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The determinants of corporate profitability: an investigation of Indian manufacturing firms

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Abstract

Purpose – The purpose of this paper is to examine the firm-specific and macroeconomic determinants of profitability of Indian manufacturing firms. It assesses the main determinants of firm's profitability in the pre-crisis and post-crisis period from 2000 to 2015.

Design/methodology/approach – This methodology splits the factors that influence firm profitability in two groups: firm-specific (internal) factors and macroeconomic indicators. It further aims to look at the consistency of the factors in the pre-crisis and post-crisis period. The return on assets and the net profit margin are considered as proxy for corporate profits. The panel generalized least square and panel vector auto-regression model have been employed, and it is observed that the exchange rate seems to have played a major role in the crisis period by explaining the earning quotient for Indian firms.

Findings – This paper concludes that the firm-specific variables and exchange rate channels are quite relevant in explaining the profitability of Indian manufacturing firms. It accepts the hypotheses that size and liquidity enhances whereas leverage discourages the profitability. Few exceptions have been observed during the crisis period. The study also concludes that in the short run, the changes in exchange rate are not increasing profitability, but in the long run, it increases profitability as the volatility of nominal exchange rate is positively impacting profitability. Moreover, the study finds that the nominal exchange rate index is more informative and explains that profitability is better than real exchange rate index in the case of Indian manufacturing firms over the study period.

Research limitations/implications – The managers and the policy makers should give utmost importance to the firm-specific determinants, especially after the crisis period, and consider the appropriate exchange rate to evaluate firm performance for making any change in the policy to make any business profitable.

Originality/value – This study has been conducted over a longer time by using advanced panel data analysis techniques on the recent data. The study period properly captures the crisis time and the research includes different selection of profitability that highlights corporate earnings pattern. Moreover, validation of the exchange rate sensitivity of profitability over nominal and real exchange rate increases the robustness of the study. Moreover, on Indian manufacturing firms, the study is very significant and unique.

Keywords NPM, VAR, ROA, Corporate profitability, GLS

Paper type Research paper

Introduction

Corporate profitability is one of the main concerns of any firm and its manager. A firm requires long-term survival only through maximization of its profit and looks further for its sustainability. One of the most important questions widely studied in literature is the reason behind the change in the pattern of corporate profitability over time. We also observe the influence of the exogenous and endogenous parameters on profitability. Examination of its determinants is not a rare study, in fact numerous studies have been undertaken to see the effect of different firm-specific and industry-specific impacts on corporate profitability.

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In the 1990s, this kind of study was fascinating which is followed by the devaluation of rupee. There are also studies on the identification of the sources of variation at the firm-level profitability (Goddard *et al.*, 2005). The relationship between real exchange rate and manufacturing profits (Clarida, 1997) is some of the issues that have been discussed. However, firm-specific and macroeconomic indicators were not part of those discussions. In the last decade, studies on the issues of corporate profit considered the firm-specific and macroeconomic indicators that are atypical. Recently, corporate structure, liquidity, and other firm-specific and macroeconomic indicators are found to be the dominant players while providing any explanation of profit equation. The incorporation of the firm-specific and macroeconomic indicators while explaining the firm profitability with special concern to crisis period can probably highlight the issue regarding the unstable profitability in Indian firms. As per the recent literature, this kind of study in the recent period is rare. Hence, this paper has a strong reason to be studied.

The existing literature on accounting and finance provides endogenous reasons for intra-industry variation in explaining firms' profitability. These firm-specific internal factors include age, size, growth, market share, leverage, capital intensity, and liquidity (Ghemawat and Caves, 1986; Goddard *et al.*, 2005, 2009; Markman and Gartner, 2002; Raheman and Nasr, 2007; Samiloglu and Demirgunes, 2008; Asimakopoulos *et al.*, 2009). While it is argued that the impacts of firm, industry, and market share significantly explain the variance of firm profitability (Kessides, 1990), Shahnawaz (2007) tried to establish a link between profitability and trade. By employing panel analysis, it is observed that capital formation and openness of an industry considerably affect price-cost margins. In the period 2002-2007, firm-specific indicators like firm size, leverage, liquidity, etc., generally affected corporate profitability. Nevertheless, from 2009, the integration of domestic economy with the global economy made the economy more susceptible to external disturbances. The importance of macroeconomic factors such as exchange rate, interest rate, and the economic growth rate determines the augmentation of corporate profitability (Nandi *et al.*, 2015). Corporate performance is directly affected by exchange rates as well as interest rates. An increase in interest rate probably leads to increase in interest outgo, which in turn augments expenditure and so reduces profitability.

According to the empirical findings of several studies, firm effect is more prominent in comparison to the relatively less contributions of the impact of year, country, and industry on profitability (e.g. Schmalensee, 1985; Rumelt, 1991; McGahan and Porter, 1997; Mauri and Michaels, 1998; Hawawini *et al.*, 2003; Brito and Vasconcelos, 2006). Furthermore, several studies observed that the impact of industry-level factors can be explained in relation to less than 5 percent variation in profitability (Rumelt, 1991; Claver *et al.*, 2002; Hawawini *et al.*, 2004; Brito and Vasconcelos, 2006; Schiefer and Hartmann, 2009). Therefore, in this study, we examined the effect of crucial firm-level factors on profitability of the firm at the time of crisis. These firm-level indicators are total size, liquidity, and debt-equity ratio. Apart from all these indicators, the study includes macroeconomic indicators such as exchange rate, volatility of exchange rate, exports, imports, IIPCG (proxy for growth), and interest rate.

Previous empirical research on corporate profitability in India falls short of discussion on both firm-specific and macroeconomic indicators in the context of crisis period. This paper contributes to the literature by utilizing recent data in the panel structure for investigating the determinants of profitability of manufacturing firms in case of an open economy, where the fluctuation of exchange rate plays a significant role in determining corporate profitability. Both the return on asset (ROA) and net profit margin (NPM) have been used as proxy for profitability of manufacturing firms. Along with capturing the pre- and post-crisis scenario of corporate profitability, the study further undertakes a robustness analysis of the real and nominal exchange rate that impact corporate profitability. Additionally, the use of panel vector auto-regression (VAR) model in this

study has led to innovation in capturing the dynamics of profitability of different firm-specific and macroeconomic indicators in a multivariate framework. However, the study is unique of its kind in the Indian context.

Literature review

There exist a large number of empirical studies that examine the impact of the various hypothesized determinants of firm performance. Schmalensee (1985), Hansen and Wernfelt (1989), and Mauri and Michaels (1998) are few pioneering studies that discussed about the firm performance on the basis of firm-specific and industry-specific effects. A number of literatures exist related to the measure of performance as profitability and its determinants. Elif Akben-Selcuk (2016), Mirza and Javed (2013), Dogan (2013), Tailab (2014), Khaled Al-Jafari and Samman (2015), and Batra and Kalia (2016) are among the few recent studies that have examined the same issue. A. Magoutas *et al.* (2016) explored profitability issues and identified the key drivers of growth during crisis period. However, most of them have produced mixed results. Therefore, in this section of literature, the previous studies with theoretical underpinnings have been reviewed for better clarity.

