Capital expenditure and persistence of firm performance: an empirical study for the Indian automobiles industry

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Abstract: The purpose of the present work is to analyse the dynamic relationship between capital expenditure (CAPEX) intensity and firm performance for the automobiles industry in India. A dynamic panel methodology has been deployed. A sample of 95 listed automobiles firms in India for the period 2005 to 2014 has been considered. The results show that there exists a negative and persistent relation between performance and CAPEX. Also, a moderate level of persistence in the firm performance is observed for the sample companies. The results also indicate a possible U-shape relationship between CAPEX and firm performance. The study highlights the need for proper identification of the appropriate capital expenditure levels. This may lead to positive benefits for the Indian automobiles firms in the long-run.

Keywords: Indian automobile industry; dynamic panel; capital expenditure intensity; firm performance.


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1 Introduction

Firm performance is the subject matter of several theories. These theories are based on work done in finance, economics, strategy, organisational behaviour, and international business. Several empirical studies testing these theories have looked into many different variables that are believed to be impacting firm performance (Abor, 2005; Harrison and Wicks, 2013; Dubey et al., 2014; Wei et al., 2014; Jaisinghani, 2016). These studies have mostly relied on the fundamental presumption that the interplay between industry structure and managerial efficiency determines the overall firm performance. The initial work on firm performance, which focused almost entirely on advanced markets (Kang and Shivdasani, 1995; Koellinger, 2008; Luckerath-Rovers, 2013; Shirokova et al., 2016) is now being followed by studies from emerging markets (Bae and Lawler, 2000; Chung and Luo, 2013; Kumar et al., 2015; Xia and Walker, 2015). Many factors are responsible for driving the focus towards emerging markets. The chief among them is the increasing contribution of these economies towards the world GDP. The key emerging economies include Brazil, Russia, India, China, and South Africa (also commonly referred as BRICS). A study of these economies will provide a better understanding of the manner in which different businesses function in emerging markets (Tseng, 2009; Eunni and Manolova, 2012; Liu et al., 2013; Chkili and Nguyen, 2014).

In the recent past, there has been a radical shift from analysing the entire economy to analysing individual industries (Lee and Huang, 2012; Lin et al., 2013; Jaisinghani et al., 2015). The chief benefit of conducting an industry-wide analysis is it minimises the variability in measurement of performance and other intra-industry variables. This is mainly due to the fact that companies operating in same industry are subject to similar external environment. Besides, these companies are also subject to similar regulations and reporting guidelines. On account of these factors, the industry-specific analyses are also getting momentum in the emerging markets (Wang and Lestari, 2013; Koseoglu et al., 2013; Roy and Khastagir, 2016). However, this research is its preliminary stages and there is a pressing need to conduct an in-depth analysis in various industries, especially those in the emerging economies.

1.1 Research gaps and research objectives

The foregoing discussion points at two leading research gaps. These are analysing emerging economies and understanding industry-specific behaviour of firm performance in these markets. The current study makes an endeavour to fill these gaps. The present work aims at analysing the dynamic nature of relationship between firm performance and capital expenditure (CAPEX) for the companies operating in the Indian automobiles
industry. The study also tries to find the nonlinear relationship between firm performance and CAPEXs. Besides, the nature of performance persistence among the Indian automobile firms has also been analysed.

The rationale for considering automobiles industry is that it is widely considered as one of the most crucial industries of the Indian economy. India was the sixth largest vehicle producer in the world in 2014. Moreover, the industry had a stupendous contribution of around 7% to the country’s GDP. The industry is also estimated to be providing direct and indirect employment to about 19 million people. It is also estimated that the industry will have a share of around 25% in the total manufacturing output of India by the year 2022. Numerous factors including increased income levels, rising urban population, availability of multiple sources of finance, and potential untapped markets will lead the industry to grow at a fast rate. Besides, automobiles production requires heavy investments in the form of expenditures made in plant and machinery. Hence, the automobiles industry is an ideal setting for studying the impact of CAPEX on overall firm performance. Thus, the insights obtained from analysing automobile industry will bear several managerial as well as research implications.

The current work has several useful contributions to the theory of firm performance. First, the present work deploys an advance methodology to study the temporal dynamics of firm performance. The study utilises dynamic panel methodology in which the lagged values of the dependent variables can be included among the explanatory variables. Second, the nonlinear relationship between firm performance and CAPEXs, which is generally overlooked in the previous empirical studies, has been studied here. Last but not the least the study deploys a wide dataset consisting of many firms and a long time frame. To the best of our knowledge such a study has not been conducted earlier for Indian automobile industry.

