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Total Factor Productivity Spillovers in India

Policy brief DFID/Tilburg University research: *'Enabling Innovation and Productivity Growth in Low Income Countries' (EIP-LIC)*.

<http://www.tilburguniversity.edu/dfid-innovation-and-growth/>

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Introduction

In research and policy, the understanding and assessment of the economic impact of trade liberalisation policies on productivity of firms is a difficult endeavour. A thorough understanding of the economic impact of any policy that affects firm productivity, including trade policy, requires research into the direct effect of that policy, as well as an understanding of the various channels through which the effect of such a policy can diffuse throughout the economy. In this regard, trade policy can have an effect on the productivity of a company whose import tariff is affected, but potentially also have an (indirect) effect on the productivity of other firms with which the company interacts. Therefore, even firms not directly affected by the productivity enhancing policy can experience an increase in productivity, through their interaction with a firm that is directly affected by the policy.

In the framework of a DFID-funded research project entitled *'Enabling Innovation and Productivity Growth in Low Income Countries (EIP-LIC)*', a team of researchers from Tilburg University analysed, by applying econometrics techniques, firm-level data of the manufacturing sector in India. This builds on existing research that has identified the positive (direct) effect of trade liberalisation on firm productivity. In particular, the empirical evidence supports the hypothesis that competitive pressures due to lower import tariffs on a firm's final good, as well as access to better inputs because of lower import tariffs on the firm's intermediate goods, raises the firm's productivity. This research goes beyond this direct effect of trade liberalisation and examines whether productivity growth at the firm level has positive (or negative) spillover effects on other firms. Such spillovers take place when one firm's productivity has an effect on the productivity of another firm. The team used the positive correlation between import tariffs and firm-level productivity as an exogenous source variation in firm-level productivity, in order to estimate the size of TFP spillovers in the Indian manufacturing economy.

While there are many definitions of productivity, total factor productivity (TFP) is the most widely used measure and is defined as that part of the output that cannot be explained by the amount of inputs used (such as capital, labour, energy, intermediate inputs). TFP, as the variable accounting for effects in total output not caused by traditionally measured inputs, is thus determined by how efficiently the inputs are utilised in production. TFP growth is comprised of efficiency improvements, innovation, technical change and scale economies. As sustained TFP growth arises from technological progress, spillovers that result in such improvements are a crucial driver of economic growth, both in developed and in low income countries.

The empirical research to date on TFP spillovers in developing countries is mostly concentrated on measuring the spillover effects from Foreign Direct Investment (FDI) on domestic firms. There exists both a large empirical and theoretical literature on spillovers from FDI. The theoretical underpinning for such spillovers, however, does not have to be confined to the FDI case. Domestic firms may experience spillovers from other domestic firms, not

only from foreign firms. The empirical research on firm-level TFP spillovers among domestic firms in developing countries has been scant at best. Whether and to what extent these benefits spread to other firms and sectors remains unclear in the literature today. Compared to the study of FDI spillovers, estimating spillovers between all firms in the economy is problematic because of the potential for reverse endogeneity: if one firm's TFP can have a positive spillover effect on another domestic firm, then this spillover may well run in the opposite direction too.

Measuring the correlation between the TFP of two firms may therefore result in overestimation of the true (single direction) effect.

The original DFID research project working paper is entitled '*Total Factor Productivity Spill-overs in India*' (2014) by Marijke Bos, Benedikt Goderis and Gonzague Vannoorenberghe¹. This policy brief summarises the research methods and outcomes of the paper and discusses several policy implications.



Research approach and findings

The aim of the research is to determine whether the Indian economy benefitted from trade liberalisation not only through the direct effect on firms most exposed to international trade, but also through additional spillovers from the firms directly affected to other firms in the economy. The authors use a comprehensive dataset of Indian manufacturing firms and employ a spatial econometric technique to estimate the strength of inter-firm TFP spillovers. International trade policy (lower import tariffs) is used because of its exogenous nature, which is needed for consistent estimation of the effect of one firm's TFP on another's. Evidently, if spillovers exist, there could also be an effect of the latter firm's TFP on the former firm's TFP. The researchers correct for this by using the so-called Instrumental Variables technique, where the import tariff is used as the instrumental variable.

The research team considered several ways in which such spillovers could occur. Spillovers can arise among physically neighbouring firms, as observing new products or best practices is easiest at close quarters. Knowledge can also be transmitted across firms through the movement of labour, or through cheaper or better quality inputs in a vertical (supplier-buyer) relationship. Consequently, the paper estimates the spillover strength of three different channels: (1) spillovers through observation of neighbouring firms, (2) spillovers through the movement of labour between firms or (3) spillovers through cheaper or better quality of inputs in a vertical relationship. The study uses a weighted average of 'neighbouring' TFP as the spillover term. A positive effect of this spillover term on the original firm's TFP indicates that there are positive spillovers in that spatial dimension. For every channel, the authors define the relevant spatial dimension. Consider the example of a firm dyeing textiles in the province of Kerala. The first channel tests whether this firm's TFP is affected by the average TFP of firms located within a 50 km radius (the authors also use 100 km or the same state as a relevant geographical space). The second channel uses the average TFP of all other firms located in the same state, and tests whether TFP spillovers differ between a state like Kerala, where restrictions to labor mobility are low and a state like Gujarat, where constraints to labor mobility are much more severe. The third channel uses the average TFP of all input supplying firms (for example the dye producers).