Firm size and profitability

Empirical evidence has given varying results in relation to the relationship between firm size and profitability. In this view, Demsetz offered an alternative elucidation of the association between firm size and profitability by contending that large firms make huge profits through little or nothing to do with conventional scale economies. It is also observed in this study that in highly concentrated market, higher profit is made by large firms, but small firms make only normal return. The impact of the size of the firm is positive on profitability, and it was studied by Fukao (2006), Nunes *et al.* (2009), Asimakopoulos *et al.* (2009), Stierwald (2010), Yazdanfar (2013), Pratheepan (2014), and Zaid *et al.* (2014). However, Goddard *et al.* (2005) found a negative relation between firm size and profitability. Empirical literature has shown that there is both negative and positive relationship between firm size and profitability, but in this study, we followed the neoclassical views where the relationship is explained through economies of scale. The advantage of economies of scale may occur in multiple dimensions. First, the economies of scale may occur in different financial aspects, where large firms can get the advantage of lower interest rate and better discount rate because of its transaction in large quantity. Second, the economies of scale may take place through organizational structure, where firm can enjoy a large scope of specialization and division of labor. Third, the economies of scale may depend on technical reason, where division of high fixed costs across large number of units can easily take place, etc. Therefore, we hypothesized that:

- H1. There exists a positive relationship between firm size and profitability in Indian manufacturing firms.

Leverage and profitability

Pecking order theory and trade-off theory explain the relationship between leverage and profitability in two different dimensions. According to the pecking order theory of capital structure (Myers and Majluf, 1984), leverage and profitability is inversely related. The findings of Kester (1986), Titman and Wessels (1988), Rajan and Zingales (1995), Booth *et al.* (2001), and Khaled Al-Jafari and Samman (2015) empirically confirmed the presence of an inverse relation between the leverage ratio and profitability. Lalith (1999) found that there is a negative correlation between profitability and leverage, which suggests that lucrative firms use less leverage. However, depending on the trade-off, signaling, and agency theories, it is expected that there is an affirmative relationship between profitability

and leverage. The free cash flow theory (Jensen, 1986) suggested that debt reduces the agency cost of free cash flow and implies that there is a positive association between leverage and profitability, which is evident in several studies such as Frank and Goyal as well as Sangeetha and Sivathaasan (2013). Nunes *et al.* (2009) examined profitability, and concluded that maintenance of a lower level of debt and fixed assets are more profitable for Portuguese service companies. The impact of using debt on profitability was investigated by Burja (2011), and Mistry (2012). On the basis of above literature, we tested the null hypothesis, which states the presence of negative relationship between leverage and profitability in line with the pecking order theory, where denial of this relationship would eventually support the trade-off theory. Hence, we hypothesized that:

- H2. An increase in leverage or debt would lead to decrease of profitability of Indian manufacturing firms.

Liquidity and profitability

There are two schools of thoughts explaining the relationship between liquidity and profitability. First, holding excess liquidity or high values in the current assets leads to increase in the maintenance costs of holding excess liquidity in terms of high opportunity cost, which in turn may reduce profitability. Similar to this logic, Ross *et al.* (2000), and Mistry (2012) found that there is a negative relationship between liquidity and profitability. However, it will possibly be a short-run phenomenon. Hirigoyen found that in the medium and long run, there is the possibility of a positive relationship between liquidity and profitability because low liquidity would cause low profitability which will lead to more requirements of loans and insufficient cash flow, thereby resulting in a vicious circle. At the same time, Nunes *et al.* (2009) concluded that higher liquidity will not decrease profitability. Some of the similar kinds of studies are conducted by Goddard *et al.* (2005) and Zaid *et al.* (2014). Liquidity measures the capability of a company to meet temporary compulsions through utilization of the available liquid assets, so maintaining adequate liquidity is a positive indicator of firm's financial health. In the short run, holding liquidity may have a negative impact on profitability, but in the medium and long run, it will boost profitability with healthy fundamentals that not only increase stakeholders' confidence but also minimize the firm's risk of bankruptcy. The study being undertaken over a longer period, we hypothesized that:

- H3. There exists a positive relationship between liquidity and profitability of Indian manufacturing firms.

Exchange rate channel to firm profitability

The change in exchange rate is likely to impact corporate earnings and so is a critical indicator of corporate profitability. The common channel for establishing the relationship between exchange rate and profitability is via import and export. Through depreciation of domestic currency, corporate earnings are affected because with depreciation, export becomes cheaper and import costlier; and this will positively affect firm's profitability if the firm exports products and negatively affects firms' profitability if the firm imports raw materials (Nandi *et al.*, 2015). Few studies have been conducted to study about the impact of exchange rate fluctuations on firm-level performance such as Adler and Dumas (1984), Jorion (1990), Bodnar and Wong (2000), Dominguez and Tesar (2006), and Parsley and Popper (2006). A section of literature further studies the impact of currency fluctuations on firm-level variables such as investment or profitability (e.g. Goldberg, 1993; Campa and Goldberg, 1995, 1999; Nucci and Pozzollo, 2001). Recent studies on this issue are A. Dhasmana (2014), Sengupta and Cheung (2012), and S. Nandi *et al.* (2015), which are worth

mentioning. Bhayani (2010) examined the factors that influence profitability for cement firms from 2001 to 2008 and concluded that the crucial determinants of profitability are interest rate and inflation.

Both positive and negative relationship exists between firm exporting and profitability; and it has been found that export participation positively affect firm exporting and profitability. Lu and Beamish (2006) as well as Grazzi (2011) found a negative relationship between exports and profitability. Fryges and Wagner (2010) found a positive relationship between exports and profitability. Hansson and Tuomas *et al.* revealed the presence of a negative and significant relationship between imports and profitability, while a few studies including Veeramani (2008) have been conducted in the Indian context, which showed the effect of changes in the exchange rate on all exports:

- H4. There is a positive relationship between depreciation of exchange rate and profitability through export channel and negative relationship through import channel.

Industrial growth, interest rate and firm profitability

Goddard *et al.* (2005) carried out the first empirical study about the dynamic relationship between growth of a firm and profitability. The result demonstrated that the current profit rate acts as a positive aspect behind the rate of escalation of a given corporate size in the subsequent phase, and the current growth rate for a given corporate size negatively affects the profit rate in the subsequent phase in a statistical and significant manner. Coad (2007) argued that recent growth rate positively influences the rate of profit in the next period, which is caused by the phenomenon of dynamic increasing returns. Thus, successful companies gain more profits and prosper. Few studies such as Nakano and Kim (2011), Jang and Park (2011), and Inci and Lee (2014) showed that firm's growth exclusively affect the profitability issue. However, the findings of the empirical studies demonstrate that there is uncertain and ambiguous relationship between firm growth and profitability. Yazdanfar and Öhman (2015) assessing the profitability of SMEs found that profitability positively affects the growth of firm and thus suggest a "profitable growth now," strategy for the firms. On the one hand, research conducted by Geroski *et al.* (1997), Fitzsimmons *et al.* (2005), Claver *et al.* (2002), Samiloglu and Demirgunes (2008), and Asimakopoulos *et al.* (2009) established a positive relationship between firm growth and profitability. On the other hand, research performed by Markman and Gartner (2002) suggested that there is no association between the variables. Furthermore, Hoy *et al.* (1992) found a significant and negative relationship between growth and profitability.

