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1 Editorial advisory board

2 Incorporating risk into technical efficiency for Vietnam’s and ASEAN banks
   Tra Thanh Ngo, Minh Quang Le and Thanh Phu Ngo

17 The impact of GST implementation on the Malaysian stock market index volatility:
   an empirical approach
   Razali Haron and Salami Mansurat Ayojimi

34 Empirical study on the effective factors of social responsibility disclosure of Iranian companies
   Mahdi Salehi, Hosein Taghibi and Malihe Nozamedad

56 Analysis of the determinants of foreign direct investment in Ghana
   Michael Asiamah, Daniel Ofori and Jacob Afful

76 Asymmetric targeting of corporate cash holdings and financial constraints in Pakistani firms
   Ghulam Ayhnsa Siddiqua, Ajid ur Rehman and Shazad Hussain

98 The contingent roles of perceived budget fairness, budget goal commitment and vertical
   information sharing in driving work performance
   Nguyen Phong Nguyen, Felicitas Evangelista and Tai Anh Kieu

117 Explaining India’s current account deficit: a time series perspective
   Harendra Kumar Behera and Inder Sekhar Yadav

139 Using the ARDL-ECM approach to investigate the nexus between support price and wheat
   production: an empirical evidence from Pakistan
   Abbas Ali Chandio, Yuansheng Jiang and Abdul Rehman

153 The efficiency of Jordan insurance companies and its determinants using DEA, slacks, and logit models
   Mutasem Mahmoud Jaloudi
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Journal of Asian Business and Economic Studies

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Incorporating risk into technical efficiency for Vietnam’s and ASEAN banks

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Abstract
Purpose – The purpose of this paper is to incorporate risk in technical efficiency of ASEAN banks in a panel data framework for the period 2000 to 2015.
Design/methodology/approach – The directional distance function and semi-parametric framework are employed to estimate efficiency scores for two scenarios, one with only good outputs and the other with a combination of good and bad outputs.
Findings – The findings show there is no evidence of technological progress for banks in ASEAN and concerns about the outperformance of Vietnam’s banks. In addition, performance of Vietnam’s banks tends to be distorted by low level of loan loss reserves.
Practical implications – To reflect the true performance and shorten the period of removing bad assets, the State Bank of Vietnam can request banks in Vietnam to book more loan loss reserves.
Originality/value – By examining such a new approach, this study makes an early attempt to incorporate credit risk into the banking efficiency in ASEAN region.

Keywords Risk, Bank efficiency, Directional distance function, Semi-parametric estimation of stochastic frontier models

Paper type Research paper

1. Introduction
We try to incorporate risk into measuring technical efficiency of banking institutions in the Association of Southeast Asian Nations (ASEAN) alliance. Our motivation commences from a gap that, in the literature searching of efficiency analysis in ASEAN banking sector, risk is ignored in examining efficiency in articles of Wong and Deng (1999), Karim (2001), Gardener et al. (2011), Williams and Nguyen (2005), Sarifuddin et al. (2015) and Chan et al. (2015). We have evidences that efficiency is spurious and biased if risk is disregarded. Berger and Humphrey (1997) argue that banking efficiency would be underestimated if the risk was ignored. Meanwhile, some included risk as an environmental variable or regarded it as exogenous in the analysis of efficiency effect, such as Khan (2014) and Yueh-Cheng Wu et al. (2016). According to Laeven (1999), whereas loans are usually chosen as an output variable in the intermediation approach to modeling bank production, non-performing loans are chosen as a proxy for risk, and then they regress efficiency scores followed by...
environmental variables, including risk, there is likely risk to be endogenous that is influenced by bad management or controlling of the loan portfolio. Sarmientoa and Galán (2015) also found out that cost and profit efficiency are over- and underestimated when risk measures are not accurately modeled.

In the circumstance that financial liberalization is an inevitable trend of global and regional integration, it is very meaningful to properly incorporate risk in banking efficiency analysis for policy implications. At the end of 2015, the creation of ASEAN Economic Community (AEC) has spread out both chances and challenges for nation members on the road to achieve a highly integrated and cohesive economy in ASEAN. To support for economic development, the banking systems in many ASEAN countries are still a primary source for raising capital. Banking assets made up more than 82 percent of total financial assets in ASEAN in 2009 and for the BCLMV[2] the figure was even higher, at 98 percent, according to a study of ADB (2013). Making a push for ASEAN in financial integration, ASEAN members implemented the ASEAN Banking Integration Framework in December 2014, allowing banks satisfying certain criteria (Qualified ASEAN Banks – QABs) to open their activities in other member nations and be equally treated as domestic banks.

Once the AEC is in implementation, domestic banks could have more chances to attract capital flows from foreign investors to raise their legal capitals for the QABs’ requirements. However, the deeper integration in banking sector, the greater competition and improved quality of services, the higher pressure for commercial banks in ASEAN region to adapt and operate efficiently so that they can shorten competitiveness gaps in the common playground. Since one of QABs’ basic standards is that banks must meet appropriate risk management and internal control fit for the size and complexity of its operation, the matter of risk and efficiency is becoming more important than ever before. Greater banking openness, on the other hand, could lead to greater vulnerability as risks to financial stability in one country can spill over more quickly to another. The stories about the regional financial crisis in 1997 and the global economic downturn in 2008 remind us that information on incorporating risk in banking efficiency when compared across ASEAN nations is not only important for financial intermediaries but also for supervising sectors to build safe and sound policies for ASEAN banking system.

This paper, therefore, does not only aim to measure the efficiency of the commercial banks in ASEAN, but also incorporating risk into efficiency level. This purpose can be solved by applying the directional distance function (DDF) originally proposed by Färe et al. (2005) and customized by Huang et al. (2015) under two frameworks of parametric (Stochastic Frontier Analysis (SFA)) and semi-parametric estimation of stochastic frontier models (SEMSFA).

Incorporating risk into technical efficiency

The remainder of this paper is organized as follows. In Section 2, the literature on incorporating risk in banking efficiency analysis in ASEAN region is reviewed. In Section 3, we describe the methodology used in the paper and Section 4 discusses the data and input/output selection. Section 5 presents the empirical results and, finally, the conclusion and future research are given in Section 6.

2. Literature on incorporating risk in banking efficiency in ASEAN

There are two main streams in literature of efficiency estimation: nonparametric (or deterministic) and parametric (or stochastic) method. In which of the nonparametric methods, data envelopment analysis (DEA) is the most widely used while stochastic parametric methods are famous for SFA. Narrowing down to research articles concerning risk in efficiency estimation, we classify those relating to incorporating risk in the banking efficiency and those dealing this issue in the ASEAN banks.
2.1 Incorporating risk into bank efficiency

There are two strands of focusing on the incorporating risk in efficiency. One regards risk as exogenous to analyze efficiency effects and another way is to incorporate endogenous risk into the production analysis (Chang and Chiu, 2006). Berger and DeYoung (1997) consider risk as an exogenous in a Granger-causality model to examine the relationship between risk and cost efficiency. By a totally different way, Chang (1999) follows the nonparametric model proposed by Färe et al. (1985), treats risks as endogenous and undesirable outputs, namely, NPLs, allowance for loan losses and risky assets. To test the statistically significant differences between efficiency scores when employing three risk indicators alternatively, he uses ANOVA, Kruskal–Wallis and Wilcoxon rank-sum methods. Zhu et al. (2016) call on the advantages of both parametric and non-parametric DDF to estimate technical efficiency of 44 Chinese commercial banks during 2004–2011 and use NPLs as a proxy for risk as one undesirable output, to freely adjust direction vectors to incorporate bank’s risk preferences. Collecting unbalanced panel data over the period 1995–2008 from 17 Central and Eastern European countries, Huang et al. (2015) develop a new meta-frontier directional technology distance function under a SFA framework and regard NPLs as an undesirable output in cost efficiency estimation.

Whereas most studies in existing literature use credit risk indicators to explain bank efficiency scores, Chang and Chiu (2006) consider both credit and market risks associated with a bank’s efficiency. They employ a DEA model and Tobit regression to investigate the bank efficiency index incorporated both two types of risk. Information disclosed in annual financial reports of Taiwan’s banking industry from 1996 to 2000 is used to apply value at risk as the market risk measure and NPLs is regarded as the proxy for bank credit risk. The bank efficiency index is calculated in four different scenarios: without risk, with credit risk or market risk only, with both risk types and then the Wilcoxon matched-pairs signed-ranks test is used to test statistically significant differences in efficiency index of each scenario. Sarmientoa and Galán (2015) propose a SFA model with random inefficiency parameters to capture the influence of risk-taking on cost and profit efficiency of different types of Colombian banks for the period 2002–2012. The inference of the model is carried out via Bayesian method to formally incorporate parameter uncertainty and to derive bank-specific distributions of efficiency and risk random coefficients. As risk exposure measures with different effects on bank-specific inefficiency, they include measures of credit risk, liquidity, capital and market risk in accordance Colombian financial regulation and the Basel III standards.

2.2 Incorporating risk into bank efficiency in ASEAN banking sector

In this section, we try to sort out the studies related to incorporating risk in efficiency analysis of banking institutions in the ASEAN alliance. To have a better glance for this issue, we also direct our attention to East Asian studies of banking efficiency where necessary.

The matter of incorporating risk in banking efficiency estimation in ASEAN banks is related in some ways. Followed by the SFA approach, Karim et al. (2010) examined the relationship between efficiency and NPLs of banks in Malaysia and Singapore between 1995 and 2000. They use normal-γ efficiency distribution model proposed by Greene (1990) to estimate cost efficiency scores and then regressed them against NPLs and other control variables. The relationship between NPLs and efficiency is believed as two-way direction, hence a Tobit simultaneous equation regression model is used for the simultaneity effect. Manlagnit (2011) examines the cost efficiency of Philippine commercial banks in the period from 1990 to 2006, using stochastic cost frontier...
analysis and specifically incorporating risk (ratio of loan loss provisions to total loans) and asset quality measures in the estimation. Consistent with earlier findings, the results show substantial inefficiencies among domestic banks and that risk and asset quality affect the efficiency of banks.

The DEA approach is employed by many researchers for its flexibility in not requiring the pre-specification of production function, its linearity and its suitability for relatively small data size for each banking system (Gardener et al. (2011)). Khan (2014) proposes the intermediation DEA approach with input-oriented model to incorporate the influences of the external variables on Southeast Asian banking efficiency. With using data from five banks in the region from 1999 to 2005 in a four-stage DEA procedure, they allow slack or surpluses due to the environment variables and use it to calculate adjusted values for the primary inputs.

Laeven (1999) also applies the DEA technique to estimate the inefficiencies of banks in Indonesia, Korea, Malaysia, the Philippines and Thailand for the pre-crisis period 1992–1996 with some adjustments. Choosing the intermediate approach but differently from other researches, he bases on the output orientation to calculate technical efficiency, instead of aiming to input minimization. He also points out that, due to weak enforcement of banking regulation, bad loan data may not be inadequately reported as NPLs so applying this data in efficiency models might lead to incorrect conclusions. In the case of East Asia, until 1997, loans were not classified as NPLs until no payments were made for over one year. In such countries, a bank efficiency model might estimate a bank to be in better shape than they actually are. Therefore, he chooses excessive loan growth as a good proxy for bank risk-taking, instead of NPLs. However, in his research, Laeven (1999) also shows some weaknesses of DEA such as the difficulty to use DEA to compare efficiency among firms due to its estimation only for upper bound; not considering statistical noise which means that all the error term in the estimation is attributed to inefficiency and measuring DEA efficiency in small samples is sensitive to the difference between the number of firms and the sum of inputs and outputs used. Hence, Yueh-Cheng Wu et al. (2016), instead of choosing a traditional DEA, apply newly developed dynamic network DEA formulated by Tone and Tsutsui (2014) to deal with inefficiencies of interacting divisions that are embedded inside the banks’ production process and use loan loss provision as a proxy for risk.

2.3 Applying the DDF under parametric and semi-parametric framework to incorporate risk into measuring ASEAN banking efficiency

The literature of incorporating risk in banking efficiency almost propose either DEA or SFA or combine both of them for comparison purpose. As pointed out by Andor and Hesse (2014), DEA is a linear-based technique that constructs a nonparametric envelopment frontier over the data points. As a DEA’s advantage, it does not require the pre-specification of production function but it estimates efficiency without considering statistical noise and is thus deterministic. Conversely, SFA requires an assumption about the functional form of the production function and allows measuring efficiency while simultaneously considering the existence of statistical residuals. Because of their methodological differences and equivalent advantages and disadvantages, they are the two of the most popular approaches for measuring efficiency.

According to a comprehensive survey of frontier efficiency analysis in financial institutions, mostly banking, by Berger and Humphrey (1997), DEA is the most frequently used approach for efficiency evaluation. However, according to Yueh-Cheng Wu et al. (2016), the traditional DEA models are not sufficient to measure the banks’ complex production process because these models assume the system as a single black box that converts inputs to outputs. As a result, the banks’ complex production process
requires more sophisticated techniques to account for internal structures within the black box. In regards to traditional SFA, since the traditional stochastic frontier model[3] also cannot solve the multi-output production, which is very common in the banking industry, some researchers apply the DDF to freely adjust direction vectors such as Huang et al. (2015) and Zhu et al. (2016). Huang et al. (2015) apply DDF under SFA framework whereas Zhu et al. (2016) compare efficiency indexes under both parametric and non-parametric framework. The DDF is useful in modeling undesirable outputs in a different manner of desirable outputs while other inefficiency measurements only permit either inputs savings or output expansion, but not both simultaneously. Allowing dealing with a multiple-input, multiple-output production technology, DDF can support for simultaneously quantifying input saving and output expansion.

Recently introduced by Kuosmanen and Kortelainen (2012) and combined the strengths of the SFA and DEA methods, the Stochastic Non-smooth Envelopment of Data method is stochastic and semi-parametric, requiring no \textit{a priori} explicit assumption about the functional form of the production function. This method is employed in some researches related to efficiency analysis in farming (Vidoli and Ferrara, 2015), electricity distribution (Kuosmanen, 2012) and sales roles of bank branches (Eskelinen and Kuosmanen, 2013) but it is not seen in incorporating risk into banking efficiency. In this study, we would employ the DDF under both parametric (SFA) and semi-parametric (SEMSFA) framework and then compare efficiency scores with risk adjusted in two scenarios. To the best of the authors’ knowledge, this study makes an early attempt by examining this new approach to the banking efficiency in ASEAN region. The next section provides more details about our methodology for measuring ASEAN’s banking efficiency while concerning to risk.

3. Methodology
To incorporate undesirable outputs into inefficiency, we rely on the DDF measures that treat both sets of outputs differently. This requires a redefinition of the production technology where outputs $y \in \mathbb{R}^M$ is partitioned into desirable and undesirable outputs $y, w = (y, b), y \in \mathbb{R}^D_+, b \in \mathbb{R}^U_+$. Then, the production technology with undesirable outputs is given by:

$$T = \{(x, y, b): x \text{ can be used by banks to produce } (y, b)\}. \quad (1)$$

The DDF measure can be extended in the way that maximizes the radial increase in good outputs as well as the radial decrease in both inputs and bad outputs along the directional vector $g = (g_x, g_y, g_b) \in \mathbb{R}^N_+ \times \mathbb{R}^D_+ \times \mathbb{R}^U_+: g \neq 0$:

$$\overline{D}_T(x, y, b; g_x, g_y, g_b) = \max_\xi \{\xi \in \mathbb{R}_+: x - \xi g_x, y + \xi g_y, b - \xi g_b, \in T\}. \quad (2)$$

To solve this optimization, there are two options. First, one can follow non-parametric approach, which finds $\beta$ that maximizes the Equation (2). Second, one can choose parametric approach by following functional form with translation property:

$$\overline{D}_T(x - \xi g_x, y + \xi g_y, b - \xi g_b; g_x, g_y, g_b) = \overline{D}_T(x, y, b; g_x, g_y, g_b) - \xi. \quad (3)$$

This property means that if we translate the vector $(x, y, b)$ into $(x - \xi g_x, y + \xi g_y, b - \xi g_b)$, then the value of the distance function is reduced by the scalar $\xi$. The translation property is used to transform the DDF into an estimable regression equation.
Following Färe et al. (2005) and Huang et al. (2015), we arbitrarily choose \( \xi = y_1 \) to translate the quadratic DDF into:

\[
-y_1 = \overrightarrow{D_T}(x - \beta g_s, y + \beta g_y, b - \beta g_b; 1, 1, 1, t, \theta) + u - v
\]

\[
= \alpha_0 + \sum_{n=1}^{N} \alpha_n(x_n-y_1) + \sum_{m=2}^{M} \beta_m(y_m+y_1) + \sum_{j=1}^{J} \lambda_j(b_j-y_1)
\]

\[
+ \frac{1}{2} \sum_{n=1}^{N} \sum_{n'=1}^{N} \alpha_{n'n'}(x_n-y_1)(x_{n'}-y_1) + \frac{1}{2} \sum_{m=2}^{M} \sum_{m'=2}^{M} \alpha_{m'm'}(y_m+y_1)(y_{m'}+y_1)
\]

\[
+ \frac{1}{2} \sum_{j=1}^{J} \sum_{j=1}^{J} \lambda_{jj}(b_j-y_1)(b_j-y_1) + N \sum_{n=1}^{N} \sum_{m=2}^{M} \alpha_{nm}(y_m+y_1)(x_n-y_1)
\]

\[
+ \sum_{n=2}^{N} a_{nys} (b_j-y_1)(x_n-y_1) + \sum_{m=2}^{M} \sum_{j=1}^{J} \alpha_{jm}(y_m+y_1+y_1) + \delta_1 t + \frac{1}{2} \delta_2 y_1^2
\]

\[
+ \sum_{n=2}^{N} \psi_{nys} (x_n-y_1) + \sum_{m=2}^{M} \mu_{nys}(y_m+y_1) + \sum_{j=1}^{J} \delta_j (b_j-y_1) + \epsilon,
\]

(4)

where \( \theta = (\alpha, \beta, \lambda, \gamma, a, c, \delta, \psi, \mu) \) is a vector of parameters to be estimated and \( \epsilon = u - v \) is the composed error term. Hence, \( \overrightarrow{D_T}(\cdot) \) is the translated DDF that will be estimated later in our empirical study. In addition, \( u = D_T(x, y; b, 1, 1, t, \theta) \) is treated as a non-negative random variable, reflecting technical inefficiency of the firm under consideration, and \( v \) is a two-sided, normally distributed error with a mean of zero and a constant variance \( \sigma_v^2 \), which is traditionally assumed to be independent of \( u \).

Similar to Koutsomanoli-Filippaki et al., we specify the inefficiency term \( u \) as \( u = \alpha'z + w \geq 0 \), where \( z \) is vector of bank characteristics (equity/total asset ratio and liquid assets/total assets) and macro environment variables (GDP growth, Herfindall-Hirschman index (HHI) index, a dummy variable of unlisted, listed and delisted banks), \( \alpha \) denotes the corresponding unknown parameters and \( w \) is assumed to be \( w \sim N(0, \sigma_w^2) \).

We employ the maximum likelihood to estimate parameters in the Equation (4). Relying on the estimated parameters, we compute the conditional expectation that serves as a point estimator for technical inefficiency as:

\[
E(u|x) = \alpha'z + \mu_x + \sigma_x \frac{\phi\left(\frac{-\alpha'z - \mu_x}{\sigma_x}\right)}{1 - \phi\left(\frac{-\alpha'z - \mu_x}{\sigma_x}\right)},
\]

(5)

where \( \mu_x = -\sigma_x^2/\sigma_v^2 \), \( \sigma_a^2 = \sigma_v^2 \sigma_w^2/\sigma_u^2 \), \( \sigma_v^2 = \sigma_x^2 + \sigma_w^2 \) and \( \epsilon = v - w \). The conditional expectation in the Equation (4) is non-negative. The higher the value of \( E(u|x) \) is, the higher technically inefficient the bank is.

In applications, forcing to belong to a parametric family of functions like Translog, Cobb-Douglas may lead to a serious modeling bias and hence misleading conclusion about the link between \( x_1 \) and other variables in Equation (4). To overcome these drawbacks, we use a GAM framework for the estimation of stochastic production frontier models. A GAM fits a response variable \( x_1 \) using a sum of smooth functions of the explanatory variables.
In a regression context with Normal response, the model is:

$$\mu = E(x_1 | X = x) = \alpha + \sum_{j=1}^{p} f_j(X_j), \quad (6)$$

where the $f_j(\cdot)$ denotes standardized smooth functions so that $E[f_j(X_j)] = 0$. GAM can provide useful approximations to the regression surface, but relaxing the linear (polynomial) structure of the additive effects.

In a panel regression setting, Equation (4) becomes:

$$x_{1it} = f(x_{it}) + v_{it} + u_{it}, \quad i = 1, \ldots, n, \quad (7)$$

where we employ GAM to model the unknown function $f(\cdot)$ in order to relax the linear assumption between inputs and outputs. We estimate the conditional expectation of the mean frontier $E(x_1 | X = x)$ and two error term parameters ($\sigma_v, \sigma_u$). To guarantee the smoothness of the fitted production frontier, we use thin plate regression splines to represent the $f_j(\cdot)$ smooth function with smoothing parameters selected by generalized cross validation criterion: $n \times (D/(n-\text{DoF})^2)$ where $D$ is the deviance; $n$ the number of data; and DoF, the effective degrees of freedom of the model.

Once obtaining the mean frontier $E(x_1 | X = x)$, the estimation of the production function $f(\cdot)$ will be achieved by shifting the estimation of the conditional expectation in an amount equal to the average estimate of the expected value of the term of inefficiency.

We will consider the estimation of model (7) with unknown $f(\cdot)$ modeled using a penalized regression splines with penalty by introducing effects of interactions among covariates in following way:

In step 1, we use the semiparametric or nonparametric regression techniques to relax parametric restrictions of the functional form representing technology:

$$f(\cdot) = \alpha + \sum_{j=1}^{p} f_j(x_j) + \sum_{j=1}^{p} \sum_{k < p} f_{jk}(x_k, x_j). \quad (8)$$

In step 2, we estimate variance parameters by pseudolikelihood estimators:

$$\min_{\alpha, \beta, \delta, i} \left\{ \left( \sum_{i=1}^{n} \left( y_i - \hat{f}_i \right)^2 \right) \right\} = \hat{x}_i + \hat{\beta}_i x_i, \forall i = 1, \ldots, n$$

$$\beta_i \geq 0, \forall i = 1, \ldots, n \quad (9)$$

where $\delta$ represents the average effect of contextual variables $z_i$ on performances and $z_i^2 \delta - u_i$ can be seen as the overall efficiency of bank $i$, where the term $z_i^2 \delta$ represents technical inefficiency that is explained by the contextual variables; and the component $u_i$, the proportion of inefficiency that remains unexplained.

4. Data statistics

The data used in this study are taken from FitchConnect, which is a rich source for balance sheet and profit and loss account data for individual banks across the world. Our main target is unlisted and listed banks from ASEAN countries. Relying on the FitchConnect database, we compile unbalanced panel data from 2000 to 2015 from eight ASEAN countries, including Brunei, Cambodia, Indonesia, Laos, Malaysia, the Philippines, Thailand and Vietnam. We exclude bank-year observations with not available value for our input and output variables, forming a sample of 331 unique banks and 2,805 bank-year observations.
The whole sample includes 1,523 unlisted bank-year observations, 1,076 listed bank-year observations and 206 delisted bank-year observations.

We identify inputs and outputs in accordance with the intermediation approach. For the inputs of banks, we select labor expense ($x_1$), fixed assets as physical capital ($x_2$) and borrowed funds ($x_3$) which is total deposits and short-term borrowings. For the desirable outputs, we employ total loans ($y_1$), investment ($y_2$) and noninterest income ($y_3$). In addition to these good outputs, we consider provision for loan loss ($b$) as a proxy for undesirable output. We also include micro and macro environmental factors to reflect the different atmospheres to explain technical inefficiency. The micro factors include ratio of equity to total assets ($z_1$) and liquidity position ($z_2$) which is the ratio of liquid assets to total assets. The macro environment factors are GDP growth ($z_3$) and the HHI competition index ($z_4$). We use GDP growth to represent the overall economic condition, influencing the bank activities and this efficiency. HHI is used to measure the market concentration or competition pressure where banks operate.

Table I shows the sample statistics for inputs, outputs and environmental factors. The average amounts of good outputs, including loans, investments, noninterest income are 5,208, 1,721 and $102$m, respectively. The mean of bad output (loan loss reserves) is equal to $189$m. Three inputs have means at 81, 86, and $1,740$m, respectively. The micro environmental factors reveal banks in ASEAN with equity and liquid ratio, showed by 13.39 and 25.8 percent, respectively. Finally, the macro environment factors suggest a highly concentrated market with HHI index at 1,068 and relatively high GDP growth rate at 5.25 percent.

5. Estimation results
5.1 Primary results: no evidence of technological progress?
We estimate ASEAN bank efficiency by DDF and SEMSFA. We use the results of DDF to compare with that of SEMSFA because the later method includes two stages, in which the first stage measure parameters relying on the semiparametric regression, which is almost "similar" to the quadratic regression in DDF. Hence, technical efficiencies measured by the two methods are expected to be also akin.

Efficiency estimations from both DDF and SEMSFA are presented in Figures 1 and 2 correspondingly. For the DDF approach, we estimate efficiency from the coefficients of Equation (4). The Equation (4) estimates a translog production frontier with bank-year

<table>
<thead>
<tr>
<th>Variables ($\text{$ million}$)</th>
<th>Symbol</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outputs</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loans</td>
<td>$y_1$</td>
<td>5,208.06</td>
<td>12,823.80</td>
</tr>
<tr>
<td>Investment</td>
<td>$y_2$</td>
<td>1,721.42</td>
<td>5,145.48</td>
</tr>
<tr>
<td>Noninterest income</td>
<td>$y_3$</td>
<td>102.93</td>
<td>239.96</td>
</tr>
<tr>
<td>Undesirable (loan loss reserves)</td>
<td>$b$</td>
<td>189.46</td>
<td>397.23</td>
</tr>
<tr>
<td><strong>Inputs</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labor</td>
<td>$x_1$</td>
<td>81.28</td>
<td>174.00</td>
</tr>
<tr>
<td>Physical capital</td>
<td>$x_2$</td>
<td>80.26</td>
<td>171.83</td>
</tr>
<tr>
<td>Borrowed funds</td>
<td>$x_3$</td>
<td>1,740.39</td>
<td>14,262.77</td>
</tr>
<tr>
<td><strong>Environment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equity/Total assets (%)</td>
<td>$z_1$</td>
<td>13.39</td>
<td>11.35</td>
</tr>
<tr>
<td>Liquidity (%)</td>
<td>$z_2$</td>
<td>25.8</td>
<td>16</td>
</tr>
<tr>
<td>GDP growth (%)</td>
<td>$z_3$</td>
<td>5.25</td>
<td>2.04</td>
</tr>
<tr>
<td>HHI</td>
<td>$z_4$</td>
<td>1,068.54</td>
<td>2,744.99</td>
</tr>
</tbody>
</table>

**Source:** Authors’ computation from FitchConnect

Table I. Descriptive statistics for the sample

Incorporating risk into technical efficiency
observation efficiencies that account for non-constant rates of technological change as well as biased technological change. To test for the suitability of the translog production function, we employ likelihood ratio test. The value of \( \chi^2 \) test statistic on one-sided error is 1,374.2 for good output model and 741.6 for bad output model. The \( \chi^2 \) test statistics clearly reject the OLS stochastic frontier model and support for a translog production model.

We show DDF regression results and the \( \chi^2 \) test statistics at the appendices.

Technical efficiency is the outcome of comparing one bank to the best performing bank on the frontier line. Our efficiency estimations are displayed in Figures 1 and 2. Both approaches yield the efficiency with provision for loan loss (as a proxy for an undesirable output) that is higher the efficiency without the bad output. Their corresponding efficiencies are 89 and 64 percent under DDF, and 83 and 67 percent under SEMSFA. Figures 1 and 2 show the densities of efficiency, in which the density of efficiency with bad output (the red line) lies to the right of the density of efficiency with good outputs (the green line). The difference looks illogic because efficiency with bad output should be lower than that with good ones.
Reason for the illogic difference originates from the adjustment of performance of the best banks in term of risk. The adjustment degrades the performance of the best bank so that the frontier line moves toward the coordinate angle. Once the performance of the benchmark decreases, the performance of other banks upgrades. From the degradation of the best performing bank and the upgradation of the rest of the banks when we take risk into account, we can conclude that the best performer faces higher risk. Hence, it is necessary to incorporate risk into examining bank performance.

When outputs are all good, most coefficients from the regression results are significant, except for time variables \( t \) and \( t^2 \). As the coefficients of \( t \) and \( t^2 \) are not significant, one interesting finding from the model is that there is no significant evidence of technological progress in ASEAN banks. The same finding for the case of bad output model, the coefficient of variable \( t \) is not significant, but \( t^2 \) has a significantly negative coefficient, implying a long-term technological regress. The retreating performance of ASEAN banks is exhibited in Figure 4 and in Table AII.

The means of efficiency under both methods for good and bad outputs are not much different, but the trend of efficiency is much different under each method. While the DDF method yields a reduction of efficiency in ASEAN (as shown in Figures 3 and 4), the SEMSFA shows a stable trend in the good output scenario (in Figure 5) and even increasing tendency of efficiency in bad output scenario (in Figure 6). The divergence of tendency under the two methods shows disadvantage of parametric DDF approach and highlights the advantage of nonparametric/semi-parametric SEMSFA. For a parametric model to estimate efficiency, knowing just the parameters (which is measured from the mean value of observation) from translog regression is enough. However, the SEMSFA helps us to measure efficiency by relying not just on the parameters (actually the parameters change in corresponding to each observation) but also in the current state of data that has been observed. By capturing the current state of data, the SEMSFA helps us to gain more correct efficiency estimation.

5.2 Vietnam’s banks: outperforming?
The second finding from both DDF and SEMSFA is that banks in Vietnam outperform their peers in ASEAN nations. Regardless the difference in efficiency trend under both methods, the average efficiency level of Vietnam’s banks lies above the average level of ASEAN
banks as shown in Figures 3–6. Our estimation supports the outperformance of banks in Vietnam even taking risk into account. In other words, banks in Vietnam are both more efficient and safer than their peers in ASEAN.

Regardless the better performance, the efficiency of banks in Vietnam ignites two concerns. Our first concern is that both methods show a drop in efficiency of Vietnam’s banks under the good output scenario. The speed of efficiency reduction of banks in Vietnam exceeds the average speed reduction of their competitors in ASEAN. In the SEMSFA method, Vietnam’s banks have shown a persistently reducing performance since 2005 and commence a lower efficiency in 2005 (Figure 7).

Our second concern is about the amount of loan loss reserve of banks in Vietnam. Our data show Vietnam’s banks have used much lower capital resources to reserve for loan loss. During 2000–2015, the loan loss reserve ratio of total gross loan is stable around 2 percent for banks in Vietnam. We are doubtful about the amount loan loss reserves of banks in Vietnam. The amount of reserves is set up relying on their nonperforming loans.
Our suspicion originates from the very low nonperforming loans that are disclosed by both banks and the State Bank of Vietnam. As the non-performing loans are underestimated, the disclosure does not capture the real risk of banks in the country and banks in Vietnam may become riskier as their low provision for loan loss. If their clients cannot pay loans on due, the banks may have not enough resources to deal with the credit risk and liquidity risk. To stop “systemic risk” among banks, the State Bank of Vietnam has recently acquired five distressed banks. The acquisition supports our skepticism about the fact that nonperforming loan ratio of banks in Vietnam is “flatten.”

Our skepticism is also supported by Moody’s report[4] as “the banks’ loan loss reserves and capital are likely insufficient to absorb potential losses on problem assets.” Moody’s report also mentions that the problem assets ratio[5] should be 6.9 percent at the end 2015. If it is true, the loan loss provision in the country accounts for about one-third of the total credit risk. The benefit of recording low level of loan loss reserves helps to boost profitability in the short-term; but the long-term adverse effect is that it will take the banks many years before legacy problem assets are prudently covered by reserves and/or written off. In sum, we emphasize that low level of loan loss provision is a root of this instability and it takes longer period for Vietnam’s banks to have enough loan loss provision to remove the true high level of bad loans.
6. Conclusion
In this paper, risk is incorporated into efficiency measurement by DDF and SEMSFA. Thanks to the two methods, we can point out the performance of banks in Vietnam and their peers in ASEAN countries. Our research has two interesting findings that are no evidence of technological progress for banks in ASEAN and concerns about the outperformance of Vietnam’s banks. For the technological regress problem, ASEAN banks can improve efficiency via investing more on technology and management. For the concern of the performance of banks in Vietnam, the State Bank of Vietnam can request banks in Vietnam to book more loan loss reserves to shorten the period of removing bad assets.

Notes
1. Originally established in Bangkok in 1967 and consisted of five member countries (Indonesia, Malaysia, Philippines, Singapore and Thailand), the Association of Southeast Asian Nations (ASEAN) is nowadays a diverse group of five original states (ASEAN-5) and five newer members: Brunei Darussalam, Cambodia, Lao PDR, Myanmar and Vietnam (BCLMV), aiming towards a politically cohesive, economically integrated, and socially responsible community.
2. Brunei Darussalam, Cambodia, the Lao People’s Democratic Republic (Lao PDR), Myanmar and Vietnam.
3. The SFA model is defined as \( y_{it} = f(X_{it}; \beta) + v_i + u_{it} \), where \( Y_{it} \in \mathbb{R}_+ \) is the outputs of bank \( i \) at time \( t \), \( X_{it} \in \mathbb{R}^p_+ \) is the vector of inputs, \( f(\cdot) \) defines a production (frontier) relationship between inputs \( X \) and the outputs \( Y \), \( v_i \sim N(0, \sigma_v^2) \) is a symmetric two-side error representing random effects and \( u_{it} > 0 \) is one-side error term representing technical inefficiency (\( u_{it} \sim N(0, \sigma_u^2) \)).
5. The non-performing asset ratio is collected from www.moodys.com/research/Moodys-Outlook-for-Vietnam-banks-stable-supported-by-the-countrys–PR_358832

References
Incorporating risk into technical efficiency


Table AI. DDF regression for only good output

Notes: Number of observations = 2,805; log-likelihood function = 1,880; LR ($\chi^2$) test statistic on one-sided error = 1,374.2. *,**,***Denote significance at the 10, 5 and 1 percent levels, respectively

Table AII. DDF regression for both good and bad outputs

Notes: Number of observations = 2,805; log-likelihood function = 1,730.2; LR ($\chi^2$) test statistic on one-sided error = 741.6. *,**,***Denote significance at the 10, 5 and 1 percent levels, respectively

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The impact of GST implementation on the Malaysian stock market index volatility

An empirical approach

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Abstract

Purpose – The purpose of this paper is to examine the impact of the Goods and Service Tax (GST) implementation on Malaysian stock market index.

Design/methodology/approach – This study used daily closing prices of the Malaysian stock index and futures markets for the period ranging from June 2009 to November 2016. Empirical estimation is based on the generalised autoregressive conditional heteroscedasticity (1, 1) model for pre- and post-announcement of the GST.

Findings – Result shows that volatility of Malaysian stock market index increases in the post-announcement than in the pre-announcement of the GST which indicates that educative programs employed by the government before the GST announcement did not yield meaningful result. The volatility of the Malaysian stock market index is persistent during the GST announcement and highly persistent after the implementation. Noticeable increase in post-announcement is in support with the expectation of the market about GST policy in Malaysia.

Practical implications – The finding of this study is consistent with expectation of the market that GST policy will increase the price of the goods and services and might reduce standard of living. This is supported by a noticeable increase in the volatility of the Malaysian stock market index in the post-announcement of GST which is empirically shown during the announcement and after the implementation of GST. Although the GST announcement could be classified as a scheduled announcement, unwillingness to accept the policy prevails in the market as shown by the increase in the market volatility.

Originality/value – Past studies on Malaysian stock market index volatility focus on the impact of Asian and global financial crisis whereas this study examines the impact of the GST announcement and implementation on the volatility of the Malaysian stock market index.

Keywords GARCH, GST, KLCI-Futures, Market volatility

Paper type Research paper

1. Introduction

Goods and Service Tax (GST), a new tax approach in Malaysia, is a key component of the government’s long-term fiscal reform initiatives. The GST was announced on 19 June 2014 and implemented on 1 April 2015. The GST imposes a 6 per cent tax on about 1,200 selected items. Several advantages and disadvantages of the GST have been aggressively discussed among all parties in the economy particularly the consumers, being a broad-based tax on consumptions; the GST can protect revenue from tax evasion by retailers, thus, ensures a...
stable and reliable source of revenue to the government and encourages saving as well as investments to the public (Narayanan, 2014). This is then translated into a more prosperous growth of the economy in particular and the country as a whole. Stable and strong revenue can increase employment creation and enhance the country’s competitiveness.

Nevertheless, despite the advantages identified above, the announcement of GST has triggered immense worries, concerns and uncertainties to the public. The government has been delaying its implementations several times since its first introduction in the Malaysian Budget 2005 (Kraal and Kasipillai, 2016). According to Narayanan (2014), four major concerns have been thoroughly discussed since the announcement of the GST which are the concern on the possible effect on price level, the strong possibility of it being regressive that is, extracting bigger proportion of the earnings of lower incomes comparative to the higher incomes through the taxes, the possibility of the tax rate to increase overtime and the possible misuse of the revenue by irresponsible government due to corruption, opacity and lack of accountability in managing the collection (Narayanan, 2014). It is reported that the announcement of the GST has caused a shock in household spending pattern in Malaysia (Bank Negara Malaysia Economic Development Report, 2015). Anticipating price rise, households were seem to hurriedly purchase basic necessities and durable items like passenger cars, furniture and electrical appliances before the implementation of the GST. This is evidenced when a marked increase in car sales was observed, particularly in March 2015. Following this, private consumption expanded strongly by 8.8 per cent (IQ: 2015), significantly higher than its long-run average growth of 6.7 per cent (1990–2014). Most retailers, particularly supermarkets, experienced a substantial increase in sales during the last few weeks leading to the implementation of the GST.

GST is a new experience on a direct tax payment on some goods and services to the economy and to the households in Malaysia at large and can cause alarming shocks worries and uncertainties to the public and indirectly to the market. This study aims to investigate on how the market would react to the shocks and concerns triggered by the two phases of this tax reform, that is the announcement phase and the implementation phase. These kinds of shocks and uncertainties are evidenced to have significant impact on market volatility as documented in the past literature such as Bernile et al. (2016), Beber and Brandt (2006) and Vähämäk and Äijö (2011). The finding from this study and the examination on the effect of the GST pre- and post-announcement will provide crucial and beneficial empirical information with regard to the impact of the announcement and the implementation of a new tax reform on market volatility. Understanding the effect of macro-news on securities prices is essential to better understand market behaviour (Rühl and Stein, 2015). Effect of macro-news announcement on stock market is essential for market traders and policy makers for better decision making (Adjasi, 2009).

It is apparent that stock market index is volatile and it responds to future event even before the event actually takes place. This indicates a significant impact a piece of information has on the volatility of the market. Market starts reacting to new information immediately after an official announcement is made and in some cases market reacts differently after the event actually happens. Rangel (2011) stresses that to know how asset price as well as market volatility reacts to information released is essential for financial and economic decisions. Similarly, Michaelides et al. (2015) using cross-country data from 1988 to 2012 to find evidence of market negative reaction prior to sovereign rating downgrade announcement. Literature is compiling empirical evidences on impacts of macro-news announcement on financial markets. For example, Bernile et al. (2016) document how the release of macro-news can heavily impact capital markets while Chen and Gau (2010) reveal that announcement of macroeconomic indicators can alter market information structure. The body of knowledge also acknowledges evidences on how scheduled announcement affects market differently from unscheduled announcement. Studies like Beber and Brandt (2006) and Vähämäk and Äijö (2011) agree to
the notion when they find that market volatility seems to drop reacting to scheduled announcement and otherwise for unscheduled announcement.

This study examines the effect of GST on the volatility of Malaysian stock market index. GST is chosen because it was relatively a new tax policy in the Malaysian context and an unwelcome tax policy among households. Thus, this study contributes to the existing literature in three ways. First, it extends the literature by establishing the relationship between GST implementation and KLCI market in the Malaysian context. Second, it provides better understanding on the impact of GST on the Malaysian stock market index. Finally, the study is different from previous studies that investigate relationship between macroeconomic variables and Malaysian stock market index volatility while controlling the effect of other macroeconomic variables such as producer price index (PPI), consumer price index (CPI) and unemployment rate (UNEMP) on the findings.

To the best of our knowledge, our study on the impact of the GST on the Malaysian stock market index is novel and contributes significantly to the existing literature on market volatility. Previous studies focus on the impact of Asian financial crisis and/or global financial crises on Asian emerging countries. Realizing the significant of this new important event and gap it could cause in the literature of emerging market like Malaysia, this study is motivated to investigate the impact of the GST announcement and implementation on the Malaysian stock index and provides evidence by first examining the pre- and post-GST announcement on the Malaysian stock market index volatility and second, investigating whether there are changes in return to investors after the introduction of the GST. Then this study proceeds to examine the impact of the GST on the short-term and long-term volatility of the Malaysian stock market index. Bernile et al. (2016) emphasise the importance of measuring market expectation prior to the release of scheduled announcement and compare the difference between pre- and post-announcement.

First, we find in this study that volatility of Malaysian stock market index increases in post-announcement of GST than in pre-announcement. Worth noted that post-GST announcement volatility comprises of volatility of the market during announcement and after implementation of GST. Second, the result shows that lagged return of KLCI and KLCI-Futures (KLCI-F) are simultaneously significant to determine the changes in the stock return and the net benefit of investing in the Malaysian stock market index resulted in positive returns. The lagged returns of KLCI is negative while the lagged return of KLCI-F returns is positive with higher magnitude that might result in net profit which supports the futures index as risk management instrument. Third, the highest short-run volatility is observed in pre-announcement while the highest long-run persistent is recorded in post-announcement. Moreover, higher volatility persistent is found after the implementation of the GST as compared to the pre- and during announcement of the GST which could be translated into market reaction against GST policy in Malaysia.

The rest of the study is structured as follows: Section 2 outlines related literature and theoretical background on the impact of macro-news announcement on market volatility. Section 3 discusses the data, methodology employed and the analyses done in this study. Section 4 reports the empirical findings and the last section concludes the study.

2. Related literature and theoretical background

Tax policy is one of the theoretical constructs that link macro-news volatility with stock index return and are explained by arbitrage pricing theory (APT) and could be further understood by two dominant hypotheses namely the tax effect and the proxy effect hypotheses (Ross, 1976; Adjasi, 2009). APT relates return and risk as a linear function, while at the same time arguing that risk factors may be in multiples rather than single risk (Ross, 1976). It is a way of linking market return volatility with macroeconomic variables, whereby multiple factors can explain stock index return (Ross, 1976). APT takes into
account the influence of economic factors on the stock market index return (Buhl et al., 2011; Fan and Xu, 2011). Trzcinka (1986) concludes that APT remains valid as a risky asset pricing tool despite the argument on the number of factors needing to be constant before linearity of the relationship holds. According to Fama and French (1997), Blank (1989) and Bower et al. (1984), APT provides a clearer description of the expected stock return and is theoretically sound on the estimation of expected asset return. This is also supported in the study of Hodder and Jackwerth (2011), APT supports the view that macro-economy has a potential impact on asset return. In the context of this study, relationship between the macroeconomic news announcements and Malaysian stock market index volatility could also be explained by the tax effect hypothesis of Feldstein (1980) and proxy effect of Fama (1981). Both hypotheses argue that macroeconomic variable reduces stock market returns. Proxy effect hypothesis further explains that real activities are positively correlated with stock returns but negatively correlated with macroeconomic variables. As in the case of GST, it is directly imposed on the real activities such as selected goods and services. However, imposition of GST reduces purchasing power of the households by increasing price of goods and services.

Similarly, the impact of macro-news announcement on stock market volatility has caught the attention of researchers and policy makers over the years (Adjasi, 2009). Literature witnesses the development of this related study be segmented into issues, relationship between macro-news announcements and market volatility and the methodologies employed in examining the relationship. Macro-news announcement, as explained by some studies (Vrugt, 2009; Chen and Gau, 2010; Chulia et al., 2010; Jiang et al., 2012; Hitzemann et al., 2015; Bernile et al., 2016) is divided into scheduled and unscheduled announcement.

Bernile et al. (2016) suggest possible ways in which the Federal Open Market Committee (FOMC) announcement gets to the investors prior to official release of the macro-news. They point out that investors with superior ability might predict some upcoming FOMC announcement either through insiders mimic or media news and conclude that such investors could even trade during embargoes. They infer that having access to such private information has global implication such as the 2007–2008 financial crises. It is obvious that investors are not willing to take risk without commensurable return premium (Kongsilp and Mateus, 2017). Similarly, Chulia et al. (2010) examine the effects of FOMC announcement on S&P 100 stock returns focusing on the individual stocks level. The result detects different reaction of the stocks towards the shocks. For example, the reaction of financial stocks is the strongest among all, followed by the IT stocks and the response of the utilities stocks is the least. A significant move in price was reported when surprise is related to expectation of the markets (Evans, 2011). These findings support buying behaviour of the Malaysian household prior to the implementation of GST. A record of increase in the sales of certain goods was reported prior to the announcement of GST while sluggish in the sales was later documented upon the implementation of GST. Expectation that price of the goods in which GST is imposed will increase at least by 6 per cent of the original price is one of the driving factors that triggered decision of making earlier purchase of some goods.

However, Hashimoto and Ito (2010) find that earlier disclosure of information content of CPI in Tokyo area prior to the implementation of CPI at the national level has been absorbed by the exchange rate. In contrary, the findings of Hashimoto and Ito (2010) on CPI disclosure support that GST policy posed worries on Malaysian market participants. Unlike CPI, GST was considered as additional burden that might deteriorate living standard of the households and was also considered as a policy that forces households to pay national debt deficit. This supports the finding of Rühl and Stein (2015) that stress on the expectation of the market matters in predicting reaction of the market towards macro-news announcement.

In addition, Hitzemann et al. (2015) report that prior to the announcement of emissions, the market was calm with no abnormal returns but on the event day there were abnormal returns
reported followed by an increase in the market volatility. They argue that the announcement of emission has increased the volatility of the market. Likewise, Truong (2011) reveals that the Chinese equity markets acts as a driving force of abnormal returns in the post-earnings announcement. Rühl and Stein (2015) find that unexpected announcements have the strongest impact on the market volatility of the European blue chips and a short-run increase in spread prior to the European Central Bank announcement on interest rate decision. Evans (2011) reports a significant contribution of intraday jumps to price volatility and quantify the impact of the macro-news announcement to market shocks of being one-third of the shock in the market. Chen and Gau (2010) find scheduled announcement to have attracted more informed traders for short-term and speedy price discovery. This implies that several studies are arriving at a common conclusion that macro-news announcement has direct effect on the market volatility.

In line with earlier studies, Jiang et al. (2012) highlight differences in the impacts of scheduled news announcement and unscheduled news announcement of the implied volatility. Implied volatility dropped with scheduled news announcement while implied volatility increases with the unscheduled news announcement. They even point out that information uncertainty is resolved with scheduled announcements whereas, on the other hand, arises through unscheduled announcement. Contrastingly, Marshall et al. (2012) find a decline in the implied volatility on announcement day of the US macro-news but no significant change on the volatility of the market for pre- and post-announcement. Contrasting findings of Marshall et al. (2012) have not provided a debatable argument on the direct impact of macro-news announcement on the volatility of the market.

Rangel (2011) employs the generalised autoregressive conditional heteroscedasticity (GARCH) model to explain the effects of five macro-news announcement on S&P 500 index which are centred on the CPI and PPI as a measure of inflation and the federal fund rate (FFR), the nonfarm payroll employment (NFP) and the UNEMPR. He finds a significant increase in the market volatility on the employment announcement day. Vrugt (2009) studies pre- and post-impact of macro-news announcement using the GARCH models. He finds different conditional variance for the pre- and post-announcement, and on the announcement day with low on the former but higher in the latter. Hanousek et al. (2009) use the GARCH model to examine the impact of local and foreign macro-news on new European Union (EU) stock markets. They find that macro-news is released before the commencement of the markets hence erasing the element of surprise to the market as the market has absorbed the news before the market actually begins. They also account for a negative impact of the US news on Prague market and Budapest market. Similarly, Budapest market is positively affected by the EU news while Warsaw market is unaffected by foreign news. There is a slight difference in the macro-news such as CPI, PPI, FFR, NFP and UNEMPR used in the study by Rangel (2011). That macro-news have been assumed to be welcomed and accepted as a standard approach unlike GST that Malaysian Government strives over years on its implement and keep postponing to prevent negative consequences on the political party in the future, still GST policy was not considered as favourable policy by Malaysian.

