adair & Adaskou, 2015; de Jong, Verbeek, & Verwijmeren, 2011; Frank & Goyal, 2003; Lemmon & Zender, 2010; Seifert & Gonenc, 2008; Shyam-Sunder & Myers, 1999). The TOT makes prediction about the target leverage of a firm, whereas POT does not. It is also clear from the existing literature that most of the studies tested the TOT or POT in isolation. Fama and French (2005) suggested discontinuing empirical studies on a stand-alone basis.

These theories cover some aspects of financing decisions that could guide the firms in designing and maintaining capital structure. Understanding the importance of the issue, recent studies have attempted to test both the theories simultaneously (e.g. Dang, 2013; Flannery & Rangan, 2006; Shyam-Sunder & Myers, 1999). Yet, there is no clarity on which theory (TOT or POT) can better explain the financing decisions made by a firm (Allini, Rakha, McMillan, & Caldarelli, 2017; Dang, 2013; Mai, Meng, & Ye, 2017; Serrasqueiro & Caetano, 2015). Therefore, there is a need for an integrated framework that incorporates the elements of POT and TOT (Dang & Garrett, 2015; Zhou, Tan, Faff, & Zhu, 2016).

Further, these studies examined the capital structure of the firms that are operating in developed countries such as the United State of America (USA), the United Kingdom (UK), France, and Germany. Although the developed countries are a natural ground for testing the capital structure theories, it is equally important to test the applicability of the capital structure theories in emerging economies. There is a significant gap in this regard. Therefore, this study attempts to test these theories to the firms that are located in countries that are considered as emerging economies, namely China, India, and South Africa. This study examines the firms in China, India, and South Africa for mainly two reasons. First, these countries represent the biggest economies among emerging market economies and thus are the most obvious sample for testing the applicability of capital structure theories. Second, these countries belong to two different economic systems with India and South Africa being primarily the market-based economies as compared to China that is predominantly regulated by the state during the study period.

This study contributes to the existing empirical literature of capital structure in the following way. First, this study uses error correction framework as a general specification of the widely used partial adjustment model. This framework captures the firm's adjustment toward target leverage in a better way than the existing models. Further, the study also tests the TOT and POT simultaneously by augmenting the partial adjustment model and error correction model (ECM) in a unifying framework. Second, the study uses advanced panel data estimators to estimate partial adjustment model and ECM. Specifically, the study uses the Anderson and Hsiao (1982) instrumental variable estimator (hereafter AH), Arellano and Bond's (1991) generalized methods of moments estimator (hereafter GMM) and Blundell and Bond's (1998) system generalized methods of moments estimator (hereafter SYS-GMM). Finally, the different specifications are tested using a large data-set of firms in China, India, and South Africa. Hence, the results are expected to provide fresh insights regarding capital structure theories in emerging market context.

The results provide clear evidence that the TOT outperforms POT in firms in China, India, and South Africa. The firms tend to respond very quickly to target leverage change as compared to the firms in developed countries. The study also reveals the benefit of using ECM over partial adjustment model to examine the firm's dynamic capital structure behavior. Lastly, the study also suggests that the firms in China, India, and South Africa utilize debt financing to offset a small proportion of the deficit. Overall, the nested models used in the study reveals that the firm's financing decisions are better explained by the TOT rather that POT.

2. Literature review

The primary focus of testing trade-off models is to know the extent and the speed of rebalancing leveraging ratios toward the optimal level of capital structure. The results of earlier studies are mixed. Studies support the trade-off models, i.e. firms do rebalance their leverage ratios toward

optimal level (e.g. Flannery & Rangan, 2006; Harris & Raviv, 1991; Hovakimian, Opler, & Titman, 2001; Leary & Roberts, 2005; Welch, 2004). Fama and French (2002) pointed out that the firms do adjust their leverage ratio very slowly toward their optimal level/target range. They also said that firms do not adjust every period.

Subsequently, studies estimated the speed of adjustment using dynamic models by incorporating the presence of transactions and issuance costs. Mean reversion in debt ratios or appears to adjust toward target debt ratio using dynamic partial adjustment models (e.g. Auerbach, 1985; Drobetz, Schilling, & Schröder, 2015; Marsh, 1982; Opler & Titman, 1994; Robert & Taggart, 1977). The speed of adjustment is relative very high in UK firms (about 50%) (Ozkan, 2001) than US firms (about 7–18%) (Fama & French, 2002). Marsh (1982) and Opler and Titman (1994) used a logit regression model for understanding the mean reversion in debt ratio in the long run and Auerbach (1985) used target adjustment model with firm specific and time varying target to support the above findings. Oino and Ukaegbu (2015) also used dynamic adjustment model and found evidence in support of the POT in Nigerian firms. However, the recent studies using advanced dynamic panel data strongly support the TOT (e.g. Antoniou et al., 2008; Flannery & Rangan, 2006; Wojewodzki, Poon, & Shen, 2017). Flannery and Rangan (2006) found that US firms have a target leverage in the long run and do follow partial adjustment at relatively fast of 30% a year to achieve the target leverage. Recently, Tao, Sun, Zhu, and Zhang (2017) have also provided evidence supporting the TOT using China's mergers and acquisition deals.

