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Article

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Discovering Capital Structure Determinants for SAARC Energy Firms

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ABSTRACT

Energy scarcity is the core drain for the South Asian economies. However, there is a lack of studies in relation to the capital structure determinants in the context of South Asian Association for Regional Cooperation (SAARC). Thus, this study is an attempt to explore the capital structure determinants of energy sector firms which are operating in the four large economies of the SAARC region that are Pakistan, India, Bangladesh and Sri Lanka. In this context, a total of 34 energy sector firms' Panel Data is entailed over the period of 2007-2020. The six key capital structure determinants, namely asset tangibility, current ratio, return on equity, non-debt tax shield, annual gross domestic product are examined in relation to debt to total asset ratio. Deploying Panel Data Static models and Dynamic model via Generalized Method of Moments (GMM), the outcomes reveal that asset tangibility and current ratio are the most prominent determinants among all others. The significant role of profitability and tangibility through different estimators directly infers the relevance of Dynamic Trade-Off theory. The findings provide new ways for policy makers to construct parallel strategies which not only help out in overcoming the energy scarcity issues but also enhance regional level integration.

Keywords: Capital Structure, Panel Data, Energy Firms, GMM
JEL Classifications: G31, G32

1. INTRODUCTION

Capital structure is one of the key inspected areas of finance. However, the question that how to construct an optimal capital structure is still an unresolved issue. Technically, capital structure is how a firm finances its operations and assets by using dissimilar funding options such as debt, equity and retained earnings (Rajan and Zingales, 1995). The optimal capital structure is a best blend of debt and equity which moves a firm toward its long-term aim of financial performance. Thus, an optimal capital structure reduces a firm's overall cost of capital and enhances its market value. From the last few decades, the core capital structure theories and now their modern dynamic versions have been serving out firms to select appropriate capital structure determinants. The three-core traditional capital structure theories that are Modigliani Miller (MM), Pecking Order and Trade-Off theories are widely used to explain the association between capital structure and its determinants (Hadi et al., 2018; Khan et al., 2021).

Remarkably, the exploration of capital structure determinants for the energy sector firms which are functioning in the territory of South Asian Association for Regional Cooperation (SAARC) is still an unresolved problem. Clearly, the former investigations which were performed in the SAARC context are country and sector-specific (see Chakrabarti and Chakrabarti, 2019; Ghani and Bukhari, 2010; Liaqat et al., 2017), thus, not delivering holistic and conclusive findings for the entire region. Evidently, South Asia is among one of the main regions of the globe which is facing energy scarcity issues (Rahman and Velayutham, 2020). The foundation of SAARC was laid in December 1985 by seven

South Asian governments which are India, Pakistan, Bangladesh, Sri Lanka, Bhutan, Nepal and Maldives. Later, it has taken several initiatives to resolve energy related issues within the region (Alam et al., 2015). For instance, SAARC Energy Center (SEC) was launched in Islamabad, Pakistan in 2006. The SEC was formed by following Dhaka Declaration 2005 with the ambition to build energy ring and tackle energy crisis among the associated countries (Wijayatunga and Fernando, 2013).

Visibly, in the last two decades, the increasing population boosted 50% further energy demand in the South Asia and it is anticipated to be doubled in 2050 (Chen, 2022). Also, late start of new energy generating projects and mounting demand of energy affected severely the regional countries' economic growth. Clearly, Pakistan and Sri Lanka's economies are crippled by the worst energy crisis (Low and Mangi, 2022). Similarly, the escalating energy crisis is also considered as a core drain for the economy of whole South Asian region especially for Pakistan, India, Bangladesh, and Sri Lanka (Khan et al., 2022; Preethi, 2022; Shakya et al., 2022; Ferdous and Ahmed, 2022). On the other side, the firms which are functioning in the energy sectors of the SAARC region are not managing their debts efficiently, thus, governments are trying to raise these sectors' capital by increasing their tariffs (Low and Mangi, 2022; Oxford Analytica, 2019). Importantly, it is required for these firms to manage their debt and equity-related activities proficiently. Thus, the identification of region-specific capital structure determinants for energy sector firms which are operating in the SAARC region is warranted. Notably, appropriate tuning of debt and equity to formulate an optimal capital structure leads a firm toward its best financial performance i.e. profitability (Derbali, 2022).

In view of discussed background, the goal of current study is to add several additions to the existing literature by finding region-specific capital structure determinants for the firms operating in the energy sectors of SAARC economies. Also, adhering to the aim of this study, core capital structure theories which are MM, Trade-Off, and Pecking Order theories are tested to explain the theoretical relationship amongst the capital structure and selected determinants. This study relies on the large-scale Panel Data sample of four main economies of the SAARC that are Pakistan, Sri Lanka, Bangladesh and India over the period of 14 years i.e. from 2007 to 2020. Moreover, a Panel Data Static Model approach is adopted to execute the empirical inquiry. To the best of researchers' knowledge, this study is the first-ever investigation that explores region-specific capital structure determinants for the energy firms functioning in the context of SAARC region.

