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Innovation and firm performance in developing countries: The case of Pakistani textile and apparel manufacturers☆

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ABSTRACT

Using unique innovation survey data collected from a homogenous sample of firms in Pakistan, this paper presents an analysis of the firm level determinants of product innovation and its impact on firm performance. We employ a multi-stage structural model linking the decision of a firm to innovate, its innovation investment, product innovation, and firm performance using primary data from the textile and wearing apparel sector, which is the largest export sector of Pakistan. We find that product innovation leads to increased labor productivity as well as higher labor productivity growth. A 10 percent increase in innovative sales per worker is associated with a greater than 10 percent increase in labor productivity and labor productivity growth. On the determinants of innovation, we find that vertical knowledge flows from foreign clients and suppliers are important determinants of a firm's decision to innovate. Larger firms are more likely to engage in innovation, however, there is no significant evidence that they invest more in innovation. Exporting is positively associated with innovation performance and firms exporting to Europe and America are more likely to engage in innovation. There is mixed evidence on the impact of competition: foreign competition adversely affects a firm's decision to innovate, whereas, local competition increases investment in innovation. Subsidies seem to have a crowding out effect since firms receiving national subsides invest less in innovation. Furthermore, firms that have higher investment in innovation, that are more productive, and that introduce organizational innovations have higher innovative sales per worker.

1. Introduction

The availability of firm level data and recent developments in economic growth theory highlight the importance of innovation for sustained output and productivity growth. In recent years, firm level survey based data on innovation, especially, from various waves of the harmonized Community Innovation Surveys (CIS) in Europe, has helped in advancing our understanding of innovation processes, strategies, mechanisms and their impact on firm performance. Consequently, a growing body of literature has evaluated the impact of innovation on firm performance. A large number of these studies report a positive impact of technological innovation on labor productivity (Crépon et al., 1998; Lööf et al., 2003; Janz et al., 2004; Criscuolo, 2009; Mairesse et al., 2012; Hashi and Stojcic, 2013), profitability (Jefferson et al., 2006; Lööf and Heshmati, 2006), firm growth (Coad and Rao, 2008), openness (Kleinknecht and Oostendorp, 2002; Lachenmaier and Woessmann, 2006) and other firm level outcomes.[1]

In the wake of an extraordinary increase in access to information and new markets in recent years (primarily due to advances in information technology and globalization), firms in developing countries are experiencing a constantly changing landscape in the market for their products. This on one hand is providing much needed knowledge flows into developing economies, while also forcing firms to improve their competitiveness on the other. In such a situation, one would expect firms (especially those which export) to invest in new technology and also introduce new and improved products in their markets. However, our understanding of innovation and its economic impact is still limited when it comes to developing countries; most mainstream economists tend to assume that openness and easy access to foreign technology is all that matters in improving firms' productivity in the

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[1] See Mohnen and Hall (2013), Hall (2011), and Mairesse and Mohnen (2010) for a detailed review of the literature.

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context of developing countries (Chudnovsky et al., 2006). Of course much of this lack of depth could be attributed to the limited availability of detailed firm level data on innovation processes in developing countries.

The main purpose of this paper is to contribute to the thin developing country literature by using firm level data from a key export oriented manufacturing sector (textiles and apparel) in Pakistan. The contribution of this paper is twofold: first, by using the primary data from a manufacturing sector of a developing country, the paper contributes to the understanding of firm level innovation outcomes in developing countries and their implications for firm performance. Second, the paper builds on a multi-stage structural model proposed by Crépon et al. (1998) by extending the model in two important aspects by taking into account the fact that: (i) a firm's decision to engage in innovation activities and committing resources to them depends on the competitive environment of the sector, and (ii) the innovative firms follow multiple innovation strategies to maximize their innovation related outcomes. In order to cater for the role of competition, we introduce competition variables (local and foreign) signaling the extent of local and foreign competition in the decision to innovate and innovation investment intensity equations. We also incorporate the role of non-technological innovations in the implementation of product innovations by including organizational and marketing innovation in the knowledge production and labor productivity equations (see Hashi and Stojcic, 2013). We believe that by focusing on two very similar sub-sectors (textiles and apparels), we get greater homogeneity in the types of product innovation and the propensity of firms to substitute their existing products. This enables us to get more accurate estimates of innovative sales per worker as well as labor productivity.