This study focuses on few firm-specific and macroeconomic indicators such as total asset, capital structure, liquidity among specific firms, exports, imports, REER, NEER, volatility of exchange rate, IIP of consumer goods, and interest rate. Based on the theoretical framework and the literature review, this study has tested the above hypotheses as per the determinants of profitability of selected manufacturing companies.

Data

The present study uses annual data from 2000 to 2015 for 173 Indian firms listed in S&P BSE Industrials Index. According to Centre for Monitoring Indian Economy classification, the index is developed for offering investors a yardstick that represent companies considered as members of the industrial segment and incorporated in the S&P BSE. Some of the firms listed in the infrastructure index are dropped because of the lack of availability of data during the study period. The outliers are replaced with three- to five-period moving average (MA) method. The firm-specific exchange rate and control variables used in the study include total asset (TA), debt/equity ratio (DE), current ratio (LQ), net export (NEXP), net import (NIMP), real effective exchange rate (REER), nominal effective exchange rate (NEER),

GARCH (1,1) volatility of REER and NEER (VOLEX), index of industrial production of capital good (IIPCG), and annual interest rate (INT). The study covered two base periods, 1993-1994 and 2004-2005, during the study period from 2000 to 2015. To be technically correct, authors have readjusted the indices into a common base year 2004-2005 for index number of industrial production of capital goods (IIPCG), NEER, and REER. Nominal effective exchange rate (NEER) and trade-weighted real exchange rate (REER) are retrieved from RBI Bulletin. In this study, the impact of global financial crisis on Indian corporate has been studied, and corporate profitability has been analyzed by studying the pre- and post-crises performances of the corporate sector. Additionally, our economy being increasingly responsive to the external shocks, in certain situations, we identified depreciation in exchange rate on corporate profitability. The definition and sources of all the variables used in this paper are explained in Table I.

Methodology

The purpose of this study is to provide new evidence about the determinants of the profitability of Indian manufacturing firms by analyzing a unique firm-level data set of firm performance over the period 2000-2015. In this study, we addressed the value and impact of firm-specific factors and macroeconomic indicators on the corporate profitability. The data are panel in nature, and hence, allow assessment of dynamic profitability models in relation to business class at the individual firm level for testing perseverance and cyclicalities of firm's profitability. Panel data allow a thorough treatment from simultaneity bias that arises from the endogenous regressors of estimating equations and allow the existence of firm-specific but unobservable effects that may influence the econometric results. We examined that the process of ascertaining the determinants of corporate profitability constitute of two stages. In the first stage, we estimated both firm- and macroeconomic-level corporate profitability by using ROA. On the basis of some of the earlier studies (Claver *et al.*, 2002; Hawawini *et al.*, 2003), in this study, we used generalized least square (GLS) with random-effects design for the standard panel data statistical model that leads to putrefaction of the pragmatic variance in the response variable amid distinctive explanatory variables and ascertains the comparative

Symbol	Variables	Definition	Sources
<i>Dependent variables</i>			
ROA	Return on assets	Return on assets	Prowess
NPM	Net profit margin	Net profit/sales revenue	Prowess
<i>Independent variables</i>			
TA	Total asset	Total asset	Prowess
DE	Debt/equity ratio	Debt/equity ratio	Prowess
LQ	Current ratio	Current asset/current liabilities	Prowess
NEXP	Net exports	Export earning as a percentage of total sales revenue	Prowess
NIMP	Net imports	Imported raw material as a percentage of total raw material cost	Prowess
REER	Real effective exchange rate	36 currency trade-based weighted exchange rate	RBI Bulletin
NEER	Nominal effective exchange rate	Inflation unadjusted trade-based weighted exchange rate	RBI Bulletin
VOLEX	Volatility of exchange rate	GARCH volatility	Author's calculation
IIPCG	Index of industrial production of capital goods	Index of industrial production of capital goods	RBI Bulletin
INT	Interest rate	Annual interest rate	RBI Bulletin

Table I.
Description
of variables

importance of each variable while providing explanation of profitability. The following statistical model is estimated in this study:

$$\begin{aligned} ROA_{it} = & \alpha_i + \beta_1 TA_{it} + \beta_2 DE_{it} + \beta_3 LQ_{it} + \beta_4 NEXP_{it} + \beta_5 NIMP_{it} \\ & + \beta_6 REER_t + \beta_7 VOLEX_t + \beta_8 IIPCG_t + \beta_9 INT_t + \varepsilon_{it} \end{aligned} \quad (1)$$

In the second stage, we estimated both firm- and macroeconomic-level corporate profitability by using NPM. The model is as follows:

$$\begin{aligned} NPM_{it} = & \alpha_i + \beta_1 TA_{it} + \beta_2 DE_{it} + \beta_3 LQ_{it} + \beta_4 NEXP_{it} + \beta_5 NIMP_{it} \\ & + \beta_6 REER_t + \beta_7 VOLEX_t + \beta_8 IIPCG_t + \beta_9 INT_t + \varepsilon_{it} \end{aligned} \quad (2)$$

For the robustness check, the determinants of profitability were further analyzed using NEER. The models are given below:

$$\begin{aligned} ROA_{it} = & \alpha_i + \beta_1 TA_{it} + \beta_2 DE_{it} + \beta_3 LQ_{it} + \beta_4 NEXP_{it} + \beta_5 NIMP_{it} \\ & + \beta_6 NEER_t + \beta_7 VOLEX_t + \beta_8 IIPCG_t + \beta_9 INT_t + \varepsilon_{it} \end{aligned} \quad (3)$$

$$\begin{aligned} NPM_{it} = & \alpha_i + \beta_1 TA_{it} + \beta_2 DE_{it} + \beta_3 LQ_{it} + \beta_4 NEXP_{it} + \beta_5 NIMP_{it} \\ & + \beta_6 NEER_t + \beta_7 VOLEX_t + \beta_8 IIPCG_t + \beta_9 INT_t + \varepsilon_{it} \end{aligned} \quad (4)$$