Hence, impact of macro-news announcement on volatility requires appropriate modelling techniques to capture differences in the market volatility in relation to the macro-news announcement. Accurate volatility forecast delivers reliable information about future volatility to the market participant and volatility is crucial for asset pricing (Kongsilp and Mateus, 2017). As reported in several studies, volatility varies with expected and unexpected macro-news announcement of similar magnitude (Mollah and Mobarek, 2009; Tsai and Chen, 2009; Robbani et al., 2013).

3. Data and methodology

Daily closing prices of KLCI and KLCI-F are obtained from DataStream database for the period ranging from 1 June 2009 to 15 November 2016. We also obtained CPI, PPI and UNEMPR data.
from the Department of Statistics, Malaysia. The macroeconomic data are available in monthly basis. We convert the monthly data to daily data using cubic spline. Similarly, Buyuksahin and Robe (2014) used cubic spline to convert monthly data to daily data in their study on speculators, commodities and cross-market linkages. In addition, price series are grouped into four different categories to provide more in-depth report on the impact of the GST on Malaysian stock market index volatility. The first group of data which ranges from 1 June 2009 to 18 June 2014 captures the volatility of Malaysian stock market index in the pre-announcement of the GST. The second group of data which ranges from 19 June 2014 to 15 November 2016 captures the volatility of the market in the post-announcement of the GST. The second group of data is further divided into two subgroups in order to examine the differences in market volatility during the announcement and after the implementation of the GST. The data for the first subgroup range from 19 June 2014 to 31 March 2015 and the data for the second subgroup range from 1 April 2015 to 15 November 2016.

Since this study is examining the impact of GST on Malaysian stock market index volatility, the effects of CPI, PPI and UNEMPR are controlled to prevent biasness in the conclusion of this study. Several studies that have already established the effect of macroeconomic factors on the stock market index volatility have documented relationship in the stock index return and macroeconomic variables such as CPI, PPI and UNEMPR (Chen and Gau, 2010; Nguyen, 2011; Rangel, 2011; Nguyen and Ngo, 2014; López, 2015); therefore, controlling for such macroeconomic variables is required. Previous studies show that uncertainty related to CPI as macroeconomic variable may affect return volatility and financial markets are influenced by macroeconomic trend such as CPI (Cai et al., 2009; Liu and Zhang, 2015). UNEMPR is regarded as one of the economic factors that is associated with the increase in inflation (as measured by CPI). Nguyen (2011) reports significant effect of UNEMPR on the conditional mean of the study. Therefore, controlling for those macroeconomic factors is essential in examine the impact of GST on Malaysian KLCI return volatility.

Data are transformed using logarithm compounding returns as below:

\[ R_{sf}^t = 100 \times \log \left( \frac{P_t}{P_{t-1}} \right), \]  

where \( R_{sf}^t \) represents return of spot or return of futures, \( P_t \) represents current price of spot index or futures index price while \( P_{t-1} \) represents lagged price of the spot index or futures index price.

This study employs the Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) unit root tests for stationarity test. ADF and PP unit root tests capture both parametric and non-parametric tests in the respective order (Jain et al., 2013). Robustness of error distribution is required and unit root test provides necessary information about order of integration of the series (Hansen and Lunde, 2005; Cabrera and Schulz, 2016).

In this study, GARCH (1, 1) model is used to examine volatility of the Malaysian stock market index with respect to the announcement of the GST, while controlling for other macroeconomic variables such as PPI, CPI and UNEMPR. The GARCH models capture volatility properties such as volatility persistent and clustering. Previous studies show that characteristic nature of returns series could be better explained by using GARCH models and the GARCH (1, 1) outperforms other forms of GARCHs (Hansen and Lunde, 2005; Vrugt, 2009; Hanousek and Kocenda, 2011).

In reference to the study of Haugom et al. (2014), GARCH modelling techniques of examining market volatility make volatility of the market becomes an observable variable. Hence, appropriate volatility models are required to explore necessary volatility features in the study to prevent spurious conclusion of the market volatility. In this study, we also control other macroeconomic factors that might increase volatility of Malaysian stock market index to prevent
estimation bias that might lead to spurious conclusion and provide robustness in the findings. The general mean equation of the GARCH model is expressed as follows:

\[ Y_t = \alpha + \beta' X_t + e_t, \quad e_t | \Omega_t \sim N(0, h_t), \]

where \( X_t \) represents a \( k \times 1 \) vector of independent variables, \( \beta \) represents a \( k \times 1 \) vector of coefficients, \( e_t \) represents error term fulfilling the assumption of \( e_t | \Omega_t \sim N(0, h_t) \). \( \Omega_t \) represents information set. A more specific mean equation is expressed below.

Mean equations for RKLCI and RKLCI-F volatility:

\[ \Delta R_s t = \alpha_0 + \beta_{11} R_s t-1 + \beta_{12} R_f t-1 + \Delta \text{PPI}_t + \Delta \text{CPI}_t + \Delta \text{UNEMPR}_t + e_t, \]

\[ e_t | \Omega_t \sim \text{iid } N(0, h_t). \]

Besides the specific mean equations, the second moment equation of the GARCH model is expressed as follows:

\[ h_t = \alpha_0 + \sum_{i=1}^{p} \lambda_i h_{t-i} + \sum_{j=1}^{q} \gamma_j \sigma^2_{t-j}. \]

where \( h_t \) represents conditional variance composed of its own and squared errors lagged values. \( \sum_{i=1}^{p} \lambda_i \) represents the short-run persistence (ARCH term), \( \sum_{j=1}^{q} \gamma_j \) represents GARCH term and long-run persistent is determined by the sum of ARCH term and GARCH term \( (\sum_{i=1}^{p} \lambda_i + \sum_{j=1}^{q} \gamma_j) \). \( \beta \) and \( \gamma \) are non-negative integers. \( \Delta \text{PPI}_t \) represents first difference of PPI at time \( t \), \( \Delta \text{CPI}_t \) represents CPI at time \( t \) and \( \Delta \text{UNEMPR}_t \) represents UNEMPR at time \( t \).

Optimality of GARCH model is determined based on information criteria such as the Akaike information criterion (AIC) and the Schwarz information criterion (SIC). Model with smaller value of AIC and SIC is selected as the optimal model (Fan and Xu, 2011). Gil-Alana and Tripathy (2014) suggest using information criteria to select optimal model followed by diagnostic test. Several studies select the best forecasted model based on the lowest value of RMSE (Anderson et al., 2009; Cartea and Karyampas, 2011; Prokopczuk and Simen, 2014). RMSE equation is expressed as follows as in the study of Wang et al. (2016):

\[ \text{RMSE} = \frac{1}{n} \sum_{i=1}^{n} \left( \sigma^2_i - \hat{\sigma}^2_i \right)^2, \]

where \( \sigma^2_i \) represents the actual realized volatility of the model, \( \hat{\sigma}^2_i \) represents estimated realised volatility and \( n \) represents number observations for forecast.

The presence of heteroscedasticity in the residuals of the model is examined through the ARCH effect test and common model employed is Engle’s Lagrange multiplier test (Basher and Sadorsky, 2016). It is also noted that ARCH effect test is a sufficient condition for estimating market volatility (Tse and Booth, 1996; Le Pen and Sévi, 2010). The details on the preliminary test are provided in Tables I and II.

4. Results and analysis

Table I provides the properties of \( R^s_t \) and \( R^f_t \) prices through statistics summary. On average, the mean of \( R^s_t \) and \( R^f_t \) are positive for all data, and post-announcement while the mean of subdivisions are negative and the mean of pre-announcement is a mixture of positive and negative. Standard deviation of \( R^s_t \) and \( R^f_t \) are positive and are less than 1 for all groups. However, the value of mean and the standard deviation shows that unconditional daily returns display flatter tails than normal distribution of assumed normality and homoscedasticity, hence, making it suitable to be modelled on GARCH techniques.
Moreover, return series are negatively skewed and leptokurtic (kurtosis > 3) which reflected the non-normality distribution assumptions. Similarly, statistical significance of Jarque–Bera is an indication of non-normal distribution of error terms of returns which implies that return series are significantly larger than in a normal distribution (Choudhry and Hassan, 2015). In general, descriptive summary of the logarithm return series rejects the normal distribution of error term of the series. Since the returns are confirmed non-normality of error distribution, generalised error distribution (GED) is employed. GED or Student’s t is a common error distribution technique mostly employed in the previous studies (Tripathy and Gil-Alana, 2015). Besides, Table II provides details on the stationarity of \( R_s \), \( R_f \), \( \Delta PPI_t \), \( \Delta CPI_t \) and \( \Delta UNEMPR_t \).

Table II shows the intercept, trend and the intercept values for the ADF and PP unit root tests. The return series are stationary at level, which shows mean reversion property of the return as a satisfactory condition for using the return for modelling. The return series are integrated of order zero, \( I(0) \). However, PPI, CPI and UNEMPR are integrated of order one, \( I(1) \). Therefore, first difference of the macroeconomic variables is used for control variables. Understanding of time-series properties such as stationarity prior to main empirical analysis is essential to avoid spurious results (Haron and Salami, 2015).

Finally on the preliminary test, we examine the ARCH effect test. The ARCH effect test is to examine the homoscedastic of the variables and it is a common phenomenon in the studies relating to market volatility (Mensi et al., 2014; Basher and Sadorsky, 2016). The test for homoscedastic (ARCH effects test) prior to forecast volatility of market is well reported in previous studies (Haixia and Shiping, 2013; Gil-Alana and Tripathy, 2014). Reboredo et al. (2016) find ARCH effects in seven out of the eight markets being examined. ARCH effects test result provides sufficient condition to forecast the volatility of the Malaysian stock market index.
<table>
<thead>
<tr>
<th>All data</th>
<th>Test name</th>
<th>( R_s )</th>
<th>( R_f )</th>
<th>( \Delta \text{PPI} )</th>
<th>( \Delta \text{CPI} )</th>
<th>( \Delta \text{UNEMPR} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 June 2009 to 16 August 2016</td>
<td>Augmented Dickey-Fuller</td>
<td>-28.2789*</td>
<td>-45.8332*</td>
<td>-8.0976*</td>
<td>-8.5150*</td>
<td>-8.6820*</td>
</tr>
<tr>
<td>Pre-announcement</td>
<td>Augmented Dickey-Fuller</td>
<td>-39.2236*</td>
<td>-45.8900*</td>
<td>-32.4062*</td>
<td>-32.0898*</td>
<td>-35.0068*</td>
</tr>
<tr>
<td>1 June 2009 to 18 June 2014</td>
<td>Phillips-Peron</td>
<td>-39.2499*</td>
<td>-46.0181*</td>
<td>-32.3613*</td>
<td>-32.0733*</td>
<td>-34.9931*</td>
</tr>
<tr>
<td>During announcement</td>
<td>Augmented Dickey-Fuller</td>
<td>-31.8820*</td>
<td>-37.8431*</td>
<td>-32.4062*</td>
<td>-32.0898*</td>
<td>-35.0068*</td>
</tr>
<tr>
<td>19 June 2014 to 31 March 2015</td>
<td>Phillips-Peron</td>
<td>-31.8871*</td>
<td>-37.9019*</td>
<td>-32.3913*</td>
<td>-32.0733*</td>
<td>-34.9931*</td>
</tr>
<tr>
<td>After implementation</td>
<td>Augmented Dickey-Fuller</td>
<td>-22.8307*</td>
<td>-25.9387*</td>
<td>-27.7649*</td>
<td>-25.1228*</td>
<td>-25.3446*</td>
</tr>
<tr>
<td>1 April 2015 to 16 August 2016</td>
<td>Phillips-Peron</td>
<td>-22.8373*</td>
<td>-25.9310*</td>
<td>-29.0644*</td>
<td>-25.1033*</td>
<td>-25.3428*</td>
</tr>
</tbody>
</table>

**Notes:** \( R_s \) and \( R_f \) represent spot return (RKLCI) and futures return (RKLCI-F), respectively. \( \Delta \text{PPI} \) represents first difference of producer price index, \( \Delta \text{CPI} \) represents first difference of consumer price index and \( \Delta \text{UNEMPR} \) represents first difference of unemployment rate. Total data are disaggregated based on date of event and unit root test is provided accordingly. *, **, ***Significant at the 1, 5 and 10 per cent levels, respectively. 

Table II. Unit root test
The ARCH LM test is carried out and the test confirms the presence of ARCH effect in the return series therefore we proceed with GARCH model that examines the impact of GST on the volatility of the Malaysian stock market index and the results are provided in Tables III and IV. In Table III, the pre- and post-impact of the GST is examined on the volatility of Malaysian stock market index using GARCH (1, 1) model. In each situation, conditional mean and conditional variance results are presented. The non-negativity of the coefficient of ARCH ($\gamma$) and GARCH ($\lambda$) terms are not violated. Short-term shock as indicated by the coefficient of ARCH term is generally small in this study. Returns shocks captured in the ARCH term is relatively small (Wu and Xiao, 2002). The ARCH and GARCH terms satisfy the non-negativity of Bollerslev which indicates gradual fading away of generated volatility in underlying prices due to temporary exogenous shocks (Haron and Salami, 2015).

### Pre-GST announcement

The conditional mean shows that on average, mean of Malaysian stock market index (KLCI) is determined by lagged of its own return, current return of futures price and lagged return of the futures return keeping PPI, CPI and UNEMP constant. This implies that the performance of the market return and its futures returns is significantly necessary for the current return in the Malaysian stock market index. The average lagged return of the KLCI is negative and statistically significant. However, average lagged return of the KLCI-F and average current KLCI-F return are positive and statistically significant in the pre-GST announcement. This finding is consistent with several other studies (Asgharian and Nossman, 2011; Pre-GST announcement Post-GST announcement

<table>
<thead>
<tr>
<th>Equations</th>
<th>Pre-GST announcement GARCH</th>
<th>Post-GST announcement GARCH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean equation</td>
<td>$\alpha$ 0.0000 (0.4441) 1.8828* (12.6390)</td>
<td>$\lambda$ 0.1035*** (1.7717) 0.0677** (2.0869)</td>
</tr>
<tr>
<td></td>
<td>$R_{t-1}$ -0.3177* (-6.5204) -0.2270* (-8.9156)</td>
<td>$\lambda$ 0.7272* (4.5464) 0.8894* (18.5046)</td>
</tr>
<tr>
<td></td>
<td>$R_{f}$ 0.7334* (39.8910) 0.7250* (183.7495)</td>
<td>$\lambda$ 0.7272* (4.5464) 0.8894* (18.5046)</td>
</tr>
<tr>
<td></td>
<td>$\Delta LPPI$ 0.0106 (4.0039) -0.0069 (-2.5010)</td>
<td>$\lambda$ 0.7272* (4.5464) 0.8894* (18.5046)</td>
</tr>
<tr>
<td></td>
<td>$\Delta LCPI$ -0.0108 (-0.0289) 0.0494 (1.2002)</td>
<td>$\lambda$ 0.7272* (4.5464) 0.8894* (18.5046)</td>
</tr>
<tr>
<td></td>
<td>$\Delta LUNEMP$ -0.0020 (-0.2464) -0.0006 (-0.0097)</td>
<td>$\lambda$ 0.7272* (4.5464) 0.8894* (18.5046)</td>
</tr>
<tr>
<td>Variance equation</td>
<td>$\alpha$ 0.0000 (1.3929) 0.0000 (1.5147)</td>
<td>$\lambda$ 0.7272* (4.5464) 0.8894* (18.5046)</td>
</tr>
<tr>
<td></td>
<td>$\gamma$ 0.1035*** (1.7717) 0.0677** (2.0869)</td>
<td>$\lambda$ 0.7272* (4.5464) 0.8894* (18.5046)</td>
</tr>
<tr>
<td></td>
<td>$\lambda$ 0.7272* (4.5464) 0.8894* (18.5046)</td>
<td>$\lambda$ 0.7272* (4.5464) 0.8894* (18.5046)</td>
</tr>
<tr>
<td>GED</td>
<td>1.7427* 1.0679*</td>
<td>1.2709*</td>
</tr>
<tr>
<td>Adj. $R^2$</td>
<td>0.8082 0.8127</td>
<td>0.8127</td>
</tr>
<tr>
<td>RMSE</td>
<td>0.0023 0.0028</td>
<td>0.0028</td>
</tr>
<tr>
<td>MAE</td>
<td>0.0018 0.0021</td>
<td>0.0021</td>
</tr>
<tr>
<td>D-W</td>
<td>2.1764 2.3987</td>
<td>2.3987</td>
</tr>
<tr>
<td>Diagnostic test</td>
<td>ARCH 1 0.4279 0.7824</td>
<td>ARCH 2 0.6766 0.6797</td>
</tr>
<tr>
<td></td>
<td>$Q^2$-Stat(8) 0.506 0.988</td>
<td>$Q^2$-Stat(8) 0.506 0.988</td>
</tr>
</tbody>
</table>

**Notes:** *t-Statistics values are provided in parentheses. Optimality of the GARCH models is provided by AIC and SIC criteria. GED parameter indicates error distribution. Model with lowest value of RMSE and MAE is considered as the best model. Some statistical reports such as adjusted $R^2$, AIC and SIC, RMSE and MAE are taken note of and diagnostics tests such as ARCH test and $Q^2$-statistic are provided after variance equation result. $R_{t-1}$ and $R_{t-1}^f$ represent lagged spot return (RKLCI) and lagged futures return (RKLCI-F), respectively. $\Delta LPPI$, $\Delta LCPI$, and $\Delta LUNEMP$ are first difference logarithm value of control macroeconomic variable, namely producer price index, consumer price index and unemployment rate, respectively. Total data are disaggregated based on date of event. *,**,***Significant at the 1, 5 and 10 per cent levels, respectively.
It is further explained in some studies that the magnitude of lagged return explains the volatility (Daouk and Ng, 2011; López, 2015). However, some studies such as Chen and Gau (2010) and Bouri (2015) find a contradictory result. Bouri (2015) finds positive effects of lagged oil return on the Lebanese stock and also Manera et al. (2014) find positive lagged of the S&P 500 index. Chen and Gau (2010) also find a negative relationship between spot and futures prices. In the case of the study by Camilleri and Green (2014), only the first lagged return is statistically significant while other lags are not. Furthermore, a mixed result of negative and positive significant lagged returns are found in the study by Asgharian and Nossman (2011) and Mensi et al. (2013).

Negative coefficient of lagged return of the KLCI is excessively covered by investing in the KLCI-F. This implies that despite the average returns of investing in the Malaysian stock market index generates negative returns, investors are better off by taking opposite position in the futures market as the returns are positive with larger magnitude as compared to the underline market. This indicates that taking an opposite position of Malaysian stock market index in its futures market enables investors to reap the profit at least equivalent to risk-free rate irrespective of the price movement.

In the conditional variance, the ARCH and GARCH terms provide information on the extent of market volatility in the short run and long run, respectively. The ARCH term provides information on the effect of past innovations on the current volatility while the GARCH term explains past volatility on current volatility (Bouri, 2015). Persistent and clustering features of

<table>
<thead>
<tr>
<th>Equations</th>
<th>During announcement</th>
<th>After implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean equation</td>
<td>α</td>
<td>–0.0002 (–0.4068)</td>
</tr>
<tr>
<td></td>
<td>R̂‌0,1</td>
<td>–0.1846 (–1.2648)</td>
</tr>
<tr>
<td></td>
<td>R̂‌1</td>
<td>0.2898** (2.5654)</td>
</tr>
<tr>
<td></td>
<td>∆LPPI</td>
<td>–0.0401 (–0.2757)</td>
</tr>
<tr>
<td></td>
<td>∆LCPI</td>
<td>–0.0111 (–0.2768)</td>
</tr>
<tr>
<td></td>
<td>∆LUNEMPR</td>
<td>0.2094 (0.9371)</td>
</tr>
<tr>
<td>Variance equation</td>
<td>γ</td>
<td>0.1035 (1.2485)</td>
</tr>
<tr>
<td></td>
<td>λ</td>
<td>0.8088* (6.1627)</td>
</tr>
<tr>
<td></td>
<td>GED</td>
<td>1.7716*</td>
</tr>
<tr>
<td></td>
<td>AIC</td>
<td>–7.3821</td>
</tr>
<tr>
<td></td>
<td>SIC</td>
<td>–7.4488</td>
</tr>
<tr>
<td></td>
<td>RMSE</td>
<td>0.0062</td>
</tr>
<tr>
<td></td>
<td>MAE</td>
<td>0.0048</td>
</tr>
<tr>
<td></td>
<td>W-D</td>
<td>2.0563</td>
</tr>
<tr>
<td>Diagnostic test</td>
<td>ARCH 1</td>
<td>0.3483</td>
</tr>
<tr>
<td></td>
<td>ARCH 2</td>
<td>0.4090</td>
</tr>
<tr>
<td></td>
<td>Q² Stat</td>
<td>0.168</td>
</tr>
</tbody>
</table>

Notes: t-Statistics values are provided in parentheses. Optimality of the GARCH models is provided by AIC and SIC criteria. GED parameter indicates error distribution. Model with lowest value of RMSE and MAE is considered as the best model. Some statistical reports such as adjusted R², AIC and SC, RMSE and MAE are taken note of and diagnostics tests such as ARCH test and Q² statistics are provided after variance equation result. Rs‌t, Rf‌t, ∆PPI, ∆CPI, ∆LUNEMPR represent lagged spot return (RKLCI) and lagged futures return (RKLCI-F), respectively. ∆LPPI, ∆LCPI, and ∆LUNEMPR are first difference logarithm value of control macroeconomic variable, namely producer price index, consumer price index and unemployment rate, respectively. Total data are disaggregated based on date of event. Total data are disaggregated based on date of event. A relatively small R² does not prevent investors from making significant economic gain (Narayan et al., 2013). *,**,***Significant at the 1, 5 and 10 per cent levels, respectively

Table IV. During the GST announcement and after the GST implementation
the volatility are also captured. Volatility in the short run is smaller in magnitude relative to the long run for all GARCH models. Investors might not put more concern on the short-run volatility as the effect may be wiped-off in the short run. More emphasis is put on the long-run volatility of the market which might have future consequence on the entire return of the market. Basher and Sadorsky (2016) report that the short-term persistent is lower as compared to the long-term persistent. Short-run volatility as denoted by ARCH (1) is relatively small as compared to long-run volatility (GARCH (1)) and ARCH term provides information about the rate at which volatility changes (Bouri, 2015; Chang et al., 2011). The GARCH model mainly captures the persistence of volatility and volatility clustering (Charles and Darne, 2014). The persistent volatility coefficient in the pre-announcement of GST in Malaysian stock market index is 0.8307. This indicates that market volatility is more persistent but clustering as the sum coefficient of the ARCH and GARCH terms is statistical significant (Hanousek et al., 2009). According to Bouri (2015), highly persistent market volatility is assumed when the sum of ARCH and GARCH coefficient is closer to unity (1).

This indicates that prior to the introduction of the GST Malaysian stock market index volatility is considerably moderate. The investors are not facing higher risk. Other economic factors such as CPI, PPI and UNEMPR are considerably stable and do not exercise negative effect on the market that may trigger increase in the volatility of the market. The result of the pre-GST announcement supports APT as number of the macroeconomic variables account for price determination in the Malaysian stock market index.

Post-GST announcement
The report on the conditional mean of the GARCH model in the post-GST announcement is similar but differs in magnitude. There is a need to point out some noticeable differences in the first moment return of the post-GST announcement. Negative lagged return of the KLCI is absolutely lower and the lag return of KLC-F reduced after the GST has been announced and implemented. This indicates futures market consistently maintaining its role as risk mitigation technique as the magnitude of price risk exposures and risk reduction is proportional.

In the conditional variance of the model, the coefficient of the ARCH term is statistically significant in the post-GST announcement but is relatively reduced as compared with the pre-GST announcement. This implies that short-run volatility is further reduced while long-run volatility increased after the announcement of the GST. Further reduction in the short-run volatility is supported by APT as arbitrage opportunity may be short-lived. Such an increase in long-run volatility after the GST announcement has made overall volatility (0.9571) of Malaysian stock market index after the GST announcement to be more persistent compared with the pre-GST announcement (0.8307). The finding is consistent with the findings by Rangel (2011) and Vrugt (2009) where they find noticeable volatility changes upon macro-news announcement. High volatility of underline market increases the motivation of investors to hedge their position in the futures market (Chen and Gau, 2010). On the other hand, the finding is inconsistent with the tax effect hypothesis that proposed that macro-news announcement lowers the volatility of the market. Such an increase in the volatility of underlying market may increase negotiation for higher return.

For more in-depth study on the volatility of Malaysian stock market index in the post-GST announcement, we proceed to separate the impact of GST on the volatility of the Malaysian stock market index into during the GST announcement and after GST implementation which is presented in Table IV.

Table IV provides the volatility details during the announcement and after the implementation of the GST. The table shows both conditional mean and conditional variance results of the GARCH (1, 1).
During the GST announcement

The average lagged return of the Malaysian stock market index remains negative but insignificant while the average lagged return of the KLCI-F remains positive and significant for the model. This indicates that the announcement of GST has significant effect on Malaysian stock market index lag return. In contrast, average lagged return of its futures return (KLCI-F) is unaffected as its role is to mitigate price risk exposures.

In the conditional variance of the model, the short-run volatility remains as in the pre-GST announcement while the long-run volatility is higher than as in the pre-GST announcement but lower than as in the post-GST announcement. The overall volatility during the GST announcement is highly persistent (0.9123) than in the pre-GST announcement but lesser persistent as in the post-GST announcement. This implies that the announcement of GST has significant impact on the volatility of Malaysian stock market index volatility which increases the overall volatility of the Malaysian stock market index. The finding is consistent with the study of Vrugt (2009) that finds volatility change upon the announcement of macro-news. Similarly, unwelcome announcement is associated with jump in the returns (Rangel, 2011).

Impact of the GST on the Malaysian stock market index volatility in the short run is statistically insignificant. This could be a reflection that announcement of GST has become publicly available information during the period and less consumption is recorded as many household have already increased their purchases prior to the imposition of the GST. In contrary to that, long-run volatility increases and the effect of the GST on the price of the goods and services becomes noticeable as its impact reduces purchasing power.

After GST implementation

In the conditional mean after GST implementation, average lagged returns of Malaysian stock market index and own futures return are positively significant, while lagged return of its futures is negatively significant. This implies that both the KLCI and KLCI-F returns are significantly important in determining the volatility of Malaysian stock market index but in different magnitude and direction.

In the conditional variance of the model, short-run volatility is lower relative to during the announcement while the long-run volatility is more persistent than during the announcement of the GST. The volatility persistent after GST implementation (0.9577) is higher compared with the volatility in the pre-GST announcement (0.8307) and during the GST announcement (0.9123) and slightly higher compared with the volatility of the post-GST announcement (0.9571). This shows that Malaysian stock market index volatility is highly persistent and clustering after the implementation of GST. This implies that the worries of the household that implementation of the GST might increase the volatility of the market is empirically confirmed. Although release of scheduled news clarifies information uncertainty (Jiang et al., 2012), this is not translated into volatility reduction in Malaysian stock market index. Rather, it increases volatility even during the transition process and further increases volatility of the market after the GST implementation. This finding supports the finding by Rühl and Stein (2015) that the direction of macro-news announcement is governed by the expectation of the market.

In general, findings of this study are supported by APT that risk and return are explained by more than one macroeconomic factors and arbitrage opportunity short-lived. Having control for CPI, PPI and UNEMP, volatility of the Malaysian stock market index increases in the post-GST announcement than in the pre-GST announcement. However, the findings did not support the tax effect and proxy effect hypothesis as volatility of Malaysian stock market index increases instead of reduces as proposed by both hypotheses. Contradictory of this finding with the hypotheses may be supported by the expectation of the market and the unwilling attitude of the households to support the policy.
Diagnostic tests for each model is not violated, the ARCH test provided in each column is statistically insignificant as well as the $Q^2$ statistics at eight lags. Hence, the findings are robust and not misleading.

5. Conclusion
This paper has shown the effect of GST on the Malaysian stock index return volatility while controlling for other macroeconomic factors such as PPI, CPI and UNEMPR that might equally trigger volatility on the market. This study employed GARCH (1, 1) model and results of diagnostic test show that results are robust as the findings are free from serial correlation, heteroscedasticity and multicollinearity. It seems that prior to the GST announcement, Malaysian stock market index volatility is merely persistent as compared with during the GST announcement and GST implementation. Increase in volatility of Malaysian stock market index during and after the GST announcement implies that GST awareness programs sponsored by the government did not accomplish a successful result. Market participants are not in support of the imposition of GST in Malaysia as empirically shown in this study by comparing the volatility level of the Malaysian stock market index in the pre- and post-GST announcement. It is also well documented in the body of knowledge that macroeconomic news announcement increases market volatility. The GST announcement could be categorised as scheduled announcement through several educative programs employed by the government, still the market volatility increases. This finding supports the finding by Bernile et al. (2016) and Chen and Gau (2010) that macroeconomic news announcement has significant impact on market volatility. However, the finding is contrary with the findings that scheduled macroeconomic news reduced market volatility as found by Beber and Brandt (2006) and Vähämaa and Äijö (2011). This finding further shows that the readiness of the market also matters on the macroeconomic news announcement as being scheduled news is not only a sufficient condition for the market volatility to be reduced. This finding supports the findings of Rühl and Stein (2015) that expectation matters on the direction of macro-news announcement.

In conclusion, the volatility of the Malaysian stock market index prior to the GST announcement is lower compared with the volatility of the market during the GST announcement and GST implementation. This finding further agrees with the expectation of the market participants and previous studies on the impact of macro-news on stock market index. We found that the imposition of GST increases price of the goods and services and reducing purchasing power of households. Such increase in the volatility of Malaysian stock market index is consistent with the expectation of the market.

References


Malaysian stock market index volatility


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Empirical study on the effective factors of social responsibility disclosure of Iranian companies

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Department of Economics and Administrative Sciences, Attar Institute of Higher Education, Mashhad, Iran

Abstract
Purpose – The purpose of this paper is twofold: first, to investigate the relationship between some characteristics of corporations including firm size, financial leverage, profitability, firm age and the type of industry with social responsibility disclosure of firms listed on Tehran Stock Exchange (TSE); and second, to study the association between the level of corporate social responsibility disclosure (CSRD) and some of the audit variables such as audit fees, audit tenure and audit firm size.
Design/methodology/approach – The study population consists of 125 firms listed on the TSE during the years 2010–2015. Following Salehi et al. (2017), content analysis is used to measure the level of social responsibility disclosure, and hypotheses are performed using multiple regression analysis and R software.
Findings – The results represented that there is a positive significant relationship between a firm size and a firm age with the level of CSRD. However, there is a negative significant association between financial leverage and profitability with the level of CSRD. Given that CSRD is different among various industries and the type of industry can be an influential factor in CSRD, an industry type variable in the fourth hypothesis is of a type of index variable and has eight levels, of which the first level is ranked as the base level. Our findings showed that the level of CSRD at industries of machinery and appliances, production of metal products, food and beverage products, and textiles is lower than the baseline level (pharmacy). Nevertheless, companies in the fifth industry (mineral products) have a higher level of CSRD in comparison with the pharmacy industry. Moreover, the authors find that there is a significant positive connection between audit fees and CSRD. This implies that Iranian managers in an inflationary economy probably manage earnings when they provide more CSRDs, which leads to increase in the audit risk and audit fees.
Practical implications – Needless to say, the findings of this paper will have practical implications for investors, auditors and other users of financial statements. First of all, this study will aware them of the fact that when a country faces economic sanctions and most of its companies are in financial strain investors should not consider the firms engaging in corporate social responsibility activities to behave morally and provide transparent financial reports. Second, the results will convince auditors to be conservative toward the firms that are financially distressed, for audit risk of them will be high. Thus, policymakers should be cautious concerning directors' opportunistic actions and increase monitoring to enforce social obedience.
Originality/value – The turning point of this research is related to the time period of research related to firms that have faced severe financial problems due to economic sanctions. In fact, the study revealed another aspect of CSRD that could have negative consequences when managers are in financial strain and take opportunistic actions.
Keywords CSR disclosure, Firm size, Audit fees, Financial leverage
Paper type Research paper
1. Introduction
Despite the fact that corporate social responsibility (CSR) is a new term, the idea of informing its emergence in the business world has always been recognized from the earliest times. The concept that the business practices rely on moral principles and "controlled greed" was encouraged by famous western researchers like Cicero in the first century before Christ and eastern scholars like India's Kautilya in the fourth century before Christ (Blowfield and Frynas, 2005). The fact that economic groups which operated in a normative value giving environment are connected in an input–output link with other subsystems like church, family, government and school implies that the firms' accountability spreads beyond mere productive efficiency and the maximization of shareholders' wealth (Johnson, 1979). Nowadays, improved industrialization and increase in foreign investment have implications for corporate accountability, reporting on employee and ethical topics. This, in turn, has caused increase in demands for enhanced accountability and transparency in commercial practices (Belal and Owen, 2007). Apparently, organizations not only have a dynamic role in financial markets and cannot limit their attention only to economic goals, but also they must be focused on a more qualitative approach and pay attention to environmental responsibility practices through internal and external reports (Guthrie and Farneti, 2008). What is clear is that business units cannot escape from society and society cannot exist without business units; therefore, there is a two-way communication between business units and society. CSR toward the society is beneficial for both business units and society, and a better understanding of its potential benefits can lead to high returns on investment for the companies (Sandhu and Kapoor, 2010; Salehi et al., 2017). Investors and other stakeholders use environmental information in making their decisions. Extensive evidence shows that social and environmental information is useful for investors and other stakeholders' decisions (Blacconiere and Patten, 1994; Richardson and Welker, 2001; Salehi et al., 2017).

In recent years, theories have argued that business units will be able to create wealth, employment and innovation and improve their competitiveness in business if companies work together to maintain their community, and society will also provide the right platform for the development of business units (Sandhu and Kapoor, 2010). Increasing sales and customer loyalty is the example of CSR advantage; hence, a number of studies have suggested that a large and growing market has been created by companies with high social responsibility (Sandhu and Kapoor, 2010). Generally speaking, business units optionally can maximize their long-term returns through reducing its negative effects on society; therefore, nowadays a kind of belief among business units is increasing stating that their long-term success can happen through managing the company's operations, ensuring environmental protection and development of CSR (Samy et al., 2010). Therefore, paying attention to social responsibility by organizations will ensure long-term interests even when the short-term costs of social responsibility are high.

Many studies of environmental disclosure in annual reports have focused on firms among developed markets such as the USA, the UK, Canada, Australia, New Zealand, Japan and the European Union (Kolk et al., 2001). In the case of the Iranian market, a developing country, this is not known at all. Therefore, this paper investigates the narrative disclosures of environmental information in the annual reports of listed companies on the Tehran Stock Exchange (TSE) between the amount of environmental disclosure and various factors investigated in previous research. There are several main questions in the study: What is the extent and content of environmental information disclosure in Iranian corporate annual reports, and what are the factors influencing those environmental disclosures? Given the importance of social responsibility, this current study tries to investigate the association between some characteristics of corporations and some audit variables with the level of CSR disclosure in a developing country called Iran. The point is that since Iranian market has faced severe economic sanctions during the recent years, the vast majority of Iranian firms had financial problems. The key question is now whether the managers of these companies use the disclosure of social responsibility for their own opportunistic purposes when they
have many financial problems. In this economic situation, we also want to know if the long-term presence of auditors is an impediment to companies that intend to satisfy shareholders desires with environmental disclosure so that they can easily engage in earnings management actions to take a beautiful picture of their financial performance.

The rest of the aforementioned research is organized as follows: the next section describes the theoretical framework and explains the hypotheses development and literature. Section 3 presents the research design and outlines from where data are obtained and the sample selection procedure. Section 4 then presents the main results and implications drawn from statistical analyses. Finally, the last section presents the conclusion.

2. The theoretical framework, hypotheses development and literature

During the recent years, research direction in relation to CSR has changed. The focus of several researchers has shifted from evaluating corporate social responsibility disclosure (CSRD) to discovering its determinants (Purushothaman et al., 2000; Eng and Mak, 2003; Kotonen, 2009; Khlif and Souissi, 2010). These days, the commercial world is understanding the importance of CSRD and a wide range of firms is encouraged to take social responsibility action (Welford et al., 2006; Salehi et al., 2017). There is still ambiguity in academic communities about how CSR should be defined. In fact, this uncertainty is caused by a lack of clarity in relation to the underlying concepts and definitions of social responsibility (Mackey et al., 2007; Salehi et al., 2017). From Aguilera et al.’s (2007) and Salehi et al.’s (2017) point of view, researchers still disagree on fundamental topics of what establishes social responsibility. For example, CSR contains economics, law, ethics and philanthropic expectations of business units that extend to all beneficiaries (Salehi et al., 2017). Beneficiaries could be defined as any individual or group that affects the decisions, strategies or the organization’s purposes (Danko et al., 2008). Heal (2005) believed that CSR is a participation in different activities that reduce the amount of externalized costs or avoid distributional conflicts. Besides, World Bank has defined CSR as the “commitment of business to contribute to sustainable economic development, working with employees, their families, the local community and society at large to improve their quality of life, in ways that are both good for business and good for development” (WBCSD, 1998).

As far as we know, CSR disclosure is a complex issue that cannot be clarified by a single theory (LalJoshi and Gao, 2009; Huang and Kung, 2010; Salehi et al., 2017). There are several theories that explain the company’s motivation for disclosing environmental and social information. In fact, these theories include stakeholder theory, legitimacy theory, organizational theory and the theory of political economy (Jenkins and Yakovleva, 2006; Salehi et al., 2017). According to organizational theory, organizational activities are limited by a variety of external pressures. Based on the assumptions of this theory, organizations should be responsive to external demands and expectations of society in order to maintain their legitimacy (ISLAM, 2009). Political economy theory based on the literature on environmental and social accounting was extracted from the writings of Parker in the 1990s. This theory argues that accounting can play a pivotal role in the organizational structure and its surroundings (Guthrie and Parker, 1990). Furthermore, the company’s environmental and social disclosure is used as a management tool for dealing with political and social pressures (Guidry and Patten, 2012). In order to maintain a firm’s position in society, management may publish information related to environmental and social activities, and if it is determined that an organization has been involved in undesirable social activities, this leads to its destruction. According to Gray et al. (1996), legitimacy theory and stakeholder theory are both derived from political economy theory. Legitimacy theory focuses on the assumption that an organization must preserve its social role by responding to the needs of society. Based on this theory, the survival of an organization is sustainable by market pressures and society expectations (ISLAM, 2009). Legitimacy theory
is based on the fact that there is a social contract between business units and society (Deegan et al., 2000). On the basis of the social contract, the company will have a social contract with society to perform certain duties in the field of justice. Legitimacy theory has forced the company to respond to the demands of different stakeholders through legitimizing their activities (Haniffa and Cooke, 2005). Another important point is that legitimacy theory and stakeholder theory are often used to complement each other (Deegan, 2002). The stakeholder theory is one of the relatively new theories in the field of management, and the philosophy of its existence lies in corporate responsibility. Systematically, the stakeholder theory seeks to identify groups of stakeholders that deserve the most attention from managers (ISLAM, 2009). Hence, Azizul Islam and Deegan (2008) evaluated the functions of environmental reports and concluded that corporate disclosure was changed due to stakeholder’s expectations. While making decisions, activities and their operations, firms should consider the interests of all stakeholders. Actually, stakeholders are all those who are affected by the consequences of the company’s decisions and actions. Internal stakeholders are employees and shareholders who are directly influenced by the company’s decisions and operations, whereas external stakeholders are citizens, customers, suppliers, competitors, government and societal institutions. There is no getting away from the fact that corporations should respect the interests of the stakeholders and society and should be responsible for all of them (Clarkson, 1995; Salehi et al., 2017). The following six cases contain detailed information about CSR toward the environment, products, human resources, customers and society:

(1) CSR toward the environment: providing information to show that the operation is clean and in compliance with pollution laws and regulations, providing information on reducing pollution from operations, pollution control – air, water, land – prevention or damage reconstruction created in the environment in the operation process, conserving natural resources and preventing or treating the waste and reusing waste materials such as glass, plastic, etc., and supporting the activities of environmental groups and membership in environmental agencies or organizations, environmental strategies and policies are all examples of environmental disclosures (Kansal et al., 2014; Haniffa and Cooke, 2005).

(2) CSR toward the products and providing services: these include providing information about developments related to the company’s products, including its packaging and manufacture of reusable containers, research and development of products and their advantages, receiving the award on product quality and increasing their value, disclosing improved methods and health services in the preparation of the products and providing information about the product’s safety and health (Kansal et al., 2014; Muttakin and Khan, 2014).

(3) CSR toward human resources: corporate responsibility for human resources includes disclosure of the percentage or number of employees working at different levels, collecting information about the financial ability of staff, communicating with employees to improve job satisfaction and motivation, loans and other payable benefits, nondiscrimination in employment, educational programs to develop the employees’ skills and quality level, measures regarding the staff’s safety and physical and mental health, providing sports facilities and welfare and including staff welfare fund (Kansal et al., 2014; Haniffa and Cooke, 2005). People enter organizations with needs, skills and expectations and want to work in an environment where they can use their abilities to satisfy their needs. If organizations create such opportunities for their employees, levels of organizational commitment will increase (Vakola and Nikolaou, 2005).

(4) CSR toward customers: includes attention to client rights to increase sales and customer loyalty. A number of studies point out a large and growing market for
products and services created through companies with high social responsibility (Sandhu and Kapoor, 2010). According to Chunfang (2009), “in the literature of social responsibility, organizations involved with this phenomenon can obtain customers’ positive comment on the brand evaluation and selection and offer it to others and gain a good attitude and image concerning the organization and even earn additional pay satisfaction.” The client rights considered in this study can be: meet the needs of customers, customer safety, customer satisfaction and providing after-sales service facilities.

(5) CSR toward society: issues related to participation in social activities include social investments such as providing internship opportunities for students and transferring experiences and knowledge to them and giving scholarships to talented students in need, supporting or helping communities with grants, awarding grants to charities and rehabilitation institutions, supporting local industries, corporate partnerships in charitable donations and encouraging employees to participate in them, awarding grants to the research centers and financing projects related to public health, as social objectives, policies and missions of the enterprise (Kansal et al., 2014; Haniffa and Cooke, 2005).

(6) CSR toward energy: efficient use of energy or energy-saving information, research in order to promote energy efficiency, receiving rewards or penalties in relation to energy consumption, policies regarding efficient use and reducing energy consumption and the use of new sources are all instances of energy-related disclosures (Kansal et al., 2014).

This criticism is always raised by some researchers that the level of CSR disclosures among developing countries is not as adequate as developed countries (Belal and Cooper, 2011; Idemudia, 2011). Precisely because of this reason, many researchers such as Dobers and Halme (2009) and Visser (2008) believed that CSR research should be more focused on emerging markets than developed markets. Dobers and Halme (2009) investigated the CSR among developing countries and realized that the different norms and institutional environment are influential in creating different results in those countries. They also found that these countries disclose the CSR information in the form of descriptive and on a voluntary basis, whereas a study by Gjølberg (2009) in developed countries documented that firms’ CSR practices are very important and vital. Obviously, the performance of CSR disclosure among developing countries is not as strong as developed countries like America. Developing countries are facing extreme challenges to cope with high inflation, economic sanctions, education, equal social justice and much more. Especially, Iran has experienced many economic problems such as high inflation and economic sanctions during recent years (Salehi, Tarighi and Sahebkar, 2018). Undoubtedly, in such a bad economy, many companies are likely to manage profits to better demonstrate financial performance. Now, one has to ask the fundamental question of whether a long-term working relationship between the auditor and the client affects the level of CSR disclosure. Is it possible that corporate managers have a bad intention to disclose environmental information under a particular economic situation? It seems that our research will have an appropriate answer to these questions.

2.1 The relationship between CSR disclosure and firm size

Large companies are of particular interest to different groups in society, and they also are under more pressure to disclose CSR in order to legitimize their activities; hence, there is a significant positive relationship between CSR disclosure and firm size (Muttakin and Khan, 2014). For example, Maranjoori and Alikhani (2014) showed that there is a significant positive relationship between firm size and the level of social and environmental disclosure.
In other words, the disclosure of environmental and social information by Iranian larger companies is more than that of smaller firms. In fact, bigger firms suffer from greater social pressures and need to legitimize their activities in the community; in addition, the larger companies often use tools such as the disclosure of environmental and social information in order to reduce political costs (Gray et al., 2001; Haniffa and Cooke, 2005). The findings of Haro-de-Rosario et al. (2017) also showed that the largest, most money-making oil and gas firms are interested in publishing the most complete CSR reports. Based on documentation in a developing country called Romania, Badulescu et al. (2018) concluded that there is a positive connection between firm size and CSR disclosure. In other words, the younger a firm is, the less likely it is that it gets involved in CSR. Furthermore, in an interesting study, Salehi et al. (2017) found that the structure of the board of directors and company ownership does not affect CSR disclosure in Iranian market. Some previous studies have shown that on the condition that firms are larger, the level of CSR disclosure will increase (Adams et al., 1995; Belkaoui and Karpik, 1989; Cullen and Christopher, 2002; Cormier and Magnan, 2003; MohdGhazali, 2007; Naser et al., 2006; Brammer and Pavelin, 2008; Reverte, 2009; Chih et al., 2010; Suttipun and Stanton, 2011; Bounton et al., 2011; Setyorini and Ishak, 2012; Al-Gamrh and AL-Dhamari, 2016; Syed and Butt, 2017; Issa, 2017; Wuttichindanon, 2017), whereas Roberts (1992), Barako et al. (2006) and Smith et al. (2007) did not find such an association. It is understood that bigger companies disclose more social responsibility as the public sector is paying more attention to larger companies. Therefore, these firms not only are under more pressure for providing social responsibility, but also have many stakeholders who care about corporate social programs (Cowen et al., 1987). Given the foregoing, we expect the first hypothesis to be as follows:

\( H1. \) There is a significant relationship between the level of CSR disclosure and the size of the company.

### 2.2 The relationship between CSR disclosure and financial leverage

Financial leverage is one of the things that can affect CSR disclosure. Generally speaking, companies with greater financial leverage seek to legitimize their actions against creditors and shareholders (Haniffa and Cooke, 2005). Andrlikopoulos et al. (2014) examined the role of CSR reporting among financial institutions and concluded that financial institutions pay attention to the CSR. Their research on listed companies on the New York Stock Exchange shows that large corporations with high financial leverage have a high level of CSR disclosure. In Polish market, Dyduch and Krasodomska (2017) found a relationship between company turnover, the duration of the stock exchange listing, inclusion in the Respect Index portfolio and foreign capital share, and the level of CSR disclosures. Similarly, Hibbit (2003) and Orij (2007) saw a positive association between CSR disclosure and financial leverage. The studies of Christopher and Filipovic (2008) and Ma and Zhao (2009) also showed that firms with high financial leverage are very likely to disclose more the CSR information. However, Veronica Siregar and Bachtiar (2010) and Issa (2017) did not experience any linkage between financial leverage and CSRD index; additionally, Belkaoui and Karpik (1989) discovered a negative association between financial leverage and the level of CSR disclosure:

\( H2. \) There is a significant relationship between the level of CSR disclosure and financial leverage.

### 2.3 The relationship between CSR disclosure and profitability

Profitable companies try to show their contribution to the welfare of society through the disclosure of social responsibility (Muttakin and Khan, 2014). There must be a kind of
correlation between profits and other social goals, and the fair recognition of a social issue may have a positive effect on the short-term and long-term functions of the organization. Roberts (1992) and Chan and Kent (2003) supposed that social and environmental disclosures are positively related to corporate performance. Khoejastehpour and Johns (2014) examined the impact of environmental CSR (climate responsibility and natural resource utilization) on corporate/brand reputation and corporate profitability. The results of their studies proved that environmental CSR positively is connected with the corporate/brand reputation and business profitability. In the context of Bangladesh, Bhuyan et al. (2017) found that long-term disclosure plays a key role in improving firm profitability. In addition, Platonova et al. (2018) suggested that there is a significant positive association between CSR disclosure and the financial performance of Islamic banks in the Gulf Cooperation Council countries. In short, many studies have shown that corporate financial performance is positively connected with the level of CSR disclosure (Cormier and Magnan, 1999; Tagesson et al., 2009; Issa, 2017), whereas some scholars have expressed another point about the impact of CSR. For example, Cox et al. (2004), McWilliams and Siegel (2001), Smith et al. (2007) and bin Abd. Rahman et al. (2009) argued that CSR cannot have any effect on corporate performance. Given that the research results are different in relation to the company’s profitability and CSR, we will find out if there is a meaningful relationship between the company’s profitability and CSR:

H3. There is a meaningful relationship between the level of CSR disclosure and profitability.

