Drivers of manufacturing firm’s productivity in Germany and Poland: evidence from survey data

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Abstract. The main motivation behind this study is to analyse drivers of labour productivity: innovation, internationalization and human capital in manufacturing enterprises. Using data from the Management, Organisation and Innovation (MOI) Survey 2009 for a representative sample of 218 firms from Germany and 103 firms from Poland we present empirical results as a comparative study. The principal finding that emerged from the study is that patterns in internationalization and firm innovative activities are similar in both countries. However, output of innovation and productivity are significantly higher in German sample. The results of the investigation extend publications on firm-level productivity and innovation European countries based on survey data.

Keywords: innovation, productivity, German and Polish manufacturing industries

JEL Codes: L60, O31.

1. Introduction

Nowadays, firms face rapid changes of environment caused by globalization, appearance of new competitors and diversification of demand. It is a key issue to find a path to increase their productivity and to compete effectively in regional and global markets, adapt the structure to global-knowledge competition and develop new goods and services that respond to changing domestic and international demand. Though, the priority is to maintain and improve ability of firms to innovate and compete. Firms to remain competitive on the market have a need to improve research and innovative effort, the development of human capital through education, and develop new organizational strategies.

Although the transition of Eastern European countries from centrally planned economy to market driven system occurred more than two decades ago and now those countries participates in the global economic community, publications on firm-level innovation in transition economies based on survey data are sparse (Roztocki and Weistroffer, 2011). The closed economies blocked international linkages that impact on innovation, including knowledge spillovers and technology adoption. The characteristic of the command economic system resulted in low competitiveness and technological obsolescence (Winiecki, 2004). Consequently, flow of the knowledge between science and industry is weak and there are difficulties in diffusion of existing results to business use. It is mostly due to the heritage of anti-innovation bias from the command economy system when all applications of research and development (R&D) were controlled by

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state and due to insufficient financial support. For Eastern European countries one of the main issues of productivity improvement and competitiveness is innovativeness. Innovations stimulate the economic growth of countries and thus enable to catch up with developed market economies. However, in response to the introduction of market institutions and market rules in the 1990s, firms faced increased competition, had to modify their innovation behaviour and also new economic networks among firms developed rapidly.

Therefore, in this paper we provide preliminary analysis of manufacturing enterprises in Poland and Germany, as a benchmark of more advanced economy. Poland is the most important country from former communist states with rapidly growing economy and the increasing influence in the European Union. Poland managed to maintain positive growth during the crisis, so as being the only EU country not to have experienced a recession in the last twenty years. The main motivation behind this study is to compare German and Polish manufacturing enterprises: Firstly, to characterize German and Polish manufacturing enterprises including their economic performance. Secondly, to analyse differences in drivers of productivity: innovation, internationalization and human capital. The main questions underpinning the research are: 1) What are the differences between German and Polish manufacturing enterprises? 2) How huge is the gap in main productivity drivers (innovation, internationalization and human capital) between German and Polish firms?

The reminder of this paper is organised as follows. Section 2 presents data and sample design. Section 3 describes general characteristics of the firms and their performance. Section 4 reports the empirical findings on firm productivity drivers, and section 4 provides conclusions and policy implications based on those findings.