Both the models raise the possibility of judging corporate profitability from net profit point of view as well as augment the corporate profitability from the point of view of cost control and resource utilization angle, and hence, the firm managers benefit for looking at both NPM and ROA aspects of corporate profitability. Since all the variables are endogenous to the system, the present study employed a reduced form VAR approach of dynamic panel technique and estimated the parameters by regressing endogenous variables on the whole system of lagged endogenous variables to capture the sensitivity of profit in relation to various firm-specific and macroeconomic parameters considered in the interest of the study. The VAR model estimated is as follows:

$$\begin{aligned} ROA_{it} = & \sum_{j=1}^J \alpha_{11j} ROA_{it-j} + \sum_{j=1}^J \alpha_{12j} TA_{it-j} + \sum_{j=1}^J \alpha_{13j} DE_{it-j} + \sum_{j=1}^J \alpha_{14j} LQ_{it-j} \\ & + \sum_{j=1}^J \alpha_{15j} NEXP_{it-j} + \sum_{j=1}^J \alpha_{16j} NIMP_{it-j} + \sum_{j=1}^J \alpha_{17j} \Delta REER_{it-j} \\ & + \sum_{j=1}^J \alpha_{18j} VOLEX_{it-j} + \sum_{j=1}^J \alpha_{19j} IIPCG_{it-j} + \sum_{j=1}^J \alpha_{110j} INT_{it-j} + \varepsilon_{1it} \end{aligned} \quad (5)$$

After estimating the reduced form VAR model of Equation (3), the estimated error distribution are presented in the MA order by eliminating lagged independent covariates. It captures the way endogenous variables depend on their lagged residuals of the reduced form VAR model. A detailed extension of the above reduced form VAR model in continuation of Equation (3) is presented in the Appendix for reference.

Empirical results

As all the firms are different in size, the issue of heterogeneity seems to be inevitable with the model. Hence, in the study, we have undertaken three pre-estimation tests for capturing heterogeneity and cross-sectional dependence within the panel and the test statistics, as

presented in “Test for heteroskedasticity and cross-sectional dependence.” According to Breusch-Pagan test for heteroskedasticity, the null hypothesis of constant variance or homoskedasticity is rejected. Hence, the standard errors (S.Es) of the estimated parameters are expected to be controlled in order to make those parameters stable and efficient. Hence, the Breusch-Pagan LM test of independence has been conducted for capturing the correlation of the error distribution across entities, for macro panel studies with long time series. One of the samples of the study includes a full sample analysis of the data from 2000 to 2015 – merging two sub samples of pre- and post-crisis period – it is expected that the residuals across entities might be correlated. It is not possible to discard the null hypothesis, i.e., the residuals across entities are not correlated; hence, there is no cross-sectional dependence among the error distributions. Cross-sectional dependence is a serious component that can make the estimated results bias, hence, the study further uses Pesaran test of cross-sectional dependence to confirm that there is no cross-sectional dependence among the error distributions with a very small average absolute value (0.216) of the off diagonal elements. Moreover, the firms considered in this study are largely heterogeneous and the data do not have cross-sectional dependence. Since, the ordinary least square (OLS) assumption of homoskedasticity is violated, in *prima facie*, the use of OLS-based models for the study is ruled out. In such case, GLS can be used as the next best alternative to linear regression model. After using GLS random effect model for the present data structure, we have undertaken one step further by utilizing Breusch-Pagan LM test to decide the suitability between random effect models and OLS regression. The test statistics of Breusch-Pagan LM test is given along with all the estimated models in the subsequent tables. In all the cases, the null hypothesis of “No panel effects,” or “variance across entities is zero” has been rejected. So, it can be concluded that there is significant difference across entities and the use of random effect model is appropriate.

Test for heteroskedasticity and cross-sectional dependence:

- (1) Breusch-Pagan/Cook-Weisberg test for heteroskedasticity:

$$H_0: \text{constant variance (or homoskedasticity)}, \chi^2 = 823.93***$$

- (2) Breusch-Pagan LM test of independence:

$$H_0: \text{variance across entities is zero}, \chi^2 = 18.91***$$

- (3) Pesaran test for cross-sectional dependence:

H_0 : residuals across entities are not correlated, $\chi^2 = 06.15$, Avg. Abs. Off. D. Value = 0.216

Note: **, *** Represent the level of significance at 5 and 1 percent levels.

Determinants of profitability measured by ROA

To determine profitability, we employed GLS. The Wald χ^2 given in each GLS table explains the overall significance level of the model, and the ρ is the interclass correlation that explains the proportion of variance owing to the difference across the panels. The GLS estimates of Equation (1) through the use of ROA as the measure for profitability, both the pre-crisis and post-crisis samples are presented in Table II. It is noticed that firm-specific determinants are more dominant in explaining the ROA rather than the macroeconomic indicator. Among the firm-specific parameters, firm size positively and significantly influences profitability, which is similar to the theoretical expectations of different studies (e.g. Nunes *et al.*, 2009; Asimakopoulos *et al.*, 2009; Stierwald, 2010; Yazdanfar, 2013; Pratheepan, 2014). It is observed that Indian manufacturing firms are taking the advantage of economies of scale of their size and positively contributing to profitability. It is found that financial leverage is negatively and significantly influencing profitability, which is similar

Table II.
Determinants of
profitability under
three samples of the
study with ROA-REER

Random-effects GLS regression (ROA-REER)			
	Pre-crisis period (2000-2007)	Post-crisis period (2008-2015)	Full sample period (2000-2015)
Wald χ^2	86.48	101.37	73.82
Probability	0.000	0.000	0.000
ρ (interclass correlation)	0.0353	0.1922	0.0735
ROA (dependent)	Coefficient	Coefficient	Coefficient
TA	-0.484	16.275***	6.036***
DE	-0.279***	-0.237**	-0.247***
LQ	0.715***	1.89***	0.926**
NEXP	0.047**	0.070	0.034
NIMP	-0.00008	-0.021	-0.0002
Δ REER	-0.507	0.947	0.477
VOLEX	-0.393	1.120	0.351
IIPCG	0.081***	-0.078	-0.031***
INT	0.273*	-0.779*	-0.279
Const.	-1.100	-53.874	-12.971
Breusch-Pagan LM test	$\chi^2 = 19.17$ ***	$\chi^2 = 123.1$ ***	$\chi^2 = 114.7$ ***
Notes: *, **, ***Significant at 10, 5 and 1 percent levels, respectively			

to the findings of the studies by Nunes *et al.* (2009). Moreover, there exists a positive and significant relationship between liquidity and profitability, which is similar in line with the findings of the studies by Goddard *et al.* (2005) and Zaid *et al.* (2014). Considering the parameters of firms' external involvement, it is observed that net export is positively influencing profitability, but it is insignificant. In addition, net import is having minimal and insignificant impact on profitability. In the macroeconomic variables, all the variables other than IIPCG have been found to be insignificant. Thus, an overall insignificant impact of macroeconomic indicators on ROA is observed.

