R&D AND FIRM PERFORMANCE: EVIDENCE FROM FIRMS LEVEL DATA ON PAKISTAN’S MANUFACTURING SMES

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ABSTRACT
Using micro data from Pakistani manufacturing firms, this paper examines the impact of R&D on firm performance. This analysis based on OLS regression on a sample of 1247 Pakistani manufacturing SMEs. The result indicates that firm performance is positively related to process innovation, absorptive capacity, age, networking and exports orientation. This implies that firm investing in innovation and new technology have gain higher productivity growth. While R&D, product innovation and firm’s size have negative impact on firm performance, implies that R&D has a risky project and Pakistani SMEs are small in terms of assets may be constrained by their internal finance and they face a large fixed cost when investing in the knowledge base assets (R&D). The policy implication of this study is that policy makers in Pakistan should give incentives to manufacturing firms to modernize their plants through high-tech innovative investments in order to maintain productivity growth combined with job creation. Government should give incentives to develop cooperation of small and medium size firms with universities and research institutions and use global networks to identify and realize sustainable and profitable trade opportunities for the Pakistan-manufacturing firms.

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1. INTRODUCTION

In 1960s and onward, research and development (R&D) investment has been considered as an important driver of the enhancement of productivity levels. Because of knowledge can be produced and accumulated by R&D undertaking a firm or industry will then become provide to product or process innovations (Mansfield 1965, 1969), and result economic development can be promoted nationally, in fact developed economies have been conducted more investment on R&D activities in terms of their rationale. Even though, at the firm level studies shows the determinants for instance R&D investment of firm, the firm’s export intensity, the size of firm and some other factors which affecting the firm performance, but the R&D is an important factor as mentioned earlier factors and as emphasized by earlier researchers. R&D has two functions: it creates new information by innovation (product and process) and finally increases firm performance and develops the ability in the firm to assimilate and use the existing knowledge that is called absorptive capacity (Cohun and Leventhal, 1989). This study is to seek out to examine the relationship between R&D and firm performance of SMEs because it is considered in the world as backbone of the economy as their significant contribution in job creation, help to earn foreign exchange, export, an important source of reduction of poverty (Shiraziet al, 2013). In Pakistan SMEs contribute a main part of all business sectors. It shares in annual GDP by 40%. As stated by Rabbani and Kamran, (2013) SMEs provides 80% jobs for unskilled labor which contributes 35% output and contributedby 30% of export income. According to economic survey of Pakistan 3.2 million SMEs are operating in Pakistan and contribute to a major part in GDP. The rate of survival of Small and Medium Enterprises in developing countries are very lower because they are resource constraint and alternatively innovation activities (i.e.R&D) are risky and have a high cost, this implies that performance of Small and Medium Enterprises are less than large firms. So, this study has formulated a research question i.e., does R&D influence the

R&D is the creative work of to increasing the stock of knowledge and uses this stock of knowledge to develop new application (OECD, 2002).
firms performance? R&D investment is an interesting topic in the existing literature, that’s why numerous researches already have done to R&D investment. There are prior studies that researched how R&D influenced the firm performance. Most of the researches have focused mostly on the OECD-countries. These countries are the part of the organization for Economic Co-operation and development, to achieve economic progress and world trade. Most attention in the literature is paid to the companies in the US (i.e Le et al, 2006), the UK (i.e. Toivanen et al, 2002) and Japan (i.e. David O’Brien and Yoshikawa, 2008). This research paper is novel and contributes to the existing knowledge in many ways. First, few studies are done to Pakistan (e.g. Rehman, 2016; Hasan et al, 2013; Ghafar and Khan, 2014). For example, Hasan et al, (2013) explored the impact of innovation types on firm performance of 150 manufacturing firms listed in Karachi Stock Exchange (KSE), but their study show limitation in terms of only few firms. Similarly, Rehman, (2016) identified the drivers of firm growth, by studied 69 software firms in Rawalpindi and Islamabad, he studied only specific region of Pakistan not at all. Previous studies conducted on only a specific region. Therefore, this study fills the gap of studying 1247 manufacturing firms at whole country level, by using the data of World Bank Enterprise survey. The remaining paper was organized as follow: in section 2 presents reviews of related research and develop our main hypothesis, section 3 indicates data and methodology, section 4 investigate empirical analysis and section 5 indicates conclusion and policy recommendations.