The remaining paper is organised as follows. Section 2 describes the theoretical framework and discusses the related literature. Section 3 presents the data. Section 4 discusses the research methods deployed. Section 5 reports the empirical results. The final section presents the conclusion along with the scope for future research.

2 Theoretical background and literature

A majority of studies from the developed world assert the resource-based view (RBV) to be the major theory explaining firm performance. RBV claims that firms tend to be more competitive by creating resources that are valuable, heterogeneous, and immobile (Rumelt and Foss, 1984; Barney, 1986, 1991; Wernerfelt, 1984). These resources help an organisation in creating capabilities that lead to superior performance in the long run (Grant, 1996; Danneels, 2002). These capabilities can be created by sustained investments in tangible as well as intangible assets.

Rugman (2005) profess that sustained competitive advantage is created by the interplay between firm-wide and country-wide advantages. These interactions create different outcome for different combinations of firm-specific and country-specific competencies. Besides, Lin et al. (2009) study the consequences of partner selection on firm performance. The authors consider a sample of four US industries for a time period of 13 years. The authors find that the combination of resources and status is an important
consideration in selection of a partner. They finally contend that an efficient combination of these two factors leads to higher levels of performance.

Ramirez and Girdauskiene (2013) find that there is a direct relationship between knowledge creation and prediction of reverse logistics. The authors also find a direct and positive relationship between reverse logistics and firm performance. Their study, therefore, supported the RBV as the Spanish companies were able to create valuable knowledge during the study period. Lin and Wu (2014) analyse the impact of creation of dynamic capabilities on firm performance. The authors base their work on the premise of RBV and posit that dynamic capabilities have the potential to improve firm performance. They base their study on 1,000 best performing companies operating in Taiwan. They observe that dynamic capabilities act as mediator between resources and firm performance. They conclude that these capabilities make the firm’s resources more valuable and rare and hence help these firms to outperform others.

Research in emerging markets has looked into alternate explanations of firm performance. These explanations primarily include impact of ownership structure, business-group affiliation, institutional voids, and corporate governance (Hoskisson et al., 2013; Jia et al., 2013; Karabag and Berggren, 2014; Jaisinghani, 2016). Many studies have argued that the interplay among a few or all of these factors determine firm performance for organisations belonging to emerging markets (Baghdasaryan and La-Cour, 2013; Kumar et al., 2015; Taussig and Delios, 2015). The major challenge confronting researchers studying these markets is that these factors are highly dynamic and vary widely across countries. Thus, it is very difficult to suggest a comprehensive theory that captures all aspects of firm performance. This has led to the research on emerging markets being highly fragmented and context specific.

Ukaegbu (2014) has made an attempt to find the relationship between proper management of working capital and firm performance for a set of African countries. The author considers several African nations such as Kenya, South Africa, Egypt, and Nigeria to discover this relationship. The time period considered was from 2005 to 2009. The author deployed a balanced panel-data methodology using fixed-effects technique. The author found a strong negative relationship between firm performance and the length of cash conversion cycle. This led the author to conclude that there existed a positive relationship between proper management of working capital and performance.

2.1 Evidence on performance persistence

Temporal dynamics of firm performance is a widely researched topic in advanced economies. Many authors argue that firm performance persists over time (Mueller, 1977; Gschwandtner and Hirsch, 2013; Hirsch and Hartmann, 2014; Tsoulfidis et al., 2015). This is due to creation of entry barriers and exploitation of economies of scale in the short-run (Kamerschen, 1969; Krugman, 1980). Another reason for persistence in firm performance is that consumers and producers face certain inertia (Hannan, 1984; Dube et al., 2010; Madsen and Leiblein, 2015). These factors result in firm performance being persistent.

Mueller (1977) has analysed performance persistence for a sample of 472 US firms. The author considered a long time frame of 24 years. The author further segregated the firms into eight subclasses based on their performance. The author found that firms having better initial performance also displayed higher persistence in firm performance in the subsequent periods. The author also found that competition failed to prevent firms
from creating entry and exit barriers and hence did not eliminate performance persistence. Geroski and Jacquemin (1988) analysed performance persistence among a sample of firms operating in three European countries, Germany, France, and the UK. The authors found a significant level of short run performance persistence in most UK firms. However, this persistence was much lower for French and German firms. The authors found similar results when they analysed long run performance persistence for firms in these countries. These findings indicated a larger persistence in both short run and long run firm performance for the UK companies. The authors, based on these results, concluded that France and Germany were more competitive than the UK.