Evaluating corporate profitability in pre-crisis (2000-2007)

During 2002-2007, Indian economy maintained the average rate of growth of almost 8 percent, which was driven by higher corporate profitability and by rapid expansion in financial markets. The firm-specific characteristics such as leverage ratio and liquidity ratio influenced corporate profitability from 2002 to 2007. Firm size has no significant impact on ROA. In pre-crisis period, the debt-equity ratio and liquidity are significant and respectively affect the corporate profit negatively as well as positively. Net export is significant and affecting the corporate profit negatively in the pre-crisis period. However, net import has insignificant effect on corporate profit. It is surprising that both REER and VOLEX are insignificant, whereas IIPCG and interest rate significantly and positively affect ROA.

Evaluating corporate profitability in post-crisis (2008-2015)

The global recession of 2007-2009 had severely impacted the performance of Indian private corporate. In the post-recessionary period, the domestic and global economy became integrated, which made them prone to external shocks. Simultaneously, macroeconomic factors such as exchange rate, interest rate, and the IIP determine as well as amplify corporate profitability. The firm-specific factors such as firm size, leverage and liquidity play a significant role toward enhancing corporate profitability. In the pre-crisis period, firm size (TA) has negative and insignificant effect, whereas in the post-crisis period, firm size significantly and positively affects ROA. This indicates that in the post-crisis period, larger firms are expected to have higher profitability compared to medium- and small-sized firms.

It is observed that during economic crisis and recession, larger firms survive because of their diversification, whereas smaller firms find it difficult to survive and suffer more. External involvement and macroeconomic indicators except interest rate are insignificant because interest rate significantly as well as negatively affects ROA.

From Table II, we find that size and liquidity are significant and positively related, whereas leverage is significant and negatively related to profitability. Hence, we cannot reject any of the hypotheses for ROA.

Determinants of profitability measured by NPM

In Table III, the GLS estimates of Equation (2) are presented, where NPM are used as the measure for profitability. It is noticed that firm-specific determinants and macroeconomic indicators are dominant players in determining the NPM of firms. All key firm-specific determinants except total assets significantly and negatively affect the NPM. Net export is significant, but net import is insignificant. Among the macroeconomic indicators, all factors except REER significantly contribute to NPM.

Evaluating corporate profitability in pre-crisis (2000-2007)

In the pre-crisis period, the macroeconomic indicators are seen to be less powerful than the firm-specific factors in explaining the NPM. Only IIPCG is significantly contributing to profitability within the macroeconomic indicators, whereas all the firm-specific factors are significantly contributing to the corporate profitability. Among the external involvement factors, net export is significant, but net import is insignificant. Based on the result, it is observed that the impact of firm-specific factors on NPM has not undergone much change in case of full sample as well as pre-crisis sample.

Evaluating corporate profitability in post-crisis (2008-2015)

In the post-crisis period, neither firm-specific factors nor macroeconomic indicators significantly affect the corporate profitability except net exports.

Random-effects GLS regression (NPM-REER)			
	Pre-crisis period (2000-2007)	Post-crisis period (2008-2015)	Full sample period (2000-2015)
Wald $\chi^2(18)$	87.48	111.09	79.02
Probability	0.0000	0.0000	0.0000
ρ (interclass correlation)	0.0353	0.192	0.073
NPM (dependent)	Coefficient	Coefficient	Coefficient
TA	1.849***	-0.272	0.467
DE	-0.322***	-0.052	-0.186***
LQ	0.936***	-0.106	-0.381**
NEXP	0.051**	0.074***	0.053***
NIMP	-0.00002	-0.015	0.00001
Δ REER	-0.147	-0.130	-0.157
VOLEX	-0.249	0.222	0.817***
IIPCG	0.066***	-0.005	0.018***
INT	-0.055	-0.345	-0.811***
Const.	-7.66**	11.72***	7.65***
Breusch-Pagan LM test	$\chi^2 = 795.5***$	$\chi^2 = 142.2***$	$\chi^2 = 165.73***$

Note: **, ***Significant at 5 and 1 percent levels, respectively

Table III.
Determinants of
profitability under
three samples of the
study with NPM-REER

From the result presented in Table III, it is noticeable that the first and second hypothesis cannot be discarded, but the third hypothesis can be discarded because according to the result, liquidity has a negative impact on profitability.

Robustness checks

The major concern of this study is that the real exchange rate and its volatility are insignificant in both the pre-crisis and post-crisis period, which is considered to be the most important factor in the crisis period. In the post-crisis period, there is a significant volatility of exchange rate, but it was insignificant in the pre-crisis period. Many studies have inferred that the impact of exchange rate on firm's value is significant (Allayannis and Ihrig, 1997, 2001; Chow *et al.*, 1997; Dominguez and Tesar, 2001; Griffin and Stulz, 2001). Some studies demonstrated that the value impact of exchange rate is weak (Bodnar and Gentry, 1993; Jorion, 1990). For Indian markets, a recent study by Samsudheen and Shanmugasundram (2013) established that from 2010 to 2012, the sensitivity of the value of Indian firms to changes in the exchange rate was substantial. Therefore, this study tests the robustness by using NEER instead of REER (model 3 and 4). Using NEER, it is found that exchange rate plays a significant role in explaining profitability in both the cases, i.e., ROA and NPM. The results are depicted in Tables IV and V. It is seen from the result that NEER and volatility of NEER are significant throughout the sample. Moreover, it is found that the firm-specific determinants are significant and of the same sign as in the previous model (when REER used). In the full sample period, exports and imports are insignificant, whereas the exchange rate and its volatility are significant with a negative and positive sign, respectively. The fourth hypothesis is discarded and it is concluded that depreciation negatively affects profitability in the short run, but in the long run, it may lead to a profitable position. Furthermore, the channels of exports and imports are unclear.

A VAR approach to capture the sensitivity of corporate profitability

The VAR model is a theoretical equation that is used to capture the linear interdependencies among multiple parameters over time. All variables in a VAR framework are treated in a structural way, where each variable has an equation explaining its evolution based on its

Random-effects GLS regression (ROA-NEER)			
	Pre-crisis period (2000-2007)	Post-crisis period (2008-2015)	Full sample period (2000-2015)
Wald $\chi^2(18)$	121.72	108.07	75.08
Probability	0.000	0.046	0.000
ρ (interclass correlation)	0.035	0.199	0.073
ROA (dependent)	Coefficient	Coefficient	Coefficient
TA	-0.486	7.21***	6.22***
DE	-0.281**	-0.21*	-0.239***
LQ	0.724**	1.94***	0.971**
NEXP	0.0426***	0.077	0.034
NIMP	-0.00008***	-0.027	0.000
Δ NEER	-0.443**	-0.306**	-0.172***
VOLEX	0.735*	0.907***	0.481**
IIPCG	0.076***	-0.099**	-0.036***
INT	-0.409**	0.401	-0.276
Const.	1.491	-6.099***	-12.74***
Breusch-Pagan LM test	$\chi^2 = 19.21***$	$\chi^2 = 123.12**$	$\chi^2 = 114.56**$

Table IV.
Determinants of
profitability under
three samples of the
study with ROA-NEER