2. LITERATURE REVIEW

2.1. R&D and firm performance

Regarding the relationship between firm performance and R&D, in theoretical literature an important consensus was found is that R&D promote productivity growth. Currently, many theoretical and empirical researches have also investigated the relationship between R&D activities and productivity of firms (Kwun and Inue, 2003; Kem and Perk, 2003; Kaforos, 2005; Rogirs, 2006; Aw et al, 2011; Doraszilski and Jaomandreu, 2013). These researches found significant relationship between R&D and a firms productivity. Papedonogas and Voulogirates, (2005) analysed the determinants of labor productivity growth at firm level in Greek manufacturing firms. Analysing OLS regression model of a sample of 3035 firms and found that labor productivity is positively related to R&D the same result is found by Fullahiet al., (2011) in Iran manufacturing firms. Kwon and Inui (2003) applying the Cobb-Douglas production function on a sample of 3000 Japanese manufacturing firms and found that R&D has a positive statistically significant effect on firm’s laborproductivity. This findings is in line to the Wakelen (1997) examined a sample of 170 UK firms, using the Cobb-Douglas production function. She observed that a positive and statistically significant relationship between R&D and firms laborproductivity. Studies of Grileches and Maresse (1982) and Cuneo and Mairisse (1983), who done two comparative studies by estimating micro-level data and found significant nexus between R&D and laborproductivity of firms. In contrast, many empirical studies such as (Hoffman et al., 1998; Dundas, 2006) investigated that small firms are constrained to invested in R&D and can rely on networks with other research institutions for better performance. Based on the outcomes of Beeck and Kent (2006), the empirical findings of Schumpeter (1942) examined that SMEs having less resources (Low level R&D) and not more innovative than large firms. Previous studies indicate that R&D has a significantly effecting the firms labour productivity. For example many empirical researches examined that there exists a positive significantly association between R&D and firms laborproductivity (Loss and Versapagen, 1997; Olivera and Fortonato, 2005; Mancineli and Mazanti, 2007). From the above literature, it is shown that firms undertaking R&D enhancing their performance, we formulate first hypothesis:

Hypothesis 1: Firms undertaking R&D increases their performance than SMEs that do not undertake such activities.

2.2. Innovation and firm performance

Innovation has acknowledge as a significant driver of firm’s growth and productivity (Ganotakes, 2012; Slapiret al, 2011) and a leading force for international competition of industrialised countries (Kuhlmennand Edeler, 2003). 2Hall et al, (2009) studied Italian manufacturing sector regress productivity on innovation, they find out that both product and process innovation have a positive relationship with firm’s laborproductivity. Same findings are found by Griffith et al, (2006) through studied four European countries; France, Spain, Germany and UK. Their result supports the impact of innovation on productivity, the difference in the productivity associated to the degree of innovative activities. Study on Ukrainian manufacturing firms Vakhitova and Pavlenko (2010) discover that process innovation is significant impact on labor productivity of firms but product innovation has seemed to be insignificant effect on firm’s productivity. Damijanet al, (2008) examined the relationship between innovation and firm productivity, accounting firm-level innovation data of Slovenian firms in the period of 1996-2002. Using OLS estimates and found that innovation have a positive impact on firm productivity. Pters (2005) studied German data of 2001 and using the CDM model. Peter (2005) examined that product innovations increasing significant growth rate of firm labor productivity, but not the same effect has observed to process.

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2Product innovation is the introduction of new product/services or carrying of a significant progress in existing product/service (Polder, 2010). While process innovation means introducing the new production methods in existing production process (Polder, 2010).
innovations. The same finding is estimated by (Bauman and Kretikos, 2016) analysed German micro size firm level data and found that not like as process innovation, product innovation has a significantly influencing the firm’s labor productivity. Based on the theoretical and empirical research innovation has positive and significant effect on firm’s performance, we formulate second hypothesis. Hypothesis 2: Innovation (Product/Process) has positively associated with firm performance.