2. Data

This paper’s empirical descriptive analysis is based on data from Management, Organisation and Innovation (MOI) Survey 2009, a joint initiative of the European Bank for Reconstruction and Development (EBRD) and the World Bank Group (the World Bank). The MOI survey was undertaken for the first time in 2008-2009, covering 1870 manufacturing establishments with between 50 and 5000 employees from 10 Eastern European countries: Belarus, Bulgaria, Kazakhstan, Lithuania, Poland, Romania, Russia, Serbia, Ukraine, Uzbekistan, and Germany as a developed country benchmark and India as a developing country benchmark. MOI interviews were conducted face-to-face with interviewers recruited by local survey companies and took place between October 2008 and April 2010. The interviews were conducted with managers and endured on average 50 minutes. The response rate was 44 percent. The questionnaire comprised seven sections organised by topic. Initially questions were posed about the characteristics of the firm, such as legal status, ownership and number of years in operation. This was followed by sections on management practices, organisation of the firm, innovation and R&D, degree of competition and labour. The MOI questionnaire was developed and tested in two pilot surveys prior to its implementation in the field. Two main objectives of the sample is measure and compare management practices across the countries and to conduct firm performance analysis focusing on determining how management practises affect productivity and job creation in manufacturing. MOI survey was used to determine if quality of management practices is positively associated with various measures of firm performance in Eastern European countries (Bloom et al., 2012; Schweiger and Friebel, 2013). The Survey uses a standardized survey instrument and a uniform sampling methodology to minimize measurement error and generate a sample representative of the manufacturing sectors in each country. Data are comparable across the countries and the sample seize is large enough to conduct statistically robust analysis with levels of precision at minimum 7.5% precision for 90% confidence intervals (EBRD and World Bank, 2008).
Data from the MOI survey was complemented by firm performance data (balance sheets and income and loss statement) from Bureau van Dijk’s Orbis database. Given that the output variables from Bureau van Dijk’s Orbis database are not available for all countries and also for all firms in the country, we run the risk that results are driven by the specific country. Performance data: the operating revenue, profit margin, EBITDA margin, ROTA margin and spending on research and development activities are winsored at 1% to limit the impact of outliers on the result (this means that all the data below the 0.5th percentile are set to the 0.5th percentile and all the data above the 99.5th percentile are set to the 99.5th percentile as in Bloom et al. (2012)).

3. Empirical findings

3.1. General characteristics and firm performance

For the present study, we have included 218 firms from Germany and 103 firms from Poland. In Polish and German sample we observe similar distribution of enterprises regarding the technology intensity of industry in which firms operate. Those firms operate mainly in low technology industries 34% of firms in both countries mainly producing wood, pulp, paper, printing and publishing industries and in food products, beverages and tobacco. Furthermore, 25% of German and 30% of Polish firms operate in medium-low technology industries, mainly producing basic metals and fabricated metal products. In Germany more firms are medium-high technology intensive 32% and in Poland 27% in both countries producing mainly machinery and equipment. Lastly, 9% of companies in both sub-samples operate in high technology industries in Poland mainly producing pharmaceuticals and in Germany manufacturing medical, precision and optical instruments.

Regarding the size of firms based on the number of employees, firms form the sample in Germany and in Poland slightly differ. In Poland 47% of firms are large, 50% medium-sized (between 50 and 250 employees), 3% are small firms and have on average 399 workers. In Germany there are more medium-sized firms 62%, 36% large firms, 2% of small firms and have on average 310 workers. Those companies are mainly firms on they own 66% and 57% in Poland and in Germany respectively. The remaining firms are a part of a bigger firm. Comparing distribution of the firms by the legal status in both countries, firms are mainly share-holding companies, with distinction for those which are traded in the stock market 20% and 12% and with shares traded privately 68% and 76% in Poland and in Germany respectively. Firm ownership
is presented on figure 1a. In Poland 11% of the firms are still state owned, 29% were state owned in the past and 60% were not state owned. In Germany 95% were not owned by state. The ownership of the single largest block in the firm differs. In Germany 44% of firms are family owned, followed by individual ownership 21%, where in Poland most popular is that firm have multiple owners 32% and than individual ownership 26%. Taking into consideration full-time top and middle managers we observe gender gap. In Poland only 32% of managers are female and in Germany 42% of managers.