The outcomes explain that tangibility, sales and profitability are the key determinants that impact energy sector firms' choices for maintaining their capital structure in the SAARC region. The findings help out SAARC regulatory bodies such as SEC, policy makers and regional energy firms to construct a harmonized strategy that boosts energy integration across the region. Certainly, regional level cooperation, integration and diversification of energy resources to overcome the existing energy scarcity can be resolved by applying parallel strategies.

After a thorough introduction, the rest of this research article is arranged as follows: Section 2 highlights earlier literature on the topic; Section 3 clarifies the data and accepted methods for this empirical investigation; Section 4 explains the empirical findings. Subsequently, Section 5 describes in detail the outcomes of this study. Lastly, Section 6 ends up with the final conclusion, research implications and limitations.

2. LITERATURE REVIEW

From the last century, the topic of capital structure has continuously been the of finance scholars. The chase for the existence of possible debt and equity to produce an optimal capital structure is still in progress. Visibly, scholars are unable to come up with a precise solution for framing an optimal capital structure. Though, traditional capital structure theories such as Modigliani Miller, Pecking Order, Trade-off theories, and now their dynamic versions provide a guideline to select those determinants that help in the creation of a suitable debt-equity mix. Modigliani and Miller (1958) offered proposition I which states that in a perfect capital market the selection of firms to produce capital structure has no impact on its overall market value. Subsequently, proposition II clarifies that dividend payout has no impact on a firm's shareholders' return or its share price. Besides, MM proposition II also emphasizes debt risk for the firm. After the MM propositions, the Trade-off theory postulates the idea that a firm can select an appropriate debt and equity to frame an optimal capital structure. Later, Pecking Order theory that is also measured as a competitor of Trade-off theory, recommends that firms first adopt retained earning then debt and as a last resort equity for fulfilling its capital structure desires. Lately, the dynamic versions of these theories offer an idea of speed of adjustment (SOA). According to dynamic capital structure theories, the firm's capital structure is not a static property and it is dynamic in nature. Thus, in case of any deviation from its optimal level it returns back to its targeted level rapidly.

Next, the core capital structure determinants that have been indicated as a significant by aforesaid theories for the energy sectors are debt ratio, asset tangibility, liquidity, profitability and taxation. For instance, Berkman et al. (2016) investigated capital structure determinants of 79 energy firms functioning in the European market during the time period of 2009-2012. The findings specified that tangibility, liquidity and profitability are statistically significant determinants of energy firms. They further accomplish that the Pecking Order theory is more pertinent in explaining capital structure practices of energy firms functioning in the Europe. Jaworski and Czerwonka (2021) investigated capital structure determinants of energy operating firms in the Europe. By using Multiple Regression technique and a large-scale data set of 6122 firms from 25 European firms the findings are in line with the former results of Berkman et al. (2016). The results indicated strong significant and positive association of capital structure with tangibility and size. However, negative but significant relationship of capital structure is observed in relation with liquidity and profitability. Besides, this study also examined some country specific macroeconomic variables and reported negative and significant relationship of gross domestic products i.e. GDP with capital structure. Clearly, the above investigations of

(Berkman et al., 2016; Jaworski and Czerwonka, 2021) postulate that liquidity, tangibility, sales, profitability and gross domestic products are the core capital structure determinants of energy firms which are operated in the European region.

Notably, the issue of capital structure determinants for energy firms which are operating in the SAARC region is still an unresolved issue. Moreover, the former investigations that had been performed in this regard are country specific such as the studies that were performed by Ghani and Bukhari (2010); Liaqat et al. (2017) and Zhang et al. (2018) analyzed Pakistani listed energy firms. Ghani and Bukhari (2010) investigated capital structure determinants for energy firms which are operating in Pakistan. The sample consisted of 20 energy firms operating during the period of 2004 to 2008. The results indicated that size and tangibility possessed significant and positive relationship with energy firms' capital structure. Clearly, the significant relationship of size and tangibility specified the application of the Trade-off theory. On the flip side, the negative association of profitability with firms' capital structure supported the notions of the Pecking Order theory. Another Study of Liaqat et al. (2017) provided evidences that profitability is a core determinant for Pakistani energy and fuel sectors firms. By adopting Multiple Regression analysis technique and data from 2006 to 2014, this study reports significant but negative impact of return on equity and return on assets on fuel and energy sectors firms of Pakistan. Besides, they also reported that earnings per share possess a significant and positive relationship with firms' size. Similarly, Zhang et al. (2018) reported that profitability, tangibility and size have significant and positive association with Pakistani fuel and energy firms. The analysis was performed by using data from the period that started from 2010 to 2015.