2.4 The relationship between CSR disclosure and type of industry

The type of industry is one of the cases that can be effective in exposing CSR, for instance, the pressure of international buyers on the export market is an important factor as regards CSR disclosure. Hence, companies disclose CSR to illustrate their desirable international image, and failure to comply with it may result in the loss of their contracts (Belal and Owen, 2007; Azizul Islam and Deegan, 2008). Some empirical studies have shown a strong connection between corporate industry and CSR (Deegan and Gordon, 1996; Adams et al., 1998; Cormier and Magnan, 2003; Cormier et al., 2005; Brammer and Pavelin, 2008; Reverte, 2009; Hou and Reber, 2011; Bouten et al., 2011). Haniffa and Cooke (2005) claimed that companies disclose information more about the work of their hard-working employees in the manufacturing industry; besides, consumer-oriented industries are more exposed to social disclosure for a better image of themselves among consumers. Reverte (2009) in his research showed that the manufacturing industries that are more environmentally friendly are very likely to disclose environmental information more than companies in other industries. The reason is that the manufacturing processes of other industries are likely to have a negative impact on the environment. Kansal et al. (2014) examined determinants of CSR disclosures in the Indian market. Their results indicate that the size of the company and the type of industry are significantly related to corporate social disclosure. Muttakin and Khan (2014) indicated that companies in the consumer industries are less likely to disclose CSR, whereas other companies that belong to other industries disclose more CSR information. Although Syed and Butt (2017) witnessed a positive association between industry type and CSR disclosure among firms listed on Karachi Stock Exchange, Al-Gamrh and AL-Dhamari (2016) did not find any significant connection between them among firms listed on Saudi Stock Exchange. In this research, we examine the relationship between social responsibilities of TSE manufacturing companies in different industry groups. In fact, the question arises whether there is a relationship between the disclosure of social responsibility and the type of industry:

H4. There is a significant association between the level of CSR disclosure and the type of industry.
2.5 The relationship between CSR disclosure and company’s age

The age of a company can be an important factor in determining the disclosure of CSR. Alsaeed (2006) tested for the first time the company’s age variable as one of the potentially influential factors on the level of disclosure. The rationale for choosing this variable is based on the fact that older companies have expanded their financial reporting procedures over the years (Camfferman and Cooke, 2002). Regarding the probable positive impact of company’s age on CSR disclosure, Owusu-Ansah (1998) argued that younger companies may, because of competitive considerations, prefer not to disclose information such as R&D expenditures, capital expenditures and product development expenses. The costs and problems of collecting, processing and disseminating information for younger companies are heavier, too. Hence, companies with a greater lifespan disclose more social responsibility (Roberts, 1992). Chunfang (2009) investigated the impact of the effective factors on the level of CSR disclosure in China. He showed that the factors such as the scale of enterprises, years of operation, novation capacity, export intensity, management skills, financial performance, product competitiveness, government intervention and legal environment have a strong influence on improving the CSR disclosure. Waluyo (2017) showed that firm size and firm age are positively linked to CSRD. Cormier et al. (2005) and Al-Gamrh and AL-Dhamari (2016) proved that there is a positive relationship between the corporate age and the level of CSR disclosure, whereas Rahman (2011) did not find this connection between them. Given the above, we expect the fifth hypothesis to be as follows:

H5. There is a significant association between the level of CSR disclosure and the firm’s age.

2.6 The relationship between CSR disclosure and audit fee

Effective factors on audit fees are divided into two general categories. The first group is the characteristics of an audit firm, and the second group is relative to the client that invites audit firm to perform the company’s audit work (Griffin et al., 2010). In less developed countries, audit fees are determined by the level of activity and characteristics of auditors, and the determinants of audit fees in most of these countries include the size of companies, the complexity and scope of operations, and the type of auditor who audits the financial statements of the company (Karim, 2010). Based on the agency theory, there is a conflict of interest between managers and owners which results in creating agency costs (Salehi et al., 2017). What is worth mentioning is that using CSR optional disclosure, corporate managers are apt to show they are really interested in taking steps into the interests of shareholders (Salehi et al., 2017). Additionally, the disclosure of such information contributes to align the executives and minority interests (Ghazali and Weetman, 2006). Taking together, we are of the opinion that the complexity of financial statements and even the financial conditions of companies might affect audit costs. This means that the firms that have decent CSR disclosure and also have unfavorable financial conditions are likely to abuse public confidence and attempt to manipulate financial statements to mask their poor financial performance. In this regard, Muttakin et al. (2015) indicated that managers in an emerging economy manage earnings when they provide more CSR disclosures. Another reason is that since these firms have a wide range of corporate governance, they will need more audit efforts. For instance, Kim and Kim (2013) showed a positive and significant relationship between corporate audit fees, CSR’s non-financial information and corporate governance practices. Companies that have disclosure of good social responsibility and a wide range of governance pay higher audit fees because they have larger financial standards that require more auditors’ efforts to audit accurately. As formerly mentioned, since Iran faced economic sanctions during the time period of this study, the majority of Iranian firms had many financial problems. In such an economic atmosphere, they would be required to manipulate accounting figures so as to show better their financial performances. Thus, these firms even
with a high level of CSR disclosure are expected to have a high audit risk. Generally speaking, given the high audit risk of Iranian companies as well as the wider range of financial standards of companies with good CSR disclosure, it is very likely to exist a positive link between the level of CSR disclosure and audit fees in Iranian market. Thus, the purpose of the present research is to determine whether there is a meaningful relationship between the disclosure of CSR and audit fees:

**H6.** There is a significant relationship between the level of CSR disclosure and audit fees.

**2.7 The relationship between CSR disclosure and audit firm’s tenure**

In Iran, according to the instructions of the Supreme Council of the TSE, which was passed on October 27, 2007, audit firms are not allowed to re-accept the independent auditors’ position or legal inspector of the same company after four years. Advocates of the change of auditor believe that in the case of compulsory change, auditors will be able to resist the pressure and desires of managers and make a more neutral judgment. The long-term presence of auditors with a client creates an incentive to maintain the views of the client’s management, a situation that undermines their independence and impartiality. If we look at the economic conditions of Iran between 2010 and 2015, we will realize that Iranian companies suffered from financial distress due to severe economic sanctions (Salehi et al., 2017). In this situation, clients probably expect auditors with high tenure to endorse the management view of disclosing CSR. On the other hand, opponents of the change of auditor have a different opinion. They believe there are other factors that force auditors to maintain their independence, for example, the auditors’ efforts to maintain credibility and reputation and fear of the possibility of litigation against them are mechanisms that prevent auditors’ inappropriate behaviors. In this regard, Chen et al. (2008) stated that auditors gain a better understanding of the client’s activities and also gain more experience over time. Hence, it is argued that the long-term presence of auditors is an impediment to companies that intend to keep shareholders happy with environmental disclosure so that they can easily engage in earnings management activities to show a beautiful image of their own corporate financial performance. Logically, according to the views of both groups, one can expect a significant relationship between audit tenure and the level of CSR disclosure in the Iranian context:

**H7.** There is a significant connection between the level of CSR disclosure and audit tenure.

**2.8 The relationship between CSR disclosure and audit firm’s size**

In order to understand the relationship between the size of an audit firm and the level of CSR disclosure, we have to take into account a few very important points. First of all, exactly contrary to the agency theory, stewardship theory declares that the main purpose of corporate directors is to maximize shareholder wealth (Salehi et al., 2017). According to the economic climate of Iranian firms between 2010 and 2015, it can be envisaged that managers improve their corporate financial situation using the publication of social and ecological information. Another interesting point is that big auditors are more conservative compared to small ones, and they often refuse to accept the poor financially firms (Salehi, Tarighi and Sahebkar, 2018). In fact, it is anticipatable that famous and bigger firms are usually audited by big audit firms because they have better financial resources and less engage in earnings management. In other words, most popular firms tend to disclose their social responsibilities so as to attract more attention from investors and other users of financial statements because local and international investors consider social and environmental information very important in investment decisions (Yekini, 2008; Salehi et al., 2017). In this regard, Wuttichindanon (2017) believed that a firm that uses a Big 4 audit firm is more likely to participate in CSR disclosure. In Nigeria,
Uwuigbe and Egbide (2012) also concluded that there is a positive association between the size of the audit firm and the level of CSR disclosure, although some studies such as Al-Gamrh and AL-Dhamari (2016) have shown no significant influence of audit firm size on CSR disclosure. In short, it is conceivable that there is a causal relationship between the level of CSRD and the size of the audit firm. Therefore, the last hypothesis is expected to be as follows:

\[ H8. \text{ There is a significant connection between the level of CSR disclosure and audit firm size.} \]

3. Research methodology

This paper is considered correlational in terms of exploring the association between variables. After collecting the required data from reliable and available resources, they were evaluated using the R software. Just like the study of Salehi et al. (2017), “F-Limer test” was first used to determine the use of panel data model or ordinary regression model (OLS) to analyze the data. The Hausman test was then used to check random effects model vs fixed effects model. The presence or absence of serial correlation between the disturbing elements (model error), which are in fact the postulate underlying panel data model, is examined using “Breusch–Godfrey test.” Finally, the fitting results of the final model are done by using the exploratory method.

3.1 Population and statistical samples

The target population included all companies listed on the TSE, during the period 2010–2015. Common features of the companies to determine the population are as follows:

1. the type of company activity is productive; thus, investment companies, leasing, credit and financial institutions and banks are not included in the sample due to their different natures;
2. based on the research time period (2010–2015), the company is listed on the TSE before the year 2010, and its name is not removed from the companies mentioned by the end of 2015;
3. the activities of selected companies have not stopped, and their financial period has not changed during 2010–2015; and
4. the financial statements required should be available so as to extract the required data.

Regarding the above conditions, a sample size of 125 firms from firms listed on the TSE has been selected. Owing to the limited population size and the fact that the statistical method chosen easily analyzes the information from these companies, there was no need to choose the sample and then the research had no sampling methods (Table I).

<table>
<thead>
<tr>
<th>Industry name</th>
<th>No.</th>
<th>Firm-year observation</th>
<th>% of the sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pharmacy</td>
<td>1</td>
<td>72</td>
<td>9.6</td>
</tr>
<tr>
<td>Automotive and the manufacture of automotive parts</td>
<td>2</td>
<td>102</td>
<td>13.6</td>
</tr>
<tr>
<td>Machinery and appliances</td>
<td>3</td>
<td>48</td>
<td>6.4</td>
</tr>
<tr>
<td>Chemical products</td>
<td>4</td>
<td>96</td>
<td>12.8</td>
</tr>
<tr>
<td>Mineral products</td>
<td>5</td>
<td>234</td>
<td>31.2</td>
</tr>
<tr>
<td>Production of metal products</td>
<td>6</td>
<td>66</td>
<td>8.8</td>
</tr>
<tr>
<td>Food and beverage products except for sugar</td>
<td>7</td>
<td>108</td>
<td>14.4</td>
</tr>
<tr>
<td>Textiles</td>
<td>8</td>
<td>24</td>
<td>3.2</td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
<td>750</td>
<td>100</td>
</tr>
</tbody>
</table>

Table I. Firm-year observations distributed across the industry sectors
Looking at the details, as regards sample industry distribution, textiles have the lowest and mineral products have the highest number of observation in our statistical sample.

3.2 Research hypotheses test model

In the research model, using the coefficient of $\beta_1-\beta_5$, we investigate some features of corporations including firm size, financial leverage, profitability, firm age and industry type with the level of CSRD in Iranian market. Following this, the purpose of our study is to evaluate the impact of some audit variables ($\beta_6-\beta_9$) on the level of CSR disclosure:

$$CSR = \alpha + \beta_1 \text{Firm size} + \beta_2 \text{Financial leverage} + \beta_3 \text{Profitability} + \beta_4 \text{Industry}$$
$$+ \beta_5 \text{Firm age} + \beta_6 \text{Audit fee} + \beta_7 \text{Audit tenure} + \beta_8 \text{Audit size} + \epsilon.$$

3.3 The definition of variables

The dependent variable. Following Salehi et al. (2017), this study employs the content analysis method in order to analyze the CSR information disclosure level. Content analysis is a way of encoding text into different groups according to pre-defined criteria that are widely used in the research related to social and environmental disclosure since this method provides a systematic approach for researchers to analyze large unstructured data (Azizul Islam and Deegan, 2008). The coding method contains reading annual reports and determining any information related to environmental and social subjects and their classification to appropriate section and subsection. To measure the levels of environmental and social disclosure in the current research, after an extensive review of the relevant literature, the final checklist was adopted from Muttakin and Khan (2014), Kansal et al. (2014), Maranjoori and Alikhani (2014) and Salehi et al. (2017). After developing the checklist, coding rules were determined so that each disclosure subsection is defined clearly and operationally. Should the company disclose each of the indices above in financial reports and annual reports to the board of directors in the General Assembly, the dummy variable is 1, otherwise 0. The total score for each section is divided by the total relevant questions and thereby each company’s social responsibility disclosure level is measured.

Independent variables

- Firm size: total assets or total sales can be used as a basis for calculating the size of a company. In this study, the total assets of a company are used so as to measure the size of a company.
- Financial leverage: this variable is calculated through long-term debt scaled by total assets.
- Corporate profitability: in this paper, profit after deduction of tax (Pat) is considered as the corporate profitability index.
- Firm age: the length of time that a company has existed.
- Industry type: the present study examines the level of CSR disclosure in the eight manufacturing industries. These industries are comprised of Industry 1 (pharmacy), Industry 2 (automotive and the manufacture of automotive parts), Industry 3 (machinery and appliances), Industry 4 (chemical products), Industry 5 (mineral products), Industry 6 (production of metal products), Industry 7 (food and beverage products except for sugar) and Industry 8 (textiles).
- Audit fee: this variable is the natural logarithm of the total audit fee of the external auditor.
• Audit firm’s tenure: this variable is defined as the length of the auditor-client relationship. Drawing on the instructions of the Supreme Council of the TSE in 2007, audit firms are not allowed to re-accept the independent auditors’ position or legal inspector of the same company after four years. Consequently, in this study, the tenure period is defined to be between one and four years.

• Audit firm size: this indicator variable equals 1 if the auditor is a member of the auditing organization in Iran and 0 otherwise.

4. Results
4.1 Descriptive statistics
In order to evaluate the data, the descriptive statistics containing minimum, maximum, mean and standard deviation were first calculated and are presented in Table II. The average CSRD index is equal to 23 percent. It implies that the sample firms are reluctant to disclose their social responsibility and the disclosure level in selected firms is close to the ground. In addition, the results show that the minimum lifespan of companies is seven years, whereas the maximum lifetime of firms is 64 years, which is relevant to a company in Industry 7 (food and beverage products except for sugar).

Table III presents the descriptive statistics of qualitative variables. The variables of audit firm size and audit firm’s tenure are of the type of indicator variables, in which frequency of each class is specified. The outcomes of the table show that approximately 60 percent of Iranian companies are audited by big auditors. Almost one-third of Iranian audit firms have a four-year relationship with their own clients, too.

4.2 Variance inflation factor (VIF)
In econometrics, multicollinearity problem occurs when two or more explanatory variables (independent) in a multiple regression are highly correlated with each other. The correlation here is a linear relationship between independent variables. Depending on the intensity of the correlation between the independent variables, the degree and the type of collinearity will differentiate. In statistics, the VIF measures the severity of multicollinearity in an OLS regression model.
regression analysis. It provides an index that measures how much the variance of an estimated regression coefficient is increased due to collinearity (Salehi, Tarighi and Safdari, 2018) (Table IV).

As for the VIF value, in case the VIF of the estimated model coefficients is less than 10 there would be no linearity problem. As a result, this value is less than 10, which means that there is no linearity in relation to the research variables.

4.3 The results of the research model

In this paper, we are going to observe if there is a relationship between some characteristics of firms comprising firm size, financial leverage, profitability, firm age and the type of industry with social responsibility disclosure of firms listed on TSE. Moreover, the second objective of this study is surveying the connotation between the level of CSRD and some of the audit variables such as audit fees, audit tenure and audit firm’s size. Hence, the results of all the hypotheses of this research are presented in Table V.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Variance inflation factor (VIF)</th>
</tr>
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<tbody>
<tr>
<td>Firm size</td>
<td>4.001</td>
</tr>
<tr>
<td>Financial leverage</td>
<td>1.087</td>
</tr>
<tr>
<td>Profitability</td>
<td>1.001</td>
</tr>
<tr>
<td>Firm age</td>
<td>1.329</td>
</tr>
<tr>
<td>Audit fee</td>
<td>3.214</td>
</tr>
<tr>
<td>Audit firm size</td>
<td>3.007</td>
</tr>
</tbody>
</table>

Table IV.
The linearity test of model variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Standard error</th>
<th>t-statistics</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firm size</td>
<td>2.819</td>
<td>0.356</td>
<td>9.411</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Financial leverage</td>
<td>-2.537</td>
<td>1.045</td>
<td>-2.521</td>
<td>0.014</td>
</tr>
<tr>
<td>Profitability</td>
<td>-0.008</td>
<td>-0.002</td>
<td>-2.341</td>
<td>0.002</td>
</tr>
<tr>
<td>Firm age</td>
<td>0.131</td>
<td>0.034</td>
<td>-3.571</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Industry 2</td>
<td>0.133</td>
<td>1.495</td>
<td>0.179</td>
<td>0.694</td>
</tr>
<tr>
<td>Industry 3</td>
<td>-4.375</td>
<td>1.828</td>
<td>-2.535</td>
<td>0.028</td>
</tr>
<tr>
<td>Industry 4</td>
<td>1.618</td>
<td>1.008</td>
<td>1.129</td>
<td>0.443</td>
</tr>
<tr>
<td>Industry 5</td>
<td>2.835</td>
<td>1.375</td>
<td>2.044</td>
<td>0.039</td>
</tr>
<tr>
<td>Industry 6</td>
<td>-3.438</td>
<td>1.712</td>
<td>-2.035</td>
<td>0.041</td>
</tr>
<tr>
<td>Industry 7</td>
<td>-8.082</td>
<td>1.557</td>
<td>5.196</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Industry 8</td>
<td>-9.859</td>
<td>2.719</td>
<td>3.819</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Audit fee</td>
<td>3.442</td>
<td>0.933</td>
<td>3.519</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Audit tenure 2</td>
<td>-0.367</td>
<td>1.228</td>
<td>-0.301</td>
<td>0.895</td>
</tr>
<tr>
<td>Audit tenure 3</td>
<td>-0.049</td>
<td>1.316</td>
<td>-0.042</td>
<td>0.846</td>
</tr>
<tr>
<td>Audit tenure 4</td>
<td>-2.324</td>
<td>1.215</td>
<td>-2.324</td>
<td>0.019</td>
</tr>
<tr>
<td>Audit firm size</td>
<td>0.194</td>
<td>0.881</td>
<td>0.257</td>
<td>0.938</td>
</tr>
</tbody>
</table>

Summary model

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>F-statistic</td>
<td>4.839.13</td>
</tr>
<tr>
<td>Prob. F-statistic</td>
<td>0.000</td>
</tr>
<tr>
<td>Durbin–Watson state</td>
<td>2.16</td>
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<tr>
<td>$R^2$</td>
<td>0.49</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.47</td>
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<tr>
<td>Prob. F-liner test</td>
<td>0.005</td>
</tr>
<tr>
<td>Prob. Hausman test</td>
<td>0.18</td>
</tr>
<tr>
<td>Prob. Breusch–Godfrey test</td>
<td>0.034</td>
</tr>
</tbody>
</table>

Table V.
Results of the model hypotheses
What stands out from Table V is that since the $p$-value calculated for $F$-statistic is less than 0.05, the significance of the whole model can be confirmed at the 5 percent error level. The results also show that since the value of $R^2$ is high, it can be concluded that the model will fit better our data. In addition, because the amount of Durbin–Watson state is 2.16 (between 1.5 and 2.5), this provides strong evidence of the lack of serial autocorrelation (first lag) in the residuals. It should be noted that the F-Limer test in this paper is used to determine whether to use the panel data model or the normal regression (OLS). The outcomes proved that we must apply the panel method because the amount of the $p$-value is less than 5 percent. After that, the Hausman test is used to investigate the random effects model vs a fixed effects model. Given that the $p$-value is equal to 0.18 and greater than 5 percent, the panel model with random effects is accepted. Finally, the “Breusch–Godfrey test” is used to check the serial autocorrelation. Since the $p$-value is 0.034 and less than 0.05, the final research model is the panel model with random effects.

Regarding the features of firms, it can be seen that the value of $p$-value for the company size variable is less than 0.05 percent, so the coefficient of this variable has a significant relationship with the dependent variable (CSR). As a result, there is a significant relationship between company size and CSR, and the first hypothesis is accepted. Moreover, the coefficient of the financial leverage variable is 2.537 and its $p$-value is less than 5 percent; therefore, there is a meaningful and negative correlation with the CSR disclosure. Considering the significant level of corporate profitability, the third hypothesis with a $p$-value of 0.003 is not rejected. This means that there is a meaningful relationship between corporate profitability and the disclosure of CSR. In other words, the change in the company’s profit causes a change in the level of CSR disclosure. Due to the negative coefficient of the profitability variable, there is an inverse relationship between the two variables. What is more, the significance level of the company’s lifetime variable shows that this hypothesis is confirmed by a coefficient of 0.131 and a $p$-value less than the error level of 5 percent. To put it another way, the age of the company affects CSR disclosure. The coefficient of company age variable is 0.10, which means there is a positive and direct relationship between the level of CSR disclosure and corporate age. In fact, it can be said that companies with longer lifespans disclose more social responsibility.

The variable in the fourth hypothesis is of the type of index variables and has eight levels; hence, the first level (Industry 1 – pharmacy) is considered as the base level. According to the results obtained at Level 3 with a $p$-value of 0.028, the Level 6 with a $p$-value of 0.041, the Level 7 with a $p$-value of 0.001 and the Level 8 with a $p$-value of 0.001, when compared to the first level (base level), a significant effect on CSR disclosure is observed. Since the variable coefficient in these four industries is negative, it means that the level of CSR disclosure in Industries 3, 6, 7 and 8 is lower than the basic industry (pharmacy). It can be interpreted that the Iranian companies that operate in the field of the machinery and appliances, production of metal products, food and beverage products and textiles industries disclose less CSR than the basic industry (pharmaceutical industry). Given the $p$-value for the fifth industry, it can be concluded that companies that operate in the mineral industry disclose more CSR than those that are in pharmaceutical industry, whereas there does not exist any significant association between the base level (pharmacy) with Industry 2 (automotive and the manufacture of automotive parts) and Industry 4 (chemical products).

With respect to the audit variables of the research, our evidence demonstrated that the $p$-value of audit fees’ variable is less than 5 percent and therefore has a significant relationship with the dependent variable (CSR); consequently, the sixth hypothesis is accepted. This means that there is a positive and significant relationship between audit fees and the level of CSR disclosure. In addition, the variable of the audit firm tenure, which is one of the index variables, is investigated according to its relationship with CSR at
various levels. The $p$-values of the auditor’s tenure at the Levels 2 and 3 are 0.895 and 0.846, respectively, which are more than 0.05 and therefore do not show a meaningful relationship with the dependent variable (CSR). In contrast, in the fourth level, the $p$-value is 0.019 and less than 0.05. Therefore, it shows a significant relationship toward the first level (base level). Since the coefficient of the audit tenure (4) is negative, it means that the level of CSR disclosure is less than the first level (base level). The results indicate that there is no significant relationship between the size of the audit firm and the level of CSR disclosure, for a $p$-value of audit firm size is 0.938 and is more than 0.05.

5. Conclusion
In the first stage of this research, we examined the relationship between some features of Iranian corporations and the level of CSR disclosure on the TSE. Research hypotheses were tested using information about 125 companies on TSE during the years 2010–2015. The results of the first hypothesis show that there is a significant positive relationship between the CSR disclosure and the size of the company. In fact, Iranian larger companies disclose environmental and social information more than smaller companies. Probably the reason is that large corporations offer more benefits to employees in order to raise their morale and motivation and they also pay more attention to their public responsibilities toward clients and the community. Not only are they seek to spread reputation because of services and products at fair prices, but they also seek to stabilize themselves as an ideal company. This finding is consistent with studies of Brammer and Pavelin (2008), Reverte (2009), Chih et al. (2010), Suttipun and Stanton (2011), Bouten et al. (2011), Setyorini and Ishak(2012), Muttakin and Khan (2014), Maranjori and Alikhani (2014), Al-Gamrh and AL-Dhamari (2016), Syed and Butt (2017), Issa (2017), Wuttichindanon (2017), Haro-de-Rosario et al. (2017) and Badulescu et al. (2018), whereas is inconsistent with Roberts (1992), Barako et al. (2006) and Smith et al. (2007).

The results of the second hypothesis witnessed a significant relationship between CSR disclosure and financial leverage. Given the negative coefficient of the independent variable, it can be stated that companies with more financial leverage disclose less social responsibility. Although our finding is in contrast to Hibbit (2003), Haniffa and Cooke (2005), Oriji (2007), Christopher and Filipovic (2008), Ma and Zhao (2009) and Andriopoulos et al. (2014), Issa (2017), it is consistent with Belkaoui and Karpik (1989). Our third hypothesis examined the relationship between the level of CSR disclosure and corporate profitability. Our research showed that there is a significant negative relationship between disclosure of CSR and profitability of companies listed on TSE, probably because organizations and institutions do not comply with effective rules in achieving environmental and social goals. The test result of this hypothesis is inconsistent with the findings of Chan and Kent (2003), Tagesson et al. (2009), Khojastehpour and Johns (2014), Bhuyan et al. (2017), Issa (2017) and Platonova et al. (2018).

Our outcomes also indicated that the impact of the industry type on CSR disclosure is different. According to the statistical method, the first level (pharmaceutical industry) has been considered as the baseline level, and other levels have been compared to the first level. Our results indicate that the disclosure of CSR varies from industry to industry, and type of industry can be a factor affecting CSRD. Belal and Owen (2007), Azizul Islam and Deegan (2008) and Syed and Butt (2017) suggested that industry type is an important factor in environmental disclosure, which is in line with our research. Besides, our results suggest that companies with longer lifespan disclose social responsibility more than companies with a smaller lifetime. Therefore, it is a fact that the importance of companies to social responsibility affects their customers’ satisfaction, which is one of the success factors of organizations that can lead to more popularity and continuity of their activities in the long term. Roberts (1992), Cormier et al. (2005), Cormier et al. (2005), Al-Gamrh and
AL-Dhamari (2016) and Waluyo et al. (2017) agreed with our findings, whereas we do not see eye to eye with Rahman (2011).

In the second phase of this paper, the relationship between the level of CSR disclosure and some of the audit variables of companies listed on the TSE was investigated. The results of the sixth hypothesis showed that audit fees have a positive impact on CSR. Our research results are consistent with Kim and Kim’s (2013) research, which showed a positive and significant relationship between the audit fees, CSR information and corporate governance practices. One interpretation of this result is that since Iranian context has faced economic sanctions during the time period of this study, the majority of Iranian firms had many financial problems. In such an economic climate, these firms are likely to manipulate accounting figures to show their better financial performances. In other words, managers in an inflationary economy manage earnings when they provide more CSR disclosures, which leads to increase audit risk and audit fees.

The seventh hypothesis examined the impact of the auditor’s tenure on CSR. According to the statistical method, this variable is a component of the index variables and places the first level as the base level and the rest of the levels fit into the first level. The results proved that if the duration of the audit firm’s cooperation with the client reaches four years, it will have a negative significant impact on CSR disclosure compared to the first level; however, the level of CSR disclosure does not increase compared to the first level. The increasing level of lack of CSR disclosure following the increase in the auditor’s tenure can be justified as follows: The audit firms focus more on basic financial statements, whereas most Iranian companies provide their CSR information in the board’s report to the shareholders’ association in a qualitative manner. Therefore, it can be said that until the same procedures of CSR disclosure do not exist, the role of auditors in CSR is dimly seen. It can be also said that the long-term presence of auditors (four years) has a deterrent effect on companies with the intention of engaging in earnings management’ activities to better show their corporate financial performance. Finally, the last hypothesis describes the relationship between the size of the audit firm and social responsibility, which has not been verified. This means that the size of the audit firm cannot affect the level of CSR disclosure significantly. Our finding is similar to the studies of Al-Gamrh and AL-Dhamari (2016), as opposed to Uwuigbe and Egbide (2012) and Wuttichindanon (2017) who found that larger audit firms are connected with the level of CSR disclosure.

It seems that the findings of this paper will have practical implications for investors, auditors and other users of financial statements. In fact, first of all, this study will aware them from the fact that when a country faces economic sanctions and most of its companies are in financial strain, investors should not think that the firms engaging in CSR activities behave ethically and provide transparent financial reports. What is more, the results will persuade auditors to be conservative toward the firms that are financially distressed, for the audit risk of them will be high. Thus, policymakers need to be cautious about managers’ opportunistic behavior and enhance monitoring to enforce social compliance.

References


Chunfang, Y. (2009), Research on the Driving Mechanism of Corporate Social Responsibility, a thesis submitted in fulfillment of the requirements for the degree of Doctor of Philosophy, Huazhong University of Science and Technology.


# Appendix

<table>
<thead>
<tr>
<th>Index</th>
<th>Sub-index (subset)</th>
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<tbody>
<tr>
<td>Environmental issues</td>
<td>1. Pollution and pollutants control (greenhouse gases)</td>
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<tr>
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<td>2. Prevention of environmental damage</td>
</tr>
<tr>
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<td>3. Prevention or treatment of waste material/wastewater/waste</td>
</tr>
<tr>
<td></td>
<td>4. Conservation and optimal use of farmland</td>
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<tr>
<td></td>
<td>5. Research and development in environmental affairs</td>
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<td>6. Compliance with environmental policies (ISO14000)</td>
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<td>7. Investing in environmental projects</td>
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<tr>
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<td>8. Other environmental issues</td>
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<tr>
<td>Products and services</td>
<td>9. Product development/market share</td>
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<tr>
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<td>10. Product quality/ISO14000</td>
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<tr>
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<td>11. Product safety and health</td>
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<td>12. Stop production or services for a negative effect on public health</td>
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<td>13. Other products and services</td>
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<tr>
<td>Human resources</td>
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<tr>
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<td>15. Monthly salary/cash bonus and benefits</td>
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<tr>
<td></td>
<td>16. Shares owned by employees</td>
</tr>
<tr>
<td></td>
<td>17. Employees’ retirement and end-of-service benefits</td>
</tr>
<tr>
<td></td>
<td>18. Health and safety in the workplace</td>
</tr>
<tr>
<td></td>
<td>19. Training and development of staff</td>
</tr>
<tr>
<td></td>
<td>20. Sports and recreation</td>
</tr>
<tr>
<td></td>
<td>21. Loans or staff insurance</td>
</tr>
<tr>
<td></td>
<td>22. Employees’ morale and communications (support for marriage, housing, etc.)</td>
</tr>
<tr>
<td></td>
<td>23. Other human resources</td>
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<tr>
<td>Clientele</td>
<td>24. Clients’ health</td>
</tr>
<tr>
<td></td>
<td>25. Resolve complaints and customer satisfaction</td>
</tr>
<tr>
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<td>26. The policy of late payments and installments for specific customers</td>
</tr>
<tr>
<td></td>
<td>27. Provision of facilities and after-sales service</td>
</tr>
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<td></td>
<td>28. Meet the needs of customers</td>
</tr>
<tr>
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<td>29. Other clients</td>
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<td>Social responsibility</td>
<td>30. Social investment (development of science and technology, etc.)</td>
</tr>
<tr>
<td></td>
<td>31. Support for social activities</td>
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<tr>
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<td>32. Support for charities and rehabilitation centers</td>
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<tr>
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<td>33. Legal proceedings/litigation</td>
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<tr>
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<td>34. Cultural activities (conferences, seminars, etc.)</td>
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<td>35. Other social responsibilities</td>
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<td>Energy</td>
<td>36. Energy protection and saving</td>
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<td>37. Development and exploration of new resources</td>
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<td>38. Use of alternative and new sources</td>
</tr>
<tr>
<td></td>
<td>39. Other energies</td>
</tr>
</tbody>
</table>

**Table AI.** Social responsibility disclosure checklist

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Analysis of the determinants of foreign direct investment in Ghana

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Jacob Afful
Department of Finance, University of Cape Coast, Cape Coast, Ghana

Abstract
Purpose – The factors that determine foreign direct investment (FDI) are important to policy-makers, investors, the banking industry and the public at large. FDI in Ghana has received increased attention in recent times because its relevance in the Ghanaian economy is too critical to gloss over. The purpose of this paper is to examine the determinants of FDI in Ghana between the period of 1990 and 2015.

Design/methodology/approach – The study employed a causal research design. The study used the Johansen’s approach to cointegration within the framework of vector autoregressive for the data analysis.

Findings – The study found a cointegrating relationship between FDI and its determinants. The study found that both the long-run and short-run results found statistically significant negative effects of inflation rate, exchange rate and interest rate on FDI in Ghana while gross domestic product, electricity production and telephone usage (TU) had a positive effect on FDI.

Research limitations/implications – The study found a cointegrating relationship between FDI and its determinants. The study found that both the long-run and short-run results found statistically significant negative effects of inflation rate, exchange rate and interest rate on FDI in Ghana whiles gross domestic product, electricity production and TU had a positive effect on FDI.

Practical implications – This study has potential implication for boosting the economies of developing countries through its policy recommendations which if implemented can guarantee more capital inflows for the economies.

Social implications – This study has given more effective ways of attracting more FDI into countries which in effect achieve higher GDP and also higher standard of living through mechanisms and in the end creating more social protection programs for the people.

Originality/value – Although studies have been conducted to explore the determinants of FDI, some of the core macroeconomic variables such as inflation, interest rate, telephone subscriptions, electricity production, etc., which are unstable and have long-standing effects on FDI have not been much explored to give a clear picture of the relationships. Therefore, a study that will explore these and other macroeconomic variables to give clear picture of their relationships and suggest some of the possible ways of dealing with these variables in order to attract more FDI for the country to achieve its goal is what this paper seeks to do.

Keywords Cointegration, Determinants, Foreign direct investment, Autoregressive approach

Paper type Research paper
1. Introduction

Foreign direct investment (FDI) is a vital ingredient in achieving sustained growth of any nation, including Ghana. FDI serves as a critical factor that helps to propel the economic growth of every nation (Coy and Comican, 2014). FDI is essentially an international investment where the investor gains significant influence in the management of an entity outside the investor’s home country (Solomon, 2011). FDI under all circumstances has become an important force in the internationalization of investment activities in the global economy. For instance, the inflows of FDI globally totaled $1,114 bn in 2009 (UNCTAD, 2011).

The participation of developing countries in the total inflows of FDI has varied considerably over the last 25 years; increasing from 15 percent in 1980 to 46 percent in 1982, leveling off at slightly over 20 percent during the last four years. It must be pointed out, however, that the motives behind these international capital flows are still substantially different than those related to the inflows of FDI to developing countries, in spite of the changes that have taken place over the last decades. For example, the search for agricultural or mineral resources is much less important today than it was at the beginning of the twentieth century. On the other hand, the current movement of these flows is extremely complex, and is subject to a wide variety of factors related to the competitive environment in which the firms operate, to their specific characteristics and to economic factors in the home and host countries.

According to World Bank (2001), the past decade has witnessed a dramatic increase in FDI to developing countries; with FDI increasing from $24 bn (24 percent of the total foreign investment) in 1990 to $178 bn (61 percent of the total foreign investment) in 2000. This is good news, especially, for the countries that do not have access to international capital markets. However, Africa did not benefit from the FDI boom despite its efforts to attract FDI inflows. For example, from 1980–1989 to 1990–1998, FDI to Sub-Saharan Africa (SSA) grew by 59 percent. This compares disproportionately with high increase of 5,200 percent for Europe and Central Asia, 942 percent for East Asia and Pacific, 740 percent for South Asia, 455 percent for Latin America and Caribbean and 672 percent for all developing countries.

According to Gabriele et al. (2000), African countries increasingly adopt alternative strategies for mobilizing development finance. One notable strategy attempts to attract new inflows of FDI. They further indicated that this change in strategy reflects the following factors. First, both bilateral and multilateral lending institutions now focus more attention on transitional economies in Eastern Europe and emerging markets in Asia; thus depleting loanable funds available to African countries. Second, most African countries realize that debt service is a burden in their attempt to mobilize capital for domestic development projects. Third, excessive debt service burdens severely constrain the capacity of African Governments to provide quality social services (such as health, education and infrastructures) for the citizenry. Finally, their obligations to credit nations compromise the ability of these governments to act independently in the international political economy.

A number of domestic factors are important in attracting FDI to an economy. Autonomous increases in domestic money demand and increases in the domestic productivity of capital have been acknowledged by Ul Haque et al. (1997). Calvo et al. (1993) pointed out that improvement in external creditor relations, adoption of sound fiscal and monetary policies and neighborhood externalities are important for attracting FDI. Others included macroeconomic performance, the investment environment, infrastructure and resources and the quality of institutions. Chuhan et al. (1996) indicated that a stable macroeconomic environment improves credit worthiness and expands investment opportunities which in turn attract FDI. GDP growth rate and trade openness can be used to fuel the interest of foreign investors (Morisset, 2000). Bende-Nabende (2002) in a study using data on 19 SSA countries over the 1970–2000 showed that the most dominant long-run determinants of FDI in SSA were market growth, real effective exchange rates, market size and openness of the economy.
A FDI in Ghana refers to the monetary resources foreigners invest in companies or their subsidiaries listed on the Ghana Stock Exchange. Ghana’s economy was poised for rapid growth through both domestic and external resources, especially foreign investment. The precedent already existed in the mining sector and in commerce and banking for enhancing the country’s standing as a useful destination for FDI. After independence, major public investments were made in education (a number of Trust Secondary Schools and a third university at Cape Coast as well as the expansion of two existing ones), and in port facilities at Tema. The outstanding public investment, partly aimed at opening up the country for foreign investment, was the construction of the Akosombo Hydroelectric Dam (Tsikata et al., 2000).

Despite the efforts by government to attract more FDI in the country, the results were not fruitful. In a bid to restore the trend, remedial policies were initiated to create an enabling environment for medium- and long-term growth. More specifically, in its Ghana Vision 2020: The First Step 1996–2000, the government identified its goal of formulating and implementing policies which would enable the attainment of a “middle-income country status and standard of living” by 2020. In part, this will entail a long-term average GDP growth rate of over 8 percent per annum and thereby increasing average real incomes fourfold. At the sectoral level, agriculture’s share of GDP was projected to fall to below 20 percent, whilst that of industry was to rise to 37 percent by 2020. In the partial fulfillment of this “Vision,” the government embarked on a vigorous program to promote the flow of FDI. Various delegations, headed either by President Rawlings himself or his top aides and cabinet members, toured Europe, North America and South and East Asia to increase FDI inflow.

The main motivation for this study stemmed from the fact that one of Ghana’s development goals or aims is to push the country to become a higher middle-income earning country by the year 2020. This goal can only be realized if there is a high and sustainable rate of growth above 8 percent annually which can be aided by FDI in the country. Although studies have been conducted to explore the determinants of FDI, some of the core macroeconomic variables such as inflation, interest rate, telephone subscriptions, electricity production, etc., which are unstable and have longstanding effects on FDI have not been much explored to give a clear picture of the relationships. Therefore, this study contributes to the literature by exploring the effects of telephone subscriptions and electricity production on FDI which has not been dealt with in Ghana using a different methodology (ARDL) to study the relationship between FDI and other macroeconomic variables to give clear picture of their relationships and to suggest some of the possible ways of dealing with these variables in order to attract more FDI for the country to achieve its goal is what this paper seeks to do.

Thus, as seen above, there seems to be a consistent fall of the inflow FDI in Ghana. For instance, according to International Monetary Fund, trend in FDI net inflow (percent of GDP) in Ghana can be seen in (Figure 1).

Based on the above trend, it is obvious that there is regular fall in FDI inflow in Ghana from 2008 to 2013 (except 2010 and 2011).

Currently, the major interest of Ghana is whether FDI can contribute to the aim of reducing poverty. This basically depends on how the inflows from FDI are spread among sectors, workers and households. Systematic evidence on the effects of FDI on income allocation and poverty in Ghana is lacking. Therefore, the general objective of the study is to investigate the determinants of FDI in Ghana over the period.

2. Literature review

2.1 Theoretical review

This portion indicates the theoretical underpinnings of the study. Specifically, the study reviews the product life cycle developed by Vernon (1996) and eclectic theory developed by Dunning (1993/2000), which explain the nature and the institution of FDI in the host country.
2.2 The product life cycle hypothesis
Vernon (1996) developed a theory of trade that attempted to explain the tendency for the production of new goods to be concentrated in the developed countries early in the life of the product, but to move to other economies later on. He also emphasized in his work that a firm tends to become multinational at a certain stage in its growth. He said in the early stages of product cycle, initial expansion into overseas markets is by means of exports. Because countries are at different stages of economic development, separated by “technology gap,” new markets are available to receive new products through the demonstration effect of richer countries. Prior to the standardization of the production process, the firm requires close contacts with both its product market and its suppliers.

However, once the product has evolved in a standard form and competing products have developed, the firm may decide to look overseas for the lower cost locations and new markets. Here, it is not that factor inputs may be less expensive abroad but that considered scale economies from longer production runs may be obtained through the allocation of component production and assembly to different plants. The product cycle hypothesis is useful on several counts. First, it offers an explanation of the concentration of innovations in developed countries, and an integrated theory of trade and FDI. This theory helps to explain our argument that FDI inflows to any country depends on adequacy of some factors. Thus, the theory intends to address the apparent inadequacy of the comparative advantage framework in explaining trade and foreign investment and to concentrate on the issues of timing of innovation, effects of economies of scale and, to a lesser extent, the role of uncertainty. Product life cycle theory also seeks to explain how a company will begin by exporting its products and eventually undertake FDI as the product moves through its life cycle. Put differently, the theory indicates that a country’s export eventually becomes its import and there are three stages in the life of a product, which are new product stage, maturing product stage and standardized product stage. With this, FDI occurs in the latter two stages (i.e. maturing product stage and standardized product stage).

2.3 Eclectic theory
This theory of FDI is suggested by Dunning (1993/2000) and it is often referred to as the OLI paradigm. The O, L, and I in the paradigm refer to three groups of conditions that determine whether a firm, industry or company will be a source or a host of FDI. These groups are ownership advantages, locational considerations and internalization gains. Ownership advantages are those advantages that are specific to the firm. The firm enjoys...
such advantages over domestic as well as foreign competitors, so that expansion in the domestic market may be an alternative strategy. Such advantages include advantages in technology and in management and organizational skills, size and diversification, access to or control over raw materials, the ability to call on the political support of their government, access to finance on favorable terms, perhaps in foreign as well as domestic markets and the ease with which the firm can shift production between two countries.

Locational considerations encompass such things as transport costs facing both finished products and raw materials, import restrictions, the ease with which the firm can operate in another country, the profitability with which the ownership advantages may be combined with factor endowments in other countries, the tax policies in both source and host countries, and political stability in the host country.

Internalization gains concerns those factors which make it more profitable to carry out transactions within the firm than to rely on external markets. It is to be noted that such gains result from avoiding market imperfections (uncertainty, economies of scale, problem of control, the undesirability of providing full information to a prospective purchaser and so on). However, the existence of internalization gains obviously depends to some extent on the existence of ownership advantages. The essential element in the eclectic theory of FDI is that all the three types of conditions must be met before there will be FDI.

However, the eclectic theory provides no clear indication as to the relationship between trade and FDI flows. Ownership advantages, by themselves, imply less trade. If the firm invests due to ownership advantages, it is in place of exporting. Internalization, as already discussed, may lead to increased trade flows as different divisions import and export to other divisions along the verticalized process line. Location often implies a negative relationship. If FDI is chosen due to locational advantages, it would imply a decrease in trade. This is because exports are replaced by closer production in the host country market. Locational advantages relating to natural resources, however, imply an increase in trade as FDI extracts those resources for home country use. Yet, again, location seen in a regional context may lead to enhanced trade as the host country is used as a base through which the multinational corporations serve the entire region.

In a nutshell, the main idea of eclectic paradigm is that in order to invest abroad, a firm ought to have important advantages in terms of ownership, location and internalization. Ownership-specific advantages could be competitive in nature and firms could enjoy monopoly power, “possession of a bundle of scarce, unique and sustainable resources and capabilities, which essentially reflect the superior technical efficiency of a particular firm relative to those of its competitors” (Dunning, 2000). Location-specific advantages are the “immobile, natural or created endowments” which become an incentive to invest in a particular country. The internalization advantage gives international investors incentives to engage in foreign investment activities rather than franchising or licensing. The positive spillovers of FDI to host nations and their economies according to the theory can come in the form of an increase in national income, savings, financial resources (significant means of funding), higher employment rate, new technology and managerial know-how, improvements in human resources, increases in competition and economic development (Chowdhury and Mavrotas, 2006; Moghaddam and Redzuan, 2012). This theory helps to explain our assertion that foreign investors will be interested in extending FDI if these initial conditions are in place which every developing country needs.

2.4 Empirical review

2.4.1 Effect of inflation, interest rate, real effective exchange rate and market size (GDP) on FDI. Saini and Singhania (2017) investigated the potential determinants of FDI in developed and developing countries based on panel data analysis using static and dynamic modeling
for 20 countries (11 developed and 9 developing), over the period 2004–2013. They found that real GDP growth, per capita income, domestic inflation, commercial interest rates, trade openness, exchange rate and external indebtedness play a significant role in shaping the trends of foreign capital inflows.

Reenu and Sharma (2015) conducted a study on the determinants of FDI inflows in the post liberalization period in India using annual data from 1991 to 2010 by employing an ordinary least square (OLS) regression analysis. Their results indicated that market size, trade openness, interest rate and inflation are the major determinants of FDI inflows.

Kandiero and Chitiga (2014) found a negative correlation between FDI inflows and real exchange rate appreciation after examined 38 African countries.

Kaur and Sharma (2013) used a multiple regression to study FDI determinants in India. In their findings, they indicated that trade openness, inflation and forex reserves are the major determinants that affect FDI inflows. Inflation and exchange rate had negative impact on FDI and GDP, forex reserves, openness and external indebtedness had positive impact on FDI.

Singhania and Gupta (2011) used a dummy variable to account for FDI policy changes along with tracing the impact of macroeconomic variables like GDP, inflation rate, foreign trade, money supply growth and patents on FDI inflows in India. The study found that only GDP, inflation rate and scientific research had impact on FDI inflows. It was also found that the dummy variable for FDI policy changes done during 1995–1997 also had a significant effect on the inflows.

Kyereboah-Coleman and Agyire-Tettey (2008) tried to examine the relationship between exchange rate volatility and FDI inflows in Ghana. Their empirical results found that volatile exchange rate has a negative effect on FDI inflows which means that volatility of exchange rate which is a measure of risky reduces the inflow of FDI into the country. They conclude that exchange rate plays an important role in attracting FDI.

Ozturk (2007) carried out an extensive review of FDI literature and found evidence that financial market regulations and stable banking systems are significant determinants for FDI. The World Investment Prospects Survey 2008–2010 (UNCTAD, 2008) reported that of 226 companies surveyed, 50 percent of respondents expressed concern about the risk of a major global economic downturn and financial instability. Thus, the health of the banking system within a stable economic platform in Ireland is seen as important for foreign investment.

Bende-Nabende (2002) in a study using data on 19 SSA countries over the 1970–2000 showed that the most dominant long-run determinants of FDI in SSA were market growth, a less restrictive export-orientation strategy, the FDI policy liberalization, real effective exchange rates, market size and openness of the economy.

Bende-Nabende (2002) aims to provide an empirical assessment on the macro-locational determinants of FDI in SSA through the assessment of cointegration or rather long-run relationships between FDI and its determinants. The study comprises 19 SSA countries over the 1970–2000 period and employs both individual country data and panel data analyses techniques. The empirical evidence suggests that the most dominant long-run determinants of FDI in SSA are market growth, a less restrictive export-orientation strategy and the FDI policy liberalization. These are followed by real effective exchange rates and market size. Bottom on the list is the openness of the economy. Thus, as far as SSA is concerned, their long-run FDI positions can be improved by improving their macroeconomic management, liberalizing their FDI regimes and broadening their export bases.