In addition, we have compared firm performance indicators profit margin, EBITDA margin, ROTA margin (figure 1b), operating revenue and productivity (figure 1c). Profit margin is a ratio of profitability calculated as operating and financial profit divided by total operating revenue. Profit margin is very useful when comparing companies in similar industries. Polish firms on average have a higher profit margin, what indicates that have better control over its costs compared to German firms. EBITDA margin is a measurement of a company’s operating profitability. It is equal to earnings before interest, tax, depreciation and amortization (EBITDA) divided by total revenue. EBITDA margin can provide an investor with a cleaner view of a company’s core profitability. On average Polish firms have higher EBITDA margin scores. Moreover, ROTA margin defined as earnings before interest and taxes (EBIT) over total assets indicates how efficiently the company is using its assets to generate earnings before contractual obligations must be paid. German firms have greater a company’s earnings in proportion to its assets, that means they are using assets more effectively than Polish enterprises. Lastly, we compared operating revenue, which is income derived from sources related to a company’s everyday business operations. The operating revenue in 2008 expressed in millions of dollars on average is more than two times higher in German than Polish manufacturing enterprises form the sample (figure 1c). In addition, we compared firm productivity which is approximated by the operating revenue in 2008 divided by the number of full-time employees (figure 1c). The MOI survey data show that Polish companies have more than six times lower firm productivity than German.

3.2. Innovation

Nowadays, knowledge is the resource and the commodity of knowledge economy, which explains the progress in productivity (Castells, 2011). In-house research and development is needed for understanding and absorption of knowledge developed internationally, for improvement of local R&D skills and active participation in international R&D networks. Innovation begins with firm’s formal and informal R&D effects. There is empirical evidence that knowledge and subsequently innovation lead to improvement of firm productivity. Innovation can boost productivity in two ways, by firms investing in R&D themselves and reaping the benefits from new or improved products and processes, or by spillovers from creators of knowledge to other firms to compete. Studies have shown that both these processes – R&D investment and the use of external knowledge – influence the ability of firms to innovate (Criscuolo et al., 2010). International sales and innovation have been shown to be associated with superior productivity (Harris and Li, 2009). R&D activity is generally conceptualized as an input to the innovation process and can have substantial influence on the innovation performance of firms. In addition, R&D and ICT are both strongly associated with innovation and productivity, with ICT investment being more important for productivity (Hall et al., 2013). Moreover, management of innovation includes the use of available resources to generate novel methods to address organizational and marketing aspects of firm’s activities (Birkinshaw et al., 2008). Hence innovation comprises both technological and non-technological aspects which are not mutually exclusive. Some other aspects are interconnected with innovation, for example: changes of work training, improvement of human capital, organizational change in business practices in workplace or in external relations.
Figure 2 presents comparison of aspects of innovation considered in the MOI survey. Firstly, 55% of German and Polish companies have invested in R&D activities, either in-house or contracted with other companies (outsourced). However, on average German manufacturing firms had almost three times higher R&D expenditures (3.36 million dollars compared to 1.2 million dollars in Poland). Furthermore, outsourcing is a possible way of acquiring better quality inputs or parts than firms which produce on their own. In both countries half of firms outsourced production to other companies and 37% of Polish firms and 34% of German firms outsourced production to other countries. Moreover, profitable application of the newly created knowledge is crucial. Development of new products or services is a prime source for gaining position in the market and competitive pressure is an incentive for firms to innovate and raise productivity. Around 82% of Polish and German establishment have introduced new product or services three years. Those new products or services have generated 27% and 22% of sales in Poland and in Germany respectively. Regarding information and communication technologies (ICT) indicator in German manufacturing firms on average 41% of employees regularly uses personal computers for their job, when in Poland it is 31%. Lastly, we compared patents as a measure of the output of innovation, which is associated with higher levels of productivity. Germany have better output 42% of companies registered patents abroad, when in Poland only 10% of companies. Domestic patents registered 59% of German firms and 41% of Polish firms.

3.3. Internationalization

Foreign presence of the companies is particularly important for diffusion of knowledge and innovation. Openness allows for international spillover effect, enhancement of their catching-up process through adaptation of advanced foreign technologies and improving their productivity. Moreover, firms operating on international markets face greater competition and hence a greater incentive to invest in R&D and innovation in order to remain competitive. Internationalization makes different varieties of capital goods more accessible, which increase efficiency (Caselli and Coleman II, 2001; Barro and Sala-i-Martin, 2004). Competition raises levels and growth of productivity, enable more productive firms to grow at the expense of others and gives firm’s a clear incentive to improve performance (Disney et al., 2003). There is also considerable evidence that businesses that are able to compete internationally, as multinationals in global markets, are able to reap productivity benefits and able to grow as well as survive better in their domestic markets. To become internationally competitive, firms must be market oriented and offer products and
services of international quality (Criscuolo and Martin, 2009). Moreover, studies have shown that
competition is positively associated with innovation by firms (Aghion et al., 2005).