2.3. Absorptive capacity and firm performance

Knowledge and learning can have an important driver of firm’s labour productivity and obtain, share and absorbed new knowledge for the purpose to compete and increased themarkets that they have less or no prior experience (Auteo et al, 2000). In a similar study, Cohin and Levinthal (1989) present the concept of absorptive capacity and show that a firm to recognize absorb and utilize knowledge from the environment. Earlier, studies investigated that R&D create new knowledge and improve the firm absorptive capacity from the sp ill out of FDI (Sellero et al, 2013). Investments in insubstantial assets (i.e., knowledge based assets) for instant R&D, human capital, networks it will enhance the firm performance (Fabrizio, 2009). Okafo et al, (2016) analysed firm level panel data of Ghanian manufacturing firms during the periods between 1991 and 2002. They found that high levels of absorptive capacity of firms increases productivity growth from the contemporaneous and earlier use of imported goods, certainly for firms that operating in the input-intensive industries. Wiklend and Shepherd (2003) observed that knowledge related resources have directly positive impact on firm’s performance. Daruch (2005) also analyzed that firm’s having a knowledge base and having direct assets, so it will use their resources more efficiently, hence improving firm performance. This persuaded the research question as to whether absorptive capacity of manufacturing firms is higher and what have expected relationship with firm performance. Our third hypothesis seeks to confirm the absorptive capacity and firm performance connection that has been showed in prior theoretical and empirical studies. Hypothesis 3: Absorptive capacity has a positive impact on firm performance.

2.4. Age and Size of the firm and performance

Since the 1980 research has made cleared that firm’s age that is the time passed from the start up the firm, is the major independent variable of the firm productivity growth. For example, Yasuda, (2005) investigate the relationship between firm size, age and firm growth by studied a data of 14000 Japanese manufacturing firms. Their result indicates the firm age and size have a negatively relation with growth of firm. Evan (1987) studied panel data of US manufacturing firms and discovered the firm age and size have negatively impact on firm growth. Similarly, the same conclusion is obtained by Dunny and Hughes, (1994) in England by studying a data of 2000 manufacturing firms. Papadogonas and Voulgarides, (2005) analysed that firm size and age have negatively affected labor productivity growth. Coad et al, (2014) investigated firm level data of Sweden and found that improvement in the sales of young firms is more than for older firms. Older firms have slow growing, have less efficiency and less amount of R&D activities than young firms (Lodriri and Welchli, 2009). In contrast, Bbale and Nnyanzi, (2016) found that firm size has positive contributor to labor productivity growth. The similar results is obtained by (Liu, 2002; Becke et al, 2006). Similarly, in case of age, many researchers used learning-by-doing models like as (for example, Arrow, 1962; Sorinsen and Stuart, 2000; Changeet al, 2002) estimated and found that older firms can benefited from own large business experience, and continuously increases their growth than the younger one. In the study of Andersson and Reb (2003) observed that firm’s age negative associated to performance. Mengistea (1995) studies the Ethiopian manufacturing firms data and concluded the outcome that age of the firm has negative impact on firm growth. Moreover, Hansin (1992) regressed innovation on size and age of the firm and found that age negatively associated with firm sales growth. However, many empirical studies of Almus and Nerlinger, (2000) suggest that growth rate decreases with the firm size. Hypothesis four expects that size and age of the firm have a negative relationship with firm performance. Hypothesis 4: Firm size and age have negative relationship with firm performance.

2.5. Networking and firm performance

Based on the resource constraints and limitations of small to medium enterprises (SMEs), networking is a very useful business activity for increasing the business activities and gaining the competitive advantage (Gilmore). Gronumet al, (2012) analysed the sample of 1435 Australian SMEs observe the relationship between networking and firm’s performance. They concluded that networking positive and significantly related with firm productivity. Additionally, networking increases performance and small firm growth than the firms with no networks Havins and Seneseth (2001). Firms using new developed technology generating by cooperation with other firms for future market demand and for sharing the risk (MiotiandSachweld, 2003). The study of Child et al, (2005) networking diminishes risk and provides flexible capability and pace, and also provides entrance to resources, knowledge and skill which is not posses by the firm alone. Furthermore, Husain (2000) observed that small firm’s link among themselves (horizontal link) and links with large firms (vertical link).

\[\text{According to Ford et al (2003) Networking is an association of social interactions between organizations.}\]
may improve their market sharing, and increase their technological development and investment on them. Therefore, earlier studies have the evidence that networking should facilitate SMEs to solve the insufficient accessibility of finance (Hewett-Dundes, 2006) and share out the fixed cost with another, associated with such risky projects (Bosum and Fernández-Ribas, 2008). Thus I propose a positive association between networking and firm performance. Hypothesis 5: Networking is positively associated with firm performance.