Lemi and Asefa (2003) address the relationship between economic and political uncertainty and FDI flows in African countries. The authors stress the following contributions of their paper: the first study in formally dealing with the role of political and
economic uncertainty in affecting FDI in Africa using generalized autoregressive heteroscedastic model to generate economic uncertainty indicators. The study analyzed FDI from all source countries – overall US FDI, US manufacturing FDI and US non-manufacturing FDI – and their responses to uncertainty. Whereas previous studies disregarded how the role of uncertainty differs from industrial groups and source countries, the period of analysis and sample countries were large enough for the result to be robust, which other studies did not consider. Schoeman further analyzed how government policy (mainly deficit and taxes) affects FDI through the estimation of a long-run cointegration equation for FDI in South Africa during the past 30 years. Of special importance were the deficit/GDP ratio, representing fiscal discipline and the relative tax burden on prospective investors in South Africa.

2.4.2 Effect of infrastructure (electricity production and telephone usage) on FDI. According to Morisset (2000) and Asiedu (2006), the common perception among many observers is that FDI in African countries is largely driven by their natural resources and the size of their local markets. In an econometric study on 29 SSA countries for the period 1990–1997, Morisset (2000) found that both market size and natural resources availability have a positive influence on FDI inflows, with an elasticity of 0.91 and 0.92 using panel data and 1.4 and 1.2 using cross-section data, respectively. Panel regressions presented in Asiedu (2006) for 22 SSA countries over the period 1984–2000 showed that a standard deviation of one increase in the natural resource variable resulted in a 0.65 percent increase in the ratio of FDI to GDP, and a standard deviation of one increase in the market size variable resulted in a 2.61 percent increase in FDI/GDP. However, Moreira argued that natural and mineral resources were not the only determinants of FDI to the region. Even though the African countries that have been able to attract most FDI are those with natural and mineral resources as well as (relative) large domestic markets, many other factors influence investment decisions in Africa.

Asiedu (2002) identified return on investment, infrastructure development and openness to trade as relevant in influencing FDI to Africa. Specifically, higher marginal product of capital and better infrastructure did not drive FDI to SSA and, although openness to trade had a positive impact on FDI to SSA, the impact was lower than non-SSA countries.

3. Methodology

3.1 Model specification

Following Dunning (1993/2000), Vernon (1996), Vijayakumar et al. (2010), Asiedu (2006), the simple model for this study relating FDI and the other variables is specified as:

$$ FDI_t = f \left( \mu INP_t^{14}, INT_t^{15}, EXR_t^{16}, GDP_t^{17}, EP_t^{18}, TU_t^{19}, e^t \right) $$

Equation (1) is restated as:

$$ FDI_t = f \left( e(\mu INP_t^{14}, INT_t^{15}, EXR_t^{16}, GDP_t^{17}, EP_t^{18}, TU_t^{19}, e^t) \right), $$

where $FDI_t$ is the FDI at time $t$; FDI will be measured as the log of FDI stock; $INP_t$ is the inflation rate at time $t$, which is measured as the annual percentage change in consumer prices; $INT_t$ is the interest rate at time $t$ which is measured using the Bank of Ghana’s monetary policy rate; $EXR_t$ is the exchange rate at time $t$ which is measured as the average exchange rate divided by a price deflator; $GDP_t$ is the real GDP rate at time $t$, which is measured as the nominal GDP adjusted for inflation; $EP$ is the electricity production measured as the total number of gigawatt hours (Gwh) generated into electricity plants and
CHP plants; and TU is the telephone usage measured as all mobile subscriptions divided by the country’s population and multiplied by 100; \( \varepsilon_t \) is the error term; \( \mu = \beta_0, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5 \) and \( \beta_6 \) are the parameters to be determined. By taking the logarithm of Equation (2), we arrive at:

\[
\ln DFI_t = \beta_0 + \beta_1 \ln INF_t + \beta_2 \ln INT_t + \beta_3 \ln \text{EXR}_t + \beta_4 \ln \text{GDP}_t + \beta_5 \ln \text{TU}_t + \varepsilon_t. \tag{3}
\]

Differenting Equation (3) as a result of nonstationarity nature of the variables, gives Equation (4), the FDI equation is then stated as:

\[
\Delta \ln DFI_t = \beta_0 + \beta_1 \Delta \ln INF_t + \beta_2 \Delta \ln INT_t + \beta_3 \Delta \ln \text{EXR}_t + \beta_4 \Delta \ln \text{GDP}_t + \beta_5 \Delta \ln \text{TU}_t + \varepsilon_t, \tag{4}
\]

The \textit{a priori} signs of the explanatory variables are:

\[
\beta_1 < 0, \quad \beta_2 < 0, \quad \beta_3 > 0, \quad \beta_4 > 0, \quad \beta_5 > 0, \quad \text{and} \quad \beta_6 > 0.
\]

The vector autoregressive (VAR) representations of the variables of interest are specified below:

\[
Y_t = \delta + \gamma_1 Y_{t-1} + \ldots + \gamma_p Y_{t-p} + \nu_t, \tag{5}
\]

where \( Y_t \) is a \((K \times 1)\) vector of endogenous variables; \( \delta \) is a \((K \times 1)\) vectors of intercepts; \( \gamma_p \) are the \((K \times K)\) fixed VAR coefficients matrices and \( \nu_t = (v_{1,t}, ..., v_{K,t}) \), is an unobserved error term. It is to be noted that \( K \) is the number of variables.

### 3.2 Sources of data

In this study, FDI is the dependent variable and all the other macroeconomic variables are the independent variables. All the variables used in the models were based on the existing literature reviewed on the topic, economic theory and whether they fit well in the models in statistical terms. The time span covered in the study is from 1990 to 2015 and quarterly time series data were used. This was done through the interpolation method. The data on FDI were obtained from the World Bank Development Indicators, while series on real GDP, real effective exchange rate, electricity production, TU, and inflation were obtained from the World Bank. Series on interest rates were obtained from the Bank of Ghana. Here, the quarterly series data were generated through interpolation.

### 3.3 Estimation techniques

#### 3.3.1 Unit root test

This study started by exploring the stationarity properties of the series using the augmented-Dickey–Fuller (ADF) and Philip–Perron (PP) tests procedure. This test is done in the first place in order to avoid spurious regression which is a common problem among most of the macroeconomic variables whose data generation processes follow a time trend. The ADF test procedure tests the null hypothesis that the variables have unit root or are non-stationary as against the alternative hypothesis that the variables are stationary. The study then resorts to the VAR framework to estimate the long-run and short-run relationships between FDI and the associated explanatory variables.

### 3.4 Tools for data analysis

The study will employ both descriptive and quantitative analyses. Charts such as graphs and tables will be employed to aid in the descriptive analysis. Unit roots tests will be carried out on all variables using the ADF and PP tests to ascertain their order of integration in order to do away with spurious regression. Additionally, the study will adopt the Johansen’s
cointegration econometric methodology within the VAR framework to test for cointegration of the variables in order to obtain both the short- and long-run estimates of the variables involved. Also Granger causality test will be conducted to determine the direction of causality between the dependent variable and the independent variables. All estimations were carried out using Eviews 9.0 software packages.

4. Results and discussion

4.1 Descriptive statistics

The study first conducted the descriptive statistics of the relevant variables involved in the study which is presented in Table I. In Table I, the results show that all the variables have positive average values (means). The minimal deviation of the variables from their means as shown by the standard deviation gives indication of fast FDI (fluctuations) of these variables over the period. In terms of skewness, all of the variables are positively skewed with the exception of TU, which is negatively skewed.

The Jarque–Bera statistic which indicates the null hypothesis that all the series are drawn from a normally distributed random process cannot be rejected for FDI and the associated explanatory variables.

4.2 Results of the unit roots test

In order to examine the determinants of FDI in Ghana, the stationarity status of all the variables including the control variables in the openness model specified for the study were determined. This was done to ensure that the variables were not integrated of order two (i.e. I(2) stationary) so as to avoid spurious results.

First of all, to statistically determine the stationarity properties, the (ADF) and PP tests were applied to all variables in levels and in first difference in order to formally establish their order of integration. The Schwartz–Bayesian criterion (SBC) and Akaike information criterion (AIC) were used to determine the optimal number of lags included in the test. The study presented and used the p-values for making the unit roots decision which arrived at a similar conclusion with the critical values. The results of both tests for unit roots for all the variables at their levels with intercept and trend and their first difference are presented in Tables II and III, respectively.

From the results of unit roots test in Table II, the null hypothesis of unit roots for all the variables cannot be rejected at levels. This means that all the variables are not stationary at

<table>
<thead>
<tr>
<th>Variable</th>
<th>FDI</th>
<th>INF</th>
<th>INT</th>
<th>LNEXR</th>
<th>LNGDP</th>
<th>LNECP</th>
<th>TU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>7.556</td>
<td>1.787</td>
<td>5.841</td>
<td>3.580</td>
<td>5.967</td>
<td>3.035</td>
<td>2.672</td>
</tr>
<tr>
<td>Median</td>
<td>7.368</td>
<td>1.763</td>
<td>5.268</td>
<td>3.597</td>
<td>5.326</td>
<td>2.952</td>
<td>2.673</td>
</tr>
<tr>
<td>Max</td>
<td>8.971</td>
<td>1.923</td>
<td>3.689</td>
<td>3.289</td>
<td>15.384</td>
<td>2.376</td>
<td>2.708</td>
</tr>
<tr>
<td>Min</td>
<td>6.859</td>
<td>2.428</td>
<td>8.949</td>
<td>3.983</td>
<td>1.620</td>
<td>3.775</td>
<td>2.645</td>
</tr>
<tr>
<td>SD</td>
<td>0.545</td>
<td>0.348</td>
<td>1.339</td>
<td>0.142</td>
<td>3.149</td>
<td>0.314</td>
<td>0.116</td>
</tr>
<tr>
<td>Skewness</td>
<td>-0.040</td>
<td>0.420</td>
<td>0.739</td>
<td>0.384</td>
<td>1.059</td>
<td>0.749</td>
<td>-0.040</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>2.780</td>
<td>1.914</td>
<td>2.485</td>
<td>2.943</td>
<td>3.784</td>
<td>2.813</td>
<td>1.875</td>
</tr>
<tr>
<td>Probability</td>
<td>0.000</td>
<td>0.000</td>
<td>0.006</td>
<td>0.029</td>
<td>0.000</td>
<td>0.008</td>
<td>0.076</td>
</tr>
</tbody>
</table>

Table I.
Descriptive statistics of the variables

Notes: Max, maximum; Min, minimum; Sum SD, sum of squared deviation
Source: Computed using Eviews 9.0 Package
levels since their $p$-values for both ADF and PP are not significant at all conventional levels of significant.

However, Table III shows that at first difference all the variables are stationary, and this rejects the null hypothesis of the existence of unit roots. The study rejects the null hypothesis of the existence of unit roots in $D(FDI)$, $D(INF)$, $D(INT)$, $D(LNEXR)$, $D(LNGDP)$, $D(LNECP)$, $D(TU)$ and at the 1 percent level of significance.

From the above analysis, one can therefore conclude that all variables are integrated of order 1 and in order to avoid spurious regression, the first difference of all the variable must be employed in the estimation of the short-run equation.

4.3 VAR lag order selection criteria

One other problem in the estimation of VAR models is the selection of an appropriate lag length. The lag length plays a crucial role in diagnostic tests as well as in the estimation of VAR models for cointegration, impulse response and variance decomposition. The results of the VAR lag selection criteria are presented in Table IV.

Appropriate lag length ($p$) is chosen using standard model selection criteria (AIC and SBC) that ensure normally distributed white noise errors with no serial correlation. It can be observed from the VAR lag selection criteria presented in Table IV that there are asterisks attached to some statistics of the five lag selection criteria (AIC, LR, SC, FPE and HQ). Tracing these statistics against the first column labeled “lag” shows that they coincide with lag 2. This implies that the appropriate lag length chosen is 2.

4.4 Granger causality test

This is to find out whether the direction of causality the study conducted the pair-wise Granger causality tests. Table V presents the pair-wise Granger causality results.

<table>
<thead>
<tr>
<th>VAR</th>
<th>ADF</th>
<th>PV</th>
<th>[Lag]</th>
<th>PP</th>
<th>PV</th>
<th>[BW]</th>
</tr>
</thead>
<tbody>
<tr>
<td>LFDI</td>
<td>–2.1092</td>
<td>(0.5342)</td>
<td>[1]</td>
<td>–2.1487</td>
<td>(0.5125)</td>
<td>[5]</td>
</tr>
<tr>
<td>INF</td>
<td>–1.1801</td>
<td>(0.9927)</td>
<td>[2]</td>
<td>–1.1611</td>
<td>(0.9124)</td>
<td>[5]</td>
</tr>
<tr>
<td>INT</td>
<td>–2.3778</td>
<td>(0.4345)</td>
<td>[0]</td>
<td>–2.3645</td>
<td>(0.2974)</td>
<td>[2]</td>
</tr>
<tr>
<td>LNEXR</td>
<td>–1.8325</td>
<td>(0.6812)</td>
<td>[1]</td>
<td>–2.0551</td>
<td>(0.5639)</td>
<td>[5]</td>
</tr>
<tr>
<td>LNGDP</td>
<td>–3.3826</td>
<td>(1.2103)</td>
<td>[2]</td>
<td>–3.1613</td>
<td>(0.9984)</td>
<td>[3]</td>
</tr>
<tr>
<td>LNECP</td>
<td>–2.1635</td>
<td>(0.5041)</td>
<td>[1]</td>
<td>–2.3245</td>
<td>(0.4167)</td>
<td>[0]</td>
</tr>
<tr>
<td>TU</td>
<td>–1.5756</td>
<td>(0.7955)</td>
<td>[3]</td>
<td>–1.4960</td>
<td>(0.8246)</td>
<td>[5]</td>
</tr>
</tbody>
</table>

Source: Computed using Eviews 9.0 Package

Table II.
Test for the order of integration (ADF and Phillips–Perron): levels with (intercept and trend)

<table>
<thead>
<tr>
<th>VAR</th>
<th>ADF</th>
<th>PV</th>
<th>Lag</th>
<th>IO</th>
<th>PP</th>
<th>PV</th>
<th>BW</th>
<th>IO</th>
</tr>
</thead>
<tbody>
<tr>
<td>D(LFDI)</td>
<td>–7.9991</td>
<td>(0.0000)***</td>
<td>[2]</td>
<td>I(1)</td>
<td>–8.0685</td>
<td>(0.0000)***</td>
<td>[4]</td>
<td>I(1)</td>
</tr>
<tr>
<td>D(INF)</td>
<td>–4.1483</td>
<td>(0.0077)***</td>
<td>[5]</td>
<td>I(1)</td>
<td>–4.1483</td>
<td>(0.0000)***</td>
<td>[4]</td>
<td>I(1)</td>
</tr>
<tr>
<td>D(INT)</td>
<td>–10.068</td>
<td>(0.0000)***</td>
<td>[0]</td>
<td>I(1)</td>
<td>–10.065</td>
<td>(0.0000)***</td>
<td>[1]</td>
<td>I(1)</td>
</tr>
<tr>
<td>D(LNEXR)</td>
<td>–6.0434</td>
<td>(0.0000)***</td>
<td>[2]</td>
<td>I(1)</td>
<td>–5.8451</td>
<td>(0.0035)***</td>
<td>[4]</td>
<td>I(1)</td>
</tr>
<tr>
<td>D(LNGDP)</td>
<td>–8.1328</td>
<td>(0.0000)***</td>
<td>[0]</td>
<td>I(1)</td>
<td>–8.1884</td>
<td>(0.0000)***</td>
<td>[4]</td>
<td>I(1)</td>
</tr>
<tr>
<td>D(LNECP)</td>
<td>–5.7627</td>
<td>(0.0000)***</td>
<td>[5]</td>
<td>I(1)</td>
<td>–13.948</td>
<td>(0.0000)***</td>
<td>[4]</td>
<td>I(1)</td>
</tr>
<tr>
<td>D(TU)</td>
<td>–8.1328</td>
<td>(0.0000)***</td>
<td>[0]</td>
<td>I(1)</td>
<td>–8.1884</td>
<td>(0.0000)***</td>
<td>[4]</td>
<td>I(1)</td>
</tr>
</tbody>
</table>

Notes: IO, order of integration; D, first difference; PV, $p$-value. ***, ***Significance at 5 and 1 percent levels, respectively

Source: Computed using Eviews 9.0 Package

Table III.
Test for the order of integration (ADF and Phillips–Perron): first difference with (intercept and trend)
The results of the Granger causality test in Table V show that inflation (INF) Granger causes FDI at 5 percent level of significance. However, the results failed to reject the null hypothesis that FDI does not Granger cause inflation (INF). This means that inflation predicts FDI but not the other way round. Thus, there is unidirectional causality between FDI and inflation. In the empirical literature, the result is in consonance with the findings of Djokoto and Dzeha, Mamun and Nath, Akbar and Naqvi, who also found a unidirectional causality.

From the results in Table V, it is clear that there is causality from interest rate to FDI. This means that in Ghana, there is unidirectional causality between FDI inflows and interest rate. This result is consistent with that of Zhang, who in exploring the existence of bi-directional causation between FDI and interest rate for a sample of 11 Latin American and East Asian countries for a 30-year period, Zhang found a causal relation running from INT to FDI for five countries. It is also in consonance with the study by Esso who re-examined the relationship between FDI and interest rate in the case of ten Sub-Saharan African countries. Thus, the study suggests that interest rate significantly causes FDI in three countries, while FDI causes interest in two countries.

This study, however, contradicts the study conducted by Ericsson and Irandoust who examined the causal effects between FDI and interest rate for four OECD countries.
Their results found no causal relationship between interest rate and FDI in Denmark and Finland. It also contradicts the study of Adnan who examined the causal relation between FDI and interest rate for Liberia.

There is also a unidirectional causality between FDI and log of exchange rate. This is an indication that log of exchange rate is a critical variable in achieving FDI.

The results indicate a bi-directional causality between log of gross domestic growth and FDI at 5 percent level of significance. It is evident from the result that causality from FDI to log of GDP is stronger than the causality from log of GDP to FDI. This is in line with the long-run findings. It also gives credence to the fact that log of GDP is a real boomer for every economy in attracting FDI including that of the Ghanaian economy. Nevertheless, FDI in the economy also creates income for achieving higher GDP.

The Granger causality test results also suggests that the null hypothesis of electricity production does not Granger cause FDI is rejected at 5 percent level of significance, implying log of electricity production does Granger cause FDI. However, the null hypothesis that FDI does not Granger cause log of electricity production is no rejected, implying FDI does not Granger causes log of electricity production. Thus, a unidirectional causality has been identified from electricity production to FDI at the 5 percent significance level.

The unidirectional causality between TU and FDI is in line with the findings of Asiedu (2006) for Ghana and Chimobi (2010) for Nigeria. Asiedu (2006) found a unidirectional causality between TU and FDI running from TU to FDI. Chimobi (2010) identified a unidirectional causality between TU and FDI running from telephone to FDI. However, the study deviates from the results obtained by Gokal and Hanif (2004) who found a unidirectional causality between TU and FDI for Fiji running from FDI to TU inflation.

4.5 Tests for cointegration

This section presents the result on the Johansen cointegration analysis. In the face of non-stationary series with a unit roots, first differencing appears to provide the appropriate solution to our problems. However, first differencing has eliminated all the long-run information which economists are invariably interested in. According to Johansen (1991), cointegration can be used to establish whether there exists a linear long-term economic relationship among variables of interest. It is in the same vein that Pesaran and Shin (1999) added that cointegration enable researchers to determine whether there exists disequilibrium in various markets. In this regard, Johansen (1991) asserts that cointegration allows us to specify a process of dynamic adjustment among the cointegrated variables and in disequilibrated markets.

Given that the series are I(1), the cointegration of the series is a necessary condition for the existence of a long-run relationship. Under the assumption of linear trend in the data and an intercept and trend in the cointegration equation, the results of both the trace and maximum-eigenvalue statistic of the Johansen cointegration test are presented and displayed in Tables VI and VII, respectively. It is evident from Tables VI and VII that both the trace statistic and the maximum-eigenvalue statistic indicate the presence of cointegration among the variables. Thus, the null hypothesis of no cointegrating relationship or vector ($r = 0$) is rejected since the computed values of the trace and the maximum-eigenvalue statistics of 180.2803 and 67.08254 are greater than their respective critical values of 158.49 (1 percent) and 54.71 (1 percent), respectively. That is, applying the Johansen test to the quarterly series spanning from 1990:Q1 to 2015:Q4 leads to conclude that there exits at most one cointegrating relationship. This confirms the existence of a stable long-run relationship among FDI and the explanatory variables.

On the basis that there is one cointegrating vector among the variables, the estimated long-run equilibrium relationship for FDI was derived from the unnormalised vectors. From the unnormalized cointegrating coefficients, the seventh vector appears to be the one on
which we can normalize the FDI. The choice of this vector is based on sign expectations about the long-run relationships as indicated by theory.

The derivation of the long-run relationship was done by normalizing on FDI and dividing each of the cointegrating coefficients by the coefficient of FDI. The long-run relationship is specified as:

\[
FDI = 0.0232T - 0.5442INF - 0.2885INT - 0.0808LNEXR
+ 0.0583LNGDP + 0.5034LNNECP + 0.4642TU. \tag{6}
\]

The error-correction term of Equation (6) can be expressed as:

\[
ECM = FDI - 0.0232T + 0.5442INF + 0.2885INT + 0.0808LNEXR
- 0.0583LNGDP - 0.5034LNNECP - 0.4642TU. \tag{7}
\]

From Equation (5), it can be observed that all the variables are significant and they represent the long-run effects on FDI. Starting with the trend, it exerts a positive effect on FDI. This means that holding all other factors constant in the long run, as time passes by, FDI will grow by about 0.0322 percent each quarter. This is justified by the fact that as time passes by technology and behavior of economic variables change which will naturally impact on the investment activities.

Inflation is negative and statistically significant. Thus, the coefficient of 0.5442 means that 1 percent increase in inflation would lead to approximately 0.5442 percent increases.
in FDI holding, keeping all other variables constant. This implies that inflation experience by the country really impact negatively on FDI. This is consistent with theoretical expectation of the classical views on the role of exchange rate volatility in the macro economy. It is also consistent with other empirical studies such as Vijayakumar et al. (2010).

According to economic and investment theories, inflation induces FDI by shocks from both local and global levels, and by affecting other macroeconomic variables. For Ghana, the result obtained suggests that inflation targeting policy adopted as part of the structural reforms in the 2000s in Ghana though helped yet has also affected the economy.

In the long run, interest rate is statistically significant and it exerts a negative effect on FDI in Ghana. The coefficient of 0.2885 percent implies that in the long-run 1 percent increase in interest rate will lead to approximately 0.2885 percent decrease in FDI. This means that increasing interest rate leading to higher cost of borrowing can affect initiatives to attract FDI frequently and which derives from the belief that foreign investment produces externalities in the form of technology transfers and spillovers. Romer (1993), for example, argues that there are important “idea gaps” between rich and poor countries. He notes that foreign investment can ease the transfer of technological and business know-how to poorer countries. These transfers may have substantial spillover effects for the entire economy Vijayakumar et al. (2010).

The log of exchange rate (LNEXR) which served as an exogenous variable was statistically significant and it exerted a negative impact on FDI. This means that 1 percent increase in exchange rate in the long run would lead to 0.0808 percent decrease in FDI. Thus, the negative and significant effect of exchange rate on FDI is an indication that exchange rate is a key channel through which the economy can be in distress.

The negative impact is in conformity with the findings by Bende-Nabende (2002) and Garibaldi. Most African countries have embarked on exchange rate reduction policies that are dominated by austerity measures. In most cases, these policies were implemented without evaluating the impact of exchange rate on FDI. Thus, it is imperative to bring in adequate corrective measures to be adapted to the peculiar economic structures and the behavior of agents in Africa that would allow us to capture the full impact of exchange rate on FDI and other economic aggregates.

Also, log of GDP with a coefficient of 0.0583 has a positive and significant impact on FDI. Specifically, the result indicates that a 1 percent increase in GDP will increase FDI by 0.06 percent holding all other things constant. A higher level of GDP represents a boom in an economy. If LDCs are streamlining their investment regulatory framework, implementing policies which promote macroeconomic stability and improve infrastructure, they can achieve a higher level of FDI.

The results, however, contradict the findings by Erbaykal and Okuyan, and Chimobi (2010). Erbaykal and Okuyan showed no statistically significant long-run relationship between GDP and FDI for Turkey.

The coefficient of electricity production (LNECP) of 0.5034 shows that a 1 percent change in electricity production would result in a 0.5034 percent increase in FDI, holding all other factors constant. The sign of the electricity production support the theoretical conclusion that natural resources capital contribute positively to FDI attraction since the coefficient in this long-run equation is positive and significant. This positive relationship between electricity production and output is consistent with the expectation of the classical economic theory. It is consistent with conclusions reached by Morisset (2000) and Asiedu (2006) in the case of Ghana.

Finally, TU is positive and significant with a coefficient of 0.4442 indicating an increase in FDI by this amount if there is a 1 percent increase in the TU. This is consistent with the arguments of Morisset (2000) and Asiedu (2006).
4.6 Short-run relationship

Engle and Granger (1987) argued that when variables are cointegrated, their dynamic relationship can be specified by an error-correction representation in which an error-correction term (ECT) computed from the long-run equation must be incorporated in order to capture both the short-run and long-run relationships. It is expected to be statistically significant with a negative sign. The negative sign implies that any shock that occurs in the short run will be corrected in the long run. The larger the ECT in absolute value, the faster the convergence to equilibrium. Given that our variables are non-stationary but cointegrated, estimation of the VECM, which included a first differenced VAR with one period, lagged ECT yielded an over-parameterised model as presented. As the values of the variables are stationary, the model was estimated using the OLSs. The approach of general-to-specific modeling was employed to arrive at a more parsimonious model, where insignificant variables were deleted using the t-ratios. Rutayisire (2010) argued that this process of moving from the general to the specific brings about a simplification of the model that makes estimations more reliable and increases the power of the tests.

The results from the vector error-correction model as depicted in Table VIII suggests that the ultimate effect of previous periods’ values of FDI on current values of FDI in the short run is positive and significant at lag 5. The result below shows that the estimated coefficient of the ECT has the expected sign and it is significant. This is an indication of joint significance of the long-run coefficients. According to Kremers et al. (1992) and Bahmani-Oskooee (2001), a relatively more efficient way of establishing cointegration is through the ECT.

From the results in Table VIII, the estimated coefficient of the ECT is −0.1723 which implies that the speed of adjustment is approximately 17 percent per quarter. This negative and significant coefficient is an indication that cointegrating relationship exists among the variables under study. The size of the coefficient on the ECT denotes that about 17 percent of the disequilibrium in the economy caused by previous years’ shocks converges back to the long-run equilibrium in the current year. Thus, the study discerns that the variables in the model show evidence of moderate response to equilibrium when shocked in the short run.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>SE</th>
<th>t-statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECT(−1)</td>
<td>−0.1723</td>
<td>0.0718</td>
<td>−2.4002</td>
<td>0.0190</td>
</tr>
<tr>
<td>D(LFDI(−5))</td>
<td>0.3870</td>
<td>0.1598</td>
<td>2.4221</td>
<td>0.0180</td>
</tr>
<tr>
<td>D(INP(−1))</td>
<td>−0.5888</td>
<td>0.2117</td>
<td>−2.7813</td>
<td>0.0069</td>
</tr>
<tr>
<td>D(INT(−5))</td>
<td>0.1164</td>
<td>0.0325</td>
<td>3.5826</td>
<td>0.0006</td>
</tr>
<tr>
<td>D(LNEXR(−3))</td>
<td>−0.3636</td>
<td>0.2101</td>
<td>−1.7301</td>
<td>0.0881</td>
</tr>
<tr>
<td>D(LNGDP(−1))</td>
<td>−0.0136</td>
<td>0.0060</td>
<td>−2.2760</td>
<td>0.0257</td>
</tr>
<tr>
<td>D(LNECP(−4))</td>
<td>0.4497</td>
<td>0.1321</td>
<td>3.4039</td>
<td>0.0011</td>
</tr>
<tr>
<td>D(TU(−2))</td>
<td>−0.5604</td>
<td>0.2128</td>
<td>−2.6340</td>
<td>0.0103</td>
</tr>
<tr>
<td>C</td>
<td>0.1251</td>
<td>0.0250</td>
<td>5.0062</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

$R^2$ 0.6022  Mean dependent var 0.0146
Adjusted $R^2$ 0.5432  SD dependent var 0.0834
SE of regression 0.0721  Akaike info criterion −2.1175
Sum squared resid 0.2544  Schwarz info criterion −0.9192
Log likelihood 142.4616  F-statistic 1.7253
Durbin–Watson stat 2.0055  Prob (F-statistic) 0.0328

Diagnostic test
Jarque–Bera 0.6556 (0.7205)
LM test: $F$-statistic 1.3142 (0.2725)
ARCH test: $F$-statistic 0.1677 (0.9738)
RESET test: $F$-statistic 0.8674 (0.3569)
Log likelihood ratio 1.2338 (0.2667)

Table VIII. Results of error-correction model (VECM)
It is theoretically argued that a genuine error-correction mechanism exists whenever there is a cointegrating relationship among two or more variables. The rule of thumb is that the larger the error-correction coefficient (in absolute term), the faster the variables equilibrate in the long run when shocked (Acheampong, 2007). However, the magnitude of the coefficient in this study suggests that the speed of adjusting to long-run changes is slow.

The current value of FDI is affected by the past quarter values of FDI. Specifically, FDI at lag 5 is significant with a coefficient of 0.3870. It exerts a positive effect on FDI in the fifth quarter. This is expected in that previous growth and expansion in FDI serves as an indication of prosperity and may further attract more investment leading to more growth.

Inflation, which is one of the focus explanatory variables in this study, is significant at lags 1 and it exerts a negative effect on FDI just as the long-run effect. This implies that in the short-run inflation is reducing welfare in Ghana. This is consistent with the study by Vijayakumar et al. (2010).

In the short run, interest rate is significant at lag 5 where it exerts a negative effect on FDI in the fifth quarter with coefficient of 0.1164. Thus, in the fifth quarter, a 1 percent increase in interest rate would lead to 0.1164 percent decrease in FDI. The negative effect of interest rate reemphasizes the fact that Ghana in some way has not benefited from the spillover effect of interest rate in the country.

Also, short-run increases in exchange rate exert a negative and statistically significant impact on FDI. This means that an increase in exchange rate in the short-run exerts a negative impact on FDI. This is consistent with the long-run result.

The results also show that log of GDP which has a positive and significant impact on FDI. Specifically, a 1 percent increase in log of GDP will cause growth in FDI to increase by 0.0136 percent holding all other factors constant. This result confirms the findings of Garibaldi who argued that a higher GDP in a country can increase the level of living standard in their economic if it serves as a means to achieve further high level of economic growth.

The coefficient of log of electricity production is still positive and significant just as the long-run estimate. Thus in the short run, a 1 percent increase in electricity production would lead to approximately 0.45 percent increase in FDI in the fourth quarter. The sign of the electricity production supports the theoretical conclusion that natural resources positively contributes to greater openness both in the short and long runs since the coefficient of the variable in these two periods is positive and significant. Similarly, the growth in TU is positive and significant at 5 percent significance level. A 1 percent increase in the TU in the short run would increase FDI by 0.5604 percent all other things being equal. This is consistent with the studies by Morisset (2000) and Asiedu (2006).

4.7 Variance decomposition analysis

Following the VAR estimation, the study decomposed the forecast error variance by employing Sim's recursive Cholesky decomposition method. The forecast error variance decomposition provides complementary information for a better understanding of the relationships between the variables of a VAR model. It tells us the proportion of the movements in a sequence due to its own shock, and other identified shocks (Enders, 2004). Thus, the variance decomposition analysis will enable us identify the most effective instrument for each targeted variable based on the share of the variables to the forecast error variance of a targeted variable. The results of the forecast error variance decomposition of the endogenous variables, at various quarters are shown in Table IX.

In explaining the forecast error variance of FDI in Table IX, it is observed that in the short-term horizon (two years) innovations of exchange rate and TU are the most important sources of variations besides FDI its own shock.

Throughout the medium-term and long-term horizon, the innovations to exchange rate (LNEXR) and TU serve as the important sources of variations to FDI. The source of least
forecast error variance of FDI is the innovations of log electricity production (LNECP) throughout the short-term, medium-term and long-term horizons. The most effective instrument for FDI seems to be log of exchange rate.

5. Conclusions and policy recommendations
The study has empirically examined the determinants of FDI in Ghana using the data set for the period 1990–2015. The empirical evidence revealed the following findings: both the long-run and short-run results found statistically significant positive effects of the log of GDP, log of electricity production and telephone on FDI in Ghana. The study also found a negative and significant effect inflation, interest rate and log of exchange rate on FDI both in the long and short runs. This reemphasizes the potential effects of these variables on FDI in Ghana. From the results of the forecast error variance decomposition, the most important variable for FDI is log of exchange rate and the least variable for FDI is electricity production. The Granger causality test results revealed a unidirectional causality between inflation, interest rate, log of exchange rate, log of GDP and FDI. However, there was a bi-directional causality between electricity production, TU and FDI.

Based on the findings from the study, the following recommendations are proposed.

First, given that the study found a negative causal effect of exchange rate on FDI, the government should pursue more pragmatic policies such as exchange rate targeting strategy that will stabilize exchange rate policies in order to enhance FDI attraction. This can be done in the form of regularly monitoring the exchange rate by the Bank of Ghana. Second, another policy implication of the study is that the Bank of Ghana and other regulators need to ensure that low inflationary rate is maintained in the Ghanaian economy. This can be done through by targeting the inflation rate by Bank of Ghana and this will stabilize the economy. Third, Ministry of Communications in Ghana and other private partners need to expand the country’s telephone subscriptions. This will help to attract more FDI into the services sector of the country. This can be done through heavy investments in the economy.

Fourth, the government in collaboration with the electricity company of Ghana, Volta River Authority, and other private partners should expand electricity production in the country. This will reduce the rampant power outage in the country and in turn serve as a signal to investors.

Fifth, the study recommends that, the Government of Ghana needs to increase the country’s per capita GDP to attract more FDI into the services and manufacturing sectors of the economy.

Finally, financial institutions in Ghana need to also consider reducing their interest rate to attract borrowing from the private sector so as to boost development in the financial sector leading to more growth in the economy.
References


Determinants of FDI in Ghana

73


World Bank (2001), “Gross fixed capital formation (current US$)”.

Further reading


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Asymmetric targeting of corporate cash holdings and financial constraints in Pakistani firms

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Shahzad Hussain
Faculty of Business and Technology, Foundation University, Islamabad, Pakistan

Abstract
Purpose – The purpose of this paper is to investigate the asymmetric adjustment of cash holdings in Pakistani firms for above and below target firms.
Design/methodology/approach – The study employs generalized method of moments (GMM) to investigate the adjustment of cash holdings.
Findings – The study found that the firms which hold cash above the optimal level of cash holdings have higher speed of adjustment than the firms which hold cash below the optimal level. Financially constrained (FC) firms also adjust their cash holdings faster than financially unconstrained (FUC) firms but high speed of downward adjustment does not remain persistent after financial constraints are controlled. Findings of this study reveal this asymmetric adjustment in above and below target firms and extend these results in FC and FUC Pakistani listed firms, respectively.
Research limitations/implications – The conclusion of this study has been derived under certain limitations. There is a vast space to extend this study in different dimensions. Firms operating in capital-intensive industries may provide different results for financial constraints because their policy designing would be quite different from other firms.
Originality/value – This study contributes to cash holdings research in Pakistan by exploring the adjustment behavior of cash holdings across Pakistani non-financial firms using econometric modeling. Downward adjustment rate is supposed to be higher than upward adjustment rate and this rate is tested using dynamic panel data model. Similarly, it is inferred that this relationship holds for above target firms even after including the financial constraints in the presented model.
Keywords Cash holdings, Adjustment rate, Financial constraints, Pakistani firms, Upward and downward adjustment
Paper type Research paper

1. Introduction
The cash holding behavior of firms has obtained a great deal of consideration in finance literature after the contribution of Miller and Orr (1966) and the initial work of Modigliani and Miller (1958). However, the latter suggested that firms can easily secure funds in frictionless markets and there is no need to hoard cash for future liquidity matters. Practically, there is no existence of frictionless capital markets and firms cannot always collect as many funds...
as they need so they have to move toward external sources of raising funds. Why are the firms always in need of holding cash? Does the optimal level of cash holdings exist? Do firms with different organizational hierarchies hold a different amount of cash? To answer these fundamental questions, a number of researchers have strived to draw a clear picture of the cash holding decisions made by the firms. Keynes (1936) emphasized that cash acts as a safety measure against unpredicted contingencies. After three decades, a tradeoff model for determining a firm’s optimal cash level was presented by Miller and Orr (1966) and this model discusses the idea of making a tradeoff between costs and benefits of cash holdings. Contrarily, Myers (1984) suggested pecking order theory and argued that an optimal or target level of cash does not exist and a firm only tries to minimize information asymmetry while accessing the costs of external financing. Under this argument, firm first use their retained earnings to finance their investment projects, then obtain debt and at last, they use their equity in their investments.

It is clear that firms do not have any optimal level of cash rather cash is simply used as a buffer between investment needs and retained earnings. Alternatively, Jensen (1986) presented the theory of free cash flow postulating when managers act for their own self-interest instead of striving for the value maximization of their firm, they may commit a breach of their fiduciary obligations toward shareholders. To understand the relationship between managers and shareholders, such kind of agency problems must be taken into account. Free cash flow theory holds that managers hold cash to exacerbate their arbitrary power over the investments decisions made by the firm.

However, holding cash has its benefits and costs. The basic purpose of hoarding cash includes a reduction in the chances of financial shocks (John, 1993), minimizing transaction costs (Keynes, 1936), circumventing external sources of financing and allowing the investment projects to perform efficiently in the presence of financial constraints (Denis and Sibilkov, 2010). Holding cash in a firm’s reserves acts as a buffer against future financial shocks and firms tend to accumulate cash to cope with the financial crisis likely to occur in coming years. Holding cash also minimizes transaction cost of liquidating assets or costs associated with raising external finance (Mulligan, 1997).

However, accumulating huge volume of cash leads to double taxation especially for multinational firms that pay taxes in host country and are also subject to tax payments when repatriating foreign income to their home country (Foley et al., 2007), agency costs incurred due to conflicts between managers (agents of shareholders) and shareholders (Jensen, 1986; Harford, Li and Zhao, 2008) and opportunity cost (Uyar and Kuzey, 2014). Holding a large amount of cash may lead toward inefficiency. That is, the firm may lose certain valuable investment prospects. Firms hold cash for transaction motive, precautionary motive, agency motive and for tax motive as well. Pecking order theory suggests that firms tend to rely on internal financing more than external financing while making their investment decisions (Myers, 1984) and on the other side, agency theory (Jensen, 1986) points out a flaw, that is, when managers have excess cash, then they do not go for external sources of finance, they carry out such investment projects that may have even a negative net present value and at last, shareholders are adversely affected.

Broadly speaking, pecking order theory and agency theory do not sufficiently address the adjustment of cash holdings. So, a better explanation can be given by tradeoff theory which provides a balance between the benefits and costs which are associated with any given level of cash. An optimal or target level of cash is well determined by tradeoff theory and firms try to adjust cash to the optimal level in case of any cash deviations. This argument is relevant to hold that firms are active in rebalancing their cash holdings to the optimal level.

Numerous prior studies support the notion that an optimal or target level of cash holding exists for the firm (Opler et al., 1999; Ozkan and Ozkan, 2004; Bates et al., 2009; Rehman and
Wang, 2015). Although there is ample research material on adjustment of optimal or target level of cash holdings and adjustment rate, a very little work has been done on the asymmetric adjustment (high and low cash regimes from the optimal or target level) of corporate cash holdings in the particular context of Pakistan as most of the studies emphasized on cash holdings and adjustment rate of the firms operating in developed countries. No empirical evidence exists so far in the particular context of Pakistan which addresses the optimal level of cash holdings and adjustment rate of corporate cash holdings in Pakistani firms. Furthermore, the research is lacking in the strand of above and below target firms – how firms adjust their cash policy when the cash holdings are above or below the optimal level. Azam and Shah (2011) found that there are more financial constraints faced by Pakistani firms than the firms operating in the developed world. These constraints include high dividend payout ratio which restricts the firms to invest in future projects; firm’s age which explains that older firms tend to spend less on investment as compared to the younger firms; and uncertainty which hinders fixed investment. Firm size, earnings and energy crisis are some other important constraints which need the attention of researchers. They further investigated the underlying relationship between a firm’s level of investment and the firm size, age of the firm and its dividend payout ratio. Their findings revealed a positive linkage between investment and firm size and a negative association between investment, firm’s age and dividend payout ratio. Consequently, firm’s age and dividend payout ratio have been attributed to financial constraints.

This research is significant in certain strands. This study intends to contribute to existing literature by exploring cash management and adjustment of cash holdings in publicly listed non-financial firms. Furthermore, this research makes a contribution to literature because it is exploring the determinants of corporate cash holdings in Pakistan where the financial structure of firms is quite different from the firms operating in developed countries. The study intends to provide practicable insights and facts that may help to determine the asymmetric adjustment of cash holdings to help non-financial companies of Pakistan in their future investment and growth decisions and to understand the dynamics of optimal cash policy.

The rest of the study is structured as follows: Section 2 gives a brief review of the literature. Section 3 presents the data, methodology and empirical models. Section 4 deals with empirical results and Section 5 concludes the paper.

2. Literature review

There are a large number of prior studies about corporation’s cash management policies and these studies suggest that firms normally accumulate large amounts of cash for precautionary motives (Opler et al., 1999; Mikkelson and Partch, 2003), for efficient management of transactions (Mulligan, 1997), for payment of double taxes, i.e. multinational firms which are subject to tax payments both in host country and in home country as well (Foley et al., 2007) and to reduce agency problems (Jensen, 1986; Harford, Mansi and Maxwell, 2008; Nikolov and Whited, 2014). Dittmar et al. (2003) identified two types of costs associated with holding cash. First, cost-of-carry and agency cost. They further documented two motives which stemmed the benefits and advantages of holding cash. In the first place, the transaction cost motive of holding cash states that firms hold more cash during the periods when opportunity costs and the costs associated with raising cash are relatively higher. Second, the precautionary or preventive motive of holding cash stems from an examination of the effect of asymmetric information on fund-raising ability of a firm.

According to the financing hierarchy (Myers, 1984), there is not any target level of cash and likewise, there is no optimal level of debt. But Martínez-Sola et al. (2013) and Jarrow et al. (2018) reported that there exists an optimal level of cash which maximizes the value of a firm and any divergence from the optimal level decreases firm value. The tradeoff theory
maintains a positive association between cash level and investment made for capital expenditure while financing hierarchy holds the opposite relationship between the two (Dittmar et al., 2003). Similarly, there exists an optimal level for debt or leverage which the firms obtain after making a tradeoff between benefits and costs of obtaining debt and any deviation from that optimal level may lead firms to move toward a new leverage target (Denis and McKeon, 2012). Denis (2011) held that as leverage ratios may substantially deviate from their target level, the managers do not set leverage levels as their first-order concern for capital structure decisions. Surplus leverage due to increase in initial leverage level builds cash reserves for firms. Furthermore, they suggested that during the time of shortage of cash and liquidity crisis, firms are active in taking more and more debt even when they are above their target or optimal debt level and likewise, during the time of surplus in financial resources they payout debt to reduce their leverage level even when they are already below their target level of leverage.

In capital markets where there is an ease of access to the fund providers and funds can immediately be raised, firms tend to keep less liquid assets in their reserves. In countries, where there is the least protection of investor’s rights, companies hold twice much cash as companies in countries where investor rights are well protected. In this situation, investors cannot forbid managers to hold excessive cash. Financial instruments in a firm’s portfolio also lessen cash hoarding because these instruments can easily be used for raising capital and for hedging as well. Furthermore, large amounts of cash are mostly held by the companies that are exposed to greater investment horizons and they hoard cash to avoid opportunity cost and a shortage of cash in case of optimal investment opportunity arousal. Precautionary motive of holding cash suggests that a firm’s risk of refinancing also affects its level of cash holdings because firms hold huge amounts of cash to avoid refinancing risk and to save more cash resulting from free cash flows available to the finance providers (Harford et al., 2014; Xie et al., 2017).

In case of adjustment speed of cash holdings, different researchers hold different opinions. Chang et al. (2017) argued that firms have different adjustment costs so they follow different paths to reach their optimal level of cash. Furthermore, they hold that there is always an optimal level of cash and when the cash level deviates from the upper or lower cash regime then systematic adjustment of cash occurs. In this way, the benefits of cash level adjustment become higher than the costs. Jiang and Lie (2016) also examined the speed of adjustment of corporate cash holdings and they maintained that firms having higher levels of cash reserves have a higher speed of adjustment than the firms facing cash deficiency.

While addressing a firm’s asymmetric adjustment, a firm can make loan payments and dividend payments when its level of cash holdings is above target or optimal level and by making such payments, it can bring its level of cash holdings down to the target or optimal level (Venkiteshwaran, 2011). This argument can be made by intuition and clue. Contrary to this argument, a firm cuts its investment, raises funds from external sources and slashes its payouts when its cash level is below the optimal level (Venkiteshwaran, 2011; Garcia-Teruel and Martinez-Solano, 2008). Rehman et al. (2016) found a higher speed of downward adjustment of cash holdings than upward adjustment and this tendency is due to the reason that there are more alternatives available to the firms to bring their level of cash holdings down to the optimal or target level and lower costs associated with downward adjustment of cash holdings. So it can be suggested that it is far more convenient to bring the firm’s cash holdings down to the optimal level when the level of cash holdings is above the optimal or target level than to bring the level of cash holdings up when it is below the optimal or target level during the time of uncertainty and crisis. Above arguments provide a base for the development of following hypothesis:

**H1.** Downward adjustment rate of corporate cash holdings toward an optimal level is higher than the upward adjustment rate.
2.1 Financial constraints and corporate cash holdings

Financial constraints have a different approach to explain a firm’s cash holding tendency. Firms with a higher return on assets and firms which are paying the dividend can easily raise external finance and they hold less cash in their reserves (Chen et al., 2017). Financially constrained (FC) firms are those which are not paying dividends and financially unconstrained (FUC) firms pay dividends (Chen et al., 2017; Lozano and Durán, 2017) and FC firms hoard cash to deal with volatility in cash flows while FUC firms are not affected by this kind of volatility (Rehman et al., 2016).

Almeida et al. (2004) argued that FC firms must adopt a different approach to cash saving and the approach should be a systematic propensity toward cash hoarding. FC firms are not required to adopt this approach. They further proposed that cash flows sensitivity toward cash holdings has a positive sign in case of FC firms and it is insignificant and negative for FUC firms. These findings support the opinion that FC firms have higher levels of cash than FUC firms. FC firms have higher levels of cash holdings as a result of higher investment yields and higher value of an investment (Denis and Sibilkov, 2009). During the times of cash crunches and less liquidity, firms normally cut their investment in research and development and technology (Campello et al., 2010), and firms also tend to reduce their cash savings and dividends during such crisis. Assets liquidation can easily be made by FC firms at the time of liquidity crisis and the shortage of cash. Further linking this up to financial flexibility, marginal costs of excess cash and dynamics of capital structure, the ability to raise debt has a low transaction cost, meaning raising debt today to fund investment and subsequently seeking to pay off debt today, so that firm can raise more debt today or in future if needed (DeAngelo et al., 2011). Based upon the above discussion, it can be hypothesized that:

H2. FUC firms have higher adjustment rate of cash holdings than FC firms.

Financially flexible firms tend to access low-cost external finance to timely respond sudden cash flow volatility and an unexpected increase in growth opportunities for value maximization (Denis, 2011); however, a firm’s financial policy does not solely depend upon financial flexibility (Graham and Harvey, 2001). Financial constraints may restrict firms to avoid certain profitable projects so FC firms devise their cash policies with financial flexibility in order to cope with scarcity of financial resources during the periods of uncertainty and high cost of external finance and high uncertainty in growth opportunities lead firms to stockpile cash through low-equity payouts (Denis, 2011). For firms to be financially flexible, their unused debt capacity should be an important source of their capital structure. Gamba and Triantis (2008) reported that in case of higher debt costs, firms have a tendency to hoard more cash. They further argue that in time of low profitability, firms tend to reduce their debt burden, to avoid the triggering of any financial distress thus compelling firms to reduce their payout for debt issuance of higher costs.