Clearly, the former studies that were performed in the Pakistani context to investigate energy firms' determinants designated that tangibility, liquidity, size and profitability are the core determinants of capital structure (Ghani and Bukhari, 2010; Liaqat et al., 2017; Zhang et al., 2018). In India, Chakrabarti and Chakrabarti (2019) explored capital structure determinants for India's energy firms. A total of 141 energy firms were selected and by adopting Panel Data estimators, the results confirmed that liquidity, tangibility and size are significant determinants for Indian energy firms. However, profitability, sales, debt capacity and non-debt tax shield are reported as insignificant determinants for Indian energy firms. Similarly, Panicker (2013) explored capital structure determinants for Indian firms. The sample covers three enterprises' 4-year data from 2004 to 2008. The Panel Data Fixed Effects estimation indicated that tangibility, profitability, capital intensity ratio and size of the firm have significant impact on Indian energy firms. Likewise, the former investigations that have been conducted in Bangladesh context delivered the similar outcomes such as Uddin et al. (2022) investigated capital structure determinants of firms listed in numerous sectors of Bangladesh. Notably, energy generation sector listed firms are added in the inquiry. The study used Panel Data models such as Fixed Effect and Panel Corrected Standard Error models. The outcomes specified that liquidity, tangibility, size of firm, non-debt tax shield and firm operating age are core determinants of capital structure for the firms which are functioning in Bangladesh.

Considering the above discussion, it is clear that tangibility, liquidity, profitability and the non-debt tax shield are the core capital structure determinants that impact energy generating firms in dissimilar contexts and in South Asian countries (Berkman et al., 2016; Chakrabarti and Chakrabarti, 2019; Ghani and Bukhari, 2010; Jaworski and Czerwonka, 2021; Liaqat et al., 2017; Panicker, 2013; Zhang et al., 2018). Thus, in line with former studies this study also adopted these determinants to explore the capital structure maintaining practices of energy firms which are operating in the SAARC region. Additionally, this study adopts gross domestic product (GDP) as an independent variable. This is as per practices of former researchers (Bas et al., 2009; Jaworski and Czerwonka, 2021; Sineviciene et al., 2017) who used GDP as an independent variable while exploring regional level capital structure determinants. Thus, this study also selects GDP as an independent variable to check its impact on capital structure of SAARAC region energy firms.

Remarkably, the former investigations clarify variation in selected determinants of tangibility, liquidity, sales, profitability and non-debt tax shield. Thus, the variation in studied variables designates that capital structure of energy firms at SAARC region is dynamic in nature. Therefore, the connected hypotheses with this study are:

H_1: There is a positive relationship between leverage and tangibility.

H_2: There is a negative relationship between leverage and liquidity.

H_3: There is a positive relationship between leverage and profitability.

H_4: There is a positive relationship between leverage and gross domestic products.

H_5: There is a positive relationship between leverage and sales.

H_6: There is a negative relationship between leverage and non-debt tax shield.

H_7: There is a dynamic relationship among leverage and selected determinants.

3. DATA AND METHODOLOGY

This study involves a total of 34 energy firms from four large economies of the SAARC region that are India, Pakistan, Bangladesh and Sri Lanka over the 14 years' time period i.e. from 2007 to 2020. For that purpose, the annual secondary data is mined from the Thomson Reuters Eikon database. Importantly, Bhutan, Maldives, Nepal and Afghanistan are also SAARC members. However, this study eliminates these other four countries because of data unavailability. Moreover, after an extensive literature review, this study adopts five explanatory variables to test their relationship with capital structure. Table 1 below displays nominated variables and their measurements.

Analytically, the Panel Data Analysis (PDA) is performed to find the robust relationship among the nominated variables. Technically, Panel Data is a combination of time-series and cross-sectional data that is also termed as pooled data, longitudinal data, history, and cohort analysis (Gujarati, 2003; Hadi et al., 2018). The constructed Panel Data models are assessed by adopting Static and Dynamic Panel Data procedures. The Static Panel Data analysis comprises both Random Effect and Fixed Effect models. Whereas,

Table 1: Measurements of the variables

S#	Symbol	Variables	Measurement	References
01	DR (Y)	Capital Structure (Debt-to-Total Assets)	Total Debt/Total Assets	Sarioğlu et al. (2013); Syed et al. (2012); Demirhan (2009)
02	TANG (X_1)	Asset Tangibility	Tangible Fixed Assets/Total Assets	Berkman et al. (2016); Shah and Hijazi (2004); Sayilgan and Uysal (2011)
03	PROF (X_2)	Return On Equity	Net Income/Equity	Sarioğlu et al. (2013); Kabakci (2008); Demirhan (2009)
04	LIQ (X_3)	Current Ratio	Current Assets/Current Liabilities	Mahvish and Quasar (2012); Ata and Ag (2010)
05	SIZE (X_4)	Sales	Ln (Total Assets)	Jaworski and Czerwonka (2021); Nguyen (2020)
06	NDTS (X_6)	Non-debt Tax Shield	Depreciation/Total Assets	Jaworski and Czerwonka (2021); Cortez and Susanto (2012); Gill et al. (2009)
07	GDP (X_6)	Annual GDP growth	GDP growth (annual %)/100	Jaworski and Czerwonka (2021)

Y indicates the dependent variable and X indicates the independent variables

for the Dynamic Panel Data model a robust estimator which is named as Generalized Method of Moments (GMM) is hired to investigate the dynamic relationships among the selected variables.