In the case of Pakistan, like that of many developing countries, there is no firm level innovation data available. In 2015, we conducted a survey of a representative random sample of 614 manufacturers of textiles and apparels in twelve different districts across Pakistan to understand the innovation system and processes of these two sectors. The choice of the textile sector in Pakistan is based on the very nature of the sector and its significance in the local economy: Textiles have the longest production chain, with inherent potential for value addition at each stage of processing, from cotton to ginning, spinning, fabric production, dyeing and finishing, made-ups and garments. Additionally, textiles are one of the very few success stories (probably the only) of the manufacturing sector in Pakistan. The sector contributes approximately one-fourth of the industrial value added, is very labor intensive and employs around 40 percent of the industrial labor force. The textile sector in Pakistan is also very export oriented and has consistently been one of the main sources of foreign exchange earnings. On average it constitutes 55–60 percent of national exports.[2] Apart from a large domestic market, especially in the high thread count plain weave cloth used in Pakistani clothing, the textile sector also competes in international markets.

Our survey results find that firms in these two sectors are engaged in a variety of innovation activities. They invest resources in innovation, and they introduce both technological as well as non-technological innovations. The total amount of investment on innovation in the surveyed firms was around 9 percent of their total turnover in 2015. A number of firms report investing in internal as well as external R&D, but investing in R&D is not the most dominant innovation activity. Rather, the acquisition of machinery (mainly in the form of imported capital) seems to be the dominant innovation activity and our data shows that more than half of the innovation investment was in the form of acquisition of machinery, hardware and software. Around one-third of total investment was in R&D (both internal and external), and around 13 percent of investment on innovation was related to the training of workers. There are noticeable differences in investment behavior among firms: Firms exporting to Europe invested more than firms with any other sales market. Firms located in the export oriented city of Sialkot[3] had exceptionally high levels of investment in innovation. Overall, surveyed firms in Sialkot spent 27 percent of their turnover in 2015 on innovation. In terms of other firm characteristics, the medium sized firms and manufacturers of apparel spent more on innovations (around 18 and 22 percent of turnover in 2015, respectively).

Apart from investing in innovations, firms were also very active in introducing technological as well as non-technological innovations. Overall, 56 percent of the surveyed enterprises introduced either technological or/and non-technological innovations during the three years, 2013-15. Forty eight percent of enterprises introduced technological innovations (new products and/or new processes) while thirty one percent of enterprises introduced new or significantly improved products in their market. In terms of their degree of novelty, the majority of these innovative products were incremental in nature. Seventy nine percent of these innovative products were only new to the firm, 21 percent of the products were new to the firm's market, and 2.6 percent of products were first in the world.

Firms were also asked about the sources of knowledge spillovers and their significance in the firm's decision to introduce technological innovations. One of the interesting deviations from the existing literature found in our analysis is that surveyed firms do not consider universities and public research institutions as highly important sources of information and cooperation. In fact, only 3 percent (2 percent) of firms consider universities (public research institutions) as important sources of information and cooperation. Firms rank market sources, especially clients and suppliers as the most important source of information and cooperation. There were also noticeable differences within clients and suppliers: foreign clients and foreign suppliers were highly ranked when firm were asked about important sources of information and cooperation.

A number of interesting issues arise from our survey that we try to address in this paper. First, which factors affect a firm's decision to engage in innovation? Which attributes of a firm (size, age, type, main market, export intensity, competition, sources of information and cooperation for innovation, etc.) make it more liable to invest in innovation? Do these or a different set of attributes determine the amount a firm decides to invest in innovation? Second, do the firms that invest in innovation experience higher commercial success—a higher percentage of turnover from these innovations? And which attributes affect the commercial success of these innovations? Third, do the firms with higher innovation rates and higher commercial success of innovations also perform better? We analyze these issues in a multi-stage structural model and we find that there are substantial rewards for product innovators in the Pakistani textile and apparel sector.

The remainder of the paper is organized as follows: we begin by a review of the literature. We then discuss our data and present some descriptive statistics in Section 3. In Section 4, we present our model and define the variables. In Section 5, we present our results and in Section 6, we compare our results to those found in the previous literature. In Section 7, we conclude.

2. Review of literature

2.1. Link between innovation and productivity

There are two widely used approaches to measuring innovation in empirical studies. The first approach uses patents as a proxy for innovation output where a patent is defined as a formal means of protecting intellectual property rights associated with invention. However,

[2] Economic Survey of Pakistan 2015–2016.

[3] The city of Sialkot is known for its entrepreneurial skills and is hub of two other export oriented clusters, i.e. sports goods manufacturers and surgical instruments manufacturers.