2.6. Exports and firm’s performance

Many research studies have explained the relationship between exporting and productivity (Hansin and Lunden, 2004; Haehn, 2005) such as, Aw et al. (2009) examined the data of Taiwanese electronics industry at firm level by applying Dynamic structural model and found that exporting improving firm productivity. Baldwen and Gu (2004) examined Canadian’s manufacturing firms and observe that exports have positive effect on labor productivity through by learning effect. Bernard and Jenson (2003) studied US manufacturing sector and investigated that exporting firms have higher labor productivity and it let the firm to come into exporting. Exports transfer the resources from less productive firms to more productive firms Bernard and Jenson (2004). Additionally, Hanson and Lunden (2004) observed Swedish manufacturing firms empirical that firm’s exporting further enhances their productivity. Hansson and Lunden (2004) they described that firms exporting have more productivity than non-exporting. Head and Reis (2003) investigated Japanese manufacturing firms and indicated that firm has export overseas and investment are more productive than firms initially export. Yasir et al. (2006) examined data of Turkey’s manufacturing firms by investigated quartile and found that exporting positive impact on labor productivity. Although the firms exporting continuously have higher productivity. In additionally, Besebroeck (2003) investigating the relationship between firms export and their impact on productivity, of a panel of manufacturing firms of nine Sub-Saharan African countries. Besebroeck (2003) found that exporting firms are larger productivity than non-exporting firms. Delgaudet et al. (2002) analyzed a sample of 10,595 Spanish manufacturing plants and found evidence that exporting of firms have positive associated with firm’s labor productivity. Based on these literatures it is indicated that exporting has a positive relationship with firm performance. Our Sixth hypothesis is: Hypothesis 6: Exports has a positive impact on firm performance

3. METHODOLOGY

3.1. Data

Data for this study were drawn from “World Bank Enterprise Survey” conducted by Pakistan Bureau of Statistics and Nielsen Pakistan (Lahore) in Pakistan in 2014. The aim of Enterprise Survey is to obtain an understanding of what firms experience in the private sector. The data set of Pakistan contains information on 1247 manufacturing firms which shows stratified random sampling, stratified by geographic region, firm size and sector. The data were collected through intensive interviews with owners and managers of firms. The data set thus provide key information of our interested variables, such as R&D, innovation (Product and Process Innovation), absorptive capacity, age and size of the firm, networking, exports and firm’s labor productivity measured by (total sales/total employees in 2014). However, the survey data has certain limitations because present study use cross-sectional data which is unenough to find the causal relationship between the concerned variables i.e. R&D and labor productivity. Additionally, for financial measurement no information of return on assets and firm profitability was found. STATA 14 software was used for analysis. Dependent variable In this paper the dependent variable is labor productivity that is used by earlier researchers (Bbale and Nnyanzi, 2016; Rehman, 2015; Fallahiet al, 2011; Papadogonas and Voulgaries, 2005) in Uganda manufacturing firms, in Islamabad/ Rawalpindi software firms, in Iran manufacturing firms and in Greek manufacturing firms. Independent Variables. This paper has used five variables such as R&D, innovation (i.e. product/process innovation), absorptive capacity, networking and exports to determine the labor productivity at firm level.

3.2. Model

This paper is investigating the determinants of labor productivity as a dependent variable. Since our study focus is to isolate the effects of R&D on labor productivity and to compare our result with previous studies that examine the impact of R&D on labor productivity as measured by (Fallahiet al, 2011; Papadogonas and Voulgaries, 2005). This study issuing the model that is similar to the model of (Fallahiet al, 2011; Papadogonas and Voulgaries, 2005) that is designate to examine the factors that affecting the labor productivity in Iran and Greece manufacturing firms. Ln Labor productivity: \( \beta_0 + \beta_1 \text{R&D} + \beta_2 \text{product innovation} + \beta_3 \text{process innovation} + \beta_4 \text{absorptive capacity} + \beta_5 \text{size} + \beta_6 \text{age} + \beta_7 \text{networking} + \beta_8 \text{exports} + \mu \ldots \ldots \ldots (1) \)

The definition of above variables in the model is shown in the following table 1. Table 1 also shows the mean and standard deviations of the variables used in regression.
Table 1. Definition and descriptive statistics of variables