Firms working with high market imperfections and with higher investment needs tend to keep large cash reserves in order to cope with liquidity crunches because market frictions restrict their investment ability (Almeida et al., 2004). Furthermore, they argued that FUC firms are less prone to volatility in cash flows than FC firms. Rehman et al. (2016) incorporated financial constraints like Altman’s Z score (based upon leverage, liquidity and profitability), SA1 and SA2 index (based upon size and age of the firm) in their research model and found that FUC firms have a higher speed of adjustment than FC firms. They also provided an argument that higher downward speed of adjustment toward the optimal or target level of cash is persistent even after the financial constraints are controlled. These arguments provide a base for the development of following hypothesis:

H3. Higher downward adjustment rate of corporate cash holdings persists even after financial constraints are controlled.
2.2 Determinants of corporate cash holdings

Opler et al. (1999) suggested several determinants of cash holdings and this study follows those determinants to be substantially incorporated in underlying regression models. The section below gives a brief summary of the relationship between cash holdings and the proposed determinants of cash holdings. We include capital expenditure, leverage, firm size, growth opportunities, net working capital and operating cash flows as the control variables.

3. Methodology

3.1 Data and source

We have used a sample set of 200 non-financial firms listed on Pakistan Stock Exchange over a ten-year period (2006–2016). Data are collected from www.psx.com.pk, www.businessrecorder.com, www.investing.com, annual reports of firms and BVD OSIRIS. Firms are assigned numbers ranging from 1 to 200 and then data have been split into two subcategories, i.e., firms which hold cash above the optimal or target level and firms which hold cash below the optimal or target level. The subsamples of data into above target firms and below target firms are based upon a technique borrowed from prior studies of capital structure (Hovakimian et al., 2001; Drobetz and Wanzenried, 2006). First, cash holdings are estimated using pooled OLS estimation technique. Fitted values are estimated and then subtracted from the actual cash values. If the difference is positive it accounts for above target firms and negative values account for below target level firms. Data have been winsorized at the 5 percent level for limiting the extreme values and to reduce the effect of spurious outliers (Table I).

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of industry</th>
<th>No. of firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Automobile manufacturer</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>Automobile add-ons</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>Electric products</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>Cement manufacturer</td>
<td>15</td>
</tr>
<tr>
<td>5</td>
<td>Chemical producers</td>
<td>15</td>
</tr>
<tr>
<td>6</td>
<td>Construction materials</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>Engineering</td>
<td>9</td>
</tr>
<tr>
<td>8</td>
<td>Fertilizer</td>
<td>4</td>
</tr>
<tr>
<td>9</td>
<td>Food and personal care</td>
<td>10</td>
</tr>
<tr>
<td>10</td>
<td>Glass and ceramics</td>
<td>6</td>
</tr>
<tr>
<td>11</td>
<td>Leather and tanneries</td>
<td>3</td>
</tr>
<tr>
<td>12</td>
<td>Miscellaneous</td>
<td>3</td>
</tr>
<tr>
<td>13</td>
<td>Oil and gas</td>
<td>9</td>
</tr>
<tr>
<td>14</td>
<td>Paper and board</td>
<td>7</td>
</tr>
<tr>
<td>15</td>
<td>Pharmaceuticals</td>
<td>5</td>
</tr>
<tr>
<td>16</td>
<td>Power generation</td>
<td>9</td>
</tr>
<tr>
<td>17</td>
<td>Refinery</td>
<td>2</td>
</tr>
<tr>
<td>18</td>
<td>Sugar</td>
<td>17</td>
</tr>
<tr>
<td>19</td>
<td>Synthetic and rayon</td>
<td>2</td>
</tr>
<tr>
<td>20</td>
<td>Technology</td>
<td>5</td>
</tr>
<tr>
<td>21</td>
<td>Textile</td>
<td>51</td>
</tr>
<tr>
<td>22</td>
<td>Tobacco</td>
<td>2</td>
</tr>
<tr>
<td>23</td>
<td>Transport</td>
<td>4</td>
</tr>
<tr>
<td>24</td>
<td>Woolen</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>200</td>
</tr>
</tbody>
</table>

Table I. Distribution of firms across industries
3.2 Variables description

3.2.1 Dependent variable. The dependent variable in this study is cash holdings. Cash holdings are the assets that a firm holds in the form of ready cash. The value of cash and cash equivalents has been taken from the annual reports of the firm and the online resources mentioned above. Cash is measured by dividing the cash holdings of a firm by its total assets.

3.2.2 Independent variables. Independent variables in this study are capital expenditure, leverage, growth opportunities, firm size, cash flow, net working capital and financial constraints. Capital expenditure is the amount of money spent on the acquisition of fixed assets. It is measured by dividing the value of fixed assets by total assets. Leverage refers to the investment of borrowed money. It is measured by dividing a firm’s total debt by its total assets. Growth opportunities are the prospects for the firms to invest in projects which yield profits. These are measured by taking the ratio of the market value of equity and the book value of equity or it means to divide market value of equity with book value of equity. Firm size is the optimal size of a firm in a given industry at a given time which leads to low per unit cost of production. It is measured by taking the natural logarithm of a firm’s total assets or its sales. Cash flow is the total amount of money coming in and going out of a business and it particularly affects liquidity. Cash flow is measured by dividing the net operating cash flows of a firm with total assets. Net working capital is the sum of all the liquid assets of a firm. It is measured by subtracting accounts payable from the sum of accounts receivables and inventories and dividing the resulting by total assets for scaling purpose.

3.3 Research model
First, we have developed a static model following Opler et al. (1999) and the model is as follows:

\[
CASH^*_it = \beta_0 + \beta_1 NWC_{it} + \beta_2 SIZE_{it} + \beta_3 MTB_{it} + \beta_4 LEV_{it} + \beta_5 CAPEX_{it} + \beta_6 OCF_{it} + \epsilon_{it}. \tag{1}
\]

In Equation (1), \(CASH^*_it\) refers to cash and cash equivalents held by firm \(i\) at time \(t\). The star denotes that it is the optimal value or equilibrium represented by the fitted line of this equation. \(\beta_0\) is the intercept. \(NWC_{it}\) represents net working capital employed by firm \(i\) at time \(t\), measured by taking the difference of current assets and current liabilities. \(SIZE_{it}\) is actually the firm’s size which is measured by taking the natural log of total assets held by a firm. \(BMR_{it}\) depicts firm’s book-to-market ratio used to measure the growth opportunities of firm \(i\) at time \(t\). \(LEV_{it}\) stands for leverage of firm \(i\) at time \(t\), measured by dividing total liabilities with total assets. \(CAPEX_{it}\) is the ratio of firm’s total capital expenditure to firm’s total assets. \(OCF_{it}\) is the net operating cash flows of firm \(i\) at time \(t\). \(\epsilon_{it}\) is the random error term.

The adjustment of cash holdings of a firm to a target or optimal level is not immediate and it has its associated costs as this adjustment takes place through a partial adjustment process. So the relationship given below holds the current cash holdings and cash holdings at \(t-1\):

\[
CASH_{it} - CASH_{i,t-1} = \gamma (CASH^*_it - CASH_{i,t-1}) + \delta_{it}. \tag{2}
\]

\[
CASH_{it} = \beta_0 \gamma^t + (1-\gamma)CASH_{i,t-1} + \gamma \beta_1 NWC_{it} + \gamma \beta_2 SIZE_{it} + \gamma \beta_3 BMR_{it} + \gamma \beta_4 LEV_{it} + \gamma \beta_5 CAPEX_{it} + \gamma \beta_6 OCF_{it} + \eta_{it} + \lambda_{it} + \nu_{it}. \tag{3}
\]

In Equation (2), \(CASH^*_it\) represents the cash level of firm \(i\) at time \(t\) and \(CASH_{i,t-1}\) is the firm \(i\)’s cash level at time \(t-1\). \(CASH^*_it\) denotes the target or optimal level of cash holdings of firm \(i\) at time \(t\). \(\gamma\) denotes the coefficient of adjustment and its values range between 0 and 1.

If \(\gamma = 0\), it means that a firm will remain in its current cash position and if \(\gamma = 1\), the firms...
will tend to achieve an optimal or target level of cash holdings. By putting the value of $CASH_{it}$ from Equation (1) into Equation (2), we get the following equation.

In Equation (3), $\eta_i$ corresponds to firm-specific effects and $\lambda_t$ represents time-specific effects. By simplification of Equation (3), we have obtained the following equation:

$$CASH_{it} = \beta_0 + \rho CASH_{i,t-1} + \delta_1 NWC_{it} + \delta_2 SIZE_{it} + \delta_3 MTB_{it} + \delta_4 LEV_{it} + \delta_5 CAPEX_{it}$$

$$+ \delta_6 OCF_{it} + \delta_7 CP_{it} + \delta_8 PP_{it} + \delta_9 Q_{it} + \delta_{10} TANG_{it} + \delta_{11} CV_{it} + \eta_i + \lambda_t v_{it}. \quad (4)$$

In Equation (4), $\alpha = \gamma \beta_0; \rho = (1 - \gamma); \delta_k = \gamma \beta_k$; and $\lambda_t \nu_{it} = \gamma e_{it}$.

The use of OLS to estimate Equation (4) will lead to inconsistency because there is a problem of endogeneity between cash holdings and firm’s adjustment toward the optimal level of cash. Hence, two-step generalized method of moments (GMM) estimator will be used to resolve the issue of endogeneity and to estimate Equation (4). The reason for selecting two-step GMM is that it is more efficient than one-step GMM.

This study has estimated the equation through GMM (Arellano and Bond, 1991). One of the reasons to estimate our equation through GMM is addressing the issue of endogeneity. In post-estimation test, we estimated the Sargan test value and Abond test for the presence of second-order autocorrelation. The $p$-values for both Sargan and Abond tests are used for the validity of these tests. Then we divided the firms into above and below target firms by estimating the equation through pooled OLS and subtracting the fitted values from actual values of cash holdings as done in various capital structure studies and more recently by Rehman et al. (2016). Furthermore, we included the financial constraints in our model and re-estimated the equation for above and below target firms to control for the financial constraints.

3.4 Measurement of financial constraints

Financial constraints are measured by using two methods.

3.4.1 Altman’s Z score. First, Altman’s Z score model is used in the study to identify financially flexible firms. This model was proposed by Bancel and Mittoo (2011). It captures some unique variables and is based upon liquidity ratios, profitability ratios and leverage ratios (i.e. debt to equity ratio):

$$Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 0.999X_5,$$

where $X_1$ is the cash ratio minus trade payables ratio. It is used to measure liquidity of firm. $X_2$ is the retained earnings divided by total assets; retained earnings are profits kept for reinvestment in business. $X_3$ is the earnings before interest and taxes divided by total assets. $X_4$ is the book value of equity divided by book value of total liabilities. $X_5$ is the sales divided by total assets.

The result or score is divided into three quartiles where the highest quartile represents those firms which are FUC and lowest quartile corresponds to firms which are FC.

3.4.2 SA index. SA index was proposed by Hadlock and Pierce (2010). It describes that firm’s external factors are important to measure its financial constraints. SA index comprises size and age of the firm. Less constrained firms have high SA score and inverse will be the case for FC firms. In SA index, firm size is measured by taking the natural logarithm of its total assets or sales. Age of firm is calculated from the time of its listing:

$$SA1 = -0.737\text{Assets} + 0.043\text{Assets}^2 - 0.040\text{Firm’s age}.$$  

$$SA2 = -0.737\text{Sales} + 0.043\text{Sales}^2 - 0.040\text{Firm’s age}.$$
After the calculation of SA1 and SA2, results are divided into three quartiles where quartile 3 corresponds to FC firms and quartile 1 represents the firms which are FUC.

3.5 Distribution of firms into above and below target level
Data have been split into two subsamples: firms which hold cash above the optimal level and firms which hold cash below the optimal level. This idea of categorizing firms into above and below target firms is adopted from Rehman et al. (2016), Hovakimian et al. (2001) and Drobetz and Wanzenried (2006). Firms estimate a target or optimal level of cash holdings after making a tradeoff between the costs and benefits associated with holding more cash. First, the model is estimated by simple OLS regression which gives results comprising fitted values of regression. The resulting values of regressed fitted line represent the optimal level of cash. The values of fitted line are subtracted from the actual value of dependent variable (cash) and if the result is a positive number, it means that actual value is higher than the estimated value and the firm is above the optimal or target level of corporate cash holdings. Inversely, if the answer is a negative value, it means the firm is below the optimal or target level of cash holdings.

4. Discussion of results
4.1 Descriptive statistics
Table II comprises descriptive statistics for overall firms, and a representation of their number of observations, mean and standard deviation. The mean value (average value) for cash is 0.07 with the standard deviation of 0.14. The average value for firm size is 4.64 with the standard deviation of 0.8. For leverage, the average value is 1.16 and its standard deviation is 0.85. Operating cash flow has a mean value of 0.06 and standard deviation of 0.26. Mean value for growth is 2.10 with a standard deviation of 3.45. Average value for net working capital is −0.03 with a standard deviation of 1.77. The mean value for capital expenditure is 0.55 with a standard deviation of 0.43. Altman’s Z score’s mean value is 1.39 with a standard deviation of 1.5.

Table III corresponds to descriptive statistics for firms above the target level of corporate cash holdings and firms below the target level of corporate cash holdings. For determination of optimal or target level of cash, fitted value of OLS regression has been subtracted from actual cash values. The resulting values are both positive and negative where positive values correspond to those firms which have cash holdings above the optimal or target level and negative values represent the firms which have cash holdings below the optimal or target level of cash. In Table III, mean value of cash for above target firms is much higher than below target firms. Mean value of operating cash flow is also higher for above target firms.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Obs</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>CASH</td>
<td>1,924</td>
<td>0.07</td>
<td>0.14</td>
</tr>
<tr>
<td>SIZE</td>
<td>1,924</td>
<td>4.64</td>
<td>0.8</td>
</tr>
<tr>
<td>LEV</td>
<td>1,924</td>
<td>1.16</td>
<td>0.85</td>
</tr>
<tr>
<td>OCF</td>
<td>1,924</td>
<td>0.06</td>
<td>0.26</td>
</tr>
<tr>
<td>GROW</td>
<td>1,923</td>
<td>2.10</td>
<td>3.45</td>
</tr>
<tr>
<td>NWC</td>
<td>1,924</td>
<td>−0.03</td>
<td>1.77</td>
</tr>
<tr>
<td>CAPEX</td>
<td>1,924</td>
<td>0.55</td>
<td>0.43</td>
</tr>
<tr>
<td>ZSCORE</td>
<td>1,921</td>
<td>1.39</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Table II. Descriptive statistics for overall firms

Notes: Obs, observations; CASH, cash (dependent variable); SIZE, firm size; LEV, leverage; OCF, operating cash flow; GROW, growth opportunities; NWC, net working capital; CAPEX, capital expenditure; ZSCORE, Altman’s Z score
firms than for below target firms suggesting that above target firms tend to keep more cash to cope with liquidity crunches and financial distress. For leverage, mean value for both above and below target firms is not significantly different and it is slightly higher for below target firms which suggests that below target firms keep large amount of debts to deal with liquidity shortage. For growth opportunities, mean value is higher for above target firms than below target firms which means that firms try to hold more cash to finance higher growth opportunities. Mean value of net working capital is negative for both above and below target firms which indicates a large incurrence of current liabilities and a decrease in current assets. Capital expenditure is higher for below target firms than above target firms indicating that there are lower amounts of free cash flows to equity holders in below target firms and higher amounts of free cash flows are available to finance providers in above target firms.

4.2 Correlation matrix
Table IV represents correlation between all the variables of study. The last column corresponds to the variance inflation factor (VIF). To prove for the absence of multicollinearity, there should be no correlation between independent variable and the values of VIF must be less than 5. All the values of correlation matrix are within acceptable limits which correspond to the notion that there is no severe issue of correlation among independent variables. Furthermore, all values of VIF are also within the acceptable range (below 5). These two instances confirm the absence of multicollinearity between independent variables of the study.

4.3 Adjustment speed of overall firms
Arellano and Bond dynamic panel data model (GMM) is used to estimate Equation (4). Table V corresponds to the results of panel data regression for overall firms and the results are derived from applying GMM technique. In Table V, the value of coefficient is positive and statistically significant for lagged cash variable CASH (L1) where the value of coefficient is 0.583 and value of t-test is 22.67. It indicates that Pakistani firms follow the optimal or target level of cash holdings according to the tradeoff theory to keep a balance between costs and benefits of financing with debt and equity. The adjustment speed is calculated by subtracting the value coefficient of lagged cash variable from one.

The adjustment speed of overall firms is 0.417 (1−0.583) which is the indication of robustness of the results because the value of adjustment parameter ranges between 0 and 1. As the coefficient for the lagged value of cash is positive as well as statistically significant, it indicates that there is a partial adjustment policy followed by Pakistani firms toward the
There is a delay in adjusting to target or optimal level of cash holdings which is due to the fact that firms do not immediately adjust their cash holdings to an optimal level but take some time because adjustment also entails some costs. The results are consistent with Shah (2011) who found the same behavior of Pakistani firms to adjust to the target level of cash. Earlier, Rehman and Wang (2015) and Rehman et al. (2016) found the same adjustment behavior in Chinese firms and suggested optimal or target level of cash holdings; however, there is a delay in adjusting to target or optimal level of cash holdings which is due to the fact that firms do not immediately adjust their cash holdings to an optimal level but take some time because adjustment also entails some costs. The results are consistent with Shah (2011) who found the same behavior of Pakistani firms to adjust to the target level of cash. Earlier, Rehman and Wang (2015) and Rehman et al. (2016) found the same adjustment behavior in Chinese firms and suggested

### Table IV.
**Correlation matrix**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coef.</th>
<th>SE</th>
<th>t-test</th>
<th>( p &gt; t )</th>
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<td>0.003</td>
<td>3.04</td>
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<td>0.021</td>
<td>6.68</td>
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<td>0.005</td>
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<td>0.812</td>
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<td>0.014</td>
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<td>0.159</td>
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<td>-0.64</td>
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</tr>
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</table>

**Notes:** GMM is Arellano and Bond estimation. \( t \)-test values are given in the table. CASH is measured by dividing the cash holdings of a firm by total assets. CASH (L1) is the lagged cash variable. SIZE is measured by taking natural logarithm of a firm’s total assets. LEV is measured by dividing total debt of firm by its total assets. OCF is measured by dividing net operating cash flows of a firm with total assets. GROW is measured by taking the ratio of market value of equity and book value of equity. NWC is measured by subtracting current liabilities from current assets and then dividing the resulting figure with total assets. CAPEX is measured by dividing the amount of fixed assets by total assets. VIF is variance inflation factor.
that Chinese firms follow an optimal or target level of cash holdings and they adjust their cash holdings accordingly. This notion corresponds to a tradeoff model of cash adjustment. The GMM estimation for overall firms has statistical validity which is tested through three post-estimation tests and other parameters. The number of groups is greater than the number of instruments. The number of groups is 200 and the number of instruments is 52. Sargan test and Abond test are also statistically insignificant having values of 0.329 and 0.385, respectively. Sargan test is for robustness of model and Abond test is to check second-order autocorrelation and it has confirmed the absence of second-order autocorrelation in the model. All the independent variables have also maintained their positive coefficients and statistical significance in GMM regression except net working capital which has a negative coefficient and it is statistically insignificant as well indicating a large incurrence of current liabilities.

4.4 Determinants of corporate cash holdings

Table V also shows the relationship of cash holdings with determinants of cash holdings. Coefficient for firm size is positive and also statistically significant which suggests that firms with higher profits tend to hoard more cash than firms having lower profits because larger firms enjoy economies of scale and large market shares so they keep huge cash reserves. This notion is consistent with some previous studies which are Opler et al. (1999), Shah (2011) and Rehman et al. (2016). Leverage is also positive and statistically significant which is in line with the previous research on tradeoff theory. Firms with high debt to assets ratio tend to keep large cash reserves to cope with bankruptcy risk and financial crisis. Highly levered firms accumulate cash reserves by following precautionary motive of holding cash. The same results were derived by Rehman et al. (2016). Cash flow has a positive coefficient and it is significant as well which means that firms having huge amounts of cash inflow tend to have larger cash reserves and a large portion of cash flow is reserved as cash to be used as a ready source of liquidity later on. The results are consistent with Ferreira and Vilela (2004) and Shah (2011). Consistent with previous studies including Ozkan and Ozkan (2004), Chen (2008) and Duchin (2010), growth opportunities (GROW) also have a positive and significant sign which indicates that firms having higher growth opportunities also keep larger amounts of cash reserves because their high market-to-book ratio represents more growth opportunities for them and they keep cash reserves to finance their valuable projects. The results are in conformity with the pecking order and tradeoff theory. Net working capital has a positive coefficient yet it is statistically insignificant which means that there is excess of current liabilities incurred by firms and that there is a longer cash conversion cycle as well. For capital expenditure, both the sign and coefficient are positive which is according to the tradeoff theory which holds that firms having high capital expenditure tend to keep large cash in their reserves. This result is in line with Opler et al. (1999) and Rehman et al. (2016).

4.5 Adjustment speed for above and below target firms

Table VI shows regression results for above and below target firms. In case of above target firms, the value adjustment coefficient for lagged cash variable (CASH (L1)) is 0.373 which is positive and statistically significant with \( t \)-test value (9.71). For below target firms, the value of adjustment coefficient for lagged cash variable (CASH (L1)) is 0.502 which is also positive and statistically significant with \( t \)-test value (35.69). When adjustment coefficients of lagged cash variable are subtracted from 1, we obtained adjustment rate of 0.63 (1−0.37) and 0.5 (1−0.5) for above and below target firms, respectively. The positive and statistically significant lagged coefficient of cash holdings depicts the presence of tradeoff behavior across symmetry.
The results indicate that downward adjustment speed is higher than upward adjustment speed and the findings are consistent with Rehman et al. (2016) who tested and proved the same argument. Thus, the results provide a significant support for acceptance of our hypothesis that downward adjustment speed is higher than upward adjustment speed of corporate cash holdings. The number of groups is greater than the number of instruments for GMM and Sargan and Abond tests have shown insignificant values.

4.6 Financial constraints and adjustment speed of cash holdings

Tables VII and VIII represent results for speed of adjustment of corporate cash holdings with financial constraints. GMM estimation has been given. For financial constraints, three measures have been used. Table VII solely represents results for Altman’s Z score measure of financial constraints while Table VIII shows results for SA1 (based on assets to measure financial constraints) and SA2 (based on sales to measure financial constraints). The coefficients of lagged cash variable CASH (L1) are positive and statistically significant across all three measures of financial constraints which is the clear indication of the fact that Pakistani firms tend to follow an optimal or target level of cash holdings in both situations of FC and FUC. Adjustment coefficient which is the coefficient of lagged cash variable (CASH (L1)) for Altman’s Z score for FC and FUC firms is 0.085 and 0.43, respectively.

Based on the results of GMM for Altman’s Z score measure of financial constraints, adjustment rate is 0.92 (1–0.085) and 0.57 (1–0.43) for FC and FUC firms, respectively. The number of groups is greater than the number of instruments. Sargan test and Abond test are also insignificant.

In Table VIII, adjustment speed for SA1 index is 0.604 (1–0.396) and 0.442 (1–0.558) for FC and FUC firms, respectively. For SA2 index, adjustment speed is 0.73 (1–0.27) and 0.452 (1–0.548) for FC and FUC firms, respectively. Based on the results of above three measures

| Variables   | FC (Above target firms) | Coef. | SE  | t-test | p > t | FC (Below target firms) | Coef. | SE  | t-test | p > t |
|-------------|-------------------------|-------|-----|--------|------|--------------------------|-------|-----|--------|------|--------------------------|-------|-----|--------|------|
| CASH        | 0.373                   | 0.038 | 9.71| 0.000  | 0.502| 0.014                    | 35.69 | 0.000|
| CASH (L1)   | 0.039                   | 0.032 | 1.21| 0.225  | −0.023| 0.017                    | −1.29 | 0.196|
| SIZE        | −0.019                  | 0.007 |−2.47| 0.014  | 0.004| 0.002                    | 1.94  | 0.052|
| OCF         | 0.148                   | 0.02  | 7.26| 0.001  | 0.04 | 0.009                    | 4.46  | 0.001|
| GROW        | 0.009                   | 0.001 | 9.08| 0.001  | −0.005| 0.004                    | −1.42 | 0.156|
| NWC         | −0.004                  | 0.003 |−0.13| 0.90   | 0.027| 0.008                    | 3.14  | 0.002|
| CAPEX       | 0.008                   | 0.018 | 0.43| 0.667  | 0.004| 0.012                    | 0.03  | 0.973|
| CONS        | −0.099                  | 0.161 |−0.61| 0.539  | 0.105| 0.084                    | 1.26  | 0.208|
| Adj. rate   | 0.63                    |       | 0.5 |       |      |                          |       |      |
| No. of groups | 200                    |       |     |       |      |                          |       |      |
| Sargan test | 0.395                   |       |     |       |      |                          |       |      |
| Abond test  | 0.098                   |       |     |       |      |                          |       |      |

Table VI.

GMM regression results for above and below target firms

The results indicate that downward adjustment speed is higher than upward adjustment speed and the findings are consistent with Rehman et al. (2016) who tested and proved the same argument. Thus, the results provide a significant support for acceptance of our hypothesis that downward adjustment speed is higher than upward adjustment speed of corporate cash holdings. The number of groups is greater than the number of instruments for GMM and Sargan and Abond tests have shown insignificant values.
of financial constraints, there is no considerable evidence in support of our second hypothesis that FUC firms have higher adjustment speed for cash holdings than FC firms. According to our findings, FC firms move more quickly toward optimal level of cash holdings than FUC firms in case of deviation from the target level of cash. The results are consistent with Rashid and Ashfaq (2017) and Han and Qiu (2007) who also found a higher tendency of accumulating cash by FC firms than FUC firms. Higher levels of cash holdings in FC firms are associated with higher investment and hedging needs. Furthermore, large cash reserves allow FC firms to undertake certain profitable investments which might otherwise be ignored. FC firms also hoard cash to avoid costly external financing.

The model estimations for all the measures of financial constraints are statistically significant because all have shown more number of groups than number of instruments. Sargan test is also insignificant to prove that the results are robust. Abond test is also insignificant which shows the absence of second-order autocorrelation.

4.7 Downward and upward adjustment speed across financial constraints

Table IX corresponds to GMM regression results for asymmetric adjustment speed of corporate cash holdings to the target level while incorporating firm’s financial constraints. Firm-level observations above the optimal or target level of cash holdings are given in the first three columns of Table IX while observations below the optimal level are presented in the last three columns of Table IX. Panel A represents Altman’s Z score measure of financial constraints. Panel B corresponds to SA1 measure and Panel C is for SA2 measure of financial constraints. In Panel A for Altman’s Z score, downward adjustment speed for above target firms is 0.77 and 0.99 for FC and FUC firms, respectively. Upward adjustment speed for below target firms is 0.81 and 0.54 for FC and FUC firms, respectively. It indicates that downward adjustment speed is higher only with FUC firms and upward adjustment speed is higher only with FC firms.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Constrained firms (GMM)</th>
<th>FUC firms (GMM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CASH</td>
<td>Coef.</td>
<td>SE</td>
</tr>
<tr>
<td>CASH (L1)</td>
<td>0.085</td>
<td>0.022</td>
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<tr>
<td>SIZE</td>
<td>−0.01</td>
<td>0.028</td>
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<tr>
<td>LEV</td>
<td>0.001</td>
<td>0.007</td>
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<tr>
<td>OCF</td>
<td>0.024</td>
<td>0.022</td>
</tr>
<tr>
<td>GROW</td>
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<td>0.001</td>
</tr>
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<td>NWC</td>
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<td>0.07</td>
</tr>
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<td>125</td>
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<tr>
<td>No. of instruments</td>
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<td>52</td>
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<td>Sargan test</td>
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<tr>
<td>Abond test</td>
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<td>0.38</td>
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</table>

Notes: t-test values are given in the table. GMM is Arellano and Bond estimation. Z score is Altman’s Z score. CASH is measured by dividing the cash holdings of a firm by total assets. CASH (L1) is the lagged cash variable. Firm size is measured by taking natural logarithm of a firm’s total assets. Leverage is measured by dividing total debt of firm by its total assets. Cash flow is measured by dividing net operating cash flows of a firm with total assets. Growth opportunities are measured by dividing market value of equity with book value of equity. Net working capital is measured by subtracting current liabilities from current assets and then dividing the resulting figure with firm’s total assets for the purpose of scaling. Capital expenditure is measured by dividing the amount of fixed assets by total assets.
rate is higher only for FC firms. These are mixed results with no clear indication that downward adjustment speed is higher even after financial constraints are controlled.

Higher downward adjustment speed for FUC firms is due to excess cash holdings by these firms and higher upward speed for FC firms is because of the reason that these firms hold more cash to cope with cash flow volatility and financial crisis. Based upon GMM estimates for Altman’s Z score, the results are not consistent with our third hypothesis. According to SA1 measure in Panel B, downward adjustment speed for FC and FUC firms is 0.58 and 0.47, respectively. For below target firms, this speed is 0.61 and 0.58 for FC and FUC firms, respectively. It indicates that upward adjustment speed is higher than downward adjustment speed after controlling for financial constraints. Furthermore, while analyzing SA2 measure in Panel C, downward adjustment speed is 0.67 and 0.67 for FC and FUC firms, respectively, and for below target firms, adjustment speed is 0.6 and 0.56 for FC and FUC firms, respectively. It indicates that downward adjustment speed is higher than

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coef.</th>
<th>SE</th>
<th>t-test</th>
<th>p &gt; t</th>
<th>Coef.</th>
<th>SE</th>
<th>t-test</th>
<th>p &gt; t</th>
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<td></td>
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<td>0.02</td>
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<td>CASH (L1)</td>
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<tr>
<td>Sargan test</td>
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</tbody>
</table>

**Notes:** t-test values are given in the table. GMM is Arellano and Bond estimation. SA1 is assets-based measure of financial constraints. SA2 is sales-based measure of financial constraints. Cash is measured by dividing the cash holdings of a firm by total assets. CASH (L1) is the lagged cash variable. Firm size is measurement made by taking natural logarithm of a firm’s total assets. Leverage is measured by dividing total debt of firm by its total assets. Cash flow is measured by dividing net operating cash flows of a firm with total assets. Growth opportunities are measured by dividing market value of equity with book value of equity. Net working capital is measured by subtracting current liabilities from current assets and then dividing the resulting figure with firm’s total assets for the purpose of scaling. Capital expenditure is measured by dividing the amount of fixed assets by total assets.
upward adjustment speed even after controlling for financial constraints. The result is consistent with the findings of Rehman et al. (2016) who reported the same results for SA2 measure of financial constraints yet they presented the same findings for SA1 measure and for Altman’s Z score as well.

For firms to move downward or to adjust to their optimal or target level of cash holdings, it is quite easy because they can pay taxes, dividends and make investments in profitable ventures to cut down their excess cash holdings. Although the results of SA2 measure of financial constraints support our third hypothesis, Altman’s Z score and SA1 measure did not provide any substantial support to this hypothesis that is why it is rejected.

5. Conclusion
The main focus of this study is to find out the upward and downward adjustment behavior of Pakistani firms toward their optimal or target level of cash holdings. Prior research studies of capital structure (Drobetz and Wanzenried, 2006; Almeida et al., 2004; Han and Qiu, 2007; Al-Najjar, 2013) have been followed to understand the tendency of firms to opt for a target level of cash and for this purpose, firms have been divided into above and below target firms. For the estimation of adjustment speed for above and below target firms, Arellano and Bond (GMM) estimator has been used which is a dynamic model for panel data regression and is suitable to analyze the speed of adjustment of firms. On the first stance, the results prove that downward speed of adjustment is higher than upward speed of adjustment and it is because of the reason that firms with cash holdings above target level can easily cut down their cash reserves either by making necessary debt payments or by investing in profitable projects. Financial constraints have also been incorporated in our research model to check for the adjustment speed of FC and FUC firms and to prove that the downward speed of adjustment still remains higher even after controlling for financial constraints.

### Table IX.
Regression results for asymmetric speed and constraints

<table>
<thead>
<tr>
<th></th>
<th>Above target</th>
<th>Below target</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Constrained</td>
<td>FUC</td>
</tr>
<tr>
<td><strong>Panel A: ZSCORE</strong></td>
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</tr>
<tr>
<td>Adj. rate</td>
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<td>0.992</td>
</tr>
<tr>
<td>CASH (L1)</td>
<td>$-0.23^{***} (-14.66)$</td>
<td>$-0.008^{*} (-0.49)$</td>
</tr>
<tr>
<td>No. of groups</td>
<td>27</td>
<td>67</td>
</tr>
<tr>
<td>No. of instruments</td>
<td>44</td>
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<td>Abond test</td>
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<tr>
<td><strong>Panel B: SA1</strong></td>
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<tr>
<td>CASH (L1)</td>
<td>$0.42^{***} (11.61)$</td>
<td>$0.53^{***} (64.21)$</td>
</tr>
<tr>
<td>No. of groups</td>
<td>26</td>
<td>45</td>
</tr>
<tr>
<td>No. of instruments</td>
<td>51</td>
<td>52</td>
</tr>
<tr>
<td>Abond test</td>
<td>0.9</td>
<td>0.66</td>
</tr>
<tr>
<td><strong>Panel C: SA2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adj. rate</td>
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<td>0.67</td>
</tr>
<tr>
<td>CASH (L1)</td>
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<td>$0.33^{***} (-14.65)$</td>
</tr>
<tr>
<td>No. of groups</td>
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<td>45</td>
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<tr>
<td>No. of instruments</td>
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<tr>
<td>Abond test</td>
<td>0.69</td>
<td>0.13</td>
</tr>
</tbody>
</table>

**Notes:** *t*-test values are given in the table. Z score is Altman’s Z score. SA1 is assets-based measure of financial constraints. SA2 is sales-based measure of financial constraints. GMM is Arellano and Bond estimation. Cash is calculated by dividing the cash holdings of a firm by total assets. CASH (L1) is the lagged cash variable. **Statistical level of significance at 90 and 99 percent, respectively**
constraints. But when it comes up with financial constraints, there is not any considerable evidence that this speed of adjustment holds after controlling for financial constraints. Furthermore, this study uses three measures of financial constraints (i.e. Altman’s Z score, SA1 index and SA2 index) to explore the adjustment speed of corporate cash holdings but all three measures failed to provide any substantial support to our hypotheses.

The results are mixed as at the first place, FC firms have appeared to adjust more speedily than FUC firms and second, there is no evidence of higher rate of downward adjustment of cash holdings after controlling for financial constraints. The results are consistent with Rashid and Ashfaq (2017) who also found a positive association between corporate cash holdings and financial constraints. But for asymmetric adjustment of cash holdings across financial constraints, there is no evidence from prior literature which gives the same results.

This study fails to conciliate financial constraints to address the adjustment speed of corporate cash holdings and it is because of the fact that Pakistani firms do not adjust promptly to their optimal level when they are FC as they do not have certain valuable assets in their portfolio which can be offered as collateral to back the debt service and they may also run out of cheap debt obligations, they are mainly affected by information asymmetry, they ought to borrow at high costs and their small size, young age, lower level of income also make them to hoard more cash but still they do not adjust to the target level of cash holdings. Moreover, Pakistani firms with high levels of cash holdings are prone to financial distress (Afza and Adnan, 2007; Kruja and Borici, 2016), suffer more from cash flow volatility and spend huge amounts of cash on research and development. These factors also restrict their downward adjustment speed toward target level of cash.

There are no alternatives available to Pakistani firms for their downward adjustment of cash holdings when financial constraints are involved. There are more adjustment costs associated with downward adjustment than for upward adjustment of cash holdings. For example, Pakistani firms may have their debts matured and payable so they need to pay them first instead of using cash immediately, or they may have dividends outstanding so they need to make dividends payments immediately. These adjustment costs make it difficult for Pakistani firms to adjust quickly to their optimal level of cash. Moreover, high dividend payout ratio and firm’s age also hinder the speedy adjustment of corporate cash holdings in Pakistani firms because these factors are considered as internal financial constraints (Azam and Shah, 2011), and costly external financing is also a hurdle for firms to adjust quickly to their optimal or target level of cash. Moreover, transaction costs, opportunity costs, agency costs of financial upsets and high investment costs are other important factors responsible for lower downward speed of adjustment of Pakistani firms (Azmat, 2014).

The results are specifically useful for managers, policymakers, investors and researchers. Cash holdings policies can be revised according to the results of this study and to understand the adjustment behavior of FC and FUC firms toward an optimal or target level of cash. As FC firms appear to hoard more cash in their reserves, these findings are particularly helpful for policymakers that if they want to reduce the intensity of financial constraints, they must take steps to reduce barriers to inter-financial markets and take initiatives to improve the functioning of overall capital markets.

References


Further reading


Hsu, P.H., Li, F. and Lin, T.C. (2016), “Innovative firms hold more cash? the international evidence”, working paper, University of Hong Kong.


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The contingent roles of perceived budget fairness, budget goal commitment and vertical information sharing in driving work performance

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Abstract
Purpose – Drawing on equity theory, social exchange theory and goal setting theory, the purpose of this paper is to investigate the contingencies on the link between employees’ budgetary participation and their work performance. Specifically, this study addresses the research questions: whether vertical information sharing and budget goal commitment mediate the relationship between employees’ budgetary participation and their work performance; and whether employees’ perceived budget fairness can strengthen the positive effects of budgetary participation on vertical information sharing and budget goal commitment.

Design/methodology/approach – Survey data were collected from a sample of 556 low to middle level managers of business organizations in Vietnam. The research model and its hypotheses were tested using PLS-SEM. The standardized root mean squared residual value of the composite model was employed to assess model fit. Common method bias was also checked using the marker-variable approach.

Findings – This study has two key findings: both vertical information sharing and budget goal commitment partially mediate the positive effects of budgetary participation on work performance; and both dimensions of perceived budget fairness (distributive and procedural) elevate the positive relationships of budgetary participation – vertical information sharing and budgetary participation – budget goal commitment.

Practical implications – The findings could benefit businesses in Vietnam and similar market contexts. Specifically, top management needs to select a proper level of budgetary participation that can facilitate information sharing vertically within the organization and motivate their employees to be more committed to achieve budget goals. Besides, the top management also needs to ensure that their employees perceive the fairness in the budgeting process.

Originality/value – The study contributes a greater understanding as regards the mediating roles of vertical information sharing and budget goal commitment as well as the moderating role of perceived budget fairness on the relationship between employees’ participation in the budgeting process and their work performance, especially in the context of an emerging market – Vietnam. Overall, this study contributes to the management and accounting literature with insights concerning a more complex process explaining employees’ work performance and triggered by their budgetary participation.

Keywords Emerging markets, Budget fairness, Budget goal commitment, Budgetary participation, Vertical information sharing

Paper type Research paper

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1. Introduction
Over the past three decades, researchers have extensively examined whether employees’ involvement in and influence on their budgeting targets make them work more effectively. Despite numerous research, there is lack of consensus theoretically and empirically on the link between budgetary participation and work performance. There is empirical support for the positive relationship between employees’ participation in budgeting and their work performance in previous behavioral accounting studies (e.g. Brownell and McNes, 1986; Chong and Johnson, 2007; Dunk, 1989; Kren, 1992). Based on three meta-analyses, Bonache et al. (2012) stated that, on the whole, the direct link between one’s participation in the determining budgetary resources and their work performance in not significant. These findings of meta-analyses did not mean to discount the importance of involving employee’s involvement in budget decisions, but instead suggested that the link between budgetary participation and work performance are contingent on intervening variables. Some researchers drew on expectancy theory to argue that the relationship between budgetary participation and work performance can be predicted through employees’ motivation factors (Brownell and McNes, 1986). Higher levels of budgetary participation are found to be associated with more budget-based compensation, which in turn leads to higher firm performance (Shields and Young, 1993). Another research stream has focused on the intervening path through the cognitive benefits of the budget process in terms of information sharing (Chong and Chong, 2002; Chong and Johnson, 2007). More recent studies have examined the indirect effects of budgetary participation on work performance, operating through psychological capital (Venkatesh and Blaskovich, 2012), job satisfaction and relevant job information (Leach-López et al., 2007, 2009) and role ambiguity (Parker and Kyj, 2006).

While it appears that budgetary participation may generate a positive effect on work performance when the proper mechanisms are employed, researchers have so far disagreed on the intervening variables (Cheng, 2012). Therefore, this study attempts to contribute an improved understanding on interventions that could be designed to explain or influence the meaningful relationship between budgetary participation and work performance. More specifically, this study extends the existent literature by examining vertical information sharing and budget goal commitment as concurrently potential mediators that connect budgetary participation to enhanced work performance. These two mediators, respectively, capture cognitive-informational and motivational paths that were mostly examined separately and independently in prior research. In integrating the two mediators in one framework, the study provides insights into the relative roles of vertical information sharing and budget goal commitment in impacting employees’ work performance. Furthermore, this study also argues that employees’ perceived budget fairness may elevate the positive effects of budgetary participation on vertical information sharing and budget goal commitment. While some prior research into organizational justice or fairness examines perceived fairness as a mediating invention (Cohen-Charash and Spector, 2001; Lau and Tan, 2006), this study considers fairness could be ex post consequence that can modify the relationship between employees’ budgetary participation and their behaviors. In this regard, using equity theory and social exchange theory – where organizational justice theory is also traced to – as empirical guide (Adams, 1965; Blau, 1964; Greenberg, 1987), this study proposes that the interaction between employees’ budgetary participation and their perceived budget fairness relates to enhanced work performance through enhanced vertical information sharing and budget goal commitment. In this sense, the higher employees perceive the level of budget fairness, the more budgetary participation is related to vertical information sharing and budget goal commitment. Drawing upon the goal setting theory (Locke and Latham, 1990, 2002, 2006), this study also conjectures that a higher level of budget goal commitment can result in better work performance. Moreover, this study adds to currently limited research on how budgetary participation can enhance work
performance in the emerging markets. Many modern management theories have been rooted from the West and subjected to criticism of limited relevance in developing markets (Blunt and Jones, 1997). Much research into budgetary participation and perceived fairness has been done in the context of Western markets (e.g. De Baerdemaeker and Bruggeman, 2015; Sholihin et al., 2011). Therefore, it has been argued that research is needed to explore the application of theories in emerging market contexts (Blunt and Jones, 1997; Sheth, 2011). Therefore, while the concepts used in this study may not be novel, an important implication for this study lies with its insights from an emerging market context to maintain theoretical and practice relevance of extant theories as well as prior findings in extant literature. Vietnam was selected as the context of the study, but this is not a convenience choice. Vietnam is a sizable, fast-growing market in Asia, once a centrally planned economy and in the past decades has attracted considerable attention of foreign investment (World Bank, 2017). Therefore, Vietnam can be a meaningful context for examining the application of modern management practices in driving employees’ performance.

Overall, this study research contributes to the accounting and management literature by providing insights of the roles of budgetary participation as well as contingency factors such as information sharing, budget goal commitment and perceived budget fairness in inducing employee’s work performance, particularly with evidence from the context of an emerging market – Vietnam.

2. Hypothesis development

2.1 Budgetary participation and work performance – the mediating role of vertical information sharing

Budgetary participation is the degree to which managers influence over and engage in setting the budgets of their subunits (Ezzamel, 1990; Kenis, 1979). It also refers to the frequency and perceived influence of budget-related consultations between superiors and subordinates (O’Connor et al., 2001). Budget participation is argued to serve an informational function in that it drives employees to gather, exchange, disseminate and communicate information that is relevant to the decision-making process to other stakeholders in the organization (Nouri and Parker, 1998). The communications of information between subordinates and superiors could be either upward or downward, making up vertical information sharing (Parker and Kyj, 2006). Regarding upward communication, some studies in the accounting discipline relied upon the agency theory (Lambert, 2007) to suggest that employees often have more knowledge of their operational areas than their superiors and their participation in budget decisions will enable them to share those “private” knowledge with their superiors to negotiate realistic budget plans and goals (Nouri and Parker, 1998; Parker and Kyj, 2006). High budgetary participation also involves high frequency and broad scope of discussions between superiors and subordinates about their budget issues (Milani, 1975; Murray, 1990). The frequency and scope of such discussions allow more opportunities for subordinates to share their insights with superiors. With respect to downward communication, budgetary participation enables the sharing of information from the superiors to subordinates, in which superiors can cascade the organization’s goals and expectations of subordinates, and at the same time subordinates may obtain information regarding their own tasks and responsibilities. Hence, it is expected that budgetary participation can enhance vertical information sharing, including both upward and downward communications.

On the other hand, information sharing across members of the organizational hierarchy involving in budget decisions is also argued to be beneficial to both employees and organization (Parker and Kyj, 2006). At the individual level, both types of vertical information sharing (upward and downward) can increase employees’ work performance in a number of ways such as enabling the superiors to help develop better strategies for their
subordinates (Murray, 1990) and ensuring that subordinates receive adequate budget support (Nouri and Parker, 1998). Indeed, when employees participate in the determination of budget resources, they will use their operational knowledge and insights to negotiate budgetary goals and resources with their superiors, resulting in realistic budget plans with better informed actions. The budgetary participation also gives the employees the chances to understand the company’s strategies and expectations of them, so that they can perform their tasks more effectively. As such, it can also be posited that vertical information sharing can help enhance the employees’ work performance. Following prior meta-analyses in the literature that the direct link between employee’s budgetary participation and their work performance is not significant (Bonache et al., 2012), it can be expected that the employee’s budgetary participation influences their work performance through the operation of vertical information sharing across different organizational hierarchies. In this regard, budgetary participation can foster vertical information sharing, which in turn enhances employees’ work performance. Thus, it can be hypothesized that:

H1. Vertical (upward and downward) information sharing positively mediates the relationship between budgetary participation and work performance.

2.2 Budget participation and work performance – the mediating role of budget goal commitment

Similarly, another mechanism intervening the budgetary participation – work performance relationship is budget goal commitment. Budget goal commitment refers to the determination to strive for a budget goal and the perseverance in pursuing the goal over time (Locke et al., 1988). Regarding the participation – commitment relationship, previous studies in management and organizational behavior (e.g. Locke et al., 1988; Rhodes and Steers, 1981) have drew on goal setting theory to propose that employees’ participation in decision making increases their goal commitment. An important notion of the goal setting theory is that goals, which are human conscious intentions, regulate their subsequent behaviors or actions (Locke and Latham, 2006). In this sense, when employees get involved in the budgeting process, they could feel a sense of ownership of the budget and that feelings of control can enhance their commitment to achieving budget goals. A statistically significant association between budgetary participation and budget goal commitment is also found in some accounting studies (e.g. Jermias and Yigit, 2012; Nouri and Parker, 1998; Quirin et al., 2000). Moreover, within the context of Vietnam with a collectivist culture (i.e. low individualism index) (Hofstede, 2017), employees tend to react positively to a high budgetary participative environment because “decision making is shared among all members of the society and subordinates are viewed as equal partners by the superiors” (Jermias and Yigit, 2012, p. 36). Shields and Shields (1998) argued that the participation of employees in the decision-making process can result in less resistance to changes and more commitment to organizational decisions. Therefore, a positive relationship between budgetary participation and budget goal commitment is expected.

The relationship between organizational commitment and employees’ work performance is well established in previous studies in the areas of human resource management and organizational behavior (Jaramillo et al., 2005; Riketta, 2002). These studies theorize that a higher level of employees’ commitment can result in higher motivation, which in turn, leads to higher work performance. In the budget setting context, the relationship between budget goal commitment and work performance can also be drawn upon the goal setting theory (Locke and Latham, 1990, 2002, 2006). In accordance with this theory, once employees are committed to budget goals, they will increase their efforts required to achieve those goals. This means employees who are committed to their budget goals will try harder and persist over time, resulting in being more effective than less committed employees (Chong and Johnson, 2007).
Hence, the positive relationship between budget goal commitment and work performance is expected. Some studies in the accounting discipline also provide empirical evidence that budget goal commitment is positively linked to work performance (e.g., Chong and Chong, 2002; Kren, 1990; Marginson and Ogden, 2005; Nouri and Parker, 1998). Taking a similar line of reasoning in Section 2.1, it can be expected that budgetary participation enhances budget goal commitment, which in turn, enhances work performance. Thus, it can be hypothesized that:

H2. Budget goal commitment positively mediates the relationship between budgetary participation and work performance.