Note: **, ***Significant at 5 and 1 percent levels, respectively

Random-effects GLS regression (NPM-NEER)			
	Pre-crisis period 2000-2007	Post-crisis period 2008-2015	Full sample period 2000-2015
Wald $\chi^2(18)$	121.72	108.07	75.08
Probability	0.0000	0.046	0.0000
ρ (interclass correlation)	0.0353	0.199	0.073
ROA (dependent)	Coefficient	Coefficient	Coefficient
TA	2.248***	-0.297	0.5980
DE	-0.538**	-0.166**	-0.187***
LQ	1.44***	0.189***	-0.358*
NEXP	0.063***	0.020	0.052***
NIMP	-0.0003	-0.036***	-0.00002
Δ NEER	-0.285***	0.123***	-0.051***
VOLEX	0.568***	-0.183**	0.118*
IIPCG	0.059***	-0.002	0.013***
INT	-0.339***	-0.102	-0.641***
Const.	-7.49***	10.99***	6.36***
Breusch-Pagan LM test	$\chi^2 = 795.02***$	$\chi^2 = 141.23***$	$\chi^2 = 169.82***$

Note: *, **, ***Significant at 10, 5 and 1 percent levels, respectively

Table V.
Determinants of
profitability under
three samples of the
study with NPM-NEER

own lags and the lags of the other variables of the model. Before estimating a structural or a reduced form VAR framework in a relatively longer time series, the testing of time series within and across panels seems to be an essential pre-estimation that is necessary. Hence, before exploring the linear interdependencies among the parameters of Equation (5), the unit root property of the variables has been analyzed. We have employed three types of models developed by Hadri (2000), Levin-Lin-Chu (2002), and Im-Pesaran-Shin (2003) to test the panel unit root property of the data and the estimated statistics as presented in Table VI. LLC test statistics has discarded the null hypothesis, that is, panels contains unit root except interest rate. A similar result is suggested by Im-Pesaran-Shin, where the null hypothesis of unit root is rejected except ROA. In the case of Hadri LM, all the variables are stationary. The estimated statistics from all the three models are mostly symmetrical.

The response to Cholesky One standard deviation (S.D) Innovations to profitability with ± 2 S.E confidence interval is presented in Figure 1. Impulse response function of Equation (5) is estimated. One S.D shock on firm size exhibits a substantial response on ROA. It increases immediately and remains high throughout. But the responses of NPM are relatively smaller than ROA, and it starts decaying after three periods ahead. The effect

Variables	LLC <i>t</i> -stat.	Hadri LM <i>Z</i> -stat.	Im-Pesaran-Shin <i>W</i> -stat.
ROA	-8.54***	-1.44	1.264
TA	-7.06***	3.95	99.68***
DE	-51.45***	2.51	29.18***
LQ	-3.87***	-1.83	15.92***
Δ NEER	6.54***	18.49	85.28***
VOLEX	-39.19***	2.96	17.18***
IIPCG	-13.16***	2.65	111.33***
INT	0.300	0.17	27.03***

Notes: LLC, H_0 : panels contain unit roots; Hadri LM, H_0 : all panels are stationary; Im-Pesaran-Shin, H_0 : all panels contain unit roots. * ** * ** * Indicate rejection of the unit root hypothesis at the 10, 5 and 1 percent significance levels, respectively

Table VI.
Unit root test
statistics

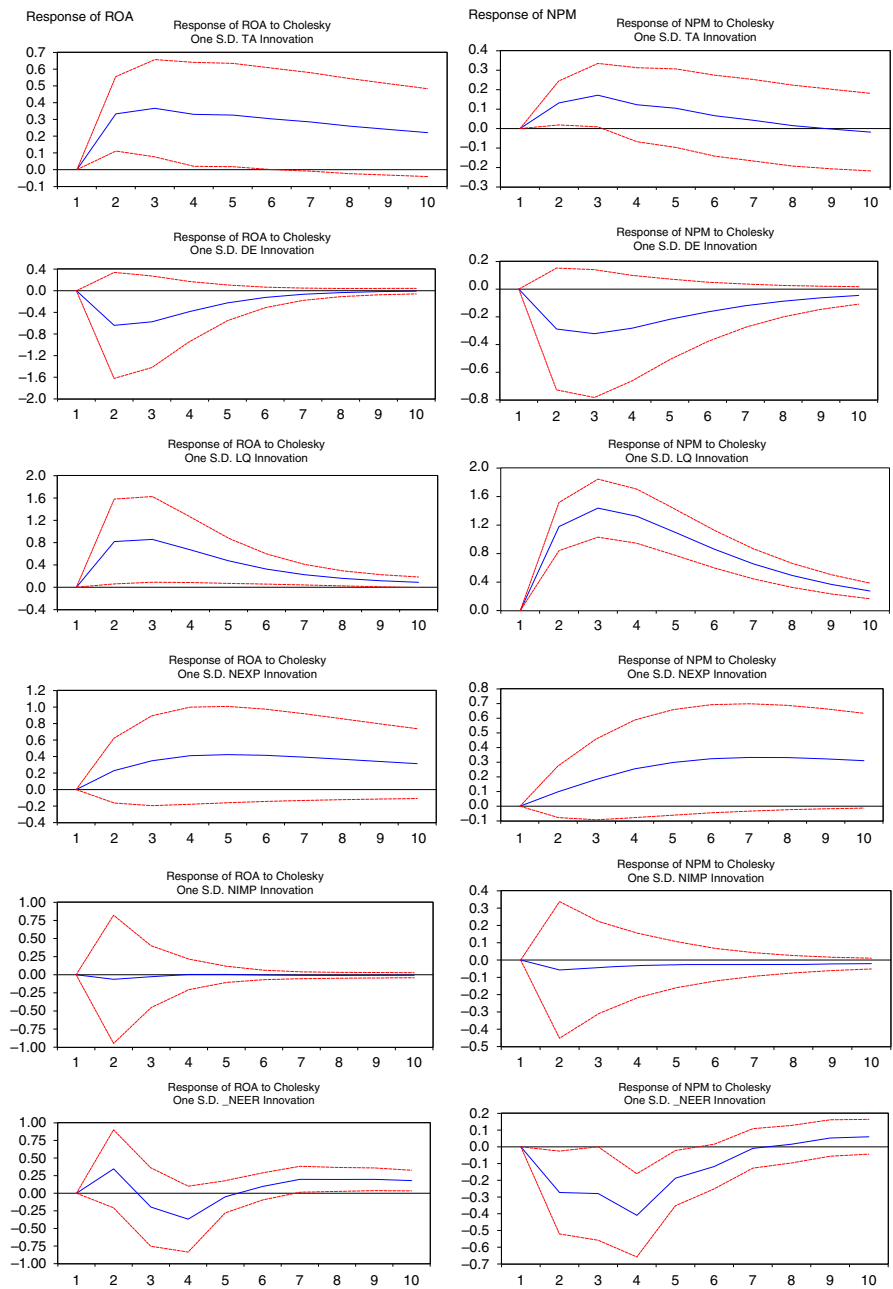


Figure 1.
Response to Cholesky
One S.D. Innovations
with ± 2 S.E.
confidence interval