POT assumes that there is no target or optimal ratio. Instead, the debt ratio is a cumulative result of hierarchical financing over a period of time. Shyam-Sunder and Myers (1999) found a strong support for POT with a sample of 157 firms. Similarly, Hovakimian et al. (2001) found support for POT only for short run. Conversely, Frank and Goyal (2003) found inconclusive support with 768 firms operating in USA by adopting model used by Shyam-Sunder and Myers (1999). However, Seifert and Gonenc (2008) investigated in developed countries (the US, the UK, and Germany) and observed the support to POT. Early studies attempted to test these theories individually using various methodologies.

The unified framework that incorporates the elements of POT and TOT is called a Modified Pecking Order Theory (MPOT) (Myers, 1984). The MPOT or nested model comprises all the variables used to test the POT and dynamic trade-off models. This nested model is considered as an error correction mechanism using panel data. This model was tested first using small companies in Italy by Bontempi (2002). Applicability of the model could be used to test the firms that operate in bank-based or market-based. Subsequently, studies have confirmed that trade-off model explains much better than POT (Dang, 2013; Frank & Goyal, 2003). Other findings are that TOT was most relevant to repurchase decisions for larger firms (de Jong et al., 2011), POT was most relevant for smaller firms (Cotei & Farhat, 2009).

It is evident from the extant literature that firm's borrowing (financing) decision is influenced by its characteristics. Myers (1984) tested the TOT by finding the relationship between debt ratios and firm characteristics such as size, asset risk, profitability, asset type, and tax status. Target leverage of sample companies is been estimated using five commonly used variables, namely the collateral value of assets, non-debt tax shields, profitability, growth opportunities, and firm size. The said variables are chosen based on the studies of Frank and Goyal (2009), Rajan and Zingales (1995), and Titman and Wessels (1988). The following section discusses these determinants of leverage.

2.1. Collateral value of assets (CVA)

CVA is measured as a ratio of fixed assets to total assets. TOT advocates that firms that have a more tangible value of assets can borrow more debt than firms that have less tangible value of assets because, assets could be beneficial as a security to alleviate the risk shifting and asset substitution problem (Jensen & Meckling, 1976). In addition, they have a lower financial/bankruptcy costs that leads to reduce the agency costs of debt. It is therefore expected to have a positive relationship

between collateral value of assets and target leverage (Johnson, 1997). However, POT suggests that collateral value of assets and target leverage are negatively related as firms that have less collateral prefer to use debt over equity (Harris & Raviv, 1991).

2.2. Profitability

Modigliani and Miller (1963) pointed that profitable firms have good reason to use debt capital as they want to maximize the tax advantages, i.e. debt tax shields. Therefore, it is expected to have a positive relationship between profitability and leverage. Further, profitable firms could face free cash flow problem that can be mitigated using debt capital (Jensen, 1986). Although static trade-off models predict a positive relationship, dynamic trade-off models predict a negative relationship by accounting time. A firm could increase their retained earnings as profit increases, thereby, less incentive to use debt. POT predicts a negative relationship between profitability and leverage (Myers, 1984) as predicted by dynamic trade-off models. Profitability is measured as a ratio of EBITDA to total assets.

2.3. Growth opportunities (GO)

Myers (1977) opined that the conflicts between bondholders and shareholders. He argues that firms underinvest while using risky debt, because shareholders get a fraction of benefits as compared with bondholders. The cost of underinvestment increases the growth opportunities. Therefore, firms facing high growth opportunities are likely to accept risky projects. Thus, it increases the costs associated with debt financing. Consequently, these firms rely on equity rather than debt. Conversely, low growth firms that are operational in mature businesses may use debt to ease the free cash flow problem (Jensen, 1986). Therefore, TOT theory expects that the leverage have positive relationship with low growth opportunities and positive relationship with high growth opportunities. The proxy of growth opportunities is measured as a ratio of market-to-book ratio.

2.4. Non-debt tax shields (NDTS)

DeAngelo and Masulis (1980) pointed out that firms that have more benefit from non-debt tax shields (tax shield on depreciation) have less incentive to exploit the tax advantage of debt financing, because non-debt tax shields may substitute for debt tax shields. It indicates that there is a negative relationship between non-debt tax shields and target leverage, which is in line with TOT. The proxy for non-debt tax shields is the ratio of depreciation to total assets.

2.5. Firm size (size)

Larger firms (i.e. having higher assets) have the ability to borrow more than smaller firms as they have a lower default risk. In addition, older firms have more debt capacity and good reputation in debt market that leads to borrow more to maximize the interest tax shields. In addition, it also decreases the agency costs associated with the asset substitution and underinvestment problem (Chung, 1993). Conversely, the smaller firms tend to have a lower leverage ratio, which is due to higher agency costs. Another advantage of smaller firms is that they could liquidated the firm when they are in financial distress (Ozkan, 2001). Therefore, larger and older firms use more debt than small and newer firms. It tells that the firm size have a positive effect on target leverage (e.g. Booth, Aivazian, Demirguc-Kunt, & Maksimovic, 2001; Frank & Goyal, 2009; Rajan & Zingales, 1995; Titman & Wessels, 1988). This study uses natural logarithm of total assets adjusted for inflation as a proxy of firm size.

Various studies have investigated about the capital structure choices faced by firms using international data (e.g. Antoniou et al., 2008; Booth et al., 2001; Dang, 2013; Deesomsak, Paudyal, & Pescetto, 2004; de Jong, Kabir, & Nguyen, 2008; Rajan & Zingales, 1995). However, only a few studies have tested the capital structure theories using nested model, that to in the developed countries context. The above findings motivated us to test these theories simultaneously in emerging economies.