<table>
<thead>
<tr>
<th>Name of variable</th>
<th>n</th>
<th>Definition</th>
<th>Mean</th>
<th>Std.dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labor productivity</td>
<td>1247</td>
<td>Measured as ratio of firm level total sales to total employees taking log in 2014.</td>
<td>5.92</td>
<td>0.958</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>1247</td>
<td>Dummy variable taking the value 1 if firm spend on R&amp;D either in-house or contracted with other companies</td>
<td>0.16</td>
<td>0.371</td>
</tr>
<tr>
<td>Product Innovation</td>
<td>1247</td>
<td>Dummy variable taking the value 1 if firm introduce new improved products/services, 0 otherwise</td>
<td>0.30</td>
<td>0.458</td>
</tr>
<tr>
<td>Process Innovation</td>
<td>1247</td>
<td>Dummy variable taking the value 1 if firm introduce new improved processes (production/supplying), 0 otherwise</td>
<td>0.26</td>
<td>0.437</td>
</tr>
<tr>
<td>Absorptive capacity</td>
<td>1247</td>
<td>Measuring Employees knowledge</td>
<td>0.46</td>
<td>0.498</td>
</tr>
<tr>
<td>Log age</td>
<td>1247</td>
<td>Log (2014 minus year of firm begin operation)</td>
<td>2.98</td>
<td>0.618</td>
</tr>
<tr>
<td>Log size</td>
<td>1247</td>
<td>Log(total employees in 2014)</td>
<td>24</td>
<td>0.658</td>
</tr>
<tr>
<td>Networking</td>
<td>1247</td>
<td>Dummy variable taking the value 1 if firm cooperate with other firms and institutions, 0 otherwise</td>
<td>0.25</td>
<td>0.435</td>
</tr>
<tr>
<td>Log exports</td>
<td>1247</td>
<td>Log(direct and indirect exports in 2014)</td>
<td>2.64</td>
<td>0.85</td>
</tr>
</tbody>
</table>

4. EMPIRICAL RESULTS

Since we are applying OLS regression, they are some aspects like multicollinearity that are to be considered when running regression. Table 2 shows the correlation matrix of variables. And we discover the Pearson Correlation of the variables, to see whether the variables correlation greater than 0.80 or 80%. If it is greater than 0.80 then we have Multicollinearity. Multicollinearity is the problem resulting when some or all of the independent variables are moderately or highly correlated with each other and it is hard to tell which variable is influencing the predicted variable (Koop, 2004). Overall, no variables showed multicollinearity. And this suggests no multicollinearity exist in the variables of our model. In case of multicollinearity R2 value are high, insignificant t-values, large variances and co-variables thus making precise estimation difficult. Furthermore, the firm’s financial information i.e. exports and productivity has been changed into international currency (US$). The average exchange rate has been calculated i.e. US$ 1 = 104 PKR in the year 2014.

Table 2. present the correlation matrix of variables

<table>
<thead>
<tr>
<th></th>
<th>LP</th>
<th>R&amp;D</th>
<th>Prodc.in</th>
<th>Process.in</th>
<th>Absor.cpct</th>
<th>Age</th>
<th>Size</th>
<th>Networking</th>
<th>Exports</th>
</tr>
</thead>
<tbody>
<tr>
<td>LP</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R&amp;D</td>
<td>-0.005</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prodc.in</td>
<td>0.018</td>
<td>0.366</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Process.in</td>
<td>0.070</td>
<td>0.497</td>
<td>0.629</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absor.cpct</td>
<td>0.053</td>
<td>0.252</td>
<td>0.303</td>
<td>0.336</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>0.099</td>
<td>0.104</td>
<td>0.167</td>
<td>0.137</td>
<td>0.131</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Size</td>
<td>-0.023</td>
<td>0.134</td>
<td>0.195</td>
<td>0.193</td>
<td>0.467</td>
<td>0.259</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Networking</td>
<td>0.031</td>
<td>0.212</td>
<td>0.235</td>
<td>0.278</td>
<td>0.620</td>
<td>0.055</td>
<td>0.378</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Exports</td>
<td>0.042</td>
<td>0.006</td>
<td>0.057</td>
<td>0.150</td>
<td>0.182</td>
<td>0.093</td>
<td>0.045</td>
<td>0.182</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: LP indicates labor productivity, Prodc.in indicates product innovation, Process.in indicates process innovation, Absor.cpct indicates absorptive capacity.