Canarella et al. (2013) have analysed industry-wide performance persistence for a sample of 1092 US firms. The authors analysed the time period from 2001 to 2010. The authors deployed panel stationarity tests to analyse the evidence of mean reverting behaviour. The authors found the firm performance to be stationary for most of the industries. The authors contended that the results signified evidence against performance persistence. However, the authors also found some level of persistence after bringing cross-section dependence in their dataset.

Kambhampati (1995) study the performance persistence of several Indian industries. The author finds that there is a significance presence of superior firm performance in many Indian industries. This performance also persists in the long run. The author also observes that the level of persistence is much more in industries in their growth phase than in industries in their maturity phase. The author finally argue that intermediation by government can control this persistence in an efficient manner.

2.2 CAPEX and firm performance

Investing funds in growth opportunities is one of the key strategic actions performed by firms across different industries. Investments having positive net present value should also have a positive impact on the accounting-based measures of firm performance. This is because investments with positive net present value will increase the future cash flows generated by firms. These cash flows can be further invested in business to tap growth opportunities (Woods and Randall, 1989; Schmit et al., 2009; Souder et al., 2016). Hence, projects with positive net present value should positively impact firm performance. However, there is always a degree of uncertainty associated with any CAPEX project. This is because massive projects have longer gestation periods and are subject to rapidly changing environments (Lerner, 1994; Rebiasz, 2007). These risks can result in the realised earnings being considerably different from the expected earnings.

Many authors regard investments in growth opportunities in the form of CAPEX to be having a significant impact on current as well as future firm performance (Scapens and Sale, 1981; McConnell and Muscarella, 1985; Appuhami, 2008; Tomczyk et al., 2013). The main contention of these authors is that CAPEX projects commit firm resources and thereby create entry and exit barriers. These barriers defer excess competition from creeping in and hence increase long run firm performance. Moreover, certain forms of CAPEX also enjoy tax credits and other incentives from government. These incentives can increase profits and hence there can be a positive relationship between CAPEX and firm performance.

However, others believe that this relationship is not universally true and investments in growth opportunities can sometime be detrimental to firm performance (King and
Navaretti et al. (2014) study the impact of firm age on the growth process for a sample of European firms. The authors observe that younger firms benefit more from growth opportunities as compared to their older counterparts.

3 Data

3.1 Sample

The dataset for the present work includes firm specific factors for 95 firms operating in the automobiles industry in India. These firms include publicly listed companies operating in the automobiles industry in India. The source for collecting the data is Prowess database that is maintained by Center for Monitoring of Indian Economy. The time frame considered is from 2005 to 2014. Indian companies follow April to March fiscal year. To get the final dataset several filters have been applied. First, all the companies having negative value of equity capital, sales, or total assets have been removed. Moreover, since the estimation technique requires a balance panel setting, companies with missing data for any of the variables have been dropped. Finally, all unlisted firms, government owned firms, and foreign firms were deleted. This resulted in a final sample of 95 firms.

3.2 Dependent variables

In order to measure firm performance the current study considers the accounting measure of return on sales (ROS). ROS is operationalised as profit before interest, tax, depreciation, and amortisation (PBDITA) scaled by total sales. ROS indicates the margin earned by a company and hence is a good representation of firm performance. Past studies that have considered similar measure for measuring firm performance include Grant et al. (1988), Ravichandran et al. (2009), Rexhauser and Rammer (2014) and Wilson (2015) among others.

3.3 Explanatory and control variables

In the present work, CAPEX intensity is the main explanatory variable. CAPEX is defined as total CAPEX scaled by total sales. CAPEX has been considered as a proxy variable representing investments in growth opportunities. Some of the major studies that have considered similar measure include Himmelberg et al. (1999), Jackling and Johl (2009), Arrfelt et al. (2015), and Owen and Yawson (2015).

In addition to the main explanatory variable, five other control variables have been considered. These include current ratio (CR), cash holding, firm size, marketing intensity, and capital structure (CS). CR is defined as total current assets as a proportion of total current liabilities. Cash holding (CASH) is operationalised as sum total of cash and cash equivalents scaled by total assets. Firm size (SIZE) is measured as the natural log of total assets. Marketing intensity (MKTG) is measured as total of advertisement and marketing expenditure scaled by total sales. Finally, CS is calculated as long-term debt scaled by total assets.
3.4 Descriptive statistics and correlation

Table 1 presents the descriptive analysis for the entire sample. Table 1 shows that the mean (median) ROS for the entire sample is 12.3% (11.0%). Table 1 further show that the average CAPEXs are around 7.9% of the total sales. The median value is considerably lesser than the mean and stands at around 5.3% of total sales. This fact highlights that there are many firms that are not investing heavily in CAPEXs. The average long-term debt is around 28% of total assets. This shows that Indian automobile firms are highly levered. The average cash holding is close to 4.8% of total sales. Last but not the least, Table 1 shows that the average investments in marketing activities is around 3.4% of total sales.