3. Research model

Early studies used various econometric techniques such as logit and probit regressions, two step approach, structural equation models, nonlinear methods, cross-sectional regression, panel data regression, generalized methods of moments (GMM), and dynamic panel threshold models. There are studies that used pooled regression with and without fixed effects (Byoun, 2008; Frank & Goyal, 2003; Shyam-Sunder & Myers, 1999). The primary objective of this paper is to test the TOT and POT simultaneously. Therefore, it is important to formulate a model that incorporates the elements of both of these theories. Since this study examines the nested model that embeds both theories and tests them simultaneously, this study used ECMs as tested by Dang (2013). This model evades various problems such as misspecification of dynamics, the target leverage estimation using historical mean, and free cash flow estimation (Bontempi, 2002).

3.1. Dynamic models of TOT and POT

Either static or dynamic trade-off models uses firm-specific characteristics as proxy for the benefits and cost of debt financing as a determinant of leverage. Conversely, POT uses event-study analysis to understand the stock price reactions to the announcement of issue of securities (debt or equity). These two quantitative approaches could not be used to test the nested model. It is important to merge the characteristics of these two models into single model. Firms seek to find an optimal capital structure and try to adjust toward the same under TOT. Therefore, the model should have a dynamic specification, partial adjustment model that encapsulate long-term target leverage with a lag in adjustment to their target leverage. The partial adjustment model is as given below:

$$\Delta D_{it} = a + b\left(D_{it}^* - D_{it-1}\right) + e_{it} \tag{1}$$

Or

$$\Delta D_{it} = a + b\text{TLD}_{it} + e_{it} \tag{2}$$

where $\text{TLD}_{it} = D_{it}^* - D_{it-1}$. In Equation 1, leverage variations $\triangle D_{it}$ are explained in terms of the deviation of the past debt ratio D_{it-1} from the target debt ratio D_{it}^*; parameter b measures the speed of adjustment of the actual debt ratio to the target. This study assumes no mean reversion as cost and benefit of debt financing vary with its determinants and thereby target leverage ratio. If $a = 0$, $b = 1$, it indicates that TOT holds well than POT (e.g. Flannery & Rangan, 2006). The value of coefficient b lies between 0 (No change at all—adjustment cost is very high) and 1(full adjustment in the current period) indicates that the presence of adjustment. This study estimated D_{it}^* using the following equation:

$$D_{it}^* = \alpha_i + b_1\text{CVA}_{it} + b_2\text{NDTS}_{it} + b_3\text{profitability}_{it} + b_4\text{GO}_{it} + b_5\text{Size}_{it} + e_{it} \tag{3}$$

The error term is composed of the unobservable individual firm and or industry fixed effect; the unobservable time effect, and the white noise error (u_{it}). The study considered the firm and/or industry-specific effects control for time-invariant unobservable characters such as, managerial skills, firm's and product's life cycle, competitiveness, strategy, and so on (Ozkan, 2001), which has not observed in Equation 3.

This study uses a two-stage estimation procedure (Fama & French, 2002; Shyam-Sunder & Myers, 1999). First, we estimate the Equation 3 in order to get the fitted values as proxy for the target leverage (D_{it}^*) and then we estimate the Equation 2. We use following methods to estimate Equation 2: AH estimator, GMM estimator and SYS-GMM estimator. These estimators are better than pooled-OLS and fixed effects estimators in providing unbiased estimates.

The partial adjusted model has been extensively used to test the TOT (e.g. Dang, 2013; Fama & French, 2002; Flannery & Rangan, 2006; Ozkan, 2001; Shyam-Sunder & Myers, 1999). However, this method assumes that the cost of adjustment and adjusting leverage toward optimal or target level

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is independent. This study considers the important role of cost of adjustment, which shall reduce the level of adjustment speed (Maddala, 2001). The ECM is the logical extension of partial adjustment model. It considers explicitly the changes in the target leverage (change in determinant of leverage used) and its influence on the adjustment cost and process.

$$\Delta D_{it} = a + b_0 TLC_{it} + b_1 LECM_{it} + u_{it} \tag{4}$$

TLC refers to the change in target leverage over time ($D^*_{it} - D^*_{it-1}$); LECM refers to the deviation of actual from target leverage in the previous accounting period ($D^*_{it} - D_{it-1}$). The coefficients b_0 and b_1 are the speed of adjustment toward the target leverage. This model is more effective if b_0 and b_1 are equal.

To estimate the error correction model (Equation 4), this study applies the same two-stage procedure used for estimating partial adjustment model. First, fitted values are used to proxy target leverage and then Equation 4 is estimated using AH, GMM, and SYS-GMM estimators.

To test the presence of POT, the study used the Dang (2013), Frank and Goyal (2003), and Shyam-Sunder and Myers (1999) empirical model. The model is:

$$\Delta D_{it} = a + b CFD_{it} + e_{it} \tag{5}$$

CFD is cash flow deficit or surplus for firm i in year t; error term as described the error term is composed of the unobservable individual firm and or industry fixed effect; the unobservable time effect, and the white noise error (u_{it}). The cash flow deficit or surplus is been calculated as follows:

$$CFD = CF + I + ED + \Delta C \tag{6}$$

CF refers to the cash flow from operating activities after tax and interest; I refer to the net investment (CAPEX plus acquisitions and disposals); ED refers to the equity dividend paid; Δc refers to the net change in cash including change in working capital. If $a = 0$, $b_0 = 1$, it indicates that firms raise (retire) debt to offset the deficit (surplus) (e.g. Shyam-Sunder & Myers, 1999).