2.3 From budgetary participation to vertical information sharing and budget goal commitment – the moderating role of perceived budget fairness

While budgetary participation can be used as a motivational and informational measure to enhance staff performance, the sharing of information or commitment to budget goals can also be preceded by the perceptions of fairness of budget decisions made by their superiors (Arnold, 2015). The organizational justice theory suggests that employees’ perceptions of fairness of organizational behaviors impact their attitudes and behaviors within the organization (Greenberg, 1987). Drawing on this theory, some researchers adopt the concept of perceptions of budget fairness, which comprises two dimensions: distributive and procedural fairness (Lau and Tan, 2006). The former concerns with the distribution of final outcomes, while the latter taps into the processes that are used to deliver the outcomes (Greenberg, 1987). The meta-analysis of Cohen-Charash and Spector (2001) suggests perceived justice serves as mediating intervention in the relationship between perceptions of organizational outcomes/practices and outcomes such as job performance (Cohen-Charash and Spector, 2001). In the same vein, the study of Lau and Tan (2006) also examines procedural fairness as a mediator of the impact of budgetary participation on job tension (Lau and Tan, 2006). In this sense, perceived fairness has been deemed as a mechanism explaining the relationship between budgetary participation and outcomes.

On the other hand, it is worth noting that the concept of justice is grounded in the equity theory, which that is rooted from Adams (1965) and Blau’s (1964) social exchange theory. In the budget setting literature, distributive fairness relates to the perceived fairness of the resource allocation that an employee receives in relation to what others receive, while procedural fairness concerns with the perceptions of fair enactment of budgeting procedures (Maiga and Jacobs, 2007). In accordance with the equity theory and the social exchange theory, employees may evaluate the exchange fairness of the relationship with the organization by comparing the efforts they contributed (time, thinking, emotions, energy […] and the rewards they got (pay, support, respect, entitlements […] (Hur et al., 2014). Such comparison is indeed the source of motivation for employees to adapt themselves in order to equalize the differences (Elamin, 2012). For example, when the employees believe that they receive unfair compensation, they can engage in harmful working behaviors (Hopkins and Weathington, 2006). It is the aim of procedural justice to minimize conflicts by facilitating the positive relationships between employees (Hur et al., 2014). Research has suggested that employees are not only concerned with organizational inequality, but also the procedures for achieving outcomes (Leventhal, 1980). Thibaut and Walker’s (1975) study found that the employees’ participation in the decision-making processes would give them a sense of control. As a result, if they perceive that they are treated fairly and that the evaluation process is satisfactory, they will believe in proper and trustworthy final results. In this regard, even the concepts of justice and fairness have been used interchangeably, they are ex ante provision and ex post consequence aspects (Cugueró-Escofet and Rosanas, 2013). Therefore, it could be deemed that the organization’s act of providing employees with the chance to participate in budgeting per se triggers their initial perceptions of fairness that led to initial information
sharing and performance; and then the perceived fairness varied through the ongoing interactions with the structure could modify the employees’ attitude and behavior.

As such, this study draws upon Blau’s (1964) equity theory and social exchange theory in arguing that when employees believe that the budgeting procedures are fair and the targets are fairly distributed, they are more likely to share information during the budgeting process and put more effort to commit to budget goals. On the other hand, employees who believe that the budgeting process is unfair are less likely to disclose information (Parker et al., 2014) and have lower commitment to budget goals. In this regard, when employees believe that budgeting procedures are fair with a high level of procedure and distributive justice, they will believe that the budget decisions are aligned with their rights and interests; consequently, they are more likely to share their private information in the budgeting process and more committed to set budget goals (Wentzel, 2002). In addition, a fair budgeting environment can enhance interpersonal trust and reduce job tension (Lau and Tan, 2006), creating a favorable condition for information sharing. Conversely, when the budgeting system is unfair, employees feel disrespected and are inclined not to share information (Parker et al., 2014) and they tend to express a low level of budget goal commitment. As theorized in this study, a fair budgeting process signals respect for the interests of the employees which encourage information sharing as well as their budget goal commitment. On the other hand, an unfair budgeting process, such as a budgeting process with favoritism, triggers negative behaviors (Hopkins and Weathington, 2006), demotivates employees to share information and weakens their budget goal commitment (Parker et al., 2014). Methodologically, mediation and moderation are not mutually exclusive, or in other words, the consideration of an intervening variable as a mediator does not mean that variable can never be examined as a moderator, provided that there is no multicollinearity issue (Jose, 2013). In light of these above reasoning, this study hypothesizes that when employees perceive a higher level of budget fairness, the positive influences of budgetary participation on vertical information sharing and budget goal commitment can be strengthened. Thus, it can be hypothesized that:

**H3a.** Perceived budget distributive fairness positively moderates the relationship between budgetary participation and vertical information sharing.

**H3b.** Perceived budget procedural fairness positively moderates the relationship between budgetary participation and vertical information sharing.

**H4a.** Perceived budget distributive fairness positively moderates the relationship between budgetary participation and budget goal commitment.

**H4b.** Perceived budget procedural fairness positively moderates the relationship between budgetary participation and budget goal commitment.

Figure 1 illustrates the proposed model that integrates the above discussed hypotheses.

### 3. Research methods

#### 3.1 Sampling and data collection

This study was conducted in Vietnam – an emerging economy – with a data set of 556 mid- and low-level managers in business firms. To include these specific informants in the sample, a convenience-sampling approach was used to identify potential informants, and qualifying questions were asked at the commencement of the survey to identify relevant informants. The selection criteria included: being a mid- or low-level manager; having organizational tenure of at least two years, and having at least two-year budgetary experience/responsibilities. The informants represented various functional areas that are usually involved in budget practices, including sales, marketing, finance/accounting and manufacturing/production.
These selection criteria ensured that the chosen informants were knowledgeable about the budgeting issues in their respective organizations.

The authors distributed both e-mail and paper surveys to the target informants. The sampling frame includes contacts from the authors’ LinkedIn connections. The initial list included 15,363 potential e-mail contacts. The authors contacted the potential informants via emails asking for their participation and then created a link to the survey on Survey Monkey and the informants’ completion of the survey was considered as their consent of participation. Following the procedure suggested by Brislin (1970), the original survey items in English were translated into Vietnamese and back-translated by two academics who were competent in both English and Vietnamese. To further ensure the face validity, the translated Vietnamese questionnaire was also checked by managers and academics with respect of items wording, relevancy and comprehensions. The final version of the survey questionnaire was circulated to the potential informants via Survey Monkey, which is an online survey administration tool. From May to December 2017, 1,435 responses were received. After eliminating 360 that had no budget experience, 268 incomplete responses, 217 top-level managers and employees, and 34 responses that were done within less than five minutes for completing the survey, the final sample included 556 responses.

LinkedIn is the most successful and comprehensive professional network (Mintz and Currim, 2013). The use of LinkedIn to obtain the source of the target informants’ emails has been applied in previous studies (e.g. Mintz and Currim, 2013; Ouakouak and Ouedraogo, 2017; Michalena and Hills, 2016). To test the legitimacy of the sample, information on the profiles of the 556 surveyed informants were examined. For the 115 LinkedIn members who used company emails indicating affiliations, we found that there is no legitimacy problem. For the 441 remaining LinkedIn members who used personal emails (e.g. Gmail or Yahoo), we randomly selected 20 (5 percent of them) then used internet and telephone to check various information on their profiles (e-mail, address, name, telephone number, company name, department and job title) in term of existence. We found that no exception noted, indicating no serious legitimacy issue of the final sample.

Table I shows the demographics of the participating firms and informants. The final sample comprised 79.7 percent mid-level managers and 20.3 percent low-level managers. All informants had a bachelor degree, and 29.1 percent had a master’s degree or above. The informants’ average tenure (5.35 years) and budget experience (4.81 years) indicated that they had adequate experience to respond to the survey and were knowledgeable about budgeting issues. In relation to age, 81.7 percent of the informants were aged between 25 and 39. The informants worked in sales and marketing (43.2 percent), research and development (16.4 percent), manufacturing (16.7 percent), finance/accounting (12.1 percent),
and other departments such as purchasing, human resource management, and information technology (11.6 percent). In terms of firm characteristics, 50.9 percent of informants worked in the service industry, 27.9 percent worked in manufacturing and 21.2 percent worked in the trade industry. The sample well reflects the industrial structure of Vietnam in which the services industry accounts for approximately 50 percent of GDP of Vietnam in 2015 followed by manufacturing at 33 percent (PwC, 2016).

The informants worked for foreign companies (70.7 percent) and local companies (29.3 percent). In terms of firm size, 75.3 percent of informants worked in firms with total assets of more than VND 100bn. In addition, 75.5 percent of informants worked in firms with more than 100 full time equivalent employees. Given that the final response rate was low (3.6 percent), the study followed Armstrong and Overton’s (1977) procedure to test non-response bias. The independent t-tests revealed that there are no statistically significant differences in all measures among the first (earliest) and fourth (latest) quartiles of responses, indicating no non-response bias in this study.

3.2 Measurement scales and reliability and validity tests
This study adopts well-established scales in the existent literature to measure the variables in the research model. The main variables measured in the questionnaire were budgetary participation, perceived budget fairness, vertical information sharing, budget goal commitment and work performance. Budgetary participation was measured following previous studies (e.g. Milani, 1975; Nouri and Parker, 1998; Parker and Kyj, 2006). The scale has six seven-point items. The respondents were asked to assess the degree of involvement

<table>
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<th>Demographics</th>
<th>Frequency (n = 556)</th>
<th>Percent</th>
<th>Demographics</th>
<th>Frequency (n = 556)</th>
<th>Percent</th>
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</tr>
<tr>
<td>2–5 years</td>
<td>403</td>
<td>72.5</td>
<td>201–500</td>
<td>79</td>
<td>14.2</td>
</tr>
<tr>
<td>6–10 years</td>
<td>81</td>
<td>14.6</td>
<td>501–1,000</td>
<td>68</td>
<td>12.2</td>
</tr>
<tr>
<td>&gt; 10 years</td>
<td>72</td>
<td>12.9</td>
<td>&gt; 1,000</td>
<td>189</td>
<td>34.0</td>
</tr>
<tr>
<td>Budget experience</td>
<td></td>
<td></td>
<td>Firm size (full time equivalent employees)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2–5 years</td>
<td>396</td>
<td>71.2</td>
<td>≤ 100</td>
<td>136</td>
<td>24.5</td>
</tr>
<tr>
<td>6–10 years</td>
<td>137</td>
<td>24.6</td>
<td>101–300</td>
<td>105</td>
<td>18.9</td>
</tr>
<tr>
<td>&gt; 10 years</td>
<td>23</td>
<td>4.2</td>
<td>301–1,000</td>
<td>118</td>
<td>21.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1,001–5,000</td>
<td>103</td>
<td>18.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5,001–10,000</td>
<td>58</td>
<td>10.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>&gt; 10,000</td>
<td>36</td>
<td>6.5</td>
</tr>
</tbody>
</table>

Table I. Demographics of the participating firms and informants

Perceived budget fairness

3.2 Measurement scales and reliability and validity tests
This study adopts well-established scales in the existent literature to measure the variables in the research model. The main variables measured in the questionnaire were budgetary participation, perceived budget fairness, vertical information sharing, budget goal commitment and work performance. Budgetary participation was measured following previous studies (e.g. Milani, 1975; Nouri and Parker, 1998; Parker and Kyj, 2006). The scale has six seven-point items. The respondents were asked to assess the degree of involvement
and influence that they have in the budgeting process with the scale ranging from \(1 = \text{"very little"} \) to \(7 = \text{"very much"} \). Perceived budget fairness was operationalized by budget distributive fairness and budget procedural fairness. Budget distributive fairness was measured using managers’ responses to five seven-point Likert items (Magner and Johnson, 1995; Wentzel, 2002). These items assess various comparative bases (needs, expectations and what is deserved) that employees may use when judging the fairness of distributions as well as the interpersonal facet of distributive fairness. Budget procedural fairness was assessed using responses to eight procedural fairness statements following Magner and Johnson (1995) and Wentzel (2002). These items measure the fairness of allocation procedures (consistency across persons and time, accuracy, correctability, ethicality and bias suppression) and the informational facet of procedural fairness. Vertical information sharing is assessed via the scale of Parker and Kyj (2006). Budget goal commitment was adapted from Chong and Chong (2002). This measure derives commitment levels by asking directly about the goal. The scale ranges from \(1 = \text{"strongly disagree"} \) to \(7 = \text{"strongly agree"} \).

Employees’ work performance was measured based on a widely accepted scale, which was originally developed by Mahoney et al. (1963) and subsequently used by Hall (2008), Kren (1992) and Lau and Roopnarain (2014). This study uses self-reports, or subjective scores, to evaluate work performance because “a worker’s cognitive representation and reports of his or her own” work performance “may be more subtle than those of his or her supervisor, since a worker has much more information about the historical, contextual, intentional and other backgrounds of his or her own work activities” (Janssen, 2001, p. 192). Following previous studies (e.g. Janssen, 2001), this study incorporates three demographic variables of the informants (age, academic qualifications and organizational tenure) as control variables of work performance. See Table II for the scales of the main constructs.

The measurement scales were first tested for reliability. Table II shows that the outer loadings of all observed variables for all of the main constructs ranged between 0.60 and 0.90, which was higher than the desirable value of 0.50 (Hulland, 1999). All corresponding t-bootstrap values were well above 1.96 to be statistically significant (ranged between 16.56 and 83.82). The average variance extracted (AVE) values of all latent variables were acceptable because they were higher than 0.50 (ranged between 0.51 and 0.78). In addition, the composite reliabilities of the latent variables ranged between 0.88 and 0.91. These results indicate a high level of reliability of the measurement scales used in the model.

The discriminant validity of the measurements was evaluated following the procedure proposed by Fornell and Larcker (1981). Table III shows that the square roots of the AVE of the main constructs ranged between 0.72 and 0.89, which were well above the corresponding bootstrapped correlations between these constructs (ranged between 0.10 and 0.70), thereby indicating the discriminant validity of the measurements. In addition, discriminant validity was demonstrated when the correlation between two constructs (the off-diagonal entries) was not higher than their respective composite reliability (Fornell and Larcker, 1981). Table III indicates that no individual correlations (ranged between 0.10 and 0.70) were higher than their respective composite reliabilities (ranged between 0.88 and 0.91), thereby indicating a satisfactory discriminant validity. In addition, most of the correlations were consistently smaller than the cut-off value of 0.70, suggesting acceptable discriminant validity (Tabachnick et al., 2001). This study also employed the Heterotrait–Monotrait (HTMT) test, which is more stringent than that of Fornell and Larcker (1981), to evaluate discriminant validity (Henseler et al., 2015). Table III shows that the HTMT values, which were computed based on the bootstrapping routine, ranged between 0.12 and 0.79. These values were significantly below 1.00, thereby discriminant validity was assumed to exist.

This study also examined the corresponding variance inflation factor (VIF) values of the independent variables to ensure there was no multicollinearity (O’Brien, 2007).
<table>
<thead>
<tr>
<th>Construct and items</th>
<th>Outer</th>
<th>Loading</th>
<th>t-test</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Budgetary participation (AVE = 0.57, CR = 0.89)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The portion of the budget I am involved in setting</td>
<td>0.78</td>
<td>34.88</td>
<td></td>
</tr>
<tr>
<td>The amount of reasoning provided to me by a superior when the budget is revised</td>
<td>0.68</td>
<td>22.99</td>
<td></td>
</tr>
<tr>
<td>The frequency of budget-related discussions with superiors initiated by me</td>
<td>0.76</td>
<td>32.85</td>
<td></td>
</tr>
<tr>
<td>The amount of influence I feel I have on the final budget</td>
<td>0.84</td>
<td>57.15</td>
<td></td>
</tr>
<tr>
<td>The importance of my contribution to the budget</td>
<td>0.82</td>
<td>48.72</td>
<td></td>
</tr>
<tr>
<td>The frequency of budget-related discussions initiated by my superior when budgets are being set</td>
<td>0.62</td>
<td>17.05</td>
<td></td>
</tr>
<tr>
<td><strong>Budget goal commitment (AVE = 0.53; CR = 0.91)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am strongly committed to pursuing the budget objectives</td>
<td>0.72</td>
<td>30.51</td>
<td></td>
</tr>
<tr>
<td>I am willing to put forth a great deal of effort beyond what I'd normally do to achieve the budget objectives</td>
<td>0.76</td>
<td>33.60</td>
<td></td>
</tr>
<tr>
<td>Quite frankly, I don’t care if I achieve the budget objectives or not (R)</td>
<td>0.78</td>
<td>32.31</td>
<td></td>
</tr>
<tr>
<td>There is not much to be gained by trying to achieve the budget objectives (R)</td>
<td>0.60</td>
<td>16.56</td>
<td></td>
</tr>
<tr>
<td>It is quite likely that the budget objectives may need to be revised, depending on how things go this quarter (R)</td>
<td>0.73</td>
<td>25.05</td>
<td></td>
</tr>
<tr>
<td>It wouldn’t take much to make me abandon the budget objectives (R)</td>
<td>0.75</td>
<td>30.41</td>
<td></td>
</tr>
<tr>
<td>It’s unrealistic for me to expect to reach the budget objectives (R)</td>
<td>0.71</td>
<td>28.17</td>
<td></td>
</tr>
<tr>
<td>Since it’s not always possible to tell how tough courses are until you’ve been in them a while, it’s hard to take this goal seriously (R)</td>
<td>0.79</td>
<td>36.16</td>
<td></td>
</tr>
<tr>
<td>I think the budget objectives are a good goal to shoot for</td>
<td>0.68</td>
<td>19.65</td>
<td></td>
</tr>
<tr>
<td><strong>Vertical information sharing (AVE = 0.78; CR = 0.88)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Through the budgeting process, I share my insights with my superior about the situation in my area of responsibility</td>
<td>0.87</td>
<td>55.32</td>
<td></td>
</tr>
<tr>
<td>In the budgeting process, I communicate information to my superiors about opportunities and problems facing the organization</td>
<td>0.90</td>
<td>77.18</td>
<td></td>
</tr>
<tr>
<td><strong>Distributive fairness (AVE = 0.67; CR = 0.91)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My responsibility area received the budget that it deserved</td>
<td>0.81</td>
<td>45.18</td>
<td></td>
</tr>
<tr>
<td>The budget allocated to my responsibility area adequately reflects my needs</td>
<td>0.81</td>
<td>45.20</td>
<td></td>
</tr>
<tr>
<td>My responsibility area’s budget was what I expected it to be</td>
<td>0.87</td>
<td>83.82</td>
<td></td>
</tr>
<tr>
<td>I consider my responsibility area’s budget to be fair</td>
<td>0.79</td>
<td>40.79</td>
<td></td>
</tr>
<tr>
<td>My supervisor expresses concern and sensitivity when discussing budget restrictions placed on my area of responsibility</td>
<td>0.82</td>
<td>46.09</td>
<td></td>
</tr>
<tr>
<td><strong>Procedural fairness (AVE = 0.56, CR = 0.91)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Budgeting procedures are applied consistently across all responsibility areas</td>
<td>0.78</td>
<td>38.66</td>
<td></td>
</tr>
<tr>
<td>Budgeting procedures are applied consistently across time</td>
<td>0.77</td>
<td>40.92</td>
<td></td>
</tr>
<tr>
<td>Budgetary decisions for my area of responsibility are based on accurate information and well-informed opinions</td>
<td>0.72</td>
<td>29.72</td>
<td></td>
</tr>
<tr>
<td>The current budgeting procedures contain provisions that allow me to appeal the budget set for my area of responsibility</td>
<td>0.73</td>
<td>32.77</td>
<td></td>
</tr>
<tr>
<td>The current budgeting procedures conform to my own standards of ethics and morality</td>
<td>0.76</td>
<td>40.22</td>
<td></td>
</tr>
<tr>
<td>Budgetary decision makers try hard not to favor one responsibility area over another</td>
<td>0.73</td>
<td>30.43</td>
<td></td>
</tr>
<tr>
<td>The current budgeting procedures adequately represent the concerns of all responsibility areas</td>
<td>0.75</td>
<td>32.31</td>
<td></td>
</tr>
<tr>
<td>Budgetary decision makers adequately explain how budget allocations for my responsibility area are determined</td>
<td>0.76</td>
<td>34.75</td>
<td></td>
</tr>
<tr>
<td><strong>Work performance (AVE = 0.51; CR = 0.90)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planning for my area of responsibility</td>
<td>0.71</td>
<td>27.12</td>
<td></td>
</tr>
<tr>
<td>Coordinating my area’s activities</td>
<td>0.74</td>
<td>35.50</td>
<td></td>
</tr>
<tr>
<td>Evaluating my subordinates’ activities</td>
<td>0.75</td>
<td>32.59</td>
<td></td>
</tr>
<tr>
<td>Investigating issues in my area of responsibility</td>
<td>0.79</td>
<td>41.20</td>
<td></td>
</tr>
<tr>
<td>Supervising staff</td>
<td>0.66</td>
<td>22.06</td>
<td></td>
</tr>
<tr>
<td>Obtaining and maintaining suitable staff</td>
<td>0.71</td>
<td>30.11</td>
<td></td>
</tr>
<tr>
<td>Negotiating</td>
<td>0.62</td>
<td>19.58</td>
<td></td>
</tr>
<tr>
<td>Representing the interests of my area of responsibility</td>
<td>0.75</td>
<td>38.29</td>
<td></td>
</tr>
<tr>
<td>Overall performance</td>
<td>0.71</td>
<td>27.76</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:** AVE, average variance extracted; CR, Composite reliability; R, Reversed code.

Table II. Scale items and latent variable evaluation
VIF values for each relationship between the independent variables in the proposed model were computed to detect potential multicollinearity. The results showed that the inner VIF values ranged between 1.01 and 4.19, which were well below the threshold criterion of 10 (Hair et al., 2009), thereby indicating no multicollinearity problems in this study.

3.3 Analysis method choice
The partial least squares (PLS) method using SmartPLS3 was employed to analyze the data and test the proposed model and hypotheses. Compared to the traditional covariance-based structural equation model (SEM), PLS tends to achieve higher levels of statistical power under equal conditions (Reinartz et al., 2009) because it is a non-parametric approach based on ordinary least squares regression, and it is designed to maximize explained variance (Ringle et al., 2015). Moreover, PLS does not require a large sample, and it estimates quite precisely the parameters in the context of a small sample size (Reinartz et al., 2009). A sample size of 556 greater than the required minimum sample size for robust PLS-SEM estimations, which is suggested to be ten times of path relationships in the testing model (Barclay et al., 1995). Finally, PLS assists researchers to analyze the measurement model simultaneously with the structural model with both moderating and mediating relationships (Lee et al., 2011). PLS is also a widely accepted statistical technique adopted in recent management accounting studies (Lau and Roopnarain, 2014; Nitzl, 2016).

4. Hypotheses testing results
To test the hypotheses in the proposed theoretical model, the strength and statistical significance of structural paths were examined. Table IV indicates 5 models, providing the results of the predictive relevance of the structural paths in terms of $\beta$ coefficients and $t$-values, and the adjusted $R^2$ for endogenous constructs. The bootstrapping procedure was used with 500 times. The adjusted $R^2$ values for all predicted variables (vertical information sharing = 0.52; budget goal commitment = 0.56; and work performance $\geq 0.25$) were greater than the recommended level of 0.10 (Falk and Miller, 1992), indicating that the variances of the dependent variables can be measured within the desirable level.

$H1$ conjectured that vertical information sharing would partially mediate the relationship between budgetary participation and work performance. This hypothesis was confirmed because the $\beta$ coefficient for the path between budgetary participation and vertical information sharing was 0.39 and significant at the 1 percent level ($t = 9.22$) (see Model 1), and the $\beta$ coefficient of the path between vertical information sharing and
work performance was 0.21 and significant at the 1 percent level ($t = 4.39$) (see Model 3). H2 posited that budget goal commitment has a positive mediating effect on the relationship between budgetary participation and work performance. This hypothesis was supported because the $\beta$ coefficient for the path between budgetary participation and budget goal commitment was 0.37 and significant at the 1 percent level ($t = 9.02$) (see Model 1); and the $\beta$ coefficient of the path between budget goal commitment and work performance was 0.39 and significant at the 1 percent level ($t = 7.69$) (see Model 3).

In addition, this study employed the Baron and Kenny’s (1986) Sobel approach to test the mediating H1 and H2. The direct effect of budgetary participation on work performance in the proposed model is positive and significant ($\beta = 0.12, t = 2.91$) (see Model 3). However, when vertical information sharing and budget goal commitment were removed from the proposed model and did not act as mediating variables, this direct effect became stronger ($\beta = 0.37, t = 10.07$). The increase in significant direct effect indicates evidence of partial mediation (Kline, 2015). Thus, both vertical information sharing (IF) and budget goal commitment (COMMIT) partially mediate the relationship between budgetary participation (PAR) and work performance, thereby supporting H1 and H2.

This study further employed the Sobel test following the suggestion of Preacher and Hayes (2004) for a robustness check of H1 and H2. It used a bootstrap technique using SPSS 22.0 with the Process Macro add-in and computed the correlations between the dependent and independent variables with their corresponding confidence intervals (Preacher and Hayes, 2004). The results indicated that when vertical information sharing was included as the mediating variable, the correlation of the indirect effect of budgetary participation on work performance was 0.10 ($p < 0.05$; confidence intervals ranged between 0.07 and 0.13), Sobel statistics = 6.48 ($p < 0.01$). Moreover, when budget goal commitment was added as the mediating variable, the indirect effect of budgetary participation on work performance had the correlation of 0.12 ($p < 0.05$; confidence intervals ranged between 0.08 and 0.16 (see Model 2), Sobel statistics = 7.49 ($p < 0.01$). Thus, both vertical information sharing and budget goal commitment partially mediate the effect of budgetary participation on work performance, thereby supporting H1 and H2.

H3a–H4b posit that distributive budget fairness and procedural budget fairness positively moderate the PAR-IF and PAR-COMMIT relationships. In other words, when employees
perceive higher levels of distributive budget fairness and procedural budget fairness, the strengths of the PAR-IF and PAR-COMMIT relationships would be stronger. To test these hypotheses, this study creates two interaction terms DF×PAR and PF×PAR after mean centering the moderating variable (distributive budget fairness and procedural budget fairness) and the independent variable (budgetary participation) that constitute the interaction terms in order to mitigate potential multicollinearity (Aiken et al., 1991). The PLS results for the theoretical model show that the β coefficient of the relationship between the interaction term DF×PAR and IF is insignificant (β = 0.07, t = 0.83) (see Model 1), and thus reject H3a. However, Models 1 and 2 show that three remaining β coefficients of the three interaction terms DF×PAR and PF×PAR (that linked to vertical information sharing (IF) and budget goal commitment (COMMIT)) had t-values ranged between 2.29 (significant at the 10 percent level) and 5.06 (significant at the 1 percent level). Therefore, H3b, H4a and H4b were supported.

Moreover, we ran models 4 and 5 to further check the potential direct effects of all the independent variables, including the interaction terms DF×PAR and PF×PAR, on work performance. We found that budget participation, vertical information sharing and budget goal commitment directly influence work performance (β coefficients ranged between 0.18 and 0.40; t-values ranged between 3.36 and 6.18), in supporting H1 and H2. Models 4 and 5 reveal that except procedural fairness, the remaining variables distributive fairness and the interaction terms DF×PAR and PF×PAR do not significantly and directly affect work performance. However, these variables indirectly influence work performance via information sharing and budget goal commitment (see Models 1 and 2), supporting the mediating hypotheses H1 and H2.

4.1 Model fit and common method bias
The standardized root mean squared residual (SRMR) value of the composite model was also examined using SmartPLS3 to test the model fit. The SRMR of 0.043 was lower than the recommended value of 0.08, indicating an acceptable model fit (Henseler et al., 2016). As cross-sectional data are collected using a single-informant approach, there might be common method bias effects that lead to spurious relationships among the variables (Podsakoff et al., 2003). The marker-variable technique recommended by Lindell and Whitney (2001) was employed to test common method bias. This technique can detect common method bias by including “a measure of the assumed source of method variance as a covariate in the statistical analysis” (Podsakoff et al., 2003, p. 889). In particular, we selected the item “do you want to go overseas for this year National holiday?” which has no theoretical relevance to any variables in the proposed model, as a marker variable to control for common method bias. The mean change in correlations of the key constructs (rU−rA) when partialling out the effect of rM is insignificant at 0.02, providing evidence of no common method bias in this study.

5. Implications and limitations
5.1 Implications
This study contributes to the management and accounting literature in general and specifically budget participation literature in the following ways. First, the key premise of this study is that this positive effect of budgetary participation on work performance is partially mediated by employees’ vertical information sharing and budget goal commitment. This study integrates that both vertical information sharing and budget goal commitment act as intervening mechanisms in the budgetary participation – work performance relationship. Diverging with some studies such as Bonache et al. (2012), this study found that the direct effect of budgetary participation on work performance persists. A possible interpretation of the finding is that, apart from the motivational and informational aspects, budget participation may lead to the implementation of
improvement measures proposed by the participating employee and consequently enhance their performance. Another possible explanation could be the cultural context of this study. Vietnam is an Asian collectivist culture that is transitioning to the market economy. In the past, decisions could often be collectively made and one's performance could often be subsumed under organizational results. Therefore, it may be possible that employees in Vietnam attribute their performance directly to the participation in the collective decision making. There could be a possibility, though plausible, that other variables also operate in a similar manner just as vertical information sharing and budget goal commitment. While vertical information sharing and budget goal commitment may also be related in that the information sharing can help employees understand the goals better and thereby be more committed to goal achievement or the commitment to goals makes employees feel more compelled to information sharing. Nonetheless, this paper focused on understanding the relative role of each mediating intervention (vertical information sharing or budget goal commitment), controlling the effect of the other. Methodologically, direct associations between either concepts and work performance need to be established prior to the assessment of one as a mediator in the relationship between the other and work performance.

Second, this study enriches the budgetary participation literature by investigating the employees’ perceived budget fairness as a contingency factor of the budget participation – vertical information sharing and budget participation – goal commitment relationships. Given that the moderated mediation mechanism arguably can make the budgetary participation environment more effective, this study further examined the interaction effects between employees’ perceived budget fairness (the moderator) and budget participation on their vertical information sharing and budget goal commitment (the mediators), which in turn impact subsequent work performance. In doing so, the study adds to extant literature from the motivational and cognitive/informational perspectives examining the paths between budgetary participation – performance relationship (e.g. Chong and Johnson, 2007; Parker and Kyj, 2006; Shields and Shields, 1998; Venkatesh and Blaskovich, 2012) by introducing perceived budget fairness as a moderator on these paths. The study found that both distributive fairness and procedural fairness have positive moderating effects on the budgetary participation – vertical information sharing and budgetary participation – budget goal commitment linkages. This is an important finding as prior studies in this line of research mostly focused on linear effects of budget participation and intervening variables on work performance. Overall, this study contributes to the management and accounting literature by testing a more complex model of budgetary participation and work performance.

Furthermore, the study also leads to some practical implications. The findings of the study highlight the importance of promoting employees’ budgetary participation as a vehicle to foster employees’ vertical information sharing and their budget goal commitment toward enhancing managerial performance. The superiors need to select a proper level of budgetary participation that can facilitate vertical information sharing and motivate employees to be committed to achieve budget goals. Besides, the result relating to the interaction effects between budgetary participation and perceived budget fairness may assist top management understand the importance of ensuring budget fairness in the budgeting process. Organizations need to pay attention to employees’ perceived budget fairness as a potentially effective mechanism in managing the organizational budgeting process toward enhanced performance effectiveness.

5.2 Limitations of this study
As with any study, this research is subject to some limitations that should be considered in the interpretations of the findings. First, the research design of this study in cross-section
survey, which has limitation in making causal inferences or examining the process underlying the interrelationships between concepts (e.g. mediating variables in this research) (Rindfleisch et al., 2008; Rong and Wilkinson, 2011). A longitudinal design in future research could address this shortfall. Second, although procedural and statistical measures have been taken to mitigate the potential common method variance issue, the survey data in this research rely on self-report of respondents. Future research may need to consider triangulation of data sources, e.g., data of actual work performance of employees. Finally, this research was conducted in just one emerging market context that is Vietnam. Future research may need to attempt to collect data from other emerging markets as well as developed markets to increase the generalizability of the findings.

References


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Explaining India’s current account deficit: a time series perspective

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Department of Humanities and Social Sciences, Indian Institute of Technology Kharagpur, Kharagpur, India

Abstract
Purpose – The purpose of this paper is to examine the issue of high current account deficit (CAD) from various perspectives focussing its behaviour, financing pattern and sustainability for India.
Design/methodology/approach – To begin with the trends, composition and dynamics of CAD for India are analysed. Next, the influence of capital flows on current account is investigated using Granger non-causality test proposed by Toda and Yamamoto (1995) between current account balance (CAB) to GDP ratio and financial account balance to GDP ratio. Also, the sustainability of India’s current account is examined using different econometrics techniques. In particular, Husted’s (1992), Johansen’s cointegration and vector error correction model (VECM) is applied along with conducting unit root and structural break tests wherever applicable. Further, long-run and short-run determinants of the CAB are estimated using Johansen’s VECM.
Findings – The study found that the widening of CAD is due to fall in household financial savings and corporate investments. Also, it was found that a large part of India’s CAD has been financed by FDI and portfolio investments which are partly replaced by short-term volatile flows. The unit root and cointegration tests indicate a sustainable current account for India. Further, econometric analysis reveals that India’s current account is driven by fiscal deficit, terms of trade growth, inflation, real deposit rate, trade openness, relative income growth and the age dependency factor.
Practical implications – Since India’s CAD has widened and is expected to widen primarily due to rise in gold and oil imports, policy makers should focus on achieving phenomenal export growth so that a sustainable current account is maintained. Also, with rising working-age and skilled population, India should focus more on high-value product exports rather than low-value manufactured items. Further, on the structural side it is important to correct fiscal deficit as it is one of the important factors contributing to large CAD.
Originality/value – The paper is an important empirical contribution towards explaining India’s CAD over time using latest and comprehensive data and econometric models.
Keywords Cointegration, Current account deficit, Twin deficit, Financial savings
Paper type Research paper

1. Introduction
The central goal of a country’s macroeconomic policy is to achieve a simultaneous balance between internal and external sectors. While maintaining internal balance requires keeping inflation low and stable, and potential output or unemployment rate at desired levels, it is imperative that the current account balance (CAB) (especially, current account deficit (CAD)) be kept at a sustainable level to achieve the external balance. However, CAD is not considered as an explicit policy variable such as money supply or fiscal position, nor is it an ultimate policy target like output growth, inflation or unemployment rate. But, CAD is often...
viewed by policymakers as an important “intermediate target” that reflects the stance of a country’s macroeconomic policies and doubles as a source of information about the behaviour of economic agents. As the actions and expectations of market participants in an open economy are reflected in the movement of current account, policymakers often stress the importance of this variable when explaining its behaviour – particularly from the perspective of the factors driving a CAD (and whether it is sustainable or not) – as well as while framing policies to keep it at a sustainable level.

India’s CAD has increased sharply to 4.8 per cent of GDP in 2012–2013 which was about 2 per cent of GDP in the quarter ended December 2017 which is further expected to increase due to rising oil prices after staying below 1.6 per cent of GDP during the 1991–2008. As expected, the CAD increased to 2.7 per cent of GDP in first-half of 2018–2019 which further widened to 2.9 per cent of the GDP in the second-quarter of the fiscal from 1.8 per cent in the corresponding period of 2017–2018. The persistently high CAD since the global financial crisis has been of great concern to policymakers, economists and rating agencies. While, theoretically, opinions may be divided between pro- and anti-CAD camps, experience suggests that the persistence of a high CAD leads to costly macroeconomic adjustments. The sharp depreciation of the Indian rupee recently is one such pitfall. Against the backdrop of a weak rupee exchange rate, inflationary concerns and decelerating economic growth, it is even more critical to examine the sustainability of this high CAD level, and raises a number of questions. Whether this level of CAD is excessive in India? Does it represent a near- or longer-term risk to the Indian economy? Why this has suddenly become a concern to everyone, as India has been experiencing deficits for decades? To answer these fundamental questions, one should identify the underlying sources of this deficit, and how their dynamics have changed. It is also essential to understand how the CAD is being financed in India. This paper seeks to answer the reasons behind the recent surge in CAD, how it is financed and the risks associated with a high CAD in India.

2. Does current account deficit matter?

The “current account” of balance of payments comprises the transactions between residents and non-residents in terms of goods, services and incomes. A deficit in current account always reflects in an increase in net financial claims of foreigners (i.e. increase in net capital flows or depletion in foreign exchange reserves). Alternatively, CAB can be derived from national accounts by deducting total expenditure (i.e. sum of consumption (C), investments (I) and government spending (G)) from gross national production (GNP). From this equation, one can derive CAB as the difference between gross national savings (S) and investments (I). In an open economy, S hardly matches with I, and thus lead to a current account imbalance.

The debate over CAB is not new in academic or policy circles, and dates back to the sixteenth century when mercantilists criticised the drainage of precious metals implied by trade deficits. The debate is still ongoing whether a country should run a deficit or surplus to sustain its external sector balance. Countries such as Australia and New Zealand have been running CADs for decades without any problems, and countries like China have sustained persistent current account surpluses over the past two decades. However, many countries in the past have faced severe crises because of high CADs. Therefore, the debate on CAD still remains an important issue in policymaking. The views on CAD can be broadly classified as positive or negative. This section documents the perceptions about CAD, and how they have changed from “CAD matters” to “CAD does not matter” and then to “CAD matters sometimes”.

The evolution of theories analysing the behaviours of current account ranges from David Hume’s “specie-flow” mechanism, through the “elasticities”, the “monetary”, the “portfolio balance” to the recent “inter-temporal optimising” approach to the balance of payments (Pitchford, 1995). The initial concerns about CAD are well reflected in the views of mercantilists who emphasised trade surplus. However, the specie-flow mechanism of Hume (1752) shows that attempts to sustain trade surpluses would be defeated because perpetual
accumulation of external wealth itself would tend to eliminate trade imbalances in a world without international capital flows. According to him, trade imbalances would be brought to balance by an automatic mechanism implicit in the use of precious metals as an accepted means of settling international obligations.

The current account debate was even prevalent in the 1940s as it could be inferred from the Keynes’ proposal for an international Clearing Union, intended to support countries during times of large payment imbalances and thereby share burdens of adjustment between both deficit and surplus nations (Edwards, 2004). The period following the Second World War analysed the behaviour of current account based on the elasticities approach and the absorption approach. The importance of elasticities in explaining trade balance, popularly known as “elasticities pessimism”, dominated the policy debates of developing countries until the mid-1970s, when most economists focused on whether currency devaluation could improve a country’s external position, including its trade and CADs (Edwards, 2002). On the other hand, the structuralist economists during that time argued that external sector imbalances in developing countries are “structural” in nature and severely constrain their ability to grow, and, therefore need to be addressed by policies ranging from industrialisation to import substitution.

The absorption approach – considering CAB as the difference between national savings and investments – emphasised how macroeconomic factors ultimately determine international borrowing or lending patterns. Until the mid-1970s, much of the emphasis was on trade balance rather than CAD per se. Even the discussions on current account were not intense as CAB was relatively stable and countries were having strong capital controls.

The debate over CAD intensified in the late 1970s after a number of countries experienced large swings in their current account due to sharp increase in oil prices, change in exchange rate regimes and with several Latin American countries entering into debt crises. Both the elasticity approach and absorption approach independently failed to explain the large swings in CAB. Of the various theories developed during that period to explain the behaviour of current account, the inter-temporal approach to current account was the most popular. The inter-temporal dimension of current account analysis extended the absorption approach through its recognition that private saving and investment decisions, and sometimes even government decisions, emanate from life-cycle considerations and depend on expected returns on investment projects.

In his influential work, Sachs (1981) argued that to the extent that a CAD is due to rise in investment, there is no cause for concern or policy action. Supporting the views of Sachs, Robischek (1981) argued that there is no reason for Chile to worry even with CAD of more than 14 per cent of GDP to the extent fiscal accounts are under control and savings are rising. In an important paper, Corden (1994) argued that “an increase in the current account deficit that results from a shift in private sector behavior – a rise in investment or a fall in savings – should not be a matter of concern at all”. Policymakers and economists having similar views argued that CAD should not be a matter of concern if it results from a change in private sector behaviour – a rise in investment or a fall in savings. The view that current account does not matter if it resulted from saving and investment decisions of the private sector, is also popularly known as consenting adults view[2]. This view, also known as Lawson Doctrine and Pitchford thesis, was carried forward by policymakers in their public statements during the late 1980s. In these ways, the debate over CAD changed from “CAD matters” to “CAD does not matter”.

However, this “consenting adults view” came under severe criticisms when several countries faced crisis due to the accumulation of huge external debts accompanied by large CADs. Some policymakers during that time criticised this inter-temporal view of current account as it was based on a few unrealistic assumptions such as perfect capital mobility and constant world interest rate. Important flaws were found in this type of approach as many countries with large CADs faced crisis in the 1980s even in the presence of rising investments and a balanced fiscal account (Edwards, 2002). In a series of papers, Fischer
(1988, 1994, 2003) showed that large CAD should be a matter of concern and it provides primary indication of a future crisis. As emphasised by Fischer (1988), what matters is not whether there is a large CAD but whether the country is running an "unsustainable" deficit. In the years following the 1982 debt crisis, many authors accentuated the importance of CAD – Cline (1988) and Kamin (1988) showed that trade and current accounts deteriorated steadily through the year immediately prior to devaluation. Edwards and Edwards (1991) in the Chilean crisis context also found serious flaws in the Lawson doctrine.

The debate on CAD intensified in the early 1990s before the Mexican peso crisis. Many had expressed their concerns about Mexico’s large CAD. World Bank (1993) noted that two-thirds of the Mexico’s CAD ascribed to lower savings, and had warned about its unsustainability. Fischer (1994) raised the concern because a large portion of Mexico’s deficit was being financed through portfolio investments. Mexican authorities in the early 1990s, defending the rising CAD stated that it was clearly not a cause for undue concern so far it was an outcome of the private sector’s decisions and fiscal accounts were under control. However, Mexico entered into the currency crisis in 1994. In the aftermath of the Mexican crisis of 1994, a large number of analysts maintained, once again, that Lawson’s Doctrine was seriously flawed (Edwards, 2002). The analysts argued that large CAD was mostly unsustainable, regardless of the factors driving them (Summers, 1996; Loser and Williams, 1997; Reisen, 1998). Many researchers and analysts had also provided the linkages between large CADs and the East Asian crisis (e.g. Corsetti, et al., 1999; Reisen, 1998; Radelet and Sachs, 2000). Corsetti et al. (1999) argued that the East Asian countries faced crisis because they were experiencing large deficits throughout the 1990s. The empirical link between large CADs, consumption booms, surges in bank lending and subsequent banking crises was also well documented (Gavin and Hausmann, 1996). Atkinson and Rios-Rull (1996) developed a model for credit-constrained countries in which they showed that changes in investor perceptions could lead to current account problems even in the presence of better fiscal and monetary policies.

The crises in the 1990s influenced many economists to pursue research on current account sustainability. Basically, the researchers tried to compare observed current account positions to those predicted by models based on macroeconomic fundamentals (e.g. Williamson, 1994). The current account positions those differ significantly from the prediction of the models were considered as unsustainable. Many analysts had also offered arbitrary level of thresholds for CAD and advised that any level exceeding the threshold should be a cause for concern (e.g. Summers, 1996). As against the traditional measures of sustainability that was based on inter-temporal solvency, Milesi-Ferreti and Razin (1996) developed a framework to analyse current account sustainability that emphasises the willingness to pay or lend in addition to solvency. Their main point was that the “sustainable” level of the current account was that level consistent with solvency. According to Milesi-Ferreti and Razin (1996), any persistent level of CAD exceeding any particular threshold (say 5 per cent of GDP) is not in itself a sufficient informative indicator of sustainability. Instead, the country should look at the imbalances in current account in conjunction with exchange rate policy, trade openness, the health of the financial system and the levels of savings and investments. Thereafter, this framework was adopted by many researchers to assess current account sustainability of different countries (e.g. Cashin and McDermott, 1996 in the Australian context; Ostry, 1997 in case of ASEAN countries; Roubini and Wachtel, 1998 and McGettigan, 2000 for Eastern Europe; Calvo et al., 1993 and Corbo and Hernandez, 1996 for Latin America; and Ades and Kaune, 1997 and Edwards, 2002 in cross-country context). As against this ex ante assessment, many had adopted ex post assessment of current account sustainability investing large current account adjustments. In a developing country context, this was closely related to the issue of sudden stops (e.g. Dornbusch et al., 1995; Calvo, 1998, 2004;

Despite a number of studies analysed current account behaviour, none of them convincingly provided any answer about the level of deficit that should be considered as excessive. Many emerging and transition countries continue to experience large CAD without knowing when it will turn out to be unsustainable. It, however, becomes apparently clear now that persistent CAD is always problematic though temporary deficit, reflecting the reallocation of capital to the country where capital is more productive, may not have adverse effects on the economy. In fact, persistent deficit invites more capital inflows to finance it through high domestic interest rates. This could burden the economy in meeting debt service payments. Therefore, Milesi-Ferretti and Razin (1996, 1998) also made the point that it is important to look beyond persistent CADs. Judgments about current account often require an understanding of real exchange rates (Roubini and Wachtel, 1998). In a recent paper, Blanchard and Milesi-Ferretti (2011) also noted that CADs stem from domestic distortions or excessive fiscal positions are considered to be “bad”. They concluded that even good current accounts are mostly bad too and hence most CADs are imbalances. In their study, Baharumshah et al. (2003) stated that large CAD may serve as a leading indicator of financial crises. Moreover, Dulger and Ozdemir (2005) noted that persistent CADs could generate a favourable environment for external crises, especially when those deficits are financed through short-term capital inflows. Therefore, it is important to examine the composition and financing pattern of CAD along with various macroeconomic policies, financial market development and other indicators of that country in order to evaluate its sustainability.

3. Trends, composition and dynamics of CAD in India

India was considered to be one of the most open economies in the world during the eighteenth century. In the nineteenth century, after becoming an agricultural exporter, it still managed a trade surplus (Desai, 2003). During the colonial rule, India’s external sector deteriorated but the country still remained one of the top 10 exporting countries in the world. According to the data compiled by Banerji (1961), India ran current account surplus in seven years during 1921–1938. However, it experienced a decline in its share of merchandise exports in the world trade from about 2.5 per cent in 1949–1950 to a mere 0.5 per cent by the late 1980s (Singh, 2009). This decline and glitches in macroeconomic policies followed during that period landed India in an external payment crisis. Indian economic policy witnessed a marked shift thereafter with massive liberalisation measures to promote trade, capital flows and, ultimately, economic growth.

3.1 External sector policies

In the period following its independence, India remained insulated from the world trading system pursuing an inward-looking development strategy to achieve economic self-sufficiency. This goal displayed itself in a trade system characterised by strictly controlled imports through various exchange controls and quantitative trade restrictions, which were accompanied by a complex tariff structure with high and differentiated rates across industries (Joshi and Little, 1994). Given the apparent share of primary exports in the export basket and the hostile international environment for primary commodities, export pessimism gained ground in the post-independence period until the second Five-Year Plan (1956–1960) (Kapur, 1997). In contrast to the pessimistic and indifferent approach during the 1950s, export promotion received major attention in the 1960s, resulting in improved export earnings, albeit at a slower pace. Fall in invisibles surplus in
conjunction with high trade deficit led by rising import demand kept the CAD high during the third Plan (1960–1965). During these first three Plan periods, the CAD was financed through foreign aid and by depleting foreign exchange reserves. The border wars with China and Pakistan and two disastrous droughts in succession also contributed to the high CAD until 1967–1968 due to defence- and food-related imports. Thereafter, the current account problem was less acute until the end of the 1970s led by higher export growth in conjunction with improvement in invisibles.

Despite a comfortable balance of payment position, the oil shocks in 1973–1974 caused the policymakers to worry about imports and overall current account. The share of crude oil and petroleum products in India’s import bill jumped from 11 per cent in 1972–1973 to 26 per cent in 1974–1975 and the import bill on account of fertiliser also increased by a substantial amount (Nayyar, 1982). India had recourse to various IMF facilities in 1974–1975 to finance its CAD.

During the mid-1960s through the end-1970s, India adopted several steps to promote exports, including a 36.5 per cent devaluation of rupee on June 6, 1966, and recognised invisibles as a source of foreign exchange by paying attention to the development of shipping and tourism and preventing leakages of remittances through unofficial channels. A recognition of shortcomings in earlier policies attached to inefficiencies in import substitution and export pessimism resulted in setting up of a number of committees by the Government of India to make changes in existing policies. However, the recommendations of those committees were mostly unimplemented until the late 1980s. Steps were taken in the late 1980s to ease industrial and import licensing, replace quantitative restrictions with tariff barriers and simplify the tariff structure, which were still less comprehensive and left a lot to be desired (Rangarajan and Mishra, 2013).