Table 1 Descriptive analysis

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Median</th>
<th>Maximum</th>
<th>Minimum</th>
<th>Std. dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROS</td>
<td>0.123</td>
<td>0.110</td>
<td>0.538</td>
<td>-0.075</td>
<td>0.0694</td>
</tr>
<tr>
<td>CAPEX</td>
<td>0.079</td>
<td>0.053</td>
<td>1.055</td>
<td>0.000</td>
<td>0.099</td>
</tr>
<tr>
<td>CR</td>
<td>1.699</td>
<td>1.384</td>
<td>21.625</td>
<td>0.146</td>
<td>1.244</td>
</tr>
<tr>
<td>CASH</td>
<td>0.048</td>
<td>0.023</td>
<td>0.778</td>
<td>0.001</td>
<td>0.071</td>
</tr>
<tr>
<td>SIZE</td>
<td>8.102</td>
<td>8.006</td>
<td>13.225</td>
<td>3.918</td>
<td>1.681</td>
</tr>
<tr>
<td>MKTG</td>
<td>0.034</td>
<td>0.026</td>
<td>0.181</td>
<td>0.001</td>
<td>0.027</td>
</tr>
<tr>
<td>CS</td>
<td>0.278</td>
<td>0.285</td>
<td>0.726</td>
<td>0.000</td>
<td>0.156</td>
</tr>
</tbody>
</table>

Notes: The sample consists of 95 publicly listed firms and the time period studied is from 2005 till 2014. ROS is measured as PBDITA scaled by total sales. CAPEX is measured as capital expenditure scaled by total sales. CR is measured as total current assets scaled by total current liabilities. CASH is measured as total of cash and cash equivalents scaled by total assets. SIZE is measured as natural log of total assets. MKTG is measured as total marketing and advertisement expenditure scaled by total sales. CS is measured as total debt scaled by total assets. The data has been collected from Prowess database, which is maintained by CMIE.

Table 2 Correlations

<table>
<thead>
<tr>
<th></th>
<th>ROS</th>
<th>CAPEX</th>
<th>CR</th>
<th>CASHI</th>
<th>SIZE</th>
<th>CS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAPEX</td>
<td>0.435</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CR</td>
<td>0.222</td>
<td>0.194</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CASH</td>
<td>0.188</td>
<td>-0.002</td>
<td>0.271</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SIZE</td>
<td>0.119</td>
<td>0.101</td>
<td>-0.281</td>
<td>-0.007</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CS</td>
<td>-0.082</td>
<td>0.221</td>
<td>0.177</td>
<td>-0.335</td>
<td>-0.006</td>
<td></td>
</tr>
<tr>
<td>MKTG</td>
<td>-0.121</td>
<td>-0.131</td>
<td>0.021</td>
<td>0.025</td>
<td>0.150</td>
<td>0.058</td>
</tr>
</tbody>
</table>

Notes: The sample consists of 95 publicly listed firms and the time period studied is from 2005 till 2014. ROS is measured as PBDITA scaled by total sales. CAPEX is measured as capital expenditure scaled by total sales. CR is measured as total current assets scaled by total current liabilities. CASH is measured as total of cash and cash equivalents scaled by total assets. SIZE is measured as natural log of total assets. MKTG is measured as total marketing and advertisement expenditure scaled by total sales. CS is measured as total debt scaled by total assets. The data has been collected from Prowess database, which is maintained by CMIE.
Table 2 presents the coefficient of correlation among the various variables. Table 2 shows that there is a positive correlation between CAPEX and firm performance as measured by ROS. The correlation analysis also shows that none of the correlations between any two explanatory variables is greater than 0.4. Hence, there is preliminary evidence that the dataset does not suffer from the problem of severe multicollinearity.

In any form of regression analysis, it is also very imperative to check for multicollinearity problem. Multicollinearity refers to the presence of correlation among two or more explanatory variables. This can cause the results to be biased. Hence, multicollinearity should be tested before performing any regression analysis. Analysing the variance inflation factor (VIF) is one of the most prominent measures of testing multicollinearity. A VIF score of less than 5 indicates that multicollinearity is within manageable limits. Table 3 presents the results of VIF analysis. Table 3 clearly indicates that the VIF for all the variables are below 5. Hence, it can be concluded that the data does not suffers from heavy multicollinearity issue.