The nested model used in the study by following the spirit of Bontempi (2002), Dang (2013), Frank and Goyal (2003), and Shyam-Sunder and Myers (1999). The augmented partial adjustment model of this study is given below:

$$\Delta D_{it} = a + b_0 TLD_{it} + b_1 CFD_{it} + u_{it} \tag{7}$$

In this model, if $a = 0$, $b_0 = 0$, and $b_1 = 1$, POT holds.

Finally, this study augments the error correction model (Equation 4) as follows:

$$\Delta D_{it} = a + b_0 TLC_{it} + b_1 LECM_{it} + b_2 FCF_{it} + u_{it} \tag{8}$$

If $a = 0$, $b_2 = 1$, $b_1 = b_0 = 0$, it indicates the presence of POT, else TOT.

Again, we use the same two-step estimation procedure and use AH, GMM, and SYS-GMM estimators to estimate the augmented partial adjustment model (Equation 7) and augmented error correction model (Equation 8).

4. Data, variables, and sample
This study examines a large panel data-set of companies from China, India, and South Africa. The data are collected from *Bloomberg* database spanning the period 1999–2016. This study applies the standard procedure in the literature (e.g. Ozkan, 2001) to put restrictions on the data-set. First, we discard the financial and utilities firms because these firms face distinctive regulatory restrictions.

Table 1. Descriptive statistics					
Variables	**Observations**	**Min**	**Max**	**Mean**	**SD**
Panel A: Chinese Firms					
Market leverage	5053	0.013	0.731	0.398	0.283
Collateral value of assets	5053	0.001	0.965	0.346	0.195
Non-debt tax shields	5053	0.000	0.071	0.023	0.014
Profitability	5053	−0.085	0.235	0.072	0.049
Growth opportunities	5053	0.364	4.558	1.846	1.015
Size	5053	17.240	24.320	19.950	1.133
Cash-flow deficit	5053	−0.465	0.325	−0.078	0.116
Panel B: Indian Firms					
Market leverage	6008	0.004	0.841	0.514	0.851
Collateral value of assets	6008	−0.083	0.946	0.369	0.187
Non-debt tax shields	6008	−0.029	0.093	0.030	0.017
Profitability	6008	−0.152	0.363	0.102	0.074
Growth opportunities	6008	0.041	2.299	0.907	0.625
Size	6008	14.960	24.060	18.830	1.382
Cash-flow deficit	6008	−0.539	0.361	−0.111	0.124
Panel C: South African Firms					
Market leverage	1126	0.007	0.536	0.273	0.432
Collateral value of assets	1126	0.000	0.980	0.343	0.227
Non-debt tax shields	1126	0.000	0.107	0.032	0.021
Profitability	1126	−0.128	0.468	0.153	0.093
Growth opportunities	1126	0.194	3.191	1.241	0.779
Size	1126	13.760	23.140	19.240	1.725
Cash-flow deficit	1126	−0.591	0.238	−0.166	0.124

Notes The table provides the descriptive statistics for all the variables defined in this study.

Second, we delete the firm-year observations that have the data missing for the required variables. Third, we retain only those firms having data for consecutive 5 years or more in order to apply AH, GMM, and SYS-GMM estimators. Fourth, all the variables are winsorized at the 1 and 99% to alleviate the effects of outliers in the sample. This leaves us with the final sample of 1,183 firms with 12,187 firm-year observations. Specifically, the sample has 412 firms (5,053 observations) for China, 675 firms (6,008 observations) for India, and 96 firms (1,126 observations) for South Africa.

Table 1 reports the descriptive statistics for Chinese, Indian, and South African firms. The descriptive statistics reported shows some noteworthy facts. The firms in South Africa have low market leverage (0.273) as compared to firms in India (0.514) and China (0.398). The tangibility (i.e. collateral value of assets) for firms is almost similar for all the countries: China (0.346), India (0.369), and South Africa (0.343). The growth opportunities for Chinese (1.846) and South African (1.241) firms are higher as compared to Indian (0.907) firms. The high growth firms tend to prefer equity than debt finance. This is consistent with the above finding that market leverage for Indian firms are much higher as compared to Chinese and South African firms.

5. Empirical results

5.1. Target leverage estimation
Table 2 shows the results of target leverage estimation using Equation 3. Overall, the results are comparable for firms in China, India, and South Africa. Also, the results are statistically significant

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Table 2. Target leverage estimation for market leverage			
Variables	**China**	**India**	**South Africa**
Collateral value of assets	0.079*	0.056	0.014
	(0.046)	(0.148)	(0.083)
Non-debt tax shields	−0.874*	1.338	1.197
	(0.512)	(1.140)	(0.881)
Profitability	−0.551**	−0.932**	−0.231
	(0.107)	(0.193)	(0.174)
Growth opportunities	−0.151**	−0.716**	−0.321**
	(0.005)	(0.032)	(0.027)
Size	0.061**	0.098**	0.019
	(0.005)	(0.028)	(0.017)
Estimator	FE	FE	FE
Observations	5053	6008	1126
R^2	0.49	0.315	0.393
Adjusted R^2	0.45	0.28	0.358
No. of firms	412	675	96

Notes: The table reports the regression result for target leverage using Equation 3. FE means the fixed-effects (within-group) estimator. Robust standard errors are in the parenthesis.

*Denotes the significance at 10% level.

