

Offshoring and research and development in Danish firms

1. Purpose

The purpose of this project is to investigate whether domestic manufacturing is a prerequisite for domestic research and development (RnD) activities using Danish firm-level trade and RnD data. I hereby hope to help qualify the debate concerning the role of the manufacturing sector for future productivity growth and job creation.

2. Motivation and background

Much concern has been raised recently by politicians and policymakers in industrialized countries as to whether domestic manufacturing activities is a prerequisite for more knowledge-based activities at home. This is seen in light of the rapid rise in offshoring to low-wage countries over the past two decades coupled with a substantial decline in manufacturing jobs at home. Since knowledge-based activities are often coupled with technological and technical advances, this debate concerns the determinants of long-run growth in general.

The economic literature provides many possible links between international trade and long-run economic growth. For instance, using Indian data, Goldberg et al. (2010) examine the effects of offshoring on expanded firm product scope, leading to increased welfare through both increased product variety for consumers and for increased input varieties for domestic firms.

International trade might also be thought of as affecting the rate of technical change itself through both investments in RnD and modern capital equipment. In Bloom et al. (2011), the authors find evidence of import competition causing increased technical change within firms. 'Trade is bringing in the robots', as the authors put it. Although the focus here is on the consequences for wage inequality, it underlines how international trade may affect the technical change crucial for long-run economic growth through various channels.

Looking explicitly at the interdependence between innovation and offshoring and using Norwegian firm-level data, Bøler et al. (2012) first establish a number of empirical regularities in their data: Only a subset of firms innovate. Among innovating firms, almost all firms import. Innovating firms are larger, source more, and have larger labour productivity and import shares. They then exploit a natural experiment arising from the 2002 tax reform in Norway to provide reduced form evidence of the connection between innovation and imports. Overall, they find that the RnD shock was accompanied by more sourcing of foreign inputs. As such, this study mainly searches for channels explaining offshoring and highlight innovation as important propulsion for internationalization. A natural question would be to examine to which degree and through which channels offshoring can explain innovation. Also, I have the option to look at other outcome measures than RnD

expenditures, such as the skill composition of employees and the number of patents taken out by the firms.

In the context of Danish data, Junge and Sørensen (2011) find evidence of a positive *correlation* between firm-level offshoring and RnD investment. As these authors clearly point out, further work would be needed to identify a causal connection. I therefore suggest focusing attention on establishing a causal link from offshoring to the RnD investment behavior of Danish firms using the identification strategy developed by Hummels et al. (2013). The concern is that, for a given firm, a local demand shock may increase the incentive to source foreign inputs as well as increasing the scope of increased RnD. By instrumenting the offshoring measure by the world export supply at the product-country-firm level, the exogenous variation caused by classical trade reasons such as comparative advantage and factor endowment changes can be captured and used for identification of the effect of offshoring on domestic RnD.

3. Danish firm-level trade and RnD data

Danish firm-level data provides unique opportunities to analyze the link between offshoring and knowledge-related investment outcomes. The need for firm-level data arises since many of the suggested channels operate through *within-firm* reallocations of production factors and product compositions. Data at this disaggregated level has rarely been applied in the literature and thus founds the basis for a contribution to the international literature. At the same time it makes the results directly relevant in a Danish policy context.

Apart from looking at firm-level RnD expenditures as the outcome, attention can be directed to the worker task composition of the firms. This can be achieved by combining the occupational codes from the Danish registry data with the O*NET task database as in Hummels et al. (2011).

The O*NET database contains employer-level questionnaires on worker task characteristics and skill requirements. From this database I can use, among others, the questions on ‘basic skills’ and their content (e.g. are scientific methods used to solve problems) and processes (e.g. is critical thinking and active learning used to understand implications for future problem solving) as well as the questions on ‘occupational requirements’ (e.g. if the individual is updating and using relevant knowledge in his occupation). In this way, I can assess whether firms indeed respond to increased offshoring opportunities by increasing their skill portfolio with respect to tasks typically characterized as knowledge-intensive.