4.2. OLS Result

Table 3. Dependent variable Log Labor productivity in 2014

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficients</th>
<th>t-values</th>
</tr>
</thead>
<tbody>
<tr>
<td>R&amp;D</td>
<td>-0.100</td>
<td>-0.850</td>
</tr>
<tr>
<td></td>
<td>(0.118)</td>
<td></td>
</tr>
<tr>
<td>Product innovation</td>
<td>-0.112</td>
<td>0.36</td>
</tr>
<tr>
<td></td>
<td>(0.123)</td>
<td></td>
</tr>
<tr>
<td>Process innovation</td>
<td>0.219</td>
<td>1.66</td>
</tr>
<tr>
<td></td>
<td>(0.132)</td>
<td></td>
</tr>
<tr>
<td>Absorptive capacity</td>
<td>0.461*</td>
<td>3.52</td>
</tr>
<tr>
<td></td>
<td>(0.207)</td>
<td></td>
</tr>
<tr>
<td>Log age</td>
<td>0.181**</td>
<td>2.52</td>
</tr>
<tr>
<td></td>
<td>(0.149)</td>
<td></td>
</tr>
<tr>
<td>Log size</td>
<td>-0.129</td>
<td>-1.744</td>
</tr>
<tr>
<td></td>
<td>(2.074)</td>
<td></td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Networking</th>
<th>0.362**</th>
<th>2.356</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log exports</td>
<td>0.095*</td>
<td>4.431</td>
</tr>
<tr>
<td>Constant</td>
<td>5.509***</td>
<td>23.604</td>
</tr>
</tbody>
</table>

N=1247  R-squared= 0.7305.  Ramsey retest value F (3, 174)= 1.98  prob> 0.04. Robust std errors in parenthesis

Table 3 illustrate the regression model for which most of the independent variables has significant relationships with labor productivity. The value of R-squared is 0.7305 that indicate that 73% variation explained in labor productivity by the explanatory variables. This shows that our model is best fitted. The value of Ramsey reset test accept null hypothesis and indicate that our model is satisfied with no misspecification errors in functional form. In contrast, to prior expectation the coefficient of R&D is negative and insignificant, negative coefficient shows that every percent change in R&D will cause 0.10 percent decrease in labor productivity. This result rejects our hypothesis that R&D has a positive relationship with labor productivity based on the earlier and similar to the finding of (Vega-Jurado et al. 2014). This implies that R&D has a risky project and Pakistani SMEs are small in terms of assets may be constrained by their internal finance and they face a large fixed cost when investing in the knowledge base assets (R&D). Production innovation negative coefficient shows negative effect of Production innovation on labor productivity in firm and rejects our prior expectation. This suggest that Pakistani manufacturing SMEs are constrained in terms of financial resources and prevent to spend on R&D due to large costs and risks related with innovation efforts that results labor productivity decreases. In contrast, confirming the initial hypothesis, coefficient of process innovation is positive and slightly significant which indicates that firm introduce new improved production process that results increases labor productivity. This finding suggests that one percent increase in process innovation raises labor productivity by 21%. Although, the coefficient of process innovation is lower and indicates minor effect of them on firm’s labor productivity. This result is similar to the finding of (Hall et al, 2009).

Coefficient of absorptive capacity is positive and significant that indicates firm’s absorptive capacity rise by 100% increases labor productivity by 46%. This This result accept our initial hypotheses and in line with result of (Okafore et al, 2016). Over this entire outcome suggests that these Pakistani SMEs have higher abilities to internalize external knowledge. The result of Age indicates a positive and significant impact on labor productivity. This implies that most of the Pakistani SMEs in the sample are older age. Result suggest that older firms are more productive than younger firms and confirm our hypothesis and within line of (Sorensen and Stuart, 2000; Change et al., 2002) empirically find that Older firms might benefit from their larger business experience, and have a higher degree of growth persistence than younger firms. In addition, confirming our initial hypothesis the coefficient of size of firm is slightly significant and infect it is negatively associated with firm’s labor productivity is not same to the economic theory, while the same results is also found in other empirical studies in Greek manufacturing firms (Papadogonas and Voulgaries, 2005) as well as in Pakistani software firms (Rehman, 2015). This negative relationship implies that small firms improve their relative labor productivity as time goes by. Additionally small firms are more elastic in making decision and have higher efficiency level. The coefficient of networking is positive and significant effect on labor productivity. This means that networking increases the labor productivity by 36%. This suggests that networking increase the access to new idea and knowledge that is obtains from other institutions and hence improves the labor productivity of SMEs. This result support our hypothesis and confirm the results found in the literature that firm networking is a positive impact on the firm’s labor productivity (Gronumet al., 2012). Coefficient of exports has a positive and significant impact on labor productivity, implies that firm’s export to international market rises by 100% as increased labor productivity by 9%. This outcome implies that the exhibition to the international competition enforce firms to improved their efficiency so as to decrease the cost, achieved competitive prices and new business development in technology improvement. Based on this exporting increases firm labor productivity and support our hypothesis. These result also confirm earlier finding, including those by (Hamsson and Lundin, 2004; Biesebroeck, 2003).