### Table 3  Multicollinearity diagnosis results

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient variance</th>
<th>VIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAPEX</td>
<td>0.00041</td>
<td>1.1244</td>
</tr>
<tr>
<td>CR</td>
<td>0.00003</td>
<td>1.3285</td>
</tr>
<tr>
<td>CASH</td>
<td>0.00094</td>
<td>1.3062</td>
</tr>
<tr>
<td>SIZE</td>
<td>0.000002</td>
<td>1.1607</td>
</tr>
<tr>
<td>CS</td>
<td>0.00019</td>
<td>1.2993</td>
</tr>
<tr>
<td>MKTG</td>
<td>0.00495</td>
<td>1.0648</td>
</tr>
</tbody>
</table>

Notes: Table 3 presents the results of multicollinearity analysis. The variance inflation factors (VIF) are an indicator of the degree of multicollinearity. A VIF score of less than 5 indicates that there is no severe multicollinearity in the data.

## 4 Methodology

The current work utilises dynamic panel regression estimation methodology. Dynamic panel methods are very helpful in determining the dependence of a variable on its past values apart from its dependence on several other variables. Dynamic panel regression estimation methodology is becoming popular in applied studies (Flannery and Hankins, 2013; Belderbos et al., 2015; Jaisinghani, 2015; Kang et al., 2016). This method is quite robust in analysing variables that have a tendency of persisting overtime. There are several reasons to believe that current performance will depend on past performance. This is because firms cannot change their production and marketing strategies in a short span of time. Besides, consumers too cannot rapidly change their preference even if there are competitive products available.

The following discussion presents the estimation procedure in dynamic panel regression analysis. The base regression equation, to be estimated, is as given below.

\[ P_t = \alpha + \theta P_{t-1} + Z_{it} \beta + e_t \]  

(1)

In the above equation \( \theta \) represents a scalar quantity, \( Z_{it} \) is a vector of order \( 1 \times K \) that contains all the independent variables. The parameters estimates of the independent
variables are represented by $\beta$, a $K \times 1$ vector. $e_i$ represents a matrix comprising the noise terms and is assumed to be having a one-way error composition as mentioned below:

$$e_{it} = \epsilon_i + \eta_i$$  \hspace{1cm} (2)

In the equation (2), $\epsilon_i$ and $\eta_i$ are independently and identically distributed (i.i.d.) error terms that have a mean value of zero and also a finite variance value. It is also assumed that there is zero autocorrelation in $\epsilon_i$ and $\eta_i$. The subscript $i$ denotes cross sectional units, whereas the subscript $t$ represents time. $P_{it}$ denotes the lagged value of the performance variable, that appears as an independent variable in the base equation.

Equation (1) as stated before has two major estimation issues. The first issue is the presence of autocorrelation in the base equation. This is primarily because the base equations explicitly contain the lagged value of the dependent variable. The second issue is that there is a presence of individual specific effects that needs to be controlled (Baltagi, 2005). The inclusion of the lagged values of the dependent variable as an independent variable in the base equation can create several difficulties in estimation. As it is clear that $P_{it}$ is a function of $\epsilon_i$, therefore, $P_{it-1}$ should also be a function of $\epsilon_i$. This can cause correlation between $P_{it-1}$ and the error term. These issues may result in biasness in the usual OLS estimators.

In order to avoid these particular issues, Arellano and Bond (1991) suggest a method that is based upon the generalised method of moments (GMM) estimation procedure. The authors posit that the issue pertaining to the correlation between $P_{it-1}$ and the error term can be prevented by deploying the technique of instrumental variable (IV). They further contend that the prevailing condition of orthogonality between the lagged values of $P_{it}$ and the error term can be efficiently exploited to obtain robust instruments. This can be achieved by considering equation (1) in the differenced form as mentioned hereunder.

$$P_{it} - P_{it-1} = \theta(P_{it-1} - P_{it-2}) + (Z_{it} - Z_{it-1}) \beta + (\eta_i - \eta_{it-1})$$ \hspace{1cm} (3)

In equation (3), the differencing process can be performed for up to three lags, that is, considering $t = 3$. In this circumstance $P_{it-2}$ will perform as a valid instrument mainly because it is having a correlation with $(P_{it-1} - P_{it-2})$ but is not having any correlation with $(\eta_i - \eta_{it-1})$. Likewise, considering a four year time frame, that is, for $t = 4$, it can be easily noticed that both $P_{it-3}$ and $P_{it-2}$ act as valid instruments. The same reasoning can be advanced for further time periods. This will yield a valid set of instruments that contains $(P_{it}, P_{it-2}, \ldots, P_{it-2})$. Moreover, the appearance of strictly exogenous variables will also increase the number of valid instruments. This is primarily due to the fact that exogenous variables also act as valid instruments. Hence, the matrix containing the complete set of valid instruments can be named as $H$. This matrix is as mentioned below.