The 1980s witnessed a gradual deterioration of current account position and a profound change in its financing reflecting the effect of second oil shock in 1979–1980, deterioration in export growth, significant legal restrictions, large public spending, heavy dependence on official capital flows and debt flows, a fixed exchange rate system coupled with fall in remittances inflows. As a result, India entered into a balance of payment crisis in 1990. Thereafter, a number of measures were undertaken to liberalise India’s external sector include removal of quantitative restrictions and reduction of tariff rates, reduction of capital controls and adoption of a market determined exchange rate system. Gradually, all the restrictions in current account were lifted and most of the restrictions in the capital account were removed. Among the various liberalisation measures undertaken, India has a strong preference for non-debt-creating flows, long-term and stable capital flows such as FDI.

3.2 Trends and composition of CAD

Until recently, the concerns about CAD are dominated by India’s foreign trade and swayed its policies and practices. India’s export basket is dominated by manufactured goods, particularly, low-value engineering products, and gems and jewellery. Although manufacturing goods remained as a major component in India’s total exports, its share in world manufacturing exports is still low at 1.6 per cent in 2012 mainly because of low value and mostly semi-skilled nature of these products. The shares of agricultural products, textiles and textile products and handicrafts in total exports have declined while the share of petroleum products are rising (the share in world’s total fuel exports is still low at 1.6 per cent). The share of India’s exports in the world, which had reduced gradually from 2.2 per cent in 1948 to about 0.5 per cent in the mid-1980s, increased to 1.6 per cent in 2012. Therefore, India’s export performance cannot be considered as phenomenal.

On the other hand, the share of petroleum and crude products and gold imports in India’s import basket are rising. While petroleum is an important input in different production processes and transportation, gold is argued to be used as a hedge against inflation by Indian households. More than used as a hedge item, gold is used for making
jewellery, which is unproductive. Realising this and in a view of a swelling CAD, the Reserve Bank of India (RBI) and the Government of India have imposed various restrictions on gold imports. The measures include a ban on gold selling by banks, a phased increase in gold import duty from 2 to 10 per cent, a ban on imports of coins and medallions, and the requirement for 20 per cent of gold imports being used for export purposes. These steps helped curtail gold imports in 2013 and the overall CAD as well. Given a high demand for gold in India and the alleged smuggling of the yellow metal recently after the imposition of restrictions, authorities will likely be forced to withdraw these restrictions in the long run once the current account returns to a comfortable zone.

India being the sixth largest economy in the world, witnessed the highest spike in fuel import growth (up 18 per cent) followed by China (up 14 per cent) in 2012. While the import growth exhibited some deceleration due to gold imports and a slowdown in domestic demand, the import demand is expected to increase in future with a potential revival of the economy and given the demographic structure of the Indian economy.

Over past six decades, merchandised trade deficit has been the leading factor behind India’s CAD. Without any exception, India had deficits in merchandised trade account in all years, much of which was offset by surplus in invisibles, particularly, services and remittances. It may also be noted that India’s invisibles account exhibited a negative balance during 1969–1970 through 1972–1973 and in the year of 1990–1991. India faced external payment crisis in 1991 essentially due to a negative invisibles balance led by sharp increase in investment income payments (debt servicing) and reduction in remittances receipts (Table I).

Since 2004, India has experienced a significant increase in merchandised trade deficit led by a significant increase in imports (particularly oil imports) as compared to exports. Recently, gold imports have contributed significantly to the rise of trade deficit and thereby the widening of CAD. Much of the trade deficit is being financed by services receipts and stable remittances inflows. However, CAD has widened recently due to deceleration in export growth, strong growth in oil and gold imports and rise in investment income payments coupled with a slowdown in investment income receipts. As a result, CAD to GDP ratio rose from an average of 1.7 per cent in 2006–2010 to 3.4 per cent during 2008–2012, reaching its historical peak of 4.8 per cent in 2012–2013. One of the reasons for the persistent CAD is CAD itself as large payments towards servicing international liabilities keep the investment income account balance in the negative zone. Therefore, prolonged deficits in current account of any country are problematic as they either put pressure on reserves or increase debt servicing burden.

A long-term view of the current account requires an understanding of the structural features of the economy, such as levels of economic development, demographic profiles and patterns of consumption and production. These factors have a role in determining the savings and investments, hence, the CAB. In the post-global crisis period, both saving and investment rates have dropped; however, a higher fall in the saving rate as compared with the investment rate has resulted in the greater CAD. A closer look at Figure 1 reveals that India’s CAB, being the mirror image of the absorptive capacity of the economy measured in terms of savings–investment (S–I) gap, is due to deficits in public (PUB) and private (PVT) sectors. The household (HH) sector always saves more than it invests resulting in a surplus in that sector. On the other hand, the public sector deficits being high over the years have larger contributions to the S–I gap. Further, the S–I gap of public sector – which had improved since 2002–2003 reflecting the impact of the FRBM Act[3] – deteriorated during 2008–2010, led by a large fiscal stimulus, and is mainly responsible for the recent surge in S–I gap as reflected in widening CAD. However, the impact of much of these deficits was offset by a reduction in private sector deficit and large surplus of household sector and therefore, the CAD could not increase substantially during 2008–2010. The CAD has widened significantly thereafter. It is also important to note that private sector deficit reduced during the post-crisis period, mainly due to a slowdown in corporate investments.
<table>
<thead>
<tr>
<th>Period</th>
<th>Goods trade balance</th>
<th>As % of GDP</th>
<th>Growth (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Oil</td>
<td>Non-oil</td>
</tr>
<tr>
<td>1951–1955</td>
<td>−0.7</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>1956–1960</td>
<td>−2.7</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>1961–1965</td>
<td>−2.1</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>1966–1970</td>
<td>−1.7</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>1971–1975</td>
<td>−0.9</td>
<td>−0.6</td>
<td>−0.3</td>
</tr>
<tr>
<td>1976–1980</td>
<td>−1.4</td>
<td>−1.7</td>
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<tr>
<td>1981–1985</td>
<td>−3.4</td>
<td>−2.3</td>
<td>−1.1</td>
</tr>
<tr>
<td>1986–1990</td>
<td>−2.9</td>
<td>−1.0</td>
<td>−1.8</td>
</tr>
<tr>
<td>1990–1991</td>
<td>−2.9</td>
<td>−1.7</td>
<td>−1.2</td>
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<tr>
<td>1991–1995</td>
<td>−2.0</td>
<td>−1.8</td>
<td>−0.2</td>
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<td>1996–2000</td>
<td>−3.5</td>
<td>−2.1</td>
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<td>2001–2005</td>
<td>−2.8</td>
<td>−2.8</td>
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<td>2006–2010</td>
<td>−7.7</td>
<td>−4.4</td>
<td>−3.4</td>
</tr>
<tr>
<td>2008–2012</td>
<td>−9.3</td>
<td>−4.9</td>
<td>−4.4</td>
</tr>
</tbody>
</table>

Notes: Net balances in invisibles may not match with the sum of services, remittances and investment income balances as some items like compensation of employees are not included any of the balances; Averages are calculated for financial year averages. – denotes not available. Includes silver also, which is negligible in value terms.

Source: Author’s compilation, based on data published in *Handbook of Statistics on the Indian Economy*, RBI.
Household saving rates have decelerated since 2009-10 mainly reflecting high inflation, contributing to the widening of S–I gap[4]. Therefore, the recent widening of CAD, despite a fall in private investments, is not necessarily because of rise in investments but due to fall in savings. Although, the large S–I gap for earlier years were fed by a rise in investments and therefore were of lesser concern, the continuation of the recent S–I gap on account of fall in savings rate presents a major risk to the sustainability of CADs.

4. The way of financing CAD

Great attention has been paid in recent literature to examine the current account sustainability, by focusing on its composition and how the deficit is financed (e.g. Beim and Calomiris, 2001; Lane, 2004, 2005; Lane and Milesi-Ferretti, 2005a, b; Tang, 2006). In this study, an attempt has been made to examine the financing patterns of CAD in the Indian context. Although India has relatively low CAD, the trade deficits[5] continue to remain at a high level over the years and have been increasing steadily since 2004–2005. It is well known that India’s CAD is low due to surplus in invisibles, including net surplus in services account as well as large workers’ remittances inflows. The underlying risk here is that any layoffs in the overseas labour markets or a ban on visa by the USA, Europe, etc. could have an adverse impact on the CAB. This is because India receives a major part of the remittances from Gulf countries (37 per cent) followed by North America (34 per cent) and Europe (12 per cent)[6]. The past experience shows that a couple of crises in Dubai, the USA and Europe impacted the remittances inflows, though the effect was not significant.

The sustainability of CAD also depends on how it is financed, whether through debt capital or equity capital, whether through short-term flows or long-term capital flows. A country that relies more on short-term or debt capital inflow to finance its deficits is considered to be vulnerable. The sustainability of current account and external debt also depends on the level of foreign exchange reserves a country holds. However, it is important to know how these reserves have been accumulated over the years. Table II presents the sources of accumulation of India’s foreign exchange reserves. As can be seen from the table, capital flows after financing $331.0bn of CADs resulted in an accumulation of $267.6bn of reserves between 1990–1991 and 2012–2013. Adding the reserves position at end-March 1991 and the valuation effects (due to movement of US dollar vis-à-vis other currencies on which a part of our reserve assets is denominated) with the $267.6bn, the foreign exchange reserves were $292.0bn at end-March 2013. Within $292.0bn, a major portion (92.6 per cent) is due to short-term capital flows. Further, the fact that net international liabilities exceed the total reserves assets, i.e. 205.9 per cent of total reserves, is a matter of concern for India’s external sector.

Figure 1. Saving-investment gap of private, public and household sector

Explaining India’s CAD

Table II

<table>
<thead>
<tr>
<th>Year</th>
<th>Source of Accumulation of Reserves</th>
<th>Total Reserves</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990–1991</td>
<td>$331.0bn</td>
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</tr>
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<td>$305.0bn</td>
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<td>1992–1993</td>
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<tr>
<td>1994–1995</td>
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</tbody>
</table>
It is generally perceived that financing of CAD through short-term capital is dangerous for an economy. One of the crucial factors that led to the payments crisis in the early 1990s was relatively high level of short-term debt and the rollover difficulties associated with the short-term liabilities. Hence, India’s policy in respect of short-term capital flows continues to be restrictive and has largely been dictated by the lessons learnt from the payments crisis of 1991. However, the recent trend shows a significant rise in short-term capital flows to India with the faster liberalisation of India’s capital account and probably due to carry trade activities on account of higher yields on rupee-denominated assets. This trend is also a reflection of India’s eagerness to attract short-term capital inflows, in an environment of a slowdown in long-term inflows, to finance the widening deficit in the post-global crisis period.

To understand the risks associated with CAD, an analysis of composition of capital inflows to India is provided. As given in Table III, non-debt creating capital inflows comprising equity flows under FDI and foreign portfolio investments have been dominating capital inflows to India during most parts of the past two decades. It may be noted that in the pre-reforms period, capital flows into India were dominated by debt-creating flows and were about 98 per cent of total capital inflows during 1990–1992. And one of the reasons behind the balance of payment crisis was India’s large external debt. A similar rising trend in external debt, particularly short-debt, has been observed in the past few years. At the same time, a slowdown in FDI inflows is fuelling the concerns. Inflows on account of short-term trade credit and net investments by FIIs were 46.6 per cent of total capital inflows during 2012–2013. Since India’s CADs were financed largely through short-term and debt capital inflows in last few years, it is required to correct this development.

Sen (2013) argued that large capital inflows causing a real appreciation of exchange rate result in higher CAD in India. Yan (2007) examined the relationship between capital mobility and CAB and found that capital mobility is demand induced and therefore finances current account in developed countries. However, he found that financial account gives rise to a current account imbalance in emerging market economies. To examine whether capital flows influence current account in India, we have applied Granger non-causality test, as proposed by Toda and Yamamoto (1995), between CAB to GDP ratio (CAB) and financial account balance (excluding reserve change) to GDP ratio (FA) for the period of 1950–2013 and three sub-periods.
<table>
<thead>
<tr>
<th>Year</th>
<th>Total net inflows</th>
<th>Total</th>
<th>Non-debt creating</th>
<th>FDI</th>
<th>Portfolio</th>
<th>Per cent to total net inflows</th>
<th>Of which: FII</th>
<th>Debt creating</th>
<th>ECB</th>
<th>STC</th>
<th>EA</th>
<th>NRI</th>
<th>Others</th>
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<td>1990–1991</td>
<td>8.2</td>
<td>100.0</td>
<td>1.2</td>
<td>1.2</td>
<td>0.1</td>
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<td>13.0</td>
<td>26.8</td>
<td>25.9</td>
<td>5.8</td>
<td></td>
<td></td>
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<tr>
<td>1991–1992</td>
<td>5.2</td>
<td>100.0</td>
<td>2.6</td>
<td>2.5</td>
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<td>97.4</td>
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<td>–100</td>
<td>59.0</td>
<td>11.2</td>
<td>9.0</td>
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<tr>
<td>1992–1993</td>
<td>4.8</td>
<td>100.0</td>
<td>11.6</td>
<td>6.6</td>
<td>5.0</td>
<td>0.0</td>
<td>88.4</td>
<td>–7.5</td>
<td>–22.5</td>
<td>38.7</td>
<td>45.0</td>
<td>34.6</td>
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<tr>
<td>1993–1994</td>
<td>9.9</td>
<td>100.0</td>
<td>42.9</td>
<td>5.9</td>
<td>36.9</td>
<td>16.9</td>
<td>57.1</td>
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<td>19.2</td>
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<td>1994–1995</td>
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<td>50.0</td>
<td>13.6</td>
<td>36.3</td>
<td>15.3</td>
<td>50.0</td>
<td>10.5</td>
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<td>15.5</td>
<td>10.0</td>
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<tr>
<td>1995–1996</td>
<td>7.8</td>
<td>100.0</td>
<td>61.8</td>
<td>27.6</td>
<td>34.2</td>
<td>25.8</td>
<td>38.2</td>
<td>16.4</td>
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<tr>
<td>1996–1997</td>
<td>13.2</td>
<td>100.0</td>
<td>46.7</td>
<td>21.6</td>
<td>25.1</td>
<td>14.6</td>
<td>53.3</td>
<td>21.6</td>
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<td>1997–1998</td>
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<td>15.8</td>
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<td>34.6</td>
<td>–0.8</td>
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<td>1998–1999</td>
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<tr>
<td>2000–2001</td>
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<td>32.6</td>
<td>22.3</td>
<td>14.9</td>
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<tr>
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<td>100.0</td>
<td>76.7</td>
<td>57.7</td>
<td>19.0</td>
<td>14.2</td>
<td>23.3</td>
<td>–15.0</td>
<td>–7.5</td>
<td>11.3</td>
<td>25.7</td>
<td>8.6</td>
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<tr>
<td>2002–2003</td>
<td>13.2</td>
<td>100.0</td>
<td>45.6</td>
<td>38.2</td>
<td>7.4</td>
<td>29</td>
<td>54.4</td>
<td>–129</td>
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<tr>
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<td>22.6</td>
<td>59.3</td>
<td>57.0</td>
<td>18.1</td>
<td>–15.3</td>
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<tr>
<td>2004–2005</td>
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<td>48.2</td>
<td>19.3</td>
<td>30.0</td>
<td>28.0</td>
<td>50.8</td>
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<td>2005–2006</td>
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<td>30.8</td>
<td>33.6</td>
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<td>5.5</td>
<td>11.5</td>
<td>–35</td>
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<td>2006–2007</td>
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<td>49.0</td>
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<td>5.3</td>
<td>51.0</td>
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<td>7.1</td>
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<td>2007–2008</td>
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<td>100.0</td>
<td>502</td>
<td>27.0</td>
<td>23.2</td>
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<td>49.8</td>
<td>17.9</td>
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<td>1.7</td>
<td>0.1</td>
<td>16.6</td>
<td></td>
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<td>2008–2009</td>
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<td>–425</td>
<td>21.1</td>
<td>18.8</td>
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<td>12.1</td>
<td>–121</td>
<td></td>
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<tr>
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<td>100.0</td>
<td>80.9</td>
<td>40.9</td>
<td>40.0</td>
<td>35.9</td>
<td>19.1</td>
<td>3.1</td>
<td>9.3</td>
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<td>3.6</td>
<td>–10</td>
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</tr>
<tr>
<td>2010–2011</td>
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<td>100.0</td>
<td>64.2</td>
<td>30.8</td>
<td>33.4</td>
<td>31.2</td>
<td>35.8</td>
<td>12.5</td>
<td>12.8</td>
<td>5.3</td>
<td>3.4</td>
<td>1.8</td>
<td></td>
</tr>
<tr>
<td>2011–2012</td>
<td>84.8</td>
<td>100.0</td>
<td>59.4</td>
<td>38.8</td>
<td>20.5</td>
<td>19.8</td>
<td>40.6</td>
<td>10.8</td>
<td>7.9</td>
<td>2.9</td>
<td>14.0</td>
<td>5.1</td>
<td></td>
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<tr>
<td>2012–2013</td>
<td>102.8</td>
<td>100.0</td>
<td>53.2</td>
<td>36.2</td>
<td>27.0</td>
<td>26.8</td>
<td>46.8</td>
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<td>21.1</td>
<td>1.2</td>
<td>14.4</td>
<td>1.7</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:** FII, Foreign Institutional Investors’ Investments; ECB, External Commercial Borrowings; STC, Short-term Trade Credits; EA, External Assistance; NRI, Non Resident Indian's Deposits. Others include drawdown of reserves of foreign assets of banks, overseas borrowings of banks, rupee debt, export credit, SDR, allocation, etc. Intercompany loans part of FDI in debt securities are included in non-debt creating flows as they are not large in magnitude. Portfolio/FII inflows include debt flows also, which is significant during last few years due to revision of limits.
The following Granger non-causality procedure has been modelled for studying the relationship between CAB and FA:

\[ CAB_t = \gamma_1 + \sum_{i=1}^{k+d_{\text{max}}} x_{1i} CAB_{t-i} + \sum_{i=1}^{k+d_{\text{max}}} \beta_{1i} FA_{t-i} + \epsilon_{1t}, \]

\[ FA_t = \gamma_2 + \sum_{i=1}^{k+d_{\text{max}}} x_{2i} CAB_{t-i} + \sum_{i=1}^{k+d_{\text{max}}} \beta_{2i} FA_{t-i} + \epsilon_{2t}. \]

To see whether FA affects CAB, we test the following hypothesis:

\[ H_0: \beta_{1i} = 0. \]

If the hypothesis is rejected, we can say that FA causes CAB and for reverse relationship, the null hypothesis is:

\[ H_0: x_{2i} = 0. \]

Testing of null hypothesis in Toda–Yamamoto Granger non-causality procedure (termed as T–Y procedure hereafter) requires an asymptotic \( \chi^2 \) distribution with modified Wald (MWald) test statistics. The T–Y involves the estimation of an augmented VAR\((k+d_{\text{max}})\) model, where \( k \) is the optimal lag length in the original VAR system and \( d_{\text{max}} \) is the maximal order of integration of the variables in the model.

Before applying Granger non-causality test, the unit root test is conducted and both the series are found to be stationary at levels. Therefore, \( d_{\text{max}} \) is 0. To get the optimal lag length \( (k) \), AIC, SIC, likelihood ratio (LR) criteria are used and the chosen \( k \) is 1 for all the periods. The Granger non-causality test results reported in Table IV reveal that current account and financial accounts do not have any statistically significant relationship for the full sample period or for the sub-period 1950–1990. However, during the post-reforms period (1991–2012) and another sub-period 1980–2012, FA causes CAB as the null hypotheses are rejected at their conventional level of significance. This result suggests that capital flows are driving India’s CADs. Large capital inflows over the years, mainly in the post-liberalisation period, facilitated easy financing of CAD, encouraging further growth in imports. In times of trouble, sudden slowdown in capital inflows made import financing difficult, thereby putting pressures on reserves and exchange rates.

<table>
<thead>
<tr>
<th>Null hypothesis</th>
<th>MWald–Stat</th>
<th>( p )-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sample: 1950–2012</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FA does not Granger cause CAB</td>
<td>1.29</td>
<td>0.26</td>
</tr>
<tr>
<td>CAB does not Granger cause FA</td>
<td>0.84</td>
<td>0.36</td>
</tr>
<tr>
<td><strong>Sample: 1980–2012</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FA does not Granger cause CAB</td>
<td>3.38</td>
<td>0.07**</td>
</tr>
<tr>
<td>CAB does not Granger cause FA</td>
<td>0.02</td>
<td>0.90</td>
</tr>
<tr>
<td><strong>Sample: 1991–2012</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FA does not Granger cause CAB</td>
<td>3.87</td>
<td>0.05*</td>
</tr>
<tr>
<td>CAB does not Granger cause FA</td>
<td>0.74</td>
<td>0.39</td>
</tr>
<tr>
<td><strong>Sample: 1950–1990</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FA does not Granger cause CAB</td>
<td>0.00</td>
<td>0.98</td>
</tr>
<tr>
<td>CAB does not Granger cause FA</td>
<td>0.75</td>
<td>0.38</td>
</tr>
</tbody>
</table>

**Table IV.** Granger non-causality test results

**Notes:** All the estimates are based on the model VAR\((k+d_{\text{max}})=1\). *,**Significant at 5 and 10 per cent levels, respectively.
5. Econometric results on sustainability issues

In the Indian context, few studies attempted to examine the sustainability issues. Khundrakpam and Ranjan (2008) using an inter-temporal model found that CAB of India was inter-temporally insolvent during the pre-reforms period but has turned solvent during the post-reform period. According to them, this result is a reflection of significant liberalisation of capital account which helped in smoothening of private consumption. Goyal (2012) estimated the medium-term sustainable level of CAD for India is in the range of 2.4–2.8 per cent of GDP based on Domar’s debt sustainability model. According to the International Monetary Fund’s (IMF, 2013) external sustainability approach, the estimated threshold is marginally lower at 2.3 per cent of GDP. Holmes et al. (2011) employing a range of parametric and nonparametric tests for cointegration between exports and imports and a set of unit root tests for CAB, for the period of 1950–2003, found favourable evidence for India’s current account sustainability since the late 1990s. Using a similar approach, Tiwari (2012) also concluded that CAD is sustainable as both non-oil exports and imports are strongly co-integrated.

In this study, sustainability of India’s current account is examined using different econometrics techniques as discussed in literature. A mean-reverting or stationary CAB is considered as sustainable. This is because a sustainable current account needs to be solvent. The present discount value of a country’s future trade surplus must be equal to the present value of its foreign debt to make it inter-temporally solvent (Milesi-Ferretti and Razin, 1996). This inter-temporal solvency condition implies that all debts will be repaid in the long run, which has been examined empirically extensively through unit root and cointegration tests (e.g. Hakkio and Rush, 1991; Husted, 1992; Sawada, 1994; Wu and et al., 1996; Bodman, 1997; Fountas and Wu, 1999; Leachman and Francis, 2000; Apergis et al. 2000; Arize, 2002; Matsubayashi, 2005; Baharumshah, et al., 2005; Wei, 2011). Furthermore, the modern inter-temporal approach combines the assumptions of perfect capital mobility and consumption-smoothing behaviour (Dulger and Ozdemir, 2005). This emphasises that the current account series should be stationary to be sustainable.

Four unit root tests, namely, Elliott–Rothenberg–Stock DF–GLS test (DF–GLS), augmented Dickey–Fuller test (ADF), Phillip–Perron test (PP) and Kwiatkowski–Phillips–Schmidt–Shin test (KPSS), are used to examine the stationarity of India’s CAB to GDP ratio (CAB). These tests are also used to examine the stationary property of data used in other empirical exercises. The data on CAB, exports, imports, deposit rate, consumer price index (CPI) for industrial workers, real GDP, real effective exchange rate (REER), gross fiscal deficit and GDP at current market price are collected from RBI’s Handbook of Statistics on the Indian Economy; age dependency, i.e. the ratio of dependents – people younger than 15 or older than 64 years – to the total working-age population in the ages of 15–64 years (DEP) is taken from World Bank’s online database; and world real GDP, unit value index (UVI) of exports and imports data are taken from International Financial Statistics of the IMF. Terms of trade (TOT) is calculated as the ratio of UVI of exports to UVI of imports multiplied with 100. For empirical exercise, CPI inflation (INF), growth in age dependency (ΔDEP), growth in TOT (ΔTOT) and ratio of India’s GDP growth to world GDP growth (RGDP) are considered. Trade openness (TOP) is defined as the sum of exports and imports of goods and services as a percentage of GDP. Gross fiscal deficit (GFD) is expressed as a percentage of GDP. Real deposit rate (RD) is calculated taking the difference between deposit rate and CPI inflation. The sample period is 1980 to 2012 except for cointegration test where the sample starts from 1950. Overall unit root test results are presented in Table V.

From the results, it can be said that CAB, RD, INF, RGDP and GFD are stationary at levels whereas other variables those are non-stationary at levels but stationary at first differences by at least one of the test criteria. The CAB is found to be stationary at levels by all test criteria suggesting that India’s current account is mean-reverting. This indicates at first insight about India’s CAD, which is not unsustainable.
To investigate the sustainability of India’s CAD, we have adopted an approach similar to Husted (1992) who examined the long-run relationship between exports and imports. According to him, the budget constraint of a consumer in small open economy is:

\[ C_0 = Y_0 + B_0 - I_0 - (1 + r_0)B_{-1}, \]

where \( C_0 \) is current consumption; \( Y_0 \) output; \( I_0 \) investment; \( r_0 \) the current period world interest rate; \( B_0 \) the size of international borrowing; and \( (1 + r_0)B_{-1} \) is the initial debt level of the consumer, corresponding to the country’s external debt. After making several assumptions, Husted (1992) derived a testable model which is given by the following regression:

\[ X_t = x + \beta MM_0 + \epsilon_t, \]

where \( X \) is exports of goods and services, \( MM \) is the imports of goods and services plus net interest and transfer payments. The economy to satisfy its inter-temporal budget constraint, \( \beta \) should be equal to \( 1 \) and \( \epsilon_t \) should be stationary. However, if trade flows are expressed relative to GNP and \( \beta \) is less than \( 1 \), the economy will fail to satisfy its budget constraint (Hakkio and Rush, 1991; Husted, 1992). Cointegration is a necessary condition for the economy to obeying its inter-temporal budget constraint. Therefore, Johansen cointegration test is used to examine the relationship between exports of goods and services to GDP ratio (\( X \)) and imports of goods and services plus net interest and transfer payments to GDP ratio (\( MM \)). A structural break for the year 2002 is identified in MM series based on Zivot–Andrew test and therefore a dummy variable DS2002 (1 for 2002 onwards and 0 for the years before 2002) is used to capture the effect[7]. Since \( X \) and \( MM \) are \( I(1) \) variables as confirmed from the results given in in Table V, we proceed to investigate the cointegrating relationship among them.

The results of Johansen cointegration test, conducted using one lag, a deterministic trend in the data and DS2002, are presented in Table VI. From the table, the eigenvalue tests suggest one cointegrating relationship between \( X \) and \( MM \) as both the \( \lambda \)-trace and \( \lambda \)-max values are higher than their respective 5 per cent level critical values rejecting the null of \( r \leq 0 \) against \( r > 0 \) in the \( \lambda \)-trace test and the null of \( r = 0 \) against \( r = 1 \) in the \( \lambda \)-max test. The cointegration test confirms about the long-run relationship between \( X \) and \( MM \). Further validity of this relationship is established using vector error correction model (VECM).
Results in Table VII provide the estimates of long-run steady-state coefficients of the variables as well as their short-run coefficients using Johansen’s VECM. The LR test statistic suggested that the (over-identifying) restriction that that the slope coefficient of $X$ (i.e. $\beta$) is equal to 1 could not be rejected at the 1 per cent level. The error correction term $ecm_{-1}$ is significant at 5 per cent level and large in magnitude indicating a sizeable amount of correction of disequilibrium error in the short-run to maintain the steady-state equilibrium. The significance of error correction term also validates the long-run relation between exports and imports, and thereby ensures the sustainability. The coefficient of $X$ is positive and statistically equal to 1 further confirms the sustainability of India’s current account position.

Both unit root and cointegration tests are useful in examining the sustainability of the current account in the medium and long run. However, they do not indicate the immediate risks associated with the current account. Although the empirical results discussed earlier show that India’s CAD is sustainable, many analysts, economists and rating agency have questioned the sustainability of India’s current account whenever it had high deficits (e.g. the late 1980s or the recent 2008–2013 period). At any time, India had high deficits, they were forced to be corrected, due to drying up of capital flows, using some policy measures. Therefore, it is important to examine the underlying factors driving the current account to take appropriate policy actions before its deterioration.

The usual proximate determinants of the CAB chiefly are the terms of trade, real exchange rate, economic growth, real interest rate, government expenditure, trade openness and the age dependency ratio (e.g. Karunaratne, 1988; Calderon, et al., 2000; Chinn and Prasad, 2003; Osakwe and Verick, 2007). In the context of developing countries,
Calderon et al. (2000) found a moderate level of persistency in the current account, beyond which it is explained by domestic output growth, savings and shocks accompanied by terms of trade or appreciation of the real exchange rate. Similarly, investigating the medium-term determinants of current account, Chinn and Prasad (2003) found that government budget balances, initial net foreign asset positions and indicators of financial deepening are positively associated with CABs while terms of trade volatility is found to be negatively correlated with CADs. Nkuna (2013) finds the statistically significant determinants of CAD in case of Malawi are population growth, terms of trade, official development assistance, net foreign assets, real exchange rate and trade openness.

Analysis of CAD requires that the fundamental causes as well as the proximate causes should be identified. Looking at the literature, we try to establish a relationship between CAB and other macroeconomic factors such as relative income growth (RGDP), inflation, real interest rate, fiscal deficit, terms of trade, trade openness and age dependency. As found earlier, inflation and real interest rate being the determinants of savings are expected to impact CAD. A high age dependency is expected to put a drag on household savings. High domestic growth could lead to higher CAD through greater import demand whereas high world growth increasing export demand is expected to reduce CAD. While fiscal deficit is expected to affect CAD negatively and indirectly through both savings and investments as predicted by twin deficit hypothesis, terms of trade could affect current account directly. Therefore, to find out the determinants of current account, we have regressed CAB on RGDP, GFD, INF, RD, TOP, ΔTOT and ΔDEP. One dummy variable is used to capture exceptional years of surplus in CAB due to strong remittances inflows despite lacklustre growth in developed countries (i.e. D2001_03, 1 for the years 2001–2003 and 0 for other years). The estimation is conducted for the period 1981–2012. The actual and fitted CAB is presented in Figure 2. The figure shows that the estimated CAB is tracking well the actual CAB, except for the years 1990 and 2012 when the difference was significantly large about 1 per cent of GDP. The significant divergence during these years indicates the deterioration of CAD, as the actual CAD was moving away from the estimated one.

The estimated results are given in Table VIII. All the coefficients except the intercept are statistically significant. The diagnostic checks are conducted for serial correlation problem using Breusch–Godfrey LM test and DW test, which reveal the absence of any...
autocorrelation problem. The overall results show that India’s current account is driven by fiscal deficit, relative income growth, terms of trade growth, inflation, real deposit rate, trade openness and age dependency factor. Fiscal deficit is found to have significant and sizeable impact on CAD, indicating that a one percentage point increase in gross fiscal deficit as per cent of GDP would increase CADs as per cent of GDP by 28 basis points. This finding is consistent with the finding of a recent study by Suresh and Tiwari (2014) on twin deficit hypothesis. A higher domestic growth as compared with world growth is found to be increasing CAD. The rise in age dependency increases CADs significantly; however, given the trend in rising working-age population, a subsequent reduction in age dependency is expected to provide comfort to the CAD in India. These medium-term determinants have important implications for policy-making. While age dependency would play a crucial role in automatic correction in CAD, policy makers should focus on reducing fiscal deficit to keep the current account in a sustainable path in the long run.

6. Concluding remarks
India’s CAD has widened in last few years mainly because of the rise in gold and oil imports, and increase in investment income payments in conjunction with fall in investment income receipts, despite a large comfort provided by services sector and private remittances. Given large demand in India, it is difficult to control import growth. However, policy makers should focus on achieving phenomenon export growth so that a sustainable current account is maintained. With rising working-age and skilled population, India could focus more on high-value product exports rather than low-value manufactured items.

On the structural side, the widening CAD is contributed to a large extent by fall in household financial savings despite a fall in corporate investments, which raises concerns. Further investigation suggests that slowdown in household savings has been mainly led by acceleration in inflation. India has been financing its CAD through capital inflows and the composition of capital inflows has changed during previous few years. In particular, currently a large portion of CAD is financed through short-term volatile capital flows. The rising short-term debt mainly due to high CAD is a risk to India’s external sector. Granger non-causality test result suggests that capital inflows in the post-liberalisation period are driving CADs rather than the causality running from the opposite side. The empirical results using unit root tests and Johansen cointegration test provide the evidence of sustainability of India’s CAD in the long run. Results from econometric analysis revealed that India’s current account is driven by fiscal deficit, term of trade, inflation, real deposit rate and age dependency factor. The results suggest that one of the important factors contributing to large CADs over the years from the structural side is fiscal deficit. Therefore, it is important to correct fiscal deficits to keep CAB at a sustainable level.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>t-stat</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.42</td>
<td>1.65</td>
<td>0.11</td>
</tr>
<tr>
<td>$RGDP_t$</td>
<td>-0.01</td>
<td>-1.95**</td>
<td>0.06</td>
</tr>
<tr>
<td>$\Delta TOT_t$</td>
<td>0.02</td>
<td>18.88*</td>
<td>0.00</td>
</tr>
<tr>
<td>$GFD_t$</td>
<td>-0.28</td>
<td>-14.40*</td>
<td>0.00</td>
</tr>
<tr>
<td>$INF_t$</td>
<td>-0.08</td>
<td>-10.13*</td>
<td>0.00</td>
</tr>
<tr>
<td>$\Delta TOT_t$</td>
<td>-0.12</td>
<td>-31.75*</td>
<td>0.00</td>
</tr>
<tr>
<td>$\Delta DEP_t$</td>
<td>-3.40</td>
<td>-35.79*</td>
<td>0.00</td>
</tr>
<tr>
<td>$RD_t$</td>
<td>-0.13</td>
<td>-11.73*</td>
<td>0.00</td>
</tr>
<tr>
<td>$D2001_03$</td>
<td>1.76</td>
<td>26.61*</td>
<td>0.00</td>
</tr>
</tbody>
</table>

$R^2 = 0.87$; DW: 1.89; LM(2) = 0.94 (0.40); No. of obs. = 32

Notes: *,**Significant at 1 and 10 per cent levels, respectively
Notes

1. GNP = C + I + G + X - M + Net income from abroad, where X, exports; M, imports.

\[ \text{CAB} = \text{GNP} - (C + I + G) = X - M + \text{Net income from abroad} = S - I, \]

where S = GNP - (C + G).

2. John Pitchford (an Australian Economist) and Nigel Lawson (former UK Chancellor of the Exchequer) used this framework to argue that large current account deficits in their respective countries (Australia and the UK) did not represent any risks, given the absence of any apparent distortions and so far the government balance is in order, which is commonly called as “consenting adults” view of current account.

3. The Fiscal Responsibility and Budget Management (FRBM) Act was enacted in 2003 to institutionalise financial discipline by eliminating revenue deficit and reducing fiscal deficit to 3 per cent of GDP by March 2008.

4. To examine the determinants of financial saving, an equation is estimated running regression of household financial saving as a percentage of GDP (HH_FN) on real deposit rate (RD), i.e. the difference between 1-3 year deposit rate and CPI inflation rate, CPI Inflation (CP_INF), GDP growth (GR), change in log of age dependency ratio (∆DEP) and its own lag for the period of 1971-2011. The results reported below show that all the variables are significant at 5 per cent level and free from serial correlation problem, while income has a significant positive impact on household financial savings, age dependency and inflation affect it negatively:

\[ HH\_FN_t = 1.57 + 0.52HH\_FN_{t-1} + 0.04RD_t + 0.4CPINF_t + 0.12GR_t - 2.08\Delta DEP_t \]

\[ R^2 = 0.84 \quad \text{Durbin's } h - \text{stat} = -0.93; \quad \text{LM}(4) = 1.40 \quad (0.25); \quad Q(4) = 3.68 \quad (0.45). \]

5. Here, trade deficits are the difference between merchandise as well as services exports and imports to GDP ratio.


7. Although the series is non-stationary with this break, the break year statistic (t-value = 2.89) is statistically significant at 1 per cent level.

References


**Further reading**


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Using the ARDL-ECM approach to investigate the nexus between support price and wheat production
An empirical evidence from Pakistan

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Abdul Rehman
Research Center of Agricultural-Rural-Peasants, Anhui University, Hefei, China

Abstract

Purpose – The purpose of this paper is to examine the effect of support price on wheat production in Pakistan during the period 1971–2016.

Design/methodology/approach – To capture the effect of support price on wheat production, the authors estimated the long-run linkage by using the ARDL bounds testing approach to cointegration.

Findings – This study confirmed the presence of a positive and long-term effect of area under cultivation, support price and fertilizer consumption on wheat production through ARDL bounds test. The results showed that both in the long run and short run, support price plays an important role in the enhancement of wheat production. The authors also found that the coefficients of the area under cultivation and fertilizer consumption variables were statistically significant and positive both in the long run and short run.

Originality/value – The use of the ARDL approach that examines the long-run and short-run effects of support price on wheat production in Pakistan makes the current study unique. An emerging economic literature suggests that only limited research has been conducted in this area.

Keywords Pakistan, ARDL, Support price, Wheat production

Paper type Research paper

1. Introduction

Agriculture sector has a dominant role in the economy of Pakistan and it directly supports the population of the country. It has about 26 percent contribution to the economic GDP. The arable land of Pakistan is about 22.45m hectares, out of which 6.34m hectares land is irrigated with canal water, about 12.52m hectares land is cultivated through tube wells and other water sources, and remaining 3.59m hectares is not associated with the water (GOP, 2013). Wheat is considered to be the main staple food in many countries including Pakistan as it is the important cereal crop and the sustainable production of wheat is the major concern of many countries (Rehman et al., 2017a,b; Rehman, Jingdong, Kabir and Hussain, 2017). The Government of Pakistan is still paying attention to improve different varieties of wheat by providing the agricultural credit support to boost the production (Chandio and Jiang, 2018; Rehman et al., 2017a,b; Rehman, Jingdong, Kabir and Hussain, 2017). Previous research on wheat crop in Pakistan has shown that the farmers are deliberate to introduce new varieties to...
promote cultivation (Iqbal et al., 2002; Chandio and Jiang, 2018). During 1997, about 1m hectares area was used for the production of wheat crop in the country, which is near about 51 percent of the entire wheat producing region (Smale et al., 2002). Although the production of wheat has doubled in the past three years, the country has imported a huge quantity of wheat to meet its rapidly growing population needs. During 2007–2008, the country imported 8.5–15.9 percent wheat (Ahmad and Farooq, 2010). Wheat is the key food crop in Pakistan because it is widely used as a source of food in everyday life and also a low-cost source of animal feed (Chandio et al., 2018). In the past several decades, the usage of pesticides and fertilizers has increased potentially, playing a chief role in many countries to boost the production of wheat. However, if the cultivated farmland meets the recent climatic potential, it can also boost the wheat production up to 70 percent, mainly through improved irrigation and fertilizer (Mueller et al., 2012). Due to huge variations in the geographical conditions and under comparable climatic conditions, there are vast yield gaps in many countries, indicating inconsistent increase in wheat yield (Licker et al., 2010; Liu et al., 2007, 2013). In different arid regions, the rain water harvesting has been practiced successfully to collect to runoff water and transport it to planting areas (Qiang et al., 2006). The adoption of suitable water harvesting techniques is required to boost production, and micro-basins can increase the efficiency of water (Zakaria et al., 2012). When it is covered with the pliable, the wheat grain production increases by 87 percent (Yazdi et al., 2011). Wheat is the major food source in Pakistan which is used daily. In Pakistan, a number of researchers such as Hussain et al. (2012), Buriro et al. (2013), Ahmad et al. (2015), Chandio et al. (2018) and Chandio and Jiang (2018) have examined the impact of credit on wheat productivity, technical efficiency of wheat and determinants of the adoption of improved wheat varieties. Thus, this empirical study differs from earlier studies by attempting to examine the effect of support price and non-price factors on wheat production in Pakistan over the period 1971–2016 by using the ARDL approach and to suggest policy guidelines for high wheat production in Pakistan.

2. Existing review of literature
The security of food is the major issue in today’s world. United nation and other international organizations are very pessimistic about the current food situation in the world. The food situation is also serious in Pakistan. Wheat and other food prices rise steeply. In addition, the price rises in the energy, transportation costs, housing, health and education costs also have eroded this situation and made the lives of poorest segments of society unaffordable (Mahmood, 2008; Niaz, 2008). In the production of wheat crop, the water management strategy for the past five years has got the attention to increase the production rationalization of irrigation water. In the study of simulation, the water productivity and wheat crop have improved (Timsina et al., 2008). The authorization of wheat support prices from the agencies is considered as legal in Pakistan. The major purpose of announcing support prices or property prices is to limit the price of bulk commodities so that they should not exceed the distributed support price levels. If the price exceeds this level, the government is prepared to buy goods that support the price. If the price is much higher than the target price, the growers sell their output on the open market (Farooq et al., 2001; Schiff and Valdes, 1992; Thiele, 2003). Wheat is considered to be famous food crop in Pakistan. However, the invasion of weed is a major bottleneck in increasing wheat yield and accounts for more than 48 percent of potential wheat yield losses (Khan and Haq, 2002). Wheat yields may also vary among farmer farms with similar topographical characteristics and access to various input resources. The main differences in the management practices employed by these farms are considered to be the major source of variation in the productivity. Furthermore, it is necessary to identify the technical level of wheat farmers and to identify important factors for wheat production, as most of the farmers are poorly resource either they do not have the right knowledge regarding production or cannot follow the production practices (Ahmad et al., 2002; Hussain et al., 2011). The yield losses are severe when the
resources are limited and crops production occurs simultaneously (Shehzad et al., 2013; Hussain et al., 2015). The yield of crops decreases when weed competition increases, which results in strong struggle and competitive pressure on crops (Fahad et al., 2014). The wheat crop which is considered the traditional crop is planted in the flat basin submerged in the irrigation water. However, such type of irrigation causes huge water losses. The losses caused by vanishing and deep seepage exacerbate severe water shortages, which contribute to further groundwater over-exploitation. In addition, different methods and techniques are necessary to boost the production of crops by employing agricultural technology (Rehman et al., 2015, 2017a, b; Rehman, Jingdong, Kabir and Hussain, 2017). The rain water also plays a vital role in the production of food crops and about 80 percent of the world agricultural land is associated with it. The agricultural risk of rainwater feeding is higher on the land receiving rain. Rainfall in semi-arid areas is insufficient for cash crop growth. Therefore, when rainfall does not meet the crop’s appropriate soil moisture conditions, supplemental irrigation is used (Oweis, 1999; Oweis and Hachum, 2009). The research by Chandio et al. (2018) on short-term loan and long-term loan revealed that short-term loans have high positive effects on wheat production in Pakistan. Similarly, Chandio and Jiang (2018) suggested that, among other considerations, formal education and farming experience of the heads of households, access to credit, extension contact, landholding size and tube-well ownership are the main determinants of the adoption of improved wheat varieties by wheat farmers in Sindh, Pakistan.

3. Data and methodology

3.1 Data description
The study uses time series data covering the period from 1971 to 2016. Annual time series data on wheat production in (000 tons), area under cultivation in (000 hectares), support price in (Pakistani rupees/40 Kg) and fertilizer consumption in (000 N/T) are sourced from the economic survey of Pakistan (various issues).

3.2 Empirical methodology
The objective of the study is to link wheat production controlling for the effect of support price, area under cultivation and fertilizer consumption. This association is given in the form of a long-linear empirical model that can be specified as:

\[ \ln WP_t = \alpha_0 + \alpha_1 \ln AR_t + \alpha_2 \ln SP_t + \alpha_3 \ln FER_t + \epsilon_t, \]  

(1)

where \( \ln \) represents the natural logarithm; WP denotes the wheat production; AR represents area under cultivation; SP represents support price; FER represents fertilizer consumption and \( \epsilon_t \) is a standard error term. Following Nwani and Bassey Orie (2016) and Nwani et al. (2016), the present paper uses the ARDL approach proposed by Pesaran et al. (2001). The ARDL[1] approach provides some desirable advantages over the other traditional cointegration approaches like EG[2] and JJCA[3]. On the other hand, these cointegration approaches require that all variables be integrated into the same order. The ARDL test process provides effective results, whether the variables are integrated at I(0) or integrated at I(1) or mutually co-integrated (Pesaran et al., 2001). A small size of observations and several order of integration of the study variables make ARDL the preferred method of this study. The equation of an ARDL model is specified as:

\[ \Delta \ln WP_t = \beta_0 + \sum_{i=1}^{p} \beta_1 \Delta \ln WP_{t-i} + \sum_{i=1}^{p} \beta_2 \Delta \ln AR_{t-i} + \sum_{i=1}^{p} \beta_3 \Delta \ln SP_{t-i} + \sum_{i=1}^{p} \beta_4 \Delta \ln FER_{t-i} \]

\[ + \beta_5 \ln WP_{t-1} + \beta_6 \ln AR_{t-1} + \beta_7 \ln SP_{t-1} + \beta_8 \ln FER_{t-1} + \epsilon_t, \]  

(2)
where \( \Delta \) denotes the difference operator. The test includes the F-test of the joint significance of the coefficient of lagged variables to verify that there is a long-term linkage among the variables. The null hypothesis of no long-term association existing among the variables \( (H_0: \beta_5 = \beta_6 = \beta_7 = \beta_8 = 0) \) is tested following Pesaran et al. (2001). The decision of \( H_0 \) can be rejected or accepted is mostly based on the following conditions: If the value of F-test > upper critical bound (UCB), then reject \( H_0 \) and the variables of the study are co-integrated, if the value of F-test < lower critical bound (LCB), then accept \( H_0 \) and the variables of the present study are not co-integrated; however, if value of F-test \( \geq \) LCB and \( \leq \) UCB, then the decision is inconclusive. The error correction model (ECM) for the estimation of the short-run linkages can be formulated as follow:

\[
\Delta \ln WP_t = \beta_0 + \sum_{i=1}^{p} \beta_1 i \Delta \ln WP_{t-i} + \sum_{i=1}^{p} \beta_2 i \Delta \ln AR_{t-i} + \sum_{i=1}^{p} \beta_3 i \Delta \ln SP_{t-i} + \sum_{i=1}^{p} \beta_4 i \Delta \ln FER_{t-i} + \alpha_1 \text{ECT}_{t-1} + \epsilon_t. \tag{3}
\]

The statistically significant and negative sign of ECM \( \alpha_1 \) coefficient implies that any long-run disequilibrium among dependent variables and a number of independent variables will converge back to the long-term equilibrium association.