German companies are more present on international markets, then Polish. 85% of German
manufacturing enterprises from the sample have establishments abroad, for Poland it is 66% of firms. In
the case of 42% of German firms the main product is sold on international market, 45% on national and 13%
local market. Polish firms mainly sold product across the country (59%), 37% on international market, 4%
locally. This data grasp if firm has any foreign affiliation, but not the importance of the outward orientation,
we do not dispose of information about the sales generated in each foreign establishment and amount of sales
on foreign market. Furthermore, external consultants can be seen as a source of providing tactic
 technological know-how in improving management and adopting new, imported technology. 41% of Polish
and 71% German firms have ever hired an external consultant to improve its area of management. In
Germany and in Poland manufacturing enterprises have a similar business environment to compete. In both
countries, 90% of companies admitted that compete with multinational firms and 75% with imports from
abroad on their main product market. Moreover, there is huge number of competitors on establishments’
main product market. 53% and 68% of companies pointed that they face more than five competitors on its
main product market, in Germany and in Poland respectively.

3.4. Human capital

Presently the importance of human capital is much higher in knowledge economy than in industrial
economy. Better quality human capital can help companies to develop their innovation activities as well as
increase ability to absorb high technology knowledge from abroad. Greater human capital is
complementarity for innovation and ICT use, also positively affects firm productivity (Brynjolfsson and Hitt,
2003; Iranzo et al., 2008; Arvanitis and Loukis, 2009). In addition, innovation abilities are strongly
connected with human capital. Wide range of skills needed for innovation, including technical skills,
academic skills, generic skills, creativity, soft skills, and management and entrepreneurial skills (Brown et
al., 2001). In Poland on average in manufacturing enterprises share of workers with university degree is
higher than in Germany. In Poland 10% of the full-time production workers, and 39% of the full-time non-
production workers graduated from university. In Germany those rates are lower: 4% and 20% respectively.
On contrary, in Poland on average only 3% of full-time top and middle managers have Master of Business
Administration (MBA), where in Germany 23%. Lastly, top managers have on average 18 and 24 years of
experience, in Poland and in Germany respectively.

4. Conclusions

We have shown empirical analysis of drivers of productivity based on the survey data from
representative sample of manufacturing enterprises from Germany and Poland. Moreover, we have
characterized German and Polish manufacturing enterprises including their economic performance. We aim
to extend publications on firm-level productivity and innovation in European countries, presented as a
comparative study based on survey data.

The following conclusions can be drawn from the present study. Firstly, in Poland huge percentage of
companies is or were state-owned firms in the past. It can be a potential explanation of worse productivity
performance and be factor that slows down innovative activities and improvement of efficiency. Secondly,
manufacturing companies in both countries have similar patterns in internationalization and firm innovative
activities. However, output of innovation approximated by patents and labour productivity are significantly
higher in German sample. To sum up, Poland after transition made a huge step to restructure economy and
Polish firms as much as Western European, have access to global technological and social development and
hence may have a wide range of benefits. Therefore, notwithstanding the recent gains, significant challenges remain in sustaining firm productivity growth and compete on international markets.

The obtained results have some policy implications. Policy makers should adopt a mix of policies to foster innovation, for instance by easing access to finance, allowing firms to cooperate with other firms and technological institutions and increasing the amount of skilled personnel. Besides, the business environment of innovation is affected by government policy, provision of infrastructure, education, industrial relations, legal institutions and research funding. The main limitation of this research is relatively small sample of enterprises included in the MOI survey database and high number of missing financial data. We have in mind existing disparities caused by firm heterogeneity across Poland and Germany and across industries. Regarding importance of this topic especially for transition economies there is a need for more data including: more countries, improving indicators, collecting data from service enterprises and small and medium enterprises and longitudinal data. The results of the investigation extend publications on firm-level productivity and innovation in European countries based on survey data.

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6. References