$$H = \begin{bmatrix} P_{it} & Z_{it} \\ 0 & [P_{it}, P_{it-2}] \\ \vdots & \vdots \\ 0 & [P_{it}, P_{it-2}, \ldots, P_{it-2}] \end{bmatrix}$$ \hspace{1cm} (4)

Furthermore, the matrix consisting of all the valid instruments, in vector form, can be described as $H = [H_1, \ldots, H_N]$. The moment equation is provided by $E(H' \Delta \eta_{it}) = 0$. Equation (3) can now be pre-multiplied by $H'$ to obtain the following functional form.
In equation (5), $\Delta Z$ denotes a matrix that comprises all the stacked values and has a total of $N(T - 2) \times K$. If $Z_i$ is predetermined and is not purely exogenous, then $H$ in equation (4) will become:

$$
\Psi_i = \begin{bmatrix}
[P_i, [Z_i', Z_{i2}'] \\
[P_1, P_2] [Z_i', Z_{i2}, Z_{i3}'] \\
\vdots \\
[P_i, P_2, \ldots, P_{T-2}, [Z_i', Z_{i2}, \ldots, Z_{iT-1}']
\end{bmatrix}
$$

(6)

Arellano and Bond (1991) have proposed a generic solution in order to estimate the values of $\theta$ and $\beta$ by deploying one-step and two-step technique. This technique is robust for datasets that have a large number of cross-sectional units and small-time periods.

In the present dataset there are 95 cross-sections (firms) and 10 time-periods. Hence, the current dataset is conducive for applying GMM estimation methodology. For the purpose of estimation, one period lagged term of the dependent variable (ROS) is included as an explanatory variable in the base model. Besides, the base form of the control variables can be having some form of endogeneity bias. To remove such bias, all the independent variables are considered in their one period lagged form. Moreover, in order to check for the presence of any nonlinear relationship between CAPEX and firm performance, the squared value of CAPEX intensity ha also been considered.

5 Results and discussion

The first step involved testing the stationarity of various variables considered. Regression analysis performed on non-stationary data can yield misleading results. The unit-root tests for stationarity have been performed and the results of the same are presented in Table 4. The null hypothesis states that the underlying variable is non-stationary. Table 4 clearly shows that the null hypothesis, for all the variables, can be easily rejected at the conventional level. Hence, the null-hypothesis of non-stationarity has been rejected. Thus, it can be concluded that the different variables considered are stationary in their base form. Therefore, the dataset is conducive for dynamic panel regression estimation.

<table>
<thead>
<tr>
<th>Table 4</th>
<th>Stationarity results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ADF-statistics</td>
</tr>
<tr>
<td>ROS</td>
<td>-9.93706</td>
</tr>
<tr>
<td>CAPEX</td>
<td>-13.4114</td>
</tr>
<tr>
<td>CR</td>
<td>-10.0736</td>
</tr>
<tr>
<td>CASH</td>
<td>-12.5394</td>
</tr>
<tr>
<td>SIZE</td>
<td>-8.3509</td>
</tr>
<tr>
<td>CS</td>
<td>-10.5254</td>
</tr>
<tr>
<td>MKTG</td>
<td>-8.838982</td>
</tr>
</tbody>
</table>

Notes: Table 4 presents the results of two different stationarity tests. The null hypothesis in both the tests is that the data has a unit root and hence is non-stationary. Thus, rejection of the null hypothesis indicates that the underlying data is stationary.
Dynamic panel regression helps in finding the impact of past values of the dependent variable and other explanatory variables on performance. However, the base model as described in equation (6) has two major limitations. First, it does not consider the presence of nonlinear relationship between firm performance and CAPEX. Second, there can be endogeneity bias among variables as all the variables are considered for the current year. To avoid the first problem a squared CAPEX term is introduced and to avoid the second issue one period lag values of all the variables is considered. This yields the modified regression model as described by equation (7).

\[
ROS_{it} = \alpha + \delta ROS_{it-1} + \beta_1 CAPEX_{it-1} + \beta_2 CR_{it-1} + \beta_3 CASH_{it-1} + \beta_4 SIZE_{it-1} + \beta_5 MKTG_{it-1} + \beta_6 CS_{it-1} + \phi CAPEX^2_{it-1} + \eta_{it}
\]

Arellano and Bond (1991) estimation, which is a robust technique in the absence of endogeneity, bias has been applied. This technique can handle several types of dynamic panels. The estimation technique assumes presence of first order autocorrelation but absence of second order autocorrelation. This method also yields robust results even in the presence of endogeneity (Flannery and Hankins, 2013). In the current study Arellano and Bond’s two-step estimation procedure has been deployed to generate the results. Further, the one period lag values of the explanatory variables are considered as the main instruments in the model.3