**Denotes the significance at 1% level.

and in line with the expectations of the trade-off theory. The variable collateral value of assets is positively related to the leverage. Though, not significant for India and South Africa, collateral value of assets is significant for China at 10% level of significance. This result is in line with the TOT that states that the firms having high collateral value of assets tend to face lower bankruptcy costs which further helps firms to borrow more. This finding is in line with the existing empirical literature (de Jong et al., 2008; Rajan & Zingales, 1995).

The variable non-debt tax shields shows mixed results. The variable is negatively related and significant for firms in China at 10% significance level. This is in line with the TOT that predicts that firm uses non-debt tax shields as a substitute for debt tax shields (DeAngelo & Masulis, 1980). Though, the variable is not significant for firms in India and South Africa. The results further show that the profitability is negatively related to leverage and is significant at 1% significance level (except for South African firms). These findings support the POT as it indicates that profitable firms are less inclined to use debt financing. Overall, the relation between leverage and profitability is consistent with the existing literature (Antoniou et al., 2008; Rajan & Zingales, 1995).

The variable growth opportunity is negatively related to the leverage and is significant at 1% level for all the firms in all countries. This result is in line with the TOT, which concurs that, the firms having high growth opportunities tend to use less debt financing to overcome the underinvestment problem. This result is strongly consistent with the existing empirical literature (Antoniou et al., 2008; de Jong et al., 2008; Rajan & Zingales, 1995).

The variable firm size is positively related to the leverage and is significant at 1% level (except South African firms). This is in line with the TOT which states that the large firms tends to experience lower distress and bankruptcy costs that in turn provide incentive to lever up and exploit tax shields. Overall, the results from the regression provide plausible explanations regarding the relationship between the target leverage and its determinants. Also, the empirical results are in line with the TOT.

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Table 3. Testing of trade-off theory by partial adjustment model									
Variables	**China**			**India**			**South Africa**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
TLD	0.327*	0.971*	0.061*	0.339*	0.774*	0.275*	0.308*	0.694*	0.067*
	(0.008)	(0.019)	(0.004)	(0.009)	(0.026)	(0.019)	(0.017)	(0.046)	(0.012)
Constant	−0.143*			0.028*			0.167*		
	(0.004)			(0.006)			(0.012)		
Estimator	AH	GMM	SYSGMM	AH	GMM	SYSGMM	AH	GMM	SYSGMM
Observations globally	5053	5053	5053	6008	6008	6008	1126	1126	1126
No. of firms	412	412	412	675	675	675	96	96	96
AR2 test		−6.819	−5.672		−1.556	1.532		0.310	1.404
Sargan test		177.215	328.545		200.994	268.781		79.728	86.597

Notes: This table reports the results of partial adjustment model specified by Equation 2. AR2 tests for the second-order autocorrelation. Sargan test is a test for over-identification in model specification. Robust standard errors are in the parenthesis.

*Denotes the significance at 1% level.

5.2. Partial adjustment model

Table 3 reports the results of TOT tested by partial adjustment model that is modeled by Equation 3. Results for the Chinese, Indian, and South African firms are reported in columns (1)–(3), (4)–(6), and (7)–(9), respectively. Columns (1), (4), and (7) use the AH estimator. Columns (2), (5), and (8) use the GMM estimator and columns (3), (6), and (9) use the SYS-GMM estimator. To test the validity of these methods, we also report Sargan test and AR2 test.

Overall, the results of the partial adjustment model are satisfactory. Sargan test and AR2 test further validates the findings by suggesting no evidence of second-order correlation and appropriateness of the instruments used. The coefficient of TLD, which represent the speed of adjustment, is significant in all the specifications for all the countries. An overall observation show that the SYS-GMM estimates are smallest followed by AH and GMM estimates and is consistent for all the countries. In economic terms, the Chinese firms seem to adjust toward their target leverage most quickly followed by Indian and South African firms. Empirically, these results are in line with the TOT, which predicts that firms actively seek adjustment toward their target leverage.

Compared to previous empirical evidence from US firms, the adjustment speeds are much faster in Chinese, Indian, and South African firms. Fama and French (2002) reported a much lower adjustment speed between 7 and 10% for US firms. Antoniou et al. (2008) and Flannery and Rangan (2006) also reported a slower speed of adjustment of 0.30 as compared to firms in China, India, and South Africa. The presence of financially constrained firms with high growth rate and large investment is the main reasons for the high adjustment speed in Chinese, Indian, and South African Firms (Drobetz et al., 2015). Further, the above target leverage and financing deficit in Indian and Chinese firms in comparison to South African firms cause the different effect on adjustment speed for the three selected countries. Overall, the results are statistically and economically significant and are in line with the TOT.