¹ The paper is accessible at the project's website (<http://www.tilburguniversity.edu/dfid-innovation-and-growth>) under 'publications and reports'.

In line with previous research, the authors confirm the presence of a direct effect of input and output tariffs on firm-level TFP. The research of the Tilburg University team, however, finds no evidence in favour of TFP spillovers between Indian firms. In contrast to the existing studies, which look at other countries and focus mostly on Foreign Direct Investment (FDI), the Tilburg University team did not find evidence in any of the abovementioned channels in the short run.

Because the empirical model takes an average of TFP of neighbouring firms as the spillover term, the zero result may be driven by the firms that have only a few neighbours. Theoretically, it may be possible that spillovers only occur when there are many other firms' TFP in the average. However, even for the sub sample of firms with many neighbours, the researchers found no spillover effect.

'... A decrease in the tariffs on the goods produced by a firm, called the output tariff, raises the competitive pressure from abroad - which can affect TFP either way (e.g. lower scale or higher incentives to innovate) - and may give rise to learning....' (Bos et al. (2014))

Policy implications

Gaining deeper insights into TFP spillovers is informative for innovation policy with a view to raising productivity, for two reasons. First, it is key to quantifying the total gains from trade liberalisation policies. When there are both direct and indirect effects, leaving out the indirect effects may lead to overestimation (if the indirect effects are positive) or underestimation (if the indirect effects are negative) of the total gain from the innovation policy. For example, a common strategy for identifying the total effect of a trade liberalisation policy on productivity is to compare those firms affected by the policy to those firms not affected. The difference is then reported as the total effect.



If the latter group is indirectly affected, however, the measured difference is actually the total effect minus the indirect effect, thus only the direct effect. Second, the strength of diffusion matters for the distributive consequences of a policy, the more so if the firms directly benefiting (e.g. the importers) systematically differ from other firms ex-ante. A policy with only a direct effect would then benefit one group, whereas if the spillovers affect the productivity of another group, the benefits from the policy would be distributed more fairly.

When innovation and productivity growth within firms spread within an economy, via spillovers, the overall TFP growth speeds up and therefore total economic growth does likewise. Whereas in theory, there may be different channels for TFP to spill over, the research team found no evidence for spillovers during the episode of trade liberalisation in India.

For policy makers, it is therefore essential to be cautious and conservative when estimating the total spillover effect among firms of trade liberalisation as one way to promote innovation and raise productivity. If policies are evaluated based on a cost-benefit analysis, and this includes some estimation of the positive effects on other firms, the benefit may be overestimated. This would result in the implementation of policies which will not live up to expectations.

The methodology not only provides a better understanding of the consequences of a particular episode of trade liberalisation in India, but acts as an instrument to identify spillovers arising from any kind of policy. Policy makers could apply this instrument to examine different channels through which such spillovers are commonly thought to arise, namely through observation or labour mobility between neighbouring firms or through intermediate input use.

Given the theoretical possibility that spillovers can exist (this research is only the second to examine inter-firm spillovers between domestic firms in a developing country), further research and insights on this topic are essential for policy making. The existing literature on spillovers between domestic firms is limited, but of great importance when examining the total beneficial effect of innovation policies. Expanding this type of research to different countries and different time periods would enable researchers to examine whether this lack of spillovers is specific to the Indian case in the early '90s, or whether this is a more general phenomenon that is supported by robust evidence.

In particular, such further research should also give insight into the ways in which institutional factors may hamper spillovers. The lack of TFP spillovers may thus not only have implications for policy, but may also imply that policy or institutional changes can be devised to facilitate and enhance spillovers between domestic firms. The absence of such spillovers may be the result of a complementary institutional context not sufficiently conducive to spreading innovations. This requires a complementary holistic view in policy analysis.

The results of this paper can be generalised to any policy, not just to trade policy. In particular, a key question regarding spillovers is: 'as a result of a given policy or other event, if the TFP of a single firm is increased, will this have a positive effect on the TFP of other firms in the economy, even when they are not directly affected by the policy?'. Further research into the institutional factors affecting the lack of spillovers in India may inform policy to promote growth through TFP spillovers between firms.

This policy brief is the product of a research project funded by the British Department for International Development (DFID) entitled 'Enabling Innovation and Productivity Growth in Low Income Countries' (EIP-LIC)⁹. The project is implemented by Tilburg University (The Netherlands) and explores SME-level innovation in Low Income Countries (LICs) and factors that contribute to or limit its diffusion. Data collection and research collaborations take place in 10 African and Asian countries (Bangladesh, Ethiopia, Ghana, India, Indonesia, Kenya, Tanzania, South Africa, Uganda and Vietnam). The policy implications of research are presented in a series of policy briefs, targeted at a broad audience of policy makers within governments, business and development agencies with a view to quantifying research outcomes and promoting evidence-based policy making.