(continued)

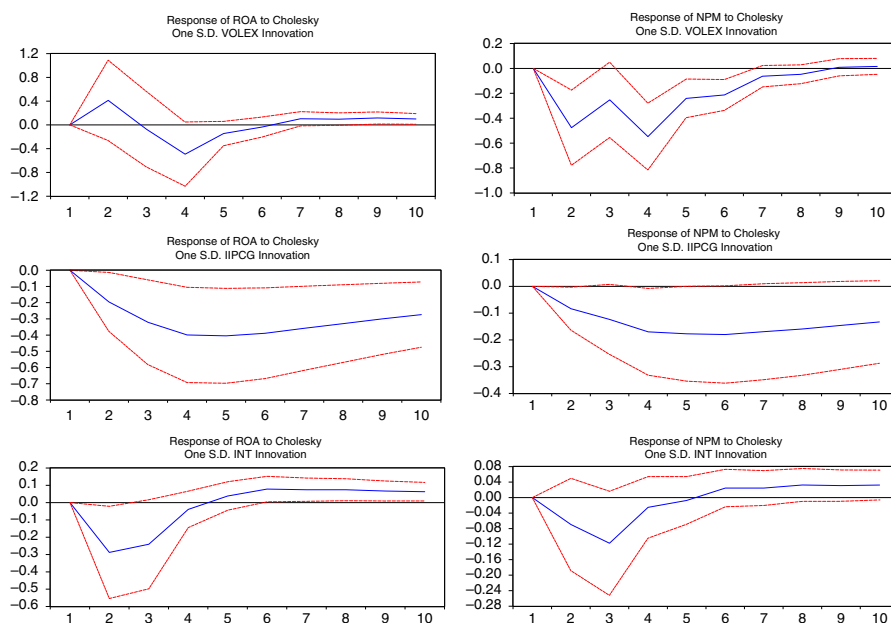


Figure 1.

of one S.D shock on firm size of NPM neutralizes almost by eighth period ahead, which is not happening in the case of ROA. This confirms the relative importance of size measured in terms of total assets on the profitability of a firm. Looking at the response of profitability due to shock in capital structure, it is very clear that increase in debt is having significantly negative impact on profitability. The response of ROA and NPM remains high and faster till the fourth period, subsequent to which it starts decaying and neutralizes around the eighth period ahead. In term of debt, NPM is more reactive than ROA. The immediate negative response of ROA due to one S.D shock in debt is relatively smaller than NPM and further decays faster than NPM. In a similar line, the impact of liquidity on firm profitability remains positive as forecasted tenth period ahead. One S.D shock in liquidity increases profitability immediately. The shock remains active till two to four periods, then starts decaying and descends closer to x -axis around the eighth period ahead. NPM is more reactive and gives stronger response than ROA. The study confirms that Indian manufacturing firms can increase their profitability by maintaining adequate liquidity. Firms might have to bear some short-term cost for holding liquidity, but in the long run, liquidity is impacting profitability positively. With respect to firm-specific factors such as firm size, leverage, and liquidity, all the three hypotheses are accepted. We have taken one more step ahead to capture the responses of profitability due to shocks in the exchange rate channel that includes change in exchange rate, its volatility, export, and import share. Since in the previous analysis of capturing the determinants of profitability, NEER appears to be more informative over REER in explaining profitability, in this section, we have considered only NEER channel. The immediate response of ROA is positive because of one S.D shock in NEER and its volatility. The effect of exchange rate and its volatility remains positive till post-second period, becomes negative between third to sixth period, and beyond the sixth period, the effect neutralizes with a marginal positive effect on ROA. But the response of NPM is negative and volatile. The decay to neutrality is after a long period, i.e., beyond seventh or eighth period ahead. This is very interesting to note that sensitivity of

two profitable indicators is behaving differently with respect to the change in nominal exchange rate and its volatility. A decreasing NPM may imply that the profitability of Indian manufacturing firms is affected more through the imported cost channel than the revenue channel. Net import has insignificant effect on ROA and slight influence on NPM. By exploring the linear interdependencies of the control variables of the system of equation, it is observed that the response of ROA to index of capital goods is minimal. It has immediate negative impact on profitability, but the response is corrected just immediately after one period. Theoretically, an increase in domestic production will have downward pressure on the price level, and an excess product and supply may aggravate the price war within the economy. Thus, the immediate impact of excess industrial production on profitability may be negative, but the firms can revise their respective demand forecast and adjust the production cycle. They may also apply various strategic production management techniques to handle the situation with immediate effect. Similarly, ROA negatively affects the interest rate shock at the first level and subsequently undergoes an adjustment of the shock. The response oscillates around x -axis and settles down immediately, which is a natural response of profitability as far as the interest rate is concerned. The nominal exchange rate seems to be a better indicator than real exchange rate, hence, we have decided to analyze and produce the sensitivity of nominal exchange rate to profitability. However, the result is verified in relation to real exchange rate, but no exceptional result is found, hence, the findings associated with the impact of nominal exchange rate on profitability have been produced.

Conclusion

The purpose of this study was to investigate the factors affecting firm profitability measured by ROA and NPM. The period of analysis covered the years between 2000 and 2015. It is found that the firm-specific determinants are dominant players in determining the corporate profitability of firms. The external involvement parameter has failed to explain the profitability in both the pre-crisis and post-crisis periods. The macroeconomic determinants also feature the same sign. IIPCG and interest rate are significantly contributing toward explaining profitability in the pre-crisis period, but in the post-crisis period, only interest rate is effective. Thus, it can be concluded that the crisis plays a significant role in explaining the profitability quotient for Indian firms. Firm's profitability is positively affected by firm size and liquidity, and is negatively affected by leverage. Therefore, it appropriately accepts the set of hypotheses stating that size and liquidity enhances the profitability, whereas leverage discourages the profitability, although there are few exceptions during the crisis period. The study further concludes that depreciation in India does not lead the firms to a profitable position in the short run, but in the long run, it may move to a profitable position as the volatility of NEER is positively associated.

Our results carry important implications for managers who are curious about the information related to the factors affecting the financial performance and competitiveness of the companies. The firm managers and policy makers should give utmost importance to the firm-specific determinants especially after the crisis period to make any change in policy for a profitable business. This paper further concludes that nominal exchange rate is more informative in the sense of explaining the firm profitability clearly rather than the real exchange rate. Firm managers may take this into account while making performance analysis of Indian firms. A nominal exchange rate has a great impact and is vital for studying profitability. This is very interesting to note that sensitivity of two profitable indicators are behaving differently with respect to the change in nominal exchange rate and its volatility, policy makers should leverage this findings while making strategic policy decisions. Financial managers could take these results into consideration for decision making and use various instruments to control some of the firm characteristics to obtain more favorable performance outcomes especially during and after crises.