Table 5 presents the results of the dynamic panel regression analysis with ROS as the dependent variable. Panel A of Table 5 displays the coefficient estimates of various variables along with their associated t-statistics and p-values. Table 5 clearly indicates that CAPEX intensity has a negative impact on profitability. The coefficient is negative and significant at the 1% level. The results indicate that automobiles firms in India are negatively impacted by heavy levels of CAPEXs. The results also highlight that there is an inverse relationship between CAPEX and firm performance. These results are quite contrary to the findings of certain previous studies that posit a direct relationship between firm performance and heavy CAPEXs (Himmelberg et al., 1999; Dezso and Ross, 2012; Gao et al., 2013; Fang et al., 2014). Results like these are usually observed when a particular industry is entering into its maturity phase and the possibilities of lateral growth are very limited. These kinds of results also occur when an economy is itself facing slowdown and the external incentives for growth are not being fruitful. Thus, the evidence in the current study clearly indicates that the automobiles industry in India is entering into its maturity phase. Besides, it is also found that the squared term of CAPEX is positive and significant. This indicates that there is a nonlinear relationship between CAPEX and firm performance.

Table 5 further presents the results of the performance persistence. The coefficient of lagged term of the dependent variable, that is, ROS is positive and significant. The coefficient of 0.336 suggests a moderate level of persistence in firm performance. This result is very intuitive because automobile firms generally have some loyal consumer base such as industrial houses, and government agencies. The repeat orders and the existence of long-term contracts with these organisations bring repeat sales for the automobile firms. This causes certain level of persistence in profitability. The coefficient value of 0.336 also suggests that the persistence is around one-third of profitability and hence automobiles firms constantly have to look for new customer base to expand their sales. This is also quite intuitive as automobiles are capital goods and the same users do not buy automobiles frequently. Besides, there is a large market for second-hand and
used automobiles in India. This resale market further weakens the persistence in the performance as this market provides an alternative to the buyers. The findings also support the entry and exit barrier argument (Kamerschen, 1969; Gschwandtner, 2012; Chaddad and Mondelli, 2013). The findings reveal that automobile industry in India is characterised by certain entry barriers that enable the incumbent firms to earn abnormal profits. The results justify the benefits of dynamic panel methodology over other techniques such as OLS and two-stage least squares (2SLS) that are common in empirical studies. The findings are similar to those obtained by Mueller (1977) and Geroski and Jacquemin (1988) who found moderate to high profit persistence in various industries.

Table 5  Dynamic panel regression results

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>SE</th>
<th>t-statistic</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROS&lt;sub&gt;t-1&lt;/sub&gt;</td>
<td>0.3360</td>
<td>0.0246</td>
<td>13.6143</td>
<td>0.0000</td>
</tr>
<tr>
<td>CAPEX&lt;sub&gt;t-1&lt;/sub&gt;</td>
<td>-0.0571</td>
<td>0.0192</td>
<td>-2.9746</td>
<td>0.0030</td>
</tr>
<tr>
<td>CAPEX&lt;sup&gt;2&lt;/sup&gt;</td>
<td>0.0802</td>
<td>0.0251</td>
<td>3.1934</td>
<td>0.0015</td>
</tr>
<tr>
<td>CR&lt;sub&gt;t-1&lt;/sub&gt;</td>
<td>-0.0231</td>
<td>0.0043</td>
<td>-5.3336</td>
<td>0.0000</td>
</tr>
<tr>
<td>CASH&lt;sub&gt;t-1&lt;/sub&gt;</td>
<td>0.1299</td>
<td>0.0247</td>
<td>5.2483</td>
<td>0.0000</td>
</tr>
<tr>
<td>SIZE&lt;sub&gt;t-1&lt;/sub&gt;</td>
<td>-0.0235</td>
<td>0.0039</td>
<td>-5.9248</td>
<td>0.0000</td>
</tr>
<tr>
<td>MKTG&lt;sub&gt;t-1&lt;/sub&gt;</td>
<td>0.0471</td>
<td>0.0841</td>
<td>0.5608</td>
<td>0.5750</td>
</tr>
<tr>
<td>CS&lt;sub&gt;t-1&lt;/sub&gt;</td>
<td>0.1523</td>
<td>0.0182</td>
<td>8.3543</td>
<td>0.0000</td>
</tr>
<tr>
<td>Sargan test (J-statistics)</td>
<td>42.9976</td>
<td>-</td>
<td>-</td>
<td>0.1661</td>
</tr>
</tbody>
</table>