5.3. Error correction model

Table 4 reports the results of TOT tested by error correction model that is modeled by Equation 4. Results for the Chinese, Indian, and South African firms are reported in columns (1)–(3), (4)–(6), and (7)–(9), respectively. Columns (1), (4), and (7) use the AH estimator. Columns (2), (5), and (8) use the GMM estimator and columns (3), (6), and (9) use the SYS-GMM estimator. To test the validity of these

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Table 4. Testing of trade-off theory by error correction model

Variables	China			India			South Africa		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
TLC	0.899*	1.076*	1.088*	0.882*	0.999*	0.993*	0.908*	0.936*	0.918*
	(0.016)	(0.030)	(0.045)	(0.020)	(0.052)	(0.064)	(0.039)	(0.083)	(0.107)
LECM	0.164*	0.708*	0.019*	0.223*	0.608*	0.168*	0.193*	0.537*	0.048*
	(008)	(0.029)	(0.002)	(0.009)	(0.034)	(0.014)	(0.017)	(0.042)	(0.009)
Constant	−0.075*			0.021*			0.103*		
	(0.004)			(0.006)			(0.011)		
Estimator	AH	GMM	SYSGMM	AH	GMM	SYSGMM	AH	GMM	SYSGMM
Observations globally	5053	5053	5053	6008	6008	6008	1126	1126	1126
No. of firms	412	412	412	675	675	675	96	96	96
AR2 test		−5.021	−3.393		0.409	2.505		0.310	1.404
Sargan test		276.045	321.241		259.638	322.664		79.728	86.597
F-test	1683.2*	384.183*	1079.034*	937.410*	334.034*	247.218*	272.530*	10.479*	183.038*

Notes: This table reports the results of error correction model specified by Equation 4. AR2 tests for the second-order autocorrelation. Sargan test is a test for over-identification in model specification. F-test is under the null that the coefficient on TLC_{it} and $LECM_{it}$ are equal. Robust standard errors are in the parenthesis.

*Denotes the significance at 1% level.

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methods, we also report Sargan test and AR2 test. We also report *F*-statistics under the null that the coefficient on TLC_{it} and $LECM_{it}$ are equal.

The AR2 test and Sargan test reveal no problem with the model specification. The results show that both the variables TLC_{it} and $LECM_{it}$ are statistically and economically significant. However, the SYSGMM estimate of $LECM_{it}$ variable shows comparatively lower estimates in all specifications. According to the definition, the deviance from the target leverage, TLD_{it}, consists of $TLC_{it,}$ i.e. change in target leverage and $LECM_{it}$, i.e. deviation from target leverage in the last accounting period. The results show that both of these variables are significant for the firm's leverage adjustment. Also, the *F*-test shows that the effects of these variables are significantly different at 1% significance level. Precisely, the speed of adjustment with respect to TLD_{it} is significantly faster than speed with respect to $LECM_{it}$. For all the firms in China, India, and South Africa, firms make rapid adjustment corresponding to any change in target leverage as compared to the change in past deviation from the target.

Overall, the results indicate that the firms in China, India, and South Africa take dynamic but asymmetric adjustment toward the target leverage. The results also highlight the benefit of error correction model over partial adjustment model in analyzing the firm's dynamic adjustment toward target leverage.

5.4. Pecking order theory

Table 5 reports the results of POT tested by fixed effects estimation that is modeled by Equation 5. Overall, the results suggest that the models have very less explanatory power revealed by the R^2 of the respective models. The variable CFD_{it} is statistically significant for China and India at 1 and 5% significance level, respectively. However, the magnitude of the variable is low and undermines the economic significance. These results reveal a weak association between changes in debt levels of firms and financing deficit. The *F*-test, however, shows that the coefficient on the CFD_{it} is statistically less than 1 in all the models at 1% significance level. This result is not in line with the POT that requires the coefficient to be equal to 1. Overall, the results are also in contrast to Shyam-Sunder and Myers (1999) but consistent with Flannery and Rangan (2006).

5.5. Augmented partial adjustment model and augmented error correction model

The Table 6 reports the results of TOT and POT tested by augmented partial adjustment model that is modeled by Equation 7. To test the validity of the models, we also report Sargan test and AR2 test. We also report *F*-statistics under the null that the coefficient on CFD_{it} is equal to one. Overall, the results reveal that the models are well specified. As noted in the previous results, the SYSGMM estimator have the smallest value followed by AH estimator and GMM estimator.

Table 5. Testing of pecking order theory: Fixed effects estimation			
Variables	China	India	South Africa
CFD	0.084**	0.157*	0.043
	(0.025)	(0.080)	(0.117)
Estimator	FE	FE	FE
Observations	5053	6008	1126
R^2	0.002	0.001	0.0003
No. of firms	412	675	96
F-test	1293.9**	128.9**	133.23**

Notes: This table reports the results of pecking order theory specified by Equation 5. *F*-test is under the null that the coefficient on CFD_{it} is equal to 1. Robust standard errors are in the parenthesis.

*Denotes the significance at 5% level.

**Denotes the significance at 1% level.

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Table 6. Testing of trade-off theory & pecking order theory by augmented partial adjustment model									
Variables	China			India			South Africa		
	1	2	3	4	5	6	7	8	9
TLD	0.322*	0.952*	0.170*	0.351*	0.745*	0.297*	0.311*	0.648*	0.211*
	(0.008)	(0.019)	(0.011)	(0.009)	(0.025)	(0.019)	(0.018)	(0.047)	(0.026)
CFD	0.126*	0.055	0.741*	0.454*	1.005*	0.141	0.080	−0.023	−0.633*
	(018)	(0.092)	(0.067)	(0.048)	(0.224)	(0.101)	(0.055)	(0.128)	(0.101)
Constant	−0.136*			0.078*			0.182*		
	(0.005)			(0.008)			(0.015)		
Estimator	AH	GMM	SYSGMM	AH	GMM	SYSGMM	AH	GMM	SYSGMM
Observations globally	5053	5053	5053	6008	6008	6008	1126	1126	1126
No. of firms	412	412	412	675	675	675	96	96	96
AR2 test		−6.654	−5.685		−1.569	1.473		0.509	1.576
Sargan test		263.264	349.981		273.364	370.951		91.922	96
F-test	2325.3*	886.475*	223.712*	129.93*	43.073*	97.395*	277.12*	85.064*	346.81*

Notes: This table reports the results of trade-off theory and pecking order theory tested by augmented partial adjustment model that is modeled by Equation 7. AR2 tests for the second-order autocorrelation. Sargan test is a test for over-identification in model specification. *F*-test is under the null that the coefficient on CFD_{it} is equal to 1. Robust standard errors are in the parenthesis.