Methodologically, the Dynamic Panel Data model is used when the existing dependent variable depends on its own earlier realizations (Flannery and Rangan, 2006). Notably, several scholars indicated that the capital structure of firms is dynamic in nature (Flannery and Rangan, 2006; Hovakimian, 2006; Rehan and Hadi, 2019). Thus, this study adopts difference GMM to explore the dynamic association among the variables. In fact, the difference GMM is able to change the dependent variable as an explanatory variable by taking its first difference which is constant over time. Moreover, the Dynamic Panel Data model is also used to find the speed of adjustment (SOA) for the firms. Technically, the idea of SOA is integrated into the Dynamic Trade-off theory which describes that firms mostly deviate from their target or optimal level of capital structure (Ghose, 2017; Supra et al., 2016). However, in the existence of speed of adjustment (SOA), they return back rapidly toward their optimal level. The traditional Panel Data Model (PDM) is given as follows:

$$PDM = y_{it} = \alpha_i + \gamma_t + \beta x_{it} + \varepsilon_{it} \quad (1)$$

Here, *i* indicates as individuals (*i=1, 2,3…., N*), t is considered as a time period *(t=1,2, 3,….,T)*, y_{it} clarifies the dependent variable of the study, α_i is used as a definite cross-sectional effects and γ_t is taken as time series effects. Furthermore, x_{it} is adopted to indicate explanatory variable and ϵ_{it} is an error term effects that has mean constant variance i.e. zero. Empirically, this study has adopted the Panel Data models which were earlier applied by Zandi et al. (2022); Hernawati et al. (2021); Rehan and Hadi (2019) and Chakrabarti and Chakrabarti (2019). The estimation models are articulated as follows:

1. Regression Model (POLS)

$$DR_{it} = \beta_0 + \beta_1 TANG_{it} + \beta_2 PROF_{it} + \beta_3 LIQ_{it} + \beta_4 SIZE_{it} + \beta_5 NDTS_{it} + \beta_6 GDP_{it} + \varepsilon_{it} \quad (2)$$

2. Fixed Effects Model (FE)

$$DR_{it} = \beta_0 + \beta_1 TANG_{it} + \beta_2 PROF_{it} + \beta_3 LIQ_{it} + \beta_4 SIZE_{it} + \beta_5 NDTS_{it} + \beta_6 GDP_{it} + \mu_{it} \quad (3)$$

Random Effects Model (RE)

$$DR_{it} = \beta_0 + \beta_1 TANG_{it} + \beta_2 PROF_{it} + \beta_3 LIQ_{it} + \beta_4 SIZE_{it} + \beta_5 NDTS_{it} + \beta_6 GDP_{it} + \varepsilon_{it} + \mu_{it} \quad (4)$$

3. Dynamic Panel Data Model

$$DR_{it} = \delta DR_{i,(t-1)} + \beta_1 TANG_{it} + \beta_2 PROF_{it} + \beta_3 LIQ_{it} + \beta_4 SIZE_{it} + \beta_5 NDTS_{it} + \beta_6 GDP_{it} + \varepsilon_{it} + \mu_{it} \quad (5)$$

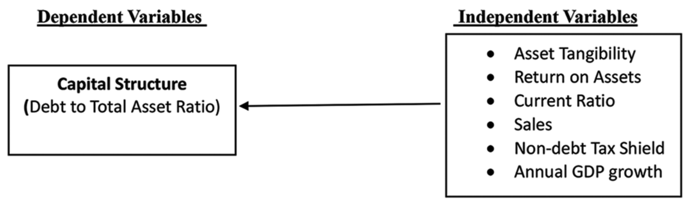
Here, DR indicates dependent variable. $\delta DR_{i,(t-1)}$ designates lagged value of dependent variable which is a function of ε_{it} whereas, TANG, PROF, LIQ, SIZE, INF, NDTS, GDP mention independent variables that are explained in Table 1. Likewise, ε_{it} represents an error term and μ_{it} random individual differences.