There is a paradigmatic notion about industry structure that determines profitability; in effect, this means that high profit firms are found in smart industries with favorable competitive structure. Hence, examining industrial factors, such as concentration, barriers to entry, and industry life cycle, might provide evidence about industry being an important determinant of firm profitability. This could be an insightful research for future studies.

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Appendix. Generalized least square (GLS) estimator

Least square estimates are based on the assumptions that errors are serially uncorrelated, as well as homoskedastic, and hence, are normally distributed. But in reality, they are mostly non-homogenous. In such case, an alternative to OLS is GLS that can be used for estimating unknown parameters in a linear model, where $E[\epsilon_t|X_t]=0$ and $var[\epsilon_t|X_t]=\Omega_0$ for a typical linear approach, i.e., $Y_t=\beta X_t+\epsilon_t$. It assumes that the conditional mean of Y given X is a linear function of X and the conditional variance of the error terms given X is a known matrix " Ω ." But practically, in most of the cases, " Ω " is not known. Hence, GLS estimator cannot be estimated unless Ω is substituted with an estimated Ω_t . The above linear regression can be rewritten in a panel form as $Y_{it}=\beta X_{it}+\epsilon_{it}$, where $i=1, 2, \dots, n$ is the number of panels; $t=1, 2, \dots, T$ is time period; and ϵ_{it} is the non-auto-correlated error term. The matrix notation of GLS estimator can be rewritten as

$(X'\Omega^{-1}X)^{-1}X'\Omega^{-1}Y$, where ε is a $n \times 1$ vector of random errors, with expected value $E(\varepsilon) = 0$ and $\text{Cov.}(\varepsilon) = E(\varepsilon\varepsilon') = \Omega$ is a symmetric matrix such as follows:

$$\text{Cov.}(\varepsilon) = E(\varepsilon\varepsilon') = \Omega = \begin{bmatrix} \sigma_{11} & \sigma_{12} & \cdots & \sigma_{1n} \\ \sigma_{21} & \sigma_{22} & \cdots & \sigma_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \sigma_{n1} & \sigma_{n2} & \cdots & \sigma_{nn} \end{bmatrix} = \begin{bmatrix} \sigma_{11} & 0 & \cdots & 0 \\ 0 & \sigma_{22} & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & \cdots & 0 & \sigma_{nn} \end{bmatrix}$$

A remarkable property of the GLS estimator is that for any choice of Ω , the GLS estimate of β is unbiased, and it imposes no distributional assumption for the random errors (ε).

Vector auto-regression (VAR) model

VAR is a system of equation, with each equation describing the dynamics of one variable as a linear function of the previous lags of every variable in the system including its own lags. The subscript j stands for the optimum lag order of the right-hand side variables of all the equations. Akaike information criterion has been used for optimum lag order identification. Since we will be primarily using the estimated error terms for analyzing impulse response and variance decomposition, the reduced form depiction of Equation (3) would purely be a forecast model, and hence, it abstains us from analyzing the individual coefficients of a reduced form VAR model (Sims, 1980). After estimating the reduced form VAR model (i.e. Equation (5)), the estimated error distribution will be presented in moving average (MA) order by eliminating lagged independent covariates. The MA representation captures the way endogenous variables depend on their lagged residuals of the reduced form VAR model as presented below:

$$\begin{aligned} \text{ROA}_{it} = & \alpha_{10} + \sum_{j=1}^{\infty} b_{11j} \varepsilon_{1it-j} + \sum_{j=1}^{\infty} b_{12j} \varepsilon_{2it-j} + \sum_{j=1}^{\infty} b_{13j} \varepsilon_{3it-j} \\ & + \sum_{j=1}^{\infty} b_{14j} \varepsilon_{4it-j} + \sum_{j=1}^{\infty} b_{15j} \varepsilon_{5it-j} + \sum_{j=1}^{\infty} b_{16j} \varepsilon_{6it-j} + \sum_{j=1}^{\infty} b_{17j} \varepsilon_{7it-j} \\ & + \sum_{j=1}^{\infty} b_{18j} \varepsilon_{8it-j} + \sum_{j=1}^{\infty} b_{19j} \varepsilon_{9it-j} + \sum_{j=1}^{\infty} b_{110j} \varepsilon_{10it-j} + \mu_{1it} \cdots \end{aligned} \quad (\text{A1})$$

Under the assumptions of endogeneity, the residuals are expected to be correlated, and hence, the estimated coefficients of Equation (A1) are not appropriate for interpretation. Hence, the residuals have to be orthogonalized by multiplying Cholesky decomposition of the covariance matrix of the residuals. These orthogonalized residuals are called shocks and the MA representation of the orthogonalized residuals is addressed as impulse response functions (IRF). The IRF addresses the response of each variable included in the model out of one Cholesky S.D shock from each of the variable of the system. The orthogonalization of Equation (A1) is presented below:

$$\begin{aligned} \text{ROA}_{it} = & A_{10} + \sum_{j=1}^{\infty} B_{11j} e_{1it-j} + \sum_{j=1}^{\infty} B_{12j} e_{2it-j} + \sum_{j=1}^{\infty} B_{13j} e_{3it-j} + \sum_{j=1}^{\infty} B_{14j} e_{4it-j} + \sum_{j=1}^{\infty} B_{15j} e_{5it-j} \\ & + \sum_{j=1}^{\infty} B_{16j} e_{6it-j} + \sum_{j=1}^{\infty} B_{17j} e_{7it-j} + \sum_{j=1}^{\infty} B_{18j} e_{8it-j} + \sum_{j=1}^{\infty} B_{19j} e_{9it-j} + \sum_{j=1}^{\infty} B_{110j} e_{10it-j} + \vartheta_{1it} \cdots \end{aligned} \quad (\text{A2})$$

where:

$$\begin{pmatrix} B_{11j}B_{12j} \cdots B_{1-10j} \\ \cdots \\ B_{10-1j}B_{10-2j} \cdots B_{10-10j} \end{pmatrix} = \begin{pmatrix} b_{11j}b_{12j} \cdots b_{1-10j} \\ \cdots \\ b_{10-1j}b_{10-2j} \cdots b_{10-10j} \end{pmatrix} XP \text{ and } \begin{pmatrix} e_{1it} \\ e_{2it} \\ \cdot \\ \cdot \\ e_{10it} \end{pmatrix} = P^{-1}X \begin{pmatrix} \varepsilon_{1it} \\ \varepsilon_{2it} \\ \cdot \\ \cdot \\ \varepsilon_{10it} \end{pmatrix}$$

Here, “ P ” is the Cholesky decomposition of the covariance matrix of the residuals and the orthogonal errors are addressed as shocks to the system of equations. The coefficients of Equation (A2) $B_{11j}B_{12j} \dots$ are called impact multipliers and they explain the current response of the dependent variable.

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