When looking at the number of patents taken out as the outcome, I can utilize the data available from the European Patent Office (EPO). Most Danish firms rarely take out patents only in Denmark, and so the EPO figures can be considered reliable. The EPO data can then be matched with the trade data at the firm level by Statistics Denmark.

4. Research questions

How does offshoring in the manufacturing sector affect RnD activities of domestic firms as measured by RnD expenditures, skill composition of the firm, and patents taken out by the firm?

This formulation of the research question helps shed light on the more general question of whether it is true that domestic manufacturing is a necessary condition for more knowledge-based activities. Hopefully, answering the research question can help point to the possible direction of the more fundamental, strategic question.

5. Policy relevance

Offshoring of manufacturing activities seems to be a faithful companion of globalization of which more is to come in the future. Since the manufacturing sector is undergoing a rapid transformation in these years, policy advice in this area seems of immediate importance. The policy implications may concern both industrial and trade policies. Is manufacturing complementary or a substitute to knowledge-based activities? Should national policies protect certain strategic industries? Or should policymakers strive to let the inevitable forces of globalization act to push for the necessary adjustments to reap the gains of trade? In either way, Denmark and other de-industrializing countries face a strategic choice of much importance for future growth opportunities.

Recently, several policy measures have been brought in place to promote growth and employment in Denmark (Finansministeriet 2013). Part of this stimulus package contains a reduction in the corporate tax rates. This can be seen in the light of the ongoing debate where advocates of the private manufacturing sector have stressed the importance of retaining manufacturing activities in Denmark. Thus, it appears to be in common interest to assess the importance of such policies. This project may help to contribute to this debate.

6. Time schedule

The estimated duration for this project is two years. The project must be completed within the PhD stipend of Svend Greniman Andersen, ending November 2015. Work on the theoretical framework and empirical specification is ready to begin. By June 2014, the bulk of the empirical analysis will have been carried out. From there, work can begin on refining the analysis and presenting the paper on international conferences to put the work in position for publication in an international top field journal such as *Journal of International Economics* by June 2015.

7. Budget

This project crucially depends on the availability of the data described in the above. Fortunately, I have already been granted access to firm-level trade and RnD data through the project

“Globalization and worker and firm outcomes” by Prof. Jakob Roland Munch. In addition to this data, it would be of great value to expand the series with the most recent years for firm sales and other characteristics. Also, to use the most recent patent data from the EPO, the data would have to be matched to Danish firms by Statistics Denmark. In addition, to promote the work internationally and to get feedback from international expertise in the field, a certain amount of conference activity is expected.

Data: update of key variables	25.000,-
Conference participation	<u>25.000,-</u>
Overhead (20 percent of the above)	<u>10.000,-</u>
Total	<u><u>60.000,-</u></u>

8. Literature

Goldberg, P. K., A. K. Khandelwal, N. Pavcnik, P. Topolova (2010): ”Imported intermediate inputs and domestic product growth: evidence from India”, *Quarterly Journal of Economics*

Bloom, N., M. Draca, J. V. Reenen (2011): “Trade induced technical change? The impact of Chinese imports on innovation, IT and productivity”, *NBER working paper*

Bøler, A. B., A. Moxnes, K. H. Ultveit-Moe (2012): ”Technological change, trade in intermediates and the joint impact on productivity”, *American Economic Review (revise and resubmit)*

Junge, M., and A. Sørensen (2011): “Erhvervslivets forskning, udvikling og offshoring”, *CEBR*.

Hummels, D., R. Jørgensen, J. R. Munch, C. Xiang (2013): ”The wage effects of offshoring: evidence from Danish matched worker-firm data”, *American Economic Review (revise and resubmit)*

Finansministeriet 2013, “Aftaler om Vækstplan DK”

Attachments

CV of Svend Greniman Andersen