*Denotes the significance at 1% level.

The results reveal that the TOT performs better than the POT for the firms in China, India, and South Africa. The statistical and economic significance of the variable TLD_{it} remains similar (Table 3) even in the presence of CFD_{it}. The speed of adjustment toward the target leverage still remains fast. Also, the *F*-test reveals that he coefficient on CFD_{it} is significantly less than 1. In addition, the variable CFD_{it} becomes insignificants for some specifications (columns 2,6,7, and 8). These results imply that the TOT dominates the POT in the current nested model.

The Table 7 reports the results of TOT and POT tested by augmented error correction model that is modeled by Equation 8. Overall, the results are in line with the TOT. The speed of adjustments reflected by TLC_{it} and $LECM_{it}$ are significant and are slightly affected by the presence of the variable CFD_{it}. Also, the magnitude of TLC_{it} and $LECM_{it}$ are similar to the error correction model (Table 4). In addition, the variable CFD_{it} becomes insignificant for many specifications (columns 2, 6, 7, and 8). Overall, the results of augmented error correction model and augmented partial adjustment model are in line with the TOT. Hence, the firm's financing decisions are better explained by TOT as compared to POT.

5.6. Robustness checks
This study has used market-based measure of leverage as the main variable that is also consistent with the existing empirical literature (Titman & Wessels, 1988; Welch, 2004). However, some empirical studies have used alternate variable, i.e. book-based measure of leverage (Myers, 1984; Shyam-Sunder & Myers, 1999). Hence, the robustness check in this study includes the alternative measure

Table 7. Testing of trade-off theory & pecking order theory by augmented error correction model

Variables	China			India			South Africa		
	1	2	3	4	5	6	7	8	9
TLC	0.896**	1.058**	1.064**	0.881**	0.927**	0.930**	0.908**	0.904**	0.890**
	(0.016)	(0.029)	(0.043)	(0.019)	(0.041)	(0.051)	(0.039)	(0.080)	(0.098)
LECM	0.168**	0.693**	0.044**	0.234**	0.596**	0.176**	0.194**	0.495**	0.116**
	(0.008)	(0.027)	(0.007)	(0.009)	(0.032)	(0.015)	(0.017)	(0.042)	(0.019)
CFD	0.050*	0.029	0.16**	0.368**	0.840**	0.109	0.045	−0.038	−0.332**
	(0.016)	(0.065)	(0.042)	(0.045)	(0.206)	(0.057)	(0.049)	(0.102)	(0.063)
Constant	−0.072**			0.062**			0.112**		
	(0.004)			(0.007)			(0.014)		
Estimator	AH	GMM	SYSGMM	AH	GMM	SYSGMM	AH	GMM	SYSGMM
Observations globally	5053	5053	5053	6008	6008	6008	1126	1126	1126
No. of firms	412	412	412	675	675	675	96	96	96
AR2 test		−4.938	−3.412		0.200	2.376		0.504	0.845
Sargan test		344.844	375.735		331.142	401.933		96	98
F-test 1	1632**	354.109**	1034.455**	912.04**	235.920**	214.405**	270.67**	8.237**	149.996**
F-test 2	3583.6**	1068.969**	902.689**	199.73**	11.93**	88.307**	370.12**	97.183**	315.981**

Notes: This table reports the results of trade–off theory and pecking order theory tested by augmented error correction model that is modeled by Equation 8. AR2 tests for the second-order autocorrelation. Sargan test is a test for over-identification in model specification. *F*-test 1 is under the null of no difference, $TLC_{it} = LECM_{it}$, *F*-test 2 is under the null that the coefficient on CFD_{it} is equal to 1. Robust standard errors are in the parenthesis.

*Denotes the significance at 5% level.

**Denotes the significance at 1% level.

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Table 8. Target leverage estimation for book leverage			
Variables	**China**	**India**	**South Africa**
Collateral value of assets	0.052	0.057	0.100
	(0.036)	(0.045)	(0.061)
Non-debt tax shields	0.408	2.080**	0.954*
	(0.398)	(0.356)	(0.401)
Profitability	−20.425**	−0.387**	−0.226*
	(0.088)	(0.054)	(0.099)
Growth opportunities	−0.016**	0.025**	0.001
	(0.003)	(0.006)	(0.008)
Size	0.048**	0.041**	0.010
	(0.004)	(0.007)	(0.012)
Estimator	FE	FE	FE
Observations	5053	6008	1126
R^2	0.201	0.101	0.058
Adjusted R^2	0.184	0.09	0.053
No. of firms	412	675	96

Notes: The table reports the regression result for target leverage for book leverage using Equation 3. FE means the fixed-effects (within-group) estimator. Robust standard errors are in the parenthesis.

*Denotes the significance at 5% level.

**Denotes the significance at 1% level.

of leverage, i.e. book-based measure of leverage, defined as the ratio of book value of total debt to book value of total assets. Table 8 reports the results of the target leverage estimation for book leverage and Table 9 reports the results of augmented error correction model of book leverage.