5. CONCLUSION

This study has investigated the determinants of firm performance in Pakistani manufacturing firms and the results that are consistent with expectations are is follow: R&D has a negative impact on labor productivity. This implies that R&D has a risky project and Pakistani SMEs are small in terms of assets may be constrained by their internal finance and they face a large fixed cost when investing in the knowledge base assets (R&D). Considering the positive impact of process innovation on labor productivity, it implies that firm introduce new improved production process that results on increases the labor productivity and networking have positive impact on productivity also. This study confirm that productive efficiency is acquired through learning and innovating new activities through the activities that support each other. This study found a positive impact of the age of firm on productivity that means new firms are better than old firm in productivity and this may be due to old firm is face problems in learning and innovation. Generally, this study finds that firm productivity is affected by the learning and innovation capacity of the firm and that these determinants are different from each other in the Pakistani manufacturing context. The findings of this study provide insights for policymakers, managers, and researchers on how to improve productivity in Pakistani manufacturing firms. A few limitations are acknowledged in this study that future researchers could address in future studies. These limitations include the cross-sectional nature of the data and the use of self-reported data. Future studies could use longitudinal data to analyze the impact of the determinants of productivity over time. Additionally, future studies could consider other factors that may affect productivity, such as the quality of management and the technological infrastructure. Finally, future studies could consider the impact of productivity on other outcomes, such as profitability and growth.

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*Ramsey reset test used for linear regression models whether non-linear combinations of the fitted values help explains the dependent variable. The perception behind the test is that if non-linear combinations of the explanatory variables have any power in explaining the dependent variable, the model is miss-specified.

*When firm obtain benefits from such innovative activity so he decrease spending on R&D and that productivity recovers. For this phenomenon required date on deferent time periods to investigate the relationship between R&D and labor productivity, which is limitation of our study and suggest for future research.
productivity. In contrast, Product innovation has a negative effect on labor productivity in firm and this suggest that Pakistani manufacturing SMEs are constrained in terms of financial resources and prevent to spend on R&D due to large costs and risks related with innovation efforts that results labor productivity decreases. Absorptive capacity has a positive effect on firms labor productivity, this shows that Pakistani SMEs have higher abilities to internalize external knowledge. Coefficient of Age indicates a positive and significant impact on labor productivity. This implies that older firms are more productive than younger firms. Size of firm is negatively associated with labor productivity; it implies that small firms improving their relative labor productivity as time goes by. Similarly, networking can positively affected the labor productivity, it means that networking create new ideas and brings new knowledge in the firms. Exports has positive relationship with labor productivity, implies that the exhibition to the international competition enforce firms to improve their efficiency to lower the cost, attain competitive prices and new business development in technology improvement.

5.2. Policy Implication

The aim of this study was to investigate the impact of determinants on labor productivity in manufacturing SMEs of Pakistan. R&D, Product and Process innovation, absorptive capacity, age, size, networking and exports suggest that firm investing in innovation and new technology have higher labor productivity. This implies that policy makers in Pakistan should give incentives to manufacturing firms to modernize their plants through high-tech innovative investments as to maintain productivity growth and to create more jobs. Another implication of this paper is that small size of Pakistani firms is not contributing to undertake the above activities, the government should give incentives to establish cooperation of small and medium size firms with universities and research institutions. Moreover, the Pakistani government should used global networks to assimilate and absorb sustainable and profitable trade opportunities for the Pakistan-manufacturing firms.

5.3. Limitation and Future Research

Cross sectional data is not conductive for analysis to capture the long run relationship between R&D and labor productivity. Perceptual measurements based on responses to questionnaire and individual responses are limited due to familiar method bias and cannot be completely excluded. The empirical results of this study are based on cross-sectional data where the causal relationships among the variables cannot be measured. In the same way, for financial measure no information was found on assets returns and firm profitability. Suggestion for future research is to use a two stage least square (2SLS) model to study the causal relationship between R&D, exports and labor productivity for Pakistan.

REFERENCES