Remarkably, the Ordinary Least Squares (POLS) is considered as homogeneous sample (Chakrabarti and Chakrabarti, 2019). Thus, the Breusch–Pagan Lagrange Multiplier (BPLM) test is applied to check individuals' effects. Besides, the Hausman test is used to recognize the Random or Fixed Effects characteristics. Principally, BPLM test used Hausman's (1978) test *m* statistics to select the appropriate hypothesis. The null hypothesis (H_0) of this test designates the selection of Pooled OLS model (H_0: Acceptance of Pooled OLS). Though, if H_0 is rejected then the Random Effects model is accepted (H_1: Acceptance of Random Effects). Importantly, if null hypothesis of Pooled OLS for BPLM is rejected then the Hausman test is used to check the existence of Fixed Effects. Therefore, Hausman's test is executed to adopt an appropriate model of Panel Data between Random and Fixed Effects models (Breusch and Pagan, 1980). The econometric model of the Hausman's test is stated as below:

$$H = (b_1 - b_0)(Var(b_0) - Var(b_1))(b_1 - b_0) \quad (5)$$

Figure 1 above explains the Panel Data Static modeling procedure to select an appropriate estimator. In addition, this study also has performed diagnostic tests to check the models' fitness. For this purpose, the Pearson Correlation test is applied to check the statistical association among the nominated variables (Chakrabarti and Chakrabarti, 2019; Hadi et al., 2015; Hadi, 2021). The Pearson Correlation clarifies that how significant and robust relationship is present among continuous variables (Benesty et al., 2009). The

Figure 2: Theoretical framework



coefficient ‘r’ of Pearson’s Correlation explains the association degree between the nominated variables. Statistically, Pearson Coefficient ‘r’ values lie between −1 and +1. Technically, the +1 identifies a perfect positive relationship, whereas, −1 identifies the perfect negative relationship between the nominated variables. Though, if coefficient is at 0, then, this designates the absence of any association between the studied variables (Zou et al., 2003). The formula of Pearson’s correlation is given as follows:

$$r = \frac{n\left(\sum xy\right) - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}} \quad (6)$$

Here, r indicates Pearson’s correlation, ∑xy mentions sum of product of x and y, ∑x is the sum of product of x, ∑y specifies sum of product of y, ‘n’ identifies number of x and y. The hypothesis for Pearson correlation is explained as follows:

H_0: P=0 Absence of correlation between the nominated variables.

H_1: p<>0 Presence of correlation between the nominated variables.

The value of ‘P’ of Pearson Correlation is used to explain the significance level. Generally, if ‘P’ value is not $>\alpha$ (i.e. 1%, 5% and 10%), then null hypothesis is rejected. Additionally, the existence of multicollinearity is also analysed by applying Variance Inflation Factor (VIF) test. Notably, multicollinearity issue exists due to strong correlation among the independent variables. Statistically, if VIF test exceeds the value of 10 (Hernawati et al., 2021; Akinwande et al. 2015; Gujarati and Porter, 2009) then serious multicollinearity issue is reported. The VIF test equation is as given below:

$$R^2Y \rightarrow Y_{it} = \alpha_0 + \beta_2 X_{2it} + \beta_3 X_{3it} + \beta_4 X_{4it} + \beta_5 X_{5it} + e_{it} \quad (7)$$

$$j = R_Y^2, R_{X1}^2, R_{X2}^2, R_{X3}^2, R_{X4}^2, R_{X5}^2 \quad (8)$$

$$Tolrance = 1 - R_j^2 \; VIF = \frac{1}{Tolerance} \quad (9)$$

Besides, to get Generalized Method of Moments (GMM) estimator accuracy, the diagnostic tests that are Sargan test and autocorrelation test i.e. AR(m) test are performed. The Sargan test is used to check the exogeneity issue in the model. An exogeneity refers to a state where independent variables are not correlated with the dependent variable. Likewise, the Autocorrelation AR(m) test is used to check the variables dependency on their own past realizations. Notably, the autoregressive model describes that the adopted variables linearly rely on its own prior figures. Technically, GMM decreases these diagnostic problems of the model (Arellano and Bond, 1991). This study adopts difference GMM estimator that converts the dependent variable into independent variable by using first difference which does not vary over time periods.

4. FINDINGS

All of the nominated variables data namely debt ratio (DR), asset tangibility (TANG), profitability (PROF), liquidity (LIQ), sales (SIZE) and non-debt tax shield (NDTS) are coded into SAS program to perform analysis. The descriptive statistics is conducted to check the variables statistics such as mean, median, minimum, maximum and standard deviation. The descriptive statistics is explained in below Table 2.

The outcomes specify in Table 2 clearly demonstrate that the mean figure of DR is 0.542. Similarly, the findings show that the mean value of TANG is 46.872, PROF is 0.887, LIQ is 1.932, SIZE is 1.803, NDTS is 0.251 and GDP is 0.920%. Visibly, the data is not exhibiting any serious variations as all the attained values are closer to each other, likewise, standard deviations of all variables do not exceed average values.