Panel B: Residual diagnosis

<table>
<thead>
<tr>
<th>Test order</th>
<th>m-statistic</th>
<th>Rho</th>
<th>SE(rho)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>AR(1)</td>
<td>-2.4621</td>
<td>-1.2441</td>
<td>0.5053</td>
<td>0.0138</td>
</tr>
<tr>
<td>AR(2)</td>
<td>1.1001</td>
<td>0.2058</td>
<td>0.1871</td>
<td>0.2713</td>
</tr>
</tbody>
</table>

Notes: Table 5 presents the results of the dynamic panel regression. The dependent variable is return on assets (ROS). One-period lagged value of ROS is included among the explanatory variables. Arellano and Bond (1991) two step procedure has been deployed to estimate the results. The estimation technique is based on generalised method of moment (GMM) using instrumental variables (IV). Panel A of the table presents the dynamic-panel regression results. Panel B presents the results of the residual diagnosis tests.

Last but not the least, Table 5 also indicates that except MKTG all the control variables are significant at the conventional levels. Table 5 clearly shows that the coefficients of CR and SIZE are negative. This implies that companies with high level of current assets are having reduced firm performance. The results also imply that there is an optimal firm size and smaller sized automobile firms are having better firm performance. The findings also have practical implications since in recent times there have been several demergers in the Indian automobile industry. For instance, Hero-Honda, which operated as a joint-venture enterprise since 1984, split into two separate firms in 2010. Similarly, Bajaj and Kawasaki discontinued their partnership in India. The coefficient of CS is positive and significant. This means that more profitable firms are better able to utilise the use of debt. This is in accordance with the pecking order theory as well as the signalling theory of CS that claim that profitable and established firms rely more on borrowings and less on
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equity (Ross, 1977; Myers, 1984). This is because markets discount equity more than debt.

The next step in a dynamic panel model involves testing of the validity of the overall model and also the identification problem. The over-identification restriction is tested using Sargan’s J-statistics. The test has the null of orthogonality between the instrument and the error term. In order for the overall model to be valid the J-statistics should be insignificant. Table 5 presents the Sargan’s J-statistics and its associated p-value. In the present case the p-value of 0.1661 clearly indicates that the null of orthogonality between the instruments and the error term cannot be rejected. Thus, the instruments are valid and the model is robust. Further, in order to test the applicability of Arellano and Bond (1991) model, it is also important to analyse the residuals for a possible presence of second order autocorrelation. The model provides robust results when the error terms follow an AR(1) scheme but not an AR(2) scheme. Panel B of Table 5 presents these results. As is clear from Table 5, the error terms follow an AR(1) scheme but not an AR(2) scheme. This provides with sufficient proof of the validity of the results.

6 Conclusions

In the current work an effort has been made to analyse the impact of CAPEX on firm performance for several companies operating in the Indian automobiles industry. Dynamic panel regression methodology has been deployed to estimate the results. The estimation technique deployed is the one developed by Arellano and Bond (1991) that utilises a GMM technique to estimate the coefficients and their error structures. The sample consisted of 95 companies that operated in the Indian automobiles industry for the period 2005 to 2014.

The results obtained highlighted certain interesting findings. It is confirmed that CAPEX and firm performance are negatively related. However, it is also observed that there is a possible nonlinear relationship between CAPEX and firm performance. The results suggest a U-shape relationship between CAPEX and ROS. It is also found that both SIZE and CR are having a negative impact on firm performance. It is further found that cash holdings and long-term debt are having a positive impact on firm performance for the sample firms.

The current study offers several managerial implications. Automobile firms should re-consider their investments in the capital projects as a means for growth. Moreover, they should abstain from investing too much into CAPEX activities. Further, the automobiles firms in India should try to streamline their operations according to their size as it is found that bigger firms are underperforming compared to smaller firms. Finally, the management of automobile firms must consider having highly skilled workforce so that they can leverage their capabilities in creating superior value for their firms.

The study has two major limitations. First, the current study has analysed only a single country and a single industry. Second, the current study did not attempted to find out the exact threshold level of CAPEX intensity. These limitations can also become scope for future research. It will be interesting to find out whether similar results are obtained for other countries such as China, Brazil, Russia, and South Africa. It will also be interesting to find out the exact threshold level of CAPEX intensity for various industries.
References


Notes
1 Source: EMIS Report – Automotive Sector India, March 2015.
3 The exercise was repeated by performing the Blundell and Bond (1998) two-step estimation technique. The results obtained were qualitatively the same. These results are not reported here in order to conserve space but are available upon request.