Overall, the results are similar but less significant for book leverage shown in Table 8. The variable growth opportunities become insignificant for South African firms and carries positive sign for Indian firms but still significant. This is inconsistent with the earlier findings with market measure of leverage though consistent with the TOT. The variable non-debt tax shields become significant for Indian and South African firms. This is not in line with the TOT that predicts that firm uses non-debt tax shields as a substitute for debt tax shields. The other variables carry expected sign and are generally significant that is consistent with the results for market leverage.

Table 9 shows the result of augmented error correction model for book leverage and reveals that the speeds of adjustment toward target leverage remains significant. The variable CFD_{it} also shows similar results as compared to market measure of leverage. Overall, the results are qualitatively similar to the earlier results obtained for market measure of leverage (Table 7). Thus, the findings in this study appear to be robust with regards to the choice of leverage measure.

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Table 9. Testing of trade-off theory & pecking order theory by augmented error correction model of book leverage

Variables	China			India			South Africa		
	1	2	3	1	2	3	1	2	3
TLC	0.827**	0.601**	0.529**	0.566**	0.642**	0.343*	0.713**	0.519**	0.639*
	(.041)	(0.102)	(0.119)	(0.034)	(0.108)	(0.127)	(0.109)	(0.189)	(0.199)
LECM	0.072**	0.294**	-0.003	0.056**	0.413**	0.054**	0.099**	0.396**	0.112**
	(0.005)	(0.038)	(0.005)	(0.004)	(0.034)	(0.008)	(0.013)	(0.051)	(0.019)
CFD	-0.003	-0.136**	-0.104**	0.057**	0.045	0.082**	-0.012	-0.039	-0.002**
	(0.008)	(0.029)	(0.026)	(0.007)	(0.038)	(0.023)	(0.018)	(0.063)	(0.057)
Constant	-0.029**			-0.004*			0.022**		
	(0.002)			(0.001)			(0.005)		
Estimator	AH	GMM	SYS-GMM	AH	GMM	SYS-GMM	AH	GMM	SYS-GMM
Observations globally	5053	5053	5053	6008	6008	6008	1126	1126	1126
No. of firms	412	412	412	675	675	675	96	96	96
AR2 test		0.434	0.538		0.388	-0.054		-1.350	-0.815
Sargan test		333.595	353.818		285.079	334.969		96	97
F-test 1	327.18**	83.323**	164.313**	226.03**	1.802	85.365**	31.338**	19.714**	48.161**
F-test 2	13,430**	4694.16**	4174.371**	15,986**	4639.119**	5195.468**	3128.4**	839.516**	1763.903**

Notes: This table reports the results of trade-off theory and pecking order theory tested by augmented error correction model of book leverage that is modeled by Equation 8. AR2 tests for the second-order autocorrelation. Sargan test is a test for over-identification in model specification. F-test 1 is under the null of no difference, $TLC_{it} = LECM_{it}$. F-test 2 is under the null that the coefficient on CFD_{it} is equal to 1. Robust standard errors are in the parenthesis.

*Denotes the significance at 5% level.

**Denotes the significance at 1% level.

6. Conclusion

Prior research on capital structure shows that most of the studies tested the TOT or POT in isolation. As suggested by Fama and French (2005), few studies have attempted to test both the theories simultaneously. Yet, there is no clarity on which theory (TOT or POT) can better explain the financing decisions made by a firm. Those studies examined the capital structure of the firms that are operating in developed countries only. The study endeavors to fill the gap by analyzing that which theory can better explain the capital structure choice made by firms that are operating in China, India, and South Africa by using an error correction model (ECM). This study contributes to the existing literature in the following way. First, the study uses the error correction model of leverage to examine the firm's dynamic leverage adjustment process in emerging countries. Second, the study results in the consistent and efficient estimates of the adjustment speeds toward target leverage using advanced econometric procedures. Third, this study is one the first empirical study, to the best of our knowledge, to test TOT and POT using data-set of firms from China, India, and South Africa.

The results provide clear evidence that the TOT outperforms POT of firms in China, India, and South Africa. Firms adjust quickly toward their target leverage. Also, the firms tend to respond very quickly to target leverage change as compared to past deviations from the target leverage as compared to the firms in developed countries. The study also reveals the benefit of using error correction model over partial adjustment model to examine the firm's dynamic capital structure behavior. Lastly, the study also suggests that the firms in China, India, and South Africa utilize debt financing to offset a small proportion of the deficit. Overall, the nested models used in the study reveals that the firm's financing decisions are better explained by the TOT rather that POT. Future studies can be focused on the role of institutional and macroeconomic framework on the choice of capital structure. Further, the studies may analyze the stability of the speed of adjustment of emerging countries. This study has also to link with corporate governance, corruption, ownership structure, which can be studied further.

Author details
M. Kannadhasan[1]
E-mail: mkdhasan@iimraipur.ac.in
ORCID ID: http://orcid.org/0000-0002-2591-2802
Bhanu Pratap Singh Thakur[1]
E-mail: bhanu.fpm2014@iimraipur.ac.in
C.P. Gupta[2]
E-mail: guptacp@gmail.com
Parikshit Charan[1]
E-mail: pcharan@iimraipur.ac.in
[1] Indian Institute of Management Raipur, GEC Campus, Old Dhamtari Road, Sejbahar, Raipur, Chhattisgarh, India.
[2] Department of Financial Studies, University of Delhi- South Campus, New Delhi, India.

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