Subsequently, this study conducted several diagnostic tests to check the constructed models’ goodness of fit. For instance, the Pearson Correlation test is performed to check the statistical associations among the selected variables.

Table 3 displays the correlation matrix analysis of all the selected seven variables which are used in the model. Notably, the correlation coefficient values range among −0.2815 and 0.6733. Visibly, the maximum correlation value is observed between DR and GDP at 0.6733. It is worthy to note that GDP is observed significant at the level of 1%. Hence GDP may be one of the determinants that may influence on energy sector firms. The obtained preliminary outcomes from Pearson’s Correlation confirm that selected determinants TANG, PROF and GDP are sound enough to impact on dependent variable DR i.e. capital structure. In addition, this study also performed the VIF test to check the multicollinearity issue in the selected predictors. The outcomes attained from VIF test are presented in Table 4.

Evidently, the attained values identify the non-appearance of multicollinearity problem as all the values are below than 5. Subsequently, this study performs Breusch Pagan LM (BPLM) test. Table 5 below displays the outcomes attained from the execution of BPLM test. Clearly, the P-value mentions the rejection of null hypothesis i.e. H_0 ($P < 0.05$). Thus, the results designate that the Random Effects model is more effective than the Pooled OLS.

Moving ahead, after the confirmation of Random Effects model, this study executed the Hausman test. This test is performed to select the most appropriate Panel Data Static model for the further analysis. The outcomes obtained from the Hausman test are mentioned in Table 6 below.

Clearly, the outcomes exposed that the P-value is larger than 0.05. Thus, the Random effect model (REM) is considered more fit than the Fixed Effects for the further estimation. The results obtained from Random Effects model are displayed below.

Tables 6 and 7 presents the findings obtained from the Two-Way Random Effects Wallace-Hussain model. Visibly, the outcomes indicate that studied variables that are asset tangibility (TANG), return on assets (PROF), sales (SIZE) and non-debt tax shield (NDTS) have significant impact on energy firms' capital structure, which are operating in the SAARC region. However, the remaining variables, which are current ratio (LIQ) and gross domestic products (GDP) are statistically not significant. Evidently, the model is also measured as a good fitted model as R-Square holds high value (0.7632).

Besides, this study performs GMM estimation to examine robust and dynamic associations among the selected variables. For that, the Sargan test is performed which is used to check the exogeneity issue in the model. The outcomes mentioned in below Table 8 clarifies that model is free from this issue, thus, null hypothesis is not rejected. Thus, the instruments that are variables used for investigation are valid and uncorrelated with the residuals.

Table 9 below displays the AR(m) test results which is used to check the autocorrelation issues in the dynamic model. The results from the diagnostic test indicate that the null hypothesis is not rejected, suggesting that the instrumental variables are uncorrelated with the residuals and valid.

Subsequently, after performing the diagnostic test, the GMM estimation is executed. Evidently, the results in Table 10 below exposed the outcomes obtained from GMM estimator.

Evidently, the findings in Table 10 exposed that asset tangibility (TANG) and return on assets (PROF) have a positive and significant association with the debt to assets ratio i.e. capital structure. Likewise, the positive and significant role of dynamic lagged variable of dependent variable (DR_1) i.e. lag variable of debt to asset ratio indicates the existence of dynamic capital structure and speed of adjustment (SOA) for the SAARC region energy firms.

Clearly, the significant coefficient value (0.2348) and P-value (0.0071**) concluded that SOA for the SAARAC energy firm is 76% (1-0.2348 = 0.7652). This elucidates that in case of any deviation from the targeted capital structure the energy sectors firms divert back to their target by 76%. In other words, the energy firms of SAARC region return back to their targeted capital structure level in not more than 1 year and few months (100 ÷ 76 = 1.315). This strongly implies the existence and application of Dynamic Trade-Off theory in the energy sectors of SAARC investigated countries.

5. DISCUSSION

Within the scope of Panel Data Analysis (PDA), this study has revealed some interesting insights for the capital structure determinants of SAARC region energy sector firms. Surprisingly, the results obtained from both approaches of Panel Data Modelling (Static and Dynamic Models) have exposed that asset tangibility and profitability are the key determinants that affects on the capital structure choices of South Asian energy firms. This confirms the reliability and validity of these two determinants. However, by deploying Panel Data Static model, which is subject to Random Effects model, the results also exhibited that sales and taxation are also the main capital structure determinants for these firms. The significant role of tangibility clarifies that as fixed assets of the firms increases the leverage related activities of energy firms also increases Undoubtedly, in the existence of sound asset tangibility, lenders such as financial institutions consider their investments secure as it provides safety and security against their investments (Harc, 2015).

