

FOREIGN FIRMS AND TECHNOLOGY SPILLOVERS IN DEVELOPING COUNTRIES: THE TURKISH CASE

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Introduction

Foreign firms in developing countries – mostly affiliates of transnational corporations – are a valuable source of new technology for domestic firms. Indeed, they possess intangible assets (technological know-how, marketing and management skills, export contacts, reputation) which enable them to compete successfully with local firms endowed with better knowledge of local economic conditions. These intangible assets, because of their non-rival and only partially excludable nature, can spill over to local firms and increase their productivity levels.

Foreign firms can influence the productivity of domestic firms through a number of channels. Two major types of technology or productivity spillovers are examined in the innovation literature: they are called horizontal and vertical technology spillovers, respectively and each type involves different spillover generating mechanisms.

Horizontal or intra-industry spillovers occur through three major channels. *First*, when foreign firms with advanced technologies enter a local market they introduce new technologies to the industry. Through direct contacts with foreign affiliates of multinationals, local firms can imitate the way foreigners operate and become more productive. *Second*, the entry of foreign firms may lead to more intense competition in the local industry, so that domestic firms are forced to use more efficiently existing technologies or introduce new technologies in order to maintain their market shares. Increased competition may also lead to the elimination of monopolistic profits and enhance the welfare of a country. However, there is also a possibility that the competition effect is harmful to the host economy if local firms are not efficient enough to compete with foreign entrants. *Finally*, the costly effort to train workers carried out by foreign firms may lead to productivity improvements in domestic firms through labor turnover, i.e. through hiring by local firms of employees who worked previously for foreign firms.

As for the vertical or inter-industry spillovers, they may occur when foreign affiliates enter in transactions with local suppliers and customers, and provide them with technical assistance, train local suppliers, or assist them in purchasing raw materials so as to maintain the quality of intermediate goods (backward linkages). Also, as technical complexity increases, domestic producers may seek to purchase intermediate or capital goods from foreign suppliers whose goods are superior to those available from local suppliers and who may provide local firms with information required to use these inputs productively (forward linkages).

A number of econometric investigations using firm-level data have been carried out in order to verify whether such spillovers occur in developing countries. Their findings are quite diverse and depend on the country and sectors examined³. Turkey is a good case study for the analysis of the impact of FDI on productivity of domestic firms: indeed, after having pursued a development strategy based on import-substitution policies from 1960 to 1980, it switched to a more outward-oriented one from 1980 onwards and implemented measures aimed at import liberalization, export and FDI promotion, a process that had mixed effects on the innovation activities of Turkish

³See Görg H. and D. Greenaway (2004), “Much ado about nothing? Do domestic firms really benefit from FDI?”, *The World Bank Research Observer*, 19(2), 171-197.

firms⁴. The post-1980 period in Turkey witnessed a steady increase in FDI inflows: the share of foreign firms in total employment increased from 6 to 15 % from 1980 to 2000 and the share of value added evolved from 11 to 25 % over the same period. By the year 2000, the share of the value added accounted by foreign firms in several medium/high tech sectors is superior to 50 % whereas this share was less than 20 % in 1980s. This steady rise in FDI flows was occurred in response to the elimination of restrictions imposed on FDI by the investment legislation in Turkey.

In our paper, we use firm-level data to test for the existence of technology spillovers from foreign to domestic firms in Turkey over the period 1980-1994, thus covering a period characterized by a substantial increase in FDI flows in the Turkish economy.

Empirical investigation

Using a firm-level dataset spanning the period 1980-1994, we examine whether productive advantages enjoyed by foreign firms in the Turkish manufacturing sector spill over to domestic firms and exert a positive impact on their productivity. These firm-level data come from the *Annual Surveys of Manufacturing Industries* conducted by the Turkish Institute of Statistics at *all* manufacturing establishments with 10 or more employees. We limit our analysis to plants with 25 or more employees since information on foreign ownership is not available for plants between 10 and 24 employees. Our dataset includes more than 75000 firm-year observations.

In order to test for horizontal and vertical productivity spillovers from foreign to domestic firms in Turkey over the period 1980-1994, we use panel data techniques in order to account for the time series and cross sectional dimensions of our data. The *dependent variable* in our model is the firm-level labour productivity. It is calculated as the ratio between the number of employees and gross product or value added, alternatively. *Explanatory variables* include alternative indicators of FDI-related horizontal and vertical technology spillovers