4. Empirical results
4.1 Descriptive statistics and correlation analysis

The descriptive statistics indicate that wheat production, area under cultivation, support price and fertilizer consumption are normally distributed, as indicated by Jarque–Bera statistics (see Table I). The pair-wise correlations analysis describes that area under cultivation, support price and fertilizer consumption are positively associated with wheat production. Area under cultivation and support price are positively correlated with fertilizer consumption. The positive correlation exists among support price and fertilizer consumption. Trend of the study variables is displayed in Figure 1.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Median</th>
<th>Max.</th>
<th>Min.</th>
<th>SD</th>
<th>Skewness</th>
<th>Kurtosis</th>
<th>Jarque–Bera</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>lnWP</td>
<td>9.609112</td>
<td>9.675244</td>
<td>10.16504</td>
<td>8.775905</td>
<td>0.402775</td>
<td>-0.431861</td>
<td>2.092407</td>
<td>3.008669</td>
<td>0.222165</td>
</tr>
<tr>
<td>lnAR</td>
<td>8.947177</td>
<td>8.991450</td>
<td>9.129564</td>
<td>8.665113</td>
<td>0.134525</td>
<td>-0.712168</td>
<td>2.459323</td>
<td>4.448502</td>
<td>0.108138</td>
</tr>
<tr>
<td>lnSP</td>
<td>5.063261</td>
<td>4.975000</td>
<td>7.170000</td>
<td>2.900000</td>
<td>1.258271</td>
<td>0.153187</td>
<td>1.970739</td>
<td>2.210384</td>
<td>0.231147</td>
</tr>
<tr>
<td>lnFER</td>
<td>7.476796</td>
<td>7.671923</td>
<td>8.380227</td>
<td>6.546153</td>
<td>0.762955</td>
<td>-0.816312</td>
<td>5.259924</td>
<td>5.416242</td>
<td>0.666649</td>
</tr>
</tbody>
</table>

Table I. Summary of descriptive statistics and correlation matrix

<table>
<thead>
<tr>
<th>Variable</th>
<th>lnWP</th>
<th>lnAR</th>
<th>lnSP</th>
<th>lnFER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>9.609112</td>
<td>8.947177</td>
<td>5.063261</td>
<td>7.476796</td>
</tr>
<tr>
<td>Median</td>
<td>9.675244</td>
<td>8.991450</td>
<td>4.975000</td>
<td>7.671923</td>
</tr>
<tr>
<td>Max.</td>
<td>10.16504</td>
<td>9.129564</td>
<td>7.170000</td>
<td>8.380227</td>
</tr>
<tr>
<td>Min.</td>
<td>8.775905</td>
<td>8.665113</td>
<td>2.900000</td>
<td>6.546153</td>
</tr>
<tr>
<td>SD</td>
<td>0.402775</td>
<td>0.134525</td>
<td>1.258271</td>
<td>0.762955</td>
</tr>
<tr>
<td>Skewness</td>
<td>-0.431861</td>
<td>-0.712168</td>
<td>0.153187</td>
<td>-0.816312</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>2.092407</td>
<td>2.459323</td>
<td>1.970739</td>
<td>5.259924</td>
</tr>
<tr>
<td>Jarque–Bera</td>
<td>3.008669</td>
<td>4.448502</td>
<td>2.210384</td>
<td>5.416242</td>
</tr>
<tr>
<td>Probability</td>
<td>0.222165</td>
<td>0.108138</td>
<td>0.231147</td>
<td>0.666649</td>
</tr>
</tbody>
</table>

Notes: max., maximum; min., minimum; sum SD, sum of SD
4.2 Unit root analysis

This study assesses the long-run linkage between area under cultivation, support price, fertilizer consumption and wheat production, before applying the ARDL (see Footnote 1) method; it is a pre-condition to find out the order of integration of the variables. The ARDL (see Footnote 1) approach can be valid if the series is stationary at $I(0)$ or $I(1)$ or $I(0)/I(1)$ i.e. integrating order of mixed. The most important assumption of the ARDL (see Footnote 1) method is that the series must be integrated at $I(0)$ or $I(1)$ if any variable of the study is integrated at $I(2)$, it is only then the $F$-test becomes invalid to take decision regarding the presence of long-run association. Therefore, in this study, we have used two unit root tests, i.e., ADF[4] and PP[5]. The results of the ADF and P–P unit root tests presented in Table I reveal that the variables of the study are stationary at different order; while lnWP and lnFER are integrated at level $I(0)$, other variables such as lnAR and lnSP are integrated $I(1)$ (Table II).

4.3 Lag length criteria

After checking the unit root test, the next stage is to use the ARDL (see Footnote 1) approach to check the long-term relationship between the series. It is necessary to choose the appropriate lag length before applying the ARDL bounds test. In addition, the choice of lag length should be exercised with caution, as inappropriate lag length can lead to biased results and cannot be accepted for policy analysis. Consequently, to confirm that the lag length is chosen appropriately, we use the AIC[6] to illustrate the relative lag length. The AIC (see Footnote 6) criterion gives robust results and has excellent performance compared to the SC[7] and HQ[8]. The results are presented in Table III. We determined that the lag 1 fits our sample size. Moreover, confirmation to choose the
Table II. Results of unit root tests

<table>
<thead>
<tr>
<th>Variables</th>
<th>ADF test (at level)</th>
<th>ADF test (at first difference)</th>
<th>P-P test (at level)</th>
<th>P-P test (at first difference)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intercept</td>
<td>Intercept and trend</td>
<td>Intercept</td>
<td>Intercept and trend</td>
</tr>
<tr>
<td>lnWP</td>
<td>-2.463375</td>
<td>-4.017828***</td>
<td>-2.248176</td>
<td>-3.967858***</td>
</tr>
<tr>
<td>lnAR</td>
<td>-1.332834</td>
<td>-2.707279</td>
<td>-2.270279</td>
<td>-2.270279</td>
</tr>
<tr>
<td>lnSP</td>
<td>-0.438368</td>
<td>-2.584670</td>
<td>-0.395604</td>
<td>-2.604481</td>
</tr>
</tbody>
</table>

Notes: **, *** Mean the rejection of null hypothesis at 5 and 1 percent levels of significance, respectively.
appropriate lag length under the VAR approach has been determined in Figure 2, by showing the polynomial graph. In this graph, all the blue dots are inside the circle that confirms that at lag 1, estimations would be applicable to get good outcomes (Table II).

### 4.4 Bound test approach
This study used the AIC (see Footnote 6) to select the lag length for ARDL approach (proposed by Pesaran et al., 2001; Narayan and Narayan, 2005). Our findings of the cointegration test based on the ARDL bounds testing approach are detailed in Table IV. Results reveal that the calculated F-statistics are 10.270, 4.978 and 5.813, which are greater than UCB at 1 and 5 percent of significance levels when wheat production, area and fertilizer consumption are used as dependent variables. The outcomes of bounds test conclude that there are three cointegrating vectors which validate the presence of long-run linkage between wheat production, area under cultivation and fertilizer consumption in Pakistan. In addition, this paper also used JICA (see Footnote 3) to check the robustness of long-run association. Results in Table V show that there are two cointegration vectors among wheat production, area under cultivation, support price and fertilizer consumption, which confirm the robustness of long-run association.

### 4.5 Long-run and short-run analysis
This study confirmed the long-run cointegration among wheat production and its determinant when wheat production is used as the dependent variable. Here, the study has estimated both long-run and short-run elasticities using Equations (2) and (3). Table VI demonstrates the long-run and short-run results. For the long-run results (see Table VI, Panel A), all explanatory variables positively and significantly affected wheat production. In long run, the impact of area under cultivation on wheat production is

![Inverse Roots of AR Characteristic Polynomial](image)

**Figure 2.** Optimal lag selection criteria under VAR model in polynomial graph

<table>
<thead>
<tr>
<th>Lag</th>
<th>LogL</th>
<th>LR(^a)</th>
<th>FPE(^b)</th>
<th>AIC</th>
<th>SC</th>
<th>HQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>97.01182</td>
<td>na</td>
<td>2.06e-07</td>
<td>-4.043992</td>
<td>-3.884980</td>
<td>-3.984425</td>
</tr>
<tr>
<td>1</td>
<td>273.1569</td>
<td>313.9978*</td>
<td>1.96e-10*</td>
<td>-11.00682*</td>
<td>-10.21176*</td>
<td>-10.70899*</td>
</tr>
<tr>
<td>2</td>
<td>287.0438</td>
<td>22.33975</td>
<td>2.18e-10</td>
<td>-10.91495</td>
<td>-9.488357</td>
<td>-10.37885</td>
</tr>
<tr>
<td>3</td>
<td>298.8304</td>
<td>16.91119</td>
<td>2.73e-10</td>
<td>-10.73176</td>
<td>-8.664596</td>
<td>-9.957385</td>
</tr>
</tbody>
</table>

**Notes:** \(^a\) LR for sequential modified LR test statistic (each test at 5 percent level); \(^b\) final prediction error (FPE). *Denotes the lag order selected by the criterion

**Table III. Lag order selection**
Table V. Results of Johansen cointegration test

<table>
<thead>
<tr>
<th>Optimal lag structure</th>
<th>LnWP</th>
<th>LnAR</th>
<th>LnSP</th>
<th>LnFER</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1, 0, 0, 0)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1, 0, 0, 0)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1, 0, 0, 0)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1, 0, 1, 0)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$F$-statistics</td>
<td>10.2706***</td>
<td>4.985628***</td>
<td>1.443394</td>
<td>5.813190***</td>
</tr>
<tr>
<td>Critical values (%)</td>
<td>1</td>
<td>5</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Lower bounds (l0)</td>
<td>4.29</td>
<td>3.23</td>
<td>2.72</td>
<td></td>
</tr>
<tr>
<td>Upper bounds (l1)</td>
<td>5.61</td>
<td>4.35</td>
<td>3.77</td>
<td></td>
</tr>
</tbody>
</table>

Table IV. Results of ARDL cointegration test

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>SE</th>
<th>$T$-ratio</th>
<th>$p$-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Delta$lnAR</td>
<td>0.877174***</td>
<td>0.029674</td>
<td>2.955963</td>
<td>0.0051</td>
</tr>
<tr>
<td>$\Delta$lnSP</td>
<td>0.135726***</td>
<td>0.023975</td>
<td>5.661246</td>
<td>0.0000</td>
</tr>
<tr>
<td>$\Delta$lnFER</td>
<td>0.214479***</td>
<td>0.054957</td>
<td>3.902636</td>
<td>0.0003</td>
</tr>
<tr>
<td>ECM (−1)</td>
<td>−1.115432***</td>
<td>0.126128</td>
<td>−8.843661</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

Table VI. Results of long-run and short-run coefficients employing the ARDL approach

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>SE</th>
<th>$T$-ratio</th>
<th>$p$-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R^2$</td>
<td>0.885502</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.984088</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Durbin–Watson stat</td>
<td>1.863229</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$F$-statistic</td>
<td>12.1708***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$F$ SERIAL</td>
<td>0.2068 (0.8148)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$F$ NORMAL</td>
<td>3.1647 (0.2054)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$F$ ARCH</td>
<td>0.0502 (0.9511)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$F$ White</td>
<td>0.7241 (0.7268)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$F$ RESET</td>
<td>0.0688 (0.5074)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: ***Significant at 1 percent
positive and highly significant. A 1 percent increase in area under cultivation will boost wheat production by 0.78 percent. Likewise, the support price is positively and significantly associated with wheat production. It is found that a 1 percent increase in support price will cause 0.12 percent wheat production increase. Similarly, wheat production will enhance by 0.19 percent due to a 1 percent increase in fertilizer consumption. The short-run results (see Table VI, Panel B) indicate a positive and highly significant effect of area under cultivation on wheat production. It is noted that a 1 percent increase in area under cultivation raises 0.87 percent wheat production. Meanwhile, in short-run estimation, the effect of support price on wheat production is positive and highly significant. The result reveals 0.13 percent of wheat production boost due to 1 percent increase in support price. The short-run coefficient of fertilizer consumption indicates that fertilizer consumption has a significant and positive effect on wheat production. A 1 percent increase in fertilizer consumption enhances wheat production by 0.21 percent. The empirical findings of this paper are contradicted with the results carried out in most of the previous studies such as Bashir et al. (2010), Buriro et al. (2015), Chandio et al. (2016, 2018). Most of these studies in the past used primary data and OLS regression approach was adopted to analyze the data; however, this empirical paper used annual time series data over the period 1971–2016 and followed ARDL approach to cointegration in order to examine the short- and long-run association in the model with desired variables. The values of $R^2$ and adjusted $R^2$ were estimated to be 98 percent, which confirms that the model is strongly good fitted. The calculated $F$-statistic is 12.1708. The error correction term ($ECT_{t-1}$) is negative and statistically significant at 1 percent significance level along with a high coefficient, which reveal that the disequilibrium can be adjusted to the long-run with higher speed, having any prior-year shock in the explanatory variables. In earlier studies (for instance, Narayan and Narayan, 2005; Qamaruzzaman and Jianguo, 2017; Paul, 2014), we performed a model stability test through several diagnostic tests including Jarque–Bera normality test, LM serial correlation test, white heteroskedasticity, autoregressive conditional heteroskedasticity test, Ramsey Reset test, respectively. The results are shown in Table VI (Panel C). The empirical findings of this study reveal that the ARDL model has passed all the diagnostic tests successfully. Meanwhile, this study has conducted two stability tests such as CUSUM[9] and CUSUMSQ[10] to investigate the stability of long- and short-run parameters. These stability tests have been suggested by Pesaran and Shin (1999). The graphs of both stability tests presented in Figures 3 and 4 identify that plots for both stability tests are between critical boundaries.
at 5 percent level of significance. This confirmed the accuracy of long-run and short-run parameters which have impact on wheat production over the period 1971–2016.

The outcomes of correlogram statistics indicated and confirmed that there is no autocorrelation and partial correlation in the ARDL model, as the Q-Stat remains statistically insignificant at 1 and 5 percent of significance levels (see Table VII).

5. Conclusions
This study examined the long-run and short-run effect of support price on wheat production in Pakistan over the period 1971–2016 by using the ARDL approach proposed by Pesaran et al. (2001). The order of integration of the study variables is tested by employing ADF and PP unit root tests. The outcomes reveal that the calculated F-tests in the ARDL bounds

<table>
<thead>
<tr>
<th>Autocorrelation</th>
<th>Partial correlation</th>
<th>Lags</th>
<th>AC</th>
<th>PAC</th>
<th>Q-stat</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>.1 .1</td>
<td>.1 .1</td>
<td>1</td>
<td>0.027</td>
<td>0.027</td>
<td>0.0352</td>
<td>0.851</td>
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<td>.1 .1</td>
<td>.1 .1</td>
<td>2</td>
<td>-0.101</td>
<td>-0.102</td>
<td>0.5386</td>
<td>0.764</td>
</tr>
<tr>
<td>.1 .1</td>
<td>.1 .1</td>
<td>3</td>
<td>0.045</td>
<td>0.051</td>
<td>0.6403</td>
<td>0.887</td>
</tr>
<tr>
<td>.1 .1</td>
<td>.1 .1</td>
<td>4</td>
<td>-0.079</td>
<td>-0.084</td>
<td>0.9638</td>
<td>0.915</td>
</tr>
<tr>
<td>.1 .1</td>
<td>.1 .1</td>
<td>5</td>
<td>-0.085</td>
<td>-0.081</td>
<td>1.4459</td>
<td>0.919</td>
</tr>
<tr>
<td>.1 .1</td>
<td>.1 .1</td>
<td>6</td>
<td>0.158</td>
<td>0.148</td>
<td>2.8027</td>
<td>0.833</td>
</tr>
<tr>
<td>.1 .1</td>
<td>.1 .1</td>
<td>7</td>
<td>0.097</td>
<td>0.079</td>
<td>3.3260</td>
<td>0.853</td>
</tr>
<tr>
<td>.1 .1</td>
<td>.1 .1</td>
<td>8</td>
<td>-0.128</td>
<td>-0.109</td>
<td>4.2662</td>
<td>0.832</td>
</tr>
<tr>
<td>.1 .1</td>
<td>.1 .1</td>
<td>9</td>
<td>0.183</td>
<td>0.193</td>
<td>6.2231</td>
<td>0.717</td>
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<tr>
<td>.1 .1</td>
<td>.1 .1</td>
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<td>-0.094</td>
<td>-0.137</td>
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<tr>
<td>.1 .1</td>
<td>.1 .1</td>
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<td>-0.135</td>
<td>-0.045</td>
<td>7.8877</td>
<td>0.723</td>
</tr>
<tr>
<td>.1 .1</td>
<td>.1 .1</td>
<td>12</td>
<td>-0.030</td>
<td>-0.059</td>
<td>7.8942</td>
<td>0.793</td>
</tr>
<tr>
<td>.1 .1</td>
<td>.1 .1</td>
<td>13</td>
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<td>-0.233</td>
<td>9.9947</td>
<td>0.694</td>
</tr>
<tr>
<td>.1 .1</td>
<td>.1 .1</td>
<td>14</td>
<td>-0.103</td>
<td>-0.044</td>
<td>10.715</td>
<td>0.708</td>
</tr>
<tr>
<td>.1 .1</td>
<td>.1 .1</td>
<td>15</td>
<td>-0.050</td>
<td>-0.165</td>
<td>10.892</td>
<td>0.760</td>
</tr>
<tr>
<td>.1 .1</td>
<td>.1 .1</td>
<td>16</td>
<td>-0.082</td>
<td>-0.154</td>
<td>11.378</td>
<td>0.786</td>
</tr>
<tr>
<td>.1 .1</td>
<td>.1 .1</td>
<td>17</td>
<td>-0.076</td>
<td>-0.025</td>
<td>11.817</td>
<td>0.811</td>
</tr>
<tr>
<td>.1 .1</td>
<td>.1 .1</td>
<td>18</td>
<td>0.042</td>
<td>-0.081</td>
<td>11.957</td>
<td>0.849</td>
</tr>
<tr>
<td>.1 .1</td>
<td>.1 .1</td>
<td>19</td>
<td>0.010</td>
<td>0.066</td>
<td>11.965</td>
<td>0.887</td>
</tr>
<tr>
<td>.1 .1</td>
<td>.1 .1</td>
<td>20</td>
<td>-0.192</td>
<td>-0.181</td>
<td>15.076</td>
<td>0.772</td>
</tr>
</tbody>
</table>

Table VII. Outcomes of correlogram statistics

Figure 4. Plot of cumulative sum of squares of recursive residuals.
testing approach to cointegration were greater than UCB at 1 and 5 percent of significance levels, as adopted from Pesaran et al. (2001). Consequently, this empirical study concludes that all explanatory variables stimulate wheat production in the long run. This study also observed that the elasticities of area under cultivation, support price and fertilizer consumption toward wheat production were positively and statistically significant influenced in both the long-run and the short-run periods. Furthermore, through timely announcement of support price, being minimum guaranteed price sustained for wheat before the beginning of planting season, one can ensure that the production of wheat can be obtained in order to meet the increasing demand of the consumers at different levels like local, national and international.

Notes
1. The autoregressive distributed lag (ARDL) bounds testing approach of cointegration.
3. See Johansen and Juselius’s (1990) cointegration approach.
6. Akaike information criterion (AIC).
7. Schwarz information criterion (SC).
8. Hannan–Quinn information criterion (HQ).
9. CUSUM the cumulative sum recursive residuals.
10. CUSUMSQ the cumulative of square of recursive residuals.

References


Wheat production in Pakistan


Further reading

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The efficiency of Jordan insurance companies and its determinants using DEA, slacks, and logit models

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Abstract
Purpose – The purpose of this paper is to evaluate the technical efficiency in the Jordan insurance market and examine the internal and external determinants that appear to affect the technical efficiency of the insurance companies.

Design/methodology/approach – The study used panel data for 22 insurance companies operating inside Jordan over the period 2000–2016. The author used the data envelopment analysis to evaluate the technical efficiency scores, slacks-based and logit models to examine the efficiency determinants.

Findings – The study found that there is a slight development of technical efficiency for the Jordanian insurance companies during the study period. In addition, there is a substantial efficiency difference among insurance companies each year, and there is a variation at the level of efficiency for each company in each year. The results also showed that owners’ equities are among the most important internal determinants of companies’ efficiency, and there is a significant correlation between type, size and return on assets of the insurer and its efficiency.

Originality/value – This study provides insurance management with relevant indicators that would guide them to make efficient use of the resource base. The period of study also covers the period following the adoption of the insurance law and the issuance of most of the legislation related to the work of insurance companies.

Keywords Jordan, Efficiency, DEA, Insurance, Logit model

Paper type Research paper

1. Introduction
The efficiency has become an issue that has begun to take an interest in the insurance sector as efficiency helps to identify efficient and inefficient companies in the market, in order to improve competition and profitability and raise the trust of the policyholders. The efficiency of the insurer refers to insurer ability to produce a given set of outputs via the use of inputs (Diacon et al., 2002).

In recent years, efficiency measurement has captured a great deal of attention. And the insurance sector, in particular, has seen extreme growth in the number of studies applying frontier efficiency methods. Frontier methodologies measure firm performance relative to best practice frontier comprised of the leading firm in the industry. Data envelopment analysis (DEA) is the most frequently applied method of frontier efficiency analysis in the insurance. DEA measures the relative performance of companies through comparing a set of inputs and outputs and developing benchmarks related to industry best practices, based
on the idea that the widespread application of these can lead to improving performance throughout the whole industry (Barros et al., 2005).

The insurance sector in Jordan consists of 24 insurance companies, whereof 1 is licensed as a life company, 9 are licensed as non-life companies and 14 are licensed as composite companies. Jordan insurance market is small by international standard. In 2016, gross written premiums in Jordan reached JOD582.9m, and the gross claims paid reached JOD438.9m. In the same year, the sector earned JOD35.1m in net profits before tax, the return on assets was 3.8 percent and the return on equity was 10.2 percent.

The importance of the insurance sector in Jordan increased during the period 2000–2016, where gross written premiums increased at an annual rate of 12 percent, insurance premiums per capita increased by 187 percent, which increased from JOD21 to 59 at that period. In addition, the ratio of gross premiums to the gross domestic product (insurance penetration ratio) increased from 1.7 percent in 2000 to 2.1 percent in 2016.

The purposes of this study are to partially fill the gap in existing literature by evaluating the technical efficiency for the Jordan insurance companies using DEA method, and examine the internal (managerial inefficiency) and external (characteristic of external environment) determinants that appear to affect the technical efficiency of the insurance companies using slacks-based and logit models.

The importance of the study stems from the importance of efficiency in the work of the insurance companies and their impact on their performance and results. The issue of efficiency in the insurance companies is of fundamental importance for the current time due to the challenges faced the insurance sector in Jordan represented by the low return on assets and weak contribution to GDP, in addition to the low per capita insurance. This study provides insurance management with a relevant indicator that would guide them to make efficient use of the resource base. The period of study also covers the period following the adoption of the insurance law and the issuance of most of the legislation related to the work of insurance companies.

2. Theoretical background
In microeconomic theory, the production function is defined in terms of the maximum output that can be produced from a specific input, given the existing technology to the firm involved (Battese, 1992). The term economic efficiency means that resources are used in such a way to generate maximum possible output with a given input. In insurance, efficiency refers to the ability of an insurance company to produce a specific set of outputs (such as premium or investment profits) from the use of a specific set of input, such as capital and labor. More specifically, the insurer has two main aspects of its business: the insurance side and the investment side. From the insurance side, output or services provided by an insurer constitute the range of activities an insurer undertakes as its effort to pool risk as premiums reflect the ability of the insurer to market a product, select a client and to accept carrying a risk. And for the investment side, the investment profit captures investment activities by the insurer. Input represents resources that the insurer employs in order to conduct its operation like labor, material and capital. Therefore, the insurer efficiency could also be interpreted as a measure of the insurer’s ability to produce outputs from its set of inputs. The insurance company is technically efficient if it can reduce its resources usage without some corresponding reduction in output, given the current state of production technology[1] in the industry[2] (Diacon, 2001). In other words, the insurer uses the optimal amounts and mix of inputs to produce given output levels, and any reduction of input will cause a reduction in the output.

Economic efficiency consists of technical efficiency and allocative efficiency (Farrell, 1957), where technical efficiency means the ability of an organization or decision-making unit (DMU)[3] to obtain the maximum amount of production using available inputs, and
The measure of technical efficiency is usually defined as the maximum reduction of all inputs allowing continual production of the same output as before. Allocative efficiency refers to the capacity of the production unit to mix optimal proportions of inputs and outputs appropriate to their current market price. Thus, economic efficiency refers to the combination of both technical efficiency and allocative efficiency. Therefore, the company cannot be 100 percent economically efficient unless it is 100 percent technically and allocative efficient (Jarraya and Bouri, 2012).

There are two approaches to calculating the efficiency indicators; the first is the input-oriented approach, which minimizes the inputs used in the production to the lowest possible level while the level of production remains constant. The other approach is the output-oriented approach, which increases the production level to the highest possible level while the input level remains constant. The two approaches can specify to the production function under the assumption of constant (CRS) or variable return to scale (VRS) (Eling and Luhnen, 2010).

Efficiency is estimated by comparing firms to the “best practice” efficient frontier formed by the most efficient firms in the industry (Farrell, 1957). The literature distinguishes two main approaches to estimating these frontiers: parametric and non-parametric approach. The parametric approach requires the specification of functional form of the production, cost and profit frontier and some distributional assumptions about the error term. On the other hand, non-parametric approach does not assume any specific functional form for evaluating efficiency, and therefore, does not take into account the error term. The most widely non-parametric or mathematical approach used is DEA introduced by Charnes et al. (1978). DEA is a non-parametric approach that employs linear programming technique to construct an efficient frontier that envelopes all the combination between inputs and outputs of firms in the sample. The efficient combination of input and output is in the frontier, while the inefficient combination will be less than that.

The objective of this model is to estimate the production frontier of DMUs that use the same input in the production. The relative efficiency of each unit measured for the purpose of making a comparison and efficiency score is usually standardized between 0 and 1, with the most (least) efficient firm receiving the value of 1 (0). The difference between a company's assigned value and the value of 1 can be interpreted as the company's improvement potential in terms of efficiency (Diacon et al., 2002).

The efficiency of any economic entities is obtained through the maximum of the weighted ratio of outputs to the weighted ratio of inputs, provided that the ratios of similar entities are less or equal to 1 (Charnes et al., 1978).

The model is generally as follows:

\[
\text{Max } \theta = \frac{\sum_{r=1}^{s} U_r Y_{r0}}{\sum_{i=1}^{m} V_i X_{i0}}
\]

subject to:

\[
\frac{\sum_{r=1}^{s} U_r Y_{rj}}{\sum_{i=1}^{m} V_i X_{ij}} \leq 1,
\]

where \( j = 1, \ldots, n \); \( U_r, V_i > 0 \); \( Y_{rj}, X_{ij} > 0 \); \( r = 1, \ldots, s; i = 1, \ldots, m; Y_{r0}, X_{i0} > 0 \); \( s \) is the number of output; \( U_r \) the weight of output \( r \); \( Y_{r0} \) the amount of \( r \) produced by DMUs; \( m \) the number of input; \( V_i \) the weight of input \( i \); and \( X_{i0} \) is the amount of input \( i \) used by DMUs.

There are two types of DEA, namely the CRS and VRS. The first model was introduced by Charnes et al. (1978) and called DEA–CCR. This model is appropriate when the
entities operate at their optimal scale of production where outputs will increase proportionally to the amount of inputs increased. The production possibilities curve can be determined under this assumption and the technical efficiency scores known as the overall technical efficiency.

The second model was developed by Banker et al. (1984) and called DEA–BCC. Many factors do not make the entities operate at its optimal level such as incomplete competition and some restrictions on financing and so on. Therefore, the DEA–CCR model may give inaccurate ratios of the technical efficiency of the entities. In this model, technical efficiency is decomposed to pure technical efficiency and scale efficiency.

Measurement of efficiency for insurance sector got significant consideration in recent years, where the empirical researches observed various matters concerning the efficiency of the insurance business. A study was prepared by Fecher et al. (1993), which included 84 life and 243 non-life insurance companies in France during the period 1984–1989. By using both parametric and non-parametric approach, the authors observed that there is a great variation in the relative efficiency levels between companies, and there is a correlation between the size, ownership, distribution, reinsurance and claims ratio of the company and its efficiency.

In order to analyze the technical efficiency of 94 insurance companies operating in Italian insurance market for the period 1985–1993 using the DEA model, Cummins et al. (1996) found that the result indicated that the level of efficiency during the study period remained constant despite the low productivity in the same period.

Cummins et al.’s (1999) study of the US market, which focuses on the life insurance companies during the period 1988–1993, found that the efficiency of insurance companies is relatively low when compared to other companies in other financial sectors in addition to the existing of significant differences in efficiency among those companies.

Diacon (2001) reviewed the efficiency of non-life insurance companies in the UK and compared their counterparts in the European Union. The study included 431 companies in six European countries. The results showed that the efficiency of insurance companies operating in the UK is medium and has the ability to be one of the most efficient companies in the EU. In a study by Diacon et al. (2002), which included 450 life insurance companies in 15 European countries, with the aim of identifying the best companies for reference and measuring the performance of other companies, they found significant differences in the level of efficiency between countries. In addition, there was a decrease in the average level of technical efficiency during the study period. Also by using tobit regression they found that mutual companies have higher levels of efficiency than stock companies, the most efficient insurer are those that specialized in particular market sectors and solvency ratios are associated with higher level of technical efficiency.

Hardwick et al. (2004) evaluated 50 life insurance companies in various organizational forms to verify the relationship between corporate governance and efficiency and found that the efficiency of companies increases as a number of board of directors increases.

Borges et al. (2008) used the DEA model to evaluate the performance of Greek life insurance companies during the period 1994–2003. They found that large and equated life insurance companies as well as those involved in merger and acquisition exhibit higher efficiency.

In Jordan, Ajlouni and Tobaishat (2010) studied 22 insurance companies listed in Amman Stock Exchange by using DEA during the period 2000–2016 and showed an improvement in the efficiency of companies during the study period, and the efficiency of life and non-life is nearly close.

3. Data and methodology
The study used panel data for 22 out of 24 insurance companies operating inside Jordan covering the period 2000–2016. Two companies excluded from the study due to
unavailability of data covering the entire study period. The data were collected from the annual financial statements of the insurance companies.

In insurance, there are three main inputs: business, capital and business services, and there are three main approaches for measuring the output of the insurance industry: asset or intermediation approach, user-cost approach and value-added approach.

The value-added approach emphasizes the importance of outputs if they contribute significant added value based on operating cost allocations. This approach is the most used approach for studying insurance companies’ efficiency (Cummins and Weiss, 2000). This approach assumes that insurers offer three main services through risk pooling and risk bearing, real financial services related to insured losses and intermediation by collecting funds and invest them.

Insurers create value added by operating a risk pool, collecting premiums from policyholders and re-distributing most of them to customers who have incurred losses. They also reduce their customers’ risks by holding capital to absorb unexpected losses. The second service, “real” financial services relating to insured losses, means that insurers create value added for their policyholders by providing real services such as financial planning (life) or the design of coverage programs (non-life). The third service is intermediation, where insurers create value added by acting as financial intermediaries that invest assets, which policyholders provide by way of their.

DEA results are sensitive to the variables used (inputs and outputs), and the choice of method and variables have an important impact on the measurement and analysis of efficiency. The following variables will be used in efficiency measurement by DEA (Diacon, 2001; Yang, 2006; Alhassan et al., 2015; Jaloudi and Bakir, 2019):

- Inputs: total operating expenses, debt and owner’s equity and total technical provisions.
- Outputs: net earned premiums and investments income.

Details of the input and output variables are given in Table I.

Because of the many constraints that prevent companies from operating at their optimal scale of production, and produce a frontier which has increasing returns to scale at low input levels and decreasing returns to scale at high input levels, the DEA model

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total operating expenses</td>
<td>Includes administrative, general expenses and commission paid as at the end of the year</td>
</tr>
<tr>
<td>Debt and owner’s equity</td>
<td>Including the paid-up capital of the company in addition to the retained earnings after the issuance of both statutory and voluntary reserves and premium on paid-up capital, as well as the value of the change in the investment valuation reserve as at the beginning of the year. Plus borrowing from banks</td>
</tr>
<tr>
<td>Total technical provisions</td>
<td>Includes the provision for unearned premiums, outstanding claim provision and the mathematical reserve at the end of the year</td>
</tr>
<tr>
<td>Net earned premiums</td>
<td>Premiums written by the company after excluding reinsurers’ share plus the value of the change in the unearned premium provision after excluding the reinsurer’s share (for non-life insurance business) or the value of the change in the mathematical reserve after deducting reinsurers’ share (for life insurance)</td>
</tr>
<tr>
<td>Investments income</td>
<td>Including the profits from financial investments in addition to the interest on deposits in banks and interest earned on bonds owned by the company</td>
</tr>
</tbody>
</table>

Table I. Input and output variables description

The efficiency of Jordan insurance companies
with a VRS (DEA–BCC) is used to evaluate the level of efficiency for insurance companies in Jordan. As follows:

$$\min_{\theta_i} \theta_i$$

subject to:

$$-Y_j + Y \lambda \geq 0$$
$$\theta X_j - X \lambda \geq 0$$
$$Z^\prime \lambda = 1$$
$$\lambda \geq 0,$$

where $[X]_{ij}$ is the input matrix; $[Y]_{rj}$ is the output matrix; $\lambda$ is the vector of the variables weights; $Z$ is scale constraint; and $\theta$ represents the technical efficiency of the DMUs, where $0 \leq \theta \leq 1$.

4. Data analysis and findings

**DEA analysis result**

Table II summaries the average technical efficiency per year for the insurance companies in Jordan during the period 2000–2016. The result of DEA analysis shows, in general, that during the period of study there is a slight development of technical efficiency for the Jordanian insurance companies, where it was 89.0 percent in 2000 and reached 92.5 percent in 2016. The year 2012 witnessed the highest level of efficiency reached by the insurance companies, i.e. 94.0 percent, while the lowest level of the efficiency of these companies was in 2001 as it was 80.1 percent.

Table III shows that DMU-1 achieved the highest level of efficiency by 100 percent and it was the benchmark for the other companies. A total of 12 companies had average efficiency

<table>
<thead>
<tr>
<th>Year</th>
<th>Average efficiency (%)</th>
<th>Year</th>
<th>Average efficiency (%)</th>
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</tr>
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</tr>
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</tr>
<tr>
<td></td>
<td></td>
<td>2016</td>
<td>92.5</td>
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<table>
<thead>
<tr>
<th>DMU</th>
<th>Efficiency score (%)</th>
<th>DMU</th>
<th>Efficiency score (%)</th>
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<td>DMU-22</td>
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Table II. Average technical efficiency per year for the insurance companies in Jordan during the period 2000–2016

Table III. Average technical efficiency per company for the insurance companies in Jordan during the period 2000–2016
greater than 90 percent during the study period, while 5 companies with an average efficiency of 80–90 percent, 4 companies’ efficiency was lower than 80 percent and the
lowest company in terms of efficiency was DMU-22 at 72.5 percent.

If a firm is fully efficient (efficiency = 100) then it has only one peer group firm, itself. Companies that are more efficient than 90 percent are considered to perform well in comparison with their inputs in the production process; this indicates that most firms operating in Jordan were highly efficient during 2000–2016. These companies are characterized either by higher output such as DMU-1 or lower use of production inputs compared to other companies as they depend on certain types of insurance such as motor compulsory insurance, which does not require high expenses to achieve premiums. And these companies can reduce their use of inputs to reach full technical efficiency.

The second group of companies, which ranged between 80 and 90 percent, could achieve the same outputs using less input; these companies are a composite insurer (life and non-life). The third and fourth groups, which ranged between 70 and 80 percent, had large inputs and could achieve the same outputs by significantly reducing their inputs. The third and fourth groups reflect a poor management skill and did not achieve the best balance between its inputs and outputs. Also, it has a diversified portfolio without the focus on certain line of insurance, which caused an increase in its expenses and disproportionate in its premiums and investment income with the inputs used.

Table AI illustrates that there is a substantial efficiency difference among insurance companies in each year, for example in 2000, 9 companies achieved the level of efficiency 100 percent, while the other companies fell from this level. In addition, the lowest level of efficiency in that year was 60.9 percent.

In addition, there is a variation at the level of each company each year, which affects the average efficiency during the study period. For example, the fluctuation in the efficiency of DMU-120, which was in 2000 68.5 percent and increased to 97.9 percent in 2002, then reach 72.2 percent in 2004, and increased to achieve the full technical efficiency during the years 2005–2008, then decreased in 2009 to 80.8 percent and fluctuated during the years 2010–2016 and reached 91.1 percent at the end of 2016.

These results are similar to those of Ajlouni and Tobaishat (2010) in terms of the technical efficiency of the insurance companies. However, there is difference in the efficiency scores of the companies between the two studies because they calculate the efficiency scores under the assumption of a CRS, contrary to our study, which uses the assumption of a VRS.

5. Determinants of efficiency

Slacks-based model

The inefficiency is either from using inputs incorrectly, or these inputs cannot achieve the required level of output. Therefore, if companies reduce their use of inputs to achieve the same level of output, it will be possible to upgrade their efficiency to achieve full technical efficiency.

For inefficient firm, the input target will be less than actual input. The difference between actual input and target input is input slack, and it can be expressed as a percentage:

\[
\text{Input slack percentage} = \frac{\text{Actual input} - \text{Input target}}{\text{Actual input}} \times 100,
\]

whereas the input target can be calculated in the following form:

\[
\text{Input target} = \text{Actual input} \times \text{Relative efficiency} / 100.
\]

Table AII shows the percentage of input that must be reduced in order to achieve the full efficiency for each company. By reviewing the ratio for each company, it is clear that the owner’s equity and debt are the most important determinant of firm efficiency, followed by technical reserves. Operating expenses were the least important determinants of efficiency.
It is possible to reach the current level of output by reducing the owner’s equity and debt by 6.33 percent, its technical reserves by 0.85 percent and operating expenses by 0.27 percent. Thus, the companies achieve the full technical efficiency.

**Logit model**

To examine how external factor affects the efficiency level for the insurance companies, this study uses the logit model to analyze the size and direction of the relative effect of the independent variable in their impact on the efficiency. One of the main advantages of logit regression is that it does not require a linear relationship between dependent and independent variables, and it can handle various types of relationships because it applies a non-linear log transformation to the predicted odds ratio. Those external variables are not decision variables that would otherwise figure in the firm’s choice of the nature or level of inputs and outputs as that already been included in the DEA analysis.

The suggested model can be formed as follows:

$$\theta_{it} = \alpha + \beta_1 \text{Size}_{it} + \beta_2 \text{Rein}_{it} + \beta_3 \text{ROA}_{it} + \beta_4 \text{Type}_{it} + \epsilon_i,$$

where $\alpha$ represents the constant; $i$ is the insurance company; $t$ the time period (in years); $\theta$ the technical efficiency; Size the natural logarithm of assets; Rein the reinsurance ratio; ROA the return on assets; Type the type of insurance company; $\beta$s the model parameters; and $\epsilon$ is the random error.

The dependent variable (efficiency) converted to a binary outcome: (0, 1) expressing that the company is efficient or not, where the variable takes the value (1) by probability ($P$) if the company is technically efficient, and the value (0) with probability of ($1 - P$) if company is not technically efficient.

Size: size of the insurer $i$ in time $t$. Large insurers expected to benefit from economies of scale and scope in the form of lower per unit cost of production derived from the large scale of production. In other hands, the inability of the larger firm to monitor and control activities of large-scale operation results in diseconomies of scale, a negative relationship. Size of the insurer is measured by natural logarithm of company assets.

Rein: reinsurance of the insurer $i$ in time $t$. Reinsurance is a way of transferring the risk from the insurer to the reinsurer, in order to protect the insurer from unexpected financial losses that may expose to it. This variable is measured by dividing the total amount transferred to the reinsurers to the total premiums written by the insurer.

ROA: return on asset of the insurer $i$ in time $t$. Profitability of insurer proxy by ROA to investigate if there is a relationship with technical efficiency.

TYPE is a dummy variable equal to 1 for composite (life and non-life) insurer and 0 for life or non-life insurer, aiming to capture the role of business line diversification on efficiency.

Table IV shows the results of the logit models that investigate the probability if the company is efficient employing the explanatory variables mentioned above.

Based on the maximum likelihood estimation, the result indicated that the type of insurance has a significant impact on the efficiency of the company. The coefficient is negative which means that the proportion of insurer being efficient decreased by 1.273 times in case if the insurer licensed as a composite (life and non-life).

This result can be explained as while the insurer being just life or non-life insurer, it will enhance the efficiency through concentrating the efforts and resources on the specific line of business in a way that increases the insurance efficiency. This finding is consistent with the number of previous studies such as Barros et al. (2005) and Diacon (2001), and contrary to what came in the study of Wasseja and Mwenda (2015).

The result supports that the size of the insurer plays a role in achieving the full technical efficiency, where the coefficient is positive and statically significant at 10 percent.
Large insurer seems to have improved flexibility to arrange the best combination of inputs and outputs and benefits from the economies of scale. This finding supports Diacon et al. (2002), Barros et al. (2005) and Yao et al. (2007).

Return on assets variable highlight the role of profitability in enhancing the chance that insurer being efficient, where the result indicates that ROA increases the chance of being efficient by 2.46 times. The result is consistent with the findings of Gramanova and Strunz (2017) and Diacon (2001).

However, reinsurance had no statically significant impact on the insurer efficiency, which means that reinsurance does not matter to efficiency.

The log likelihood ratio for the model, which is testing whether the coefficients are simultaneously significantly different from zero, confirms the general statistical significance of the model at the 1 percent level of significance. Pseudo $R^2$ values are also calculated (Cox and Snell and Nagelkerke pseudo $R^2$). This value is an indicator of the percentage of the variance in the dependent variable explained by the model; the results considered acceptable since econometric estimation based on cross-section data usually shows low $R^2$, particularly logistic regression (Gujarati, 2003).

### 6. Conclusions and recommendations

This study aimed to evaluate the insurance companies in Jordan during the period 2000–2016 by measuring the technical efficiency of these companies and its determinants. The study uses panel data for 22 insurance companies operating in Jordan, where the technical efficiency and factor that appear to affect its efficiency were estimated by utilizing DEA, slacks-based and logit models.

The study finds that there is a slight development of technical efficiency for the Jordanian insurance companies during the study period. In addition, there is a substantial efficiency difference among insurance companies in each year, and there is a variation at the level of efficiency for each company each year.

The results also showed that owners’ equity is among the most important internal determinants of companies’ efficiency, followed by technical provisions and operating expenses. The external determinants identified by the logit model support that there is a significant correlation between type, size and return on assets of the insurer and its efficiency.

Based on the results, the study recommends improving the technical efficiency of low-efficiency companies by reducing the level of inputs used, reallocating the resources used to maximize efficiency and increasing the managerial skills to achieve the full efficiency, as the results showed that it is possible to reach the same current level of output by reducing on average the owner’s equity and debt by 6.33 percent, technical provisions by 1.82 and operating expenses by 0.85 percent.

<table>
<thead>
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<th>Variable</th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
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</tr>
<tr>
<td>Reins</td>
<td>-0.08912</td>
</tr>
<tr>
<td>Type</td>
<td>-1.273139*</td>
</tr>
<tr>
<td>ROA</td>
<td>2.467615**</td>
</tr>
<tr>
<td>C</td>
<td>-3.700586</td>
</tr>
<tr>
<td>Log likelihood</td>
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</tr>
<tr>
<td>LR statistic</td>
<td>33.72552</td>
</tr>
<tr>
<td>Cox–Snell r</td>
<td>0.086229</td>
</tr>
<tr>
<td>Nagelkerke r</td>
<td>0.114976</td>
</tr>
</tbody>
</table>

Notes: Standard errors in parentheses. ***, ***Significant at 1, 5 and 10 percent levels, respectively
In addition, insurance companies should focus on specific types of insurance (life or non-life) and should increase their size through merger with each other’s (specially inefficient companies) to reach economies of scale, and regulator must take action to encourage such mergers, since the results showed that these factors positively affect the efficiency of the insurer that operates in Jordan.

Notes
1. Technology in insurance related to the information processing technology. Various insurers face the same operating environment, thus, share the same technology.
2. Insurance industry comprises of all the insurance companies active in a particular country.
3. DMUs in this study refer to the insurer operating in Jordan.
4. Appendix 1 illustrates how DEA is used to evaluate the relative efficiency.

References


Further reading


Appendix 1. DEA mathematical model

The linear programming technique is used to find the set of coefficients ($U_s$ and $V_i$) that will give the highest possible efficiency ratio of outputs to inputs for the service unit being evaluated.

In this model, $j$ is the number of decision-making units (DMUs) being compared in the DEA analysis; $D_j$ is DMU number $j$; $\theta$ is efficiency score of the DMU being evaluated by DEA; $Y_{orj}$ is amount of output $r$ used by DMU $j$; $X_{orj}$ is amount of input $i$ used by DMU $j$; $i$ is number of inputs used by the DMUs; $r$ is number of outputs generated by the DMUs; $U_r$ is coefficient or weight assigned by DEA to output $r$; and $V_i$ is the coefficient or weight assigned by DEA to input $i$.

The data required to apply DEA are the actual observed outputs produced, $Y_{orj}$, and the actual inputs used, $X_{orj}$, during one time period for each DMU in the set of units being evaluated. Hence, $X_{orj}$ is the observed amount of the $i$th input used by the $j$th DMU, and $Y_{orj}$ is the amount of $r$th output produced by the $j$th DMU.

If the value of $\theta$ for the DMU being evaluated is less than 100 percent, then that unit is inefficient, and there is the potential for that unit to produce the same level of outputs with fewer inputs.
To illustrate the DEA mathematical model:

\[
\max \theta = \frac{U_1 Y_{10} + U_2 Y_{20} + \cdots + U_r Y_{r0}}{V_1 X_{10} + V_2 X_{20} + \cdots + V_m X_{m0}} = \frac{\sum_{r=1}^{s} U_r Y_{r0}}{\sum_{r=1}^{s} V_r X_{r0}}
\]

(Maximize the efficiency score \(\theta\) for DMU 0).

This is subject to the constraint that when the same set of \(U\) and \(V\) coefficient is applied to all other DMUs being compared, no DMU will be more than 100 percent efficient as follows:

\[
\begin{align*}
\text{DMU}_1 & : \frac{U_1 Y_{11} + U_2 Y_{21} + \cdots + U_r Y_{r1}}{V_1 X_{11} + V_2 X_{21} + \cdots + V_m X_{m1}} = \frac{\sum_{r=1}^{s} U_r Y_{r1}}{\sum_{r=1}^{s} V_r X_{r1}} \leq 1 \\
\text{DMU}_2 & : \frac{U_1 Y_{12} + U_2 Y_{22} + \cdots + U_r Y_{r2}}{V_1 X_{12} + V_2 X_{22} + \cdots + V_m X_{m2}} = \frac{\sum_{r=1}^{s} U_r Y_{r2}}{\sum_{r=1}^{s} V_r X_{r2}} \leq 1 \\
& \ldots \\
\text{DMU}_0 & : \frac{U_1 Y_{10} + U_2 Y_{20} + \cdots + U_r Y_{r0}}{V_1 X_{10} + V_2 X_{20} + \cdots + V_m X_{m0}} = \frac{\sum_{r=1}^{s} U_r Y_{r0}}{\sum_{r=1}^{s} V_r X_{r0}} \leq 1 \\
& \ldots \\
\text{DMU}_j & : \frac{U_1 Y_{1j} + U_2 Y_{2j} + \cdots + U_r Y_{rj}}{V_1 X_{1j} + V_2 X_{2j} + \cdots + V_m X_{mj}} = \frac{\sum_{r=1}^{s} U_r Y_{rj}}{\sum_{r=1}^{s} V_r X_{rj}} \leq 1
\end{align*}
\]

\(U_1, \ldots, U_r > 0\) and \(V_1, \ldots, V_m \geq 0\).

DEA differs from a simple efficiency ratio in that it accommodates multiple inputs and outputs and provides significant additional information about where efficiency improvements can be achieved and the magnitude of these potential improvements. Moreover, it accomplishes this without the need to know the relative value of the outputs and inputs that were needed for ratio analysis.
## Appendix 2

<table>
<thead>
<tr>
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### Table AI.

Technical efficiency of Jordan insurance companies for the period 2000–2016

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Appendix 3

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<th>Technical reserves (%)</th>
<th>Operating expenses (%)</th>
<th>Owner’s equity+debt (%)</th>
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Average: −1.82 −0.85 −6.33

Table AII. Input slacks

About the author
Mutasem Mahmoud Jaloudi is Head of Technical Supervision Division in the insurance directorate at the Ministry of Industry, Trade and Supply in Jordan. He has a PhD Degree in Business Economics from the University of Jordan. His research interests are economics (micro and macro), insurance economics and financial economics. Mutasem Mahmoud Jaloudi can be contacted at: m_jdi@hotmail.com
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Volume 26 Number 1

1 Editorial boards

2 Incorporating risk into technical efficiency for Vietnam’s and ASEAN banks
   Tra Thanh Ngo, Minh Quang Le and Thanh Phu Ngo

17 The impact of GST implementation on the Malaysian stock market index volatility:
   an empirical approach
   Razali Haron and Salami Mansurat Ayojimi

34 Empirical study on the effective factors of social responsibility disclosure of Iranian companies
   Mahdi Salehi, Hossein Targhi and Malihe Moeznazhad

56 Analysis of the determinants of foreign direct investment in Ghana
   Michael Asiamah, Daniel Ofori and Jacob Afful

76 Asymmetric targeting of corporate cash holdings and financial constraints in Pakistani firms
   Ghulam Ayubh Siddiqua, Ajid ur Rehman and Shahnaz Hussain

98 The contingent roles of perceived budget fairness, budget goal commitment and vertical
   information sharing in driving work performance
   Nguyen Phong Nguyen, Felicitas Evangelista and Tai Anh Kieu

117 Explaining India’s current account deficit: a time series perspective
   Harendra Kumar Behera and Inder Sekhar Yadav

139 Using the ARDL-ECM approach to investigate the nexus between support price and wheat
   production: an empirical evidence from Pakistan
   Abbas Ali Chandio, Yuansheng Jiang and Abdul Rehman

153 The efficiency of Jordan insurance companies and its determinants using DEA, slacks, and logit models
   Mutasem Mahmoud Jaloudi

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