For remaining significant determinants, the Dynamic Model reports that profitability i.e. PROF and Static Model reports that sales i.e. SIZE are significant determinants. Clearly, the results postulates that energy firms of the region are holding profitable businesses and their sales are able to produce adequate income. This supposition is in line with the statement of Oxford Analytica (2019) which pointed out the steps of South Asian governments about raising the energy sector capital by increasing their tariffs. In simple, increasing tariff

Table 2: Descriptive statistics of selected variables

Variable	Obs.	Mean	Median	Max	Min	SD
DR	476	0.542	0.531	1.704	0.049	0.165
TANG	476	0.467	0.456	2.233	0.012	0.310
PROF	476	0.887	0.092	1.832	−2.010	0.331
LIQ	476	1.932	1.424	19.56	0.087	1.065
SIZE	476	1.803	1.021	33.21	−0.896	0.101
NDTS	476	0.251	0.054	0.031	0.011	0.133
GDP	476	0.920	0.012	0.031	0.082	0.211

Table 3: Pearson correlations test

Variables	DR	TANG	PROF	LIQ	SIZE	NDTS	GDP
DR (P-value)	1	−0.2815	−0.2540	0.3286	0.6213	0.3123	0.6733
		(0.03501)	(0.0348)	(0.0177)	(0.2311)	(0.0101)	(0.0001)
TANG (P-value)	−0.2815**	1	0.5233	0.6143	−0.2130	0.6032	−0.1515
	(0.001)		(0.1201)	(0.1200)	(0.1231)	(0.3201)	(0.1241)
PROF (P-value)	−0.2540**	0.5233	1	0.6012	0.4296	0.31120	0.3921
	(0.0348)	(0.1201)		(0.1201)	(0.2189)	(0.2167)	(0.0101)
LIQ (P-value)	0.3286	0.6143	0.6012	1	0.2122	0.3233	0.22120
	(0.0177)	(0.1200)	(0.1201)		(0.0137)	(0.0826)	(0.0133)
SIZE (P-value)	0.6213	−0.2130	0.4296	0.2122	1	0.2213	0.3143
	(0.2311)	(0.1231)	(0.2189)	(0.0137)		(0.0134)	(0.0154)
NDTS (P-value)	0.3123	0.6032	0.31120	0.3233	0.2213	1	0.2123
	(0.0101)	(0.3201)	(0.2167)	(0.0826)	(0.0134)		(0.0178)
GDP (P-value)	0.6733***	−0.1515	0.3921	0.22120	0.3143	0.2123	1
	(0.0001)	(0.1241)	(0.0101)	(0.0133)	(0.0154)	(0.0178)	

***Significant at 1% and ** significant at 5% level

Table 4: Variance inflation factor (VIF) test

Variables	VIF	1/VIF
DR	3.107	0.321
TANG	2.321	0.430
PROF	2.091	0.478
LIQ	3.913	0.255
SIZE	2.802	0.356
NDTS	5.402	0.185
GDP	4.302	0.232

Table 5: Breusch pagan LM test (two way)

H_0: Pooled OLS model is appropriate H_1: Random effects model is appropriate	
m-value	P >m
9388	0.007

Table 6: Hausman test

H_0: Random effects model is appropriate H_1: Fixed effects model is appropriate	
Chi-square test value	8.211
P-value	0.5962

Table 7: Static panel data random effect (RE) results

Two-way random effects				
Wallace-Hussain				
Variables	Estimate	SE	t-value	Pr >|t|
Intercept	0.1462	0.1770	0.8258	0.4088
TANG	0.1730	0.0833	2.0761	0.0379**
PROF	0.0615	0.0121	5.0793	0.0001**
LIQ	−0.0111	0.0060	−1.8500	0.0643
SIZE	0.0131	0.0030	4.3700	0.0001**
NDTS	2.5320	1.2160	2.0822	0.0373**
GDP	−0.1250	0.3170	−0.3943	0.6936
R-Square				0.7632

**significant at 5% level

Table 8: Sargan test for exogeneity

H_0: The adopted Instruments are valid H_1: The adopted Instruments are not valid	
Statistics	Prob >Chi-square
33.06	0.1822

Table 9: Autocorrelation test AR (m)

H_0: Error term is not autocorrelated with used instruments H_1: Error term is autocorrelated with used instruments		
Lag	Statistics	Prob >Chi-square
1	−3.28	0.9888

will definitely increase the amount received against sales. Therefore, profitability and sales of these sectors have established significant relationship with capital structure. Clearly, the results are also in line with the findings of Cole et al. (2015) who explained significant relationship of tangibility and profitability with capital structure for the United States Healthcare, Industrial and Energy sector firms. Besides, the results are also consistent with the conclusion of Ghani and Bukhari (2010) who described significant relationship of capital structure with tangibility, sales and profitability in Pakistani context.

Table 10: GMM estimation for dynamic panel data analysis

GMM: First Differences Transformation					
Estimation Method: Two-Step GMM					
Parameter Estimates of SAARC Energy Sector firms					
Variables	DF	Estimate	Standard Error	t-value	Pr >|t|
Intercept	1	−0.0165	0.0232	−0.7112	0.477
DR_1	1	0.2348	0.0872	2.6927	0.0071**
TANG	1	0.2634	0.0789	3.3384	0.0008**
PROF	1	0.2385	0.0722	3.3033	0.0010**
LIQ	1	0.2619	0.4089	0.6405	0.5218
SIZE	1	0.2533	0.2136	1.1859	0.2357
NDTS	1	0.1503	0.1079	1.3930	0.1636
GDP	1	−0.1513	0.048	−3.1521	0.0016**

**significant at 5% level

However, the findings are in contrast with the results of Tailab (2014) who explored capital structure determinants of American energy sector firms and reported insignificant relationship of capital structure with studied determinants that are asset tangibility, sales and profitability. Importantly, the results obtained from Random Effects analysis specified significant relationship of non-debt tax shield with energy firms' capital structure. The results are inconsistent with the findings of Chakrabarti and Chakrabarti (2019) who reported insignificant relationship of non-debt tax shield with listed energy firms of India. Overall, the confirmation of Hypothesis 1, Hypothesis 3, Hypothesis 5 on studied determinants is extremely supported. Whereas, Hypothesis 2, Hypothesis 4 and Hypothesis 6 delivered dissimilar outcomes from those which are assumed in above discussion.

While on the other side, the Dynamic model estimation reported significant but negative relationship of gross domestic products (GDP) with capital structure. This designates a negative impact of energy sector firms' leverage on SAARC countries' economic growth. The results are matched with the findings of Jaworski and Czerwonka (2021) and Škuláňová (2018) who reported negative influence of energy firms "corporate debt on countries" GDP. Likewise, the significant role of dependent lagged variable specifies the existence of dynamic capital structure and speed of adjustment (SOA) for South Asian energy sectors firms. Hence, the endorsement of Hypothesis 7 that indicates the existence of dynamic capital structure is supported. Theoretically, the aspects of tangibility and profitability are well explained by Modigliani Miller and Dynamic Trade-Off theories. Overall, the significant role of lagged dependent variable, tangibility and existence of SOA stipulate that Dynamic Trade-off theory is more prominent in explaining capital structure formulation practices of operating energy firms of the SAARC region.

6. CONCLUSION

The identification of capital structure determinants for energy sector firms which are operating in the SAARC region is still an unresolved issue. Considering this gap, this study is an attempt to explore the capital structure determinants of core South Asian economies that are Pakistan, India, Bangladesh and Sri Lanka.

The results confirm positive relationship of capital structure with profitability, tangibility, size and non-debt tax shield. Besides, a negative but significant relationship of gross domestic products is observed with capital structure. Evidently, the significant relationship of the studied determinants with capital structure confirmed that these determinants play key role in formulation of South Asian energy firms' capital structure. Likewise, the significant lagged dependent variable explained the existence of speed of adjustment for these firms. Evidently, the significant role of tangibility, profitability and lagged dependent variable confirms that Dynamic Trade-off theory is more prominent among others. The findings provide new insight to policy makers to construct parallel strategies for the formulation of capital structure of firms, operating in the SAARC region. Certainly, it will overcome the energy scarcity issues and boost regional level integration.

The existing study creates a distinctive place in the finance literature. Primarily, this study explored the region-specific capital structure determinants for the South Asian energy firms. Formerly, only rare inquiries have been accomplished which explored capital structure determinants of energy firms that are operated in the SAARC region. Remarkably, the results deliver guidelines for the regional governments and policy makers to construct parallel strategies for the energy firms' capital structure formulating practices. Visibly, the South Asian governments, particularly, India, Pakistan and Bangladesh are trying to increase energy firms' capital by raising their tariffs (Oxford Analytica, 2019). Thus, the identified capital structure determinants help them to construct capital structure in a way that moves them toward their core target of profitability. Technically, the profitable energy firms produce a low cost energy which is beneficial for the whole region. Moreover, parallel strategy for the energy firms' capital structure develops an integrated energy zone in the region to overcome energy scarcity issues. Indeed, an integrated energy market in the South Asia is a key to overcome energy scarcity issues (Chen, 2022).

The key restriction for capital structure related investigations is the accessibility of data that is the main constraint primarily in the emerging economics (Pandey, 2002). Similarly, due to data unavailability, this study eliminates four SAARC countries from the sample. Another limitation is that this study examines only six determinants. Notably, only those determinants whose data is available for the selected sample; 14 years' time period are selected. Thus, the future researchers could involve other SAARC countries which are eliminated from the investigation. Similarly, some other determinants such as inflation and debt to equity ratio should be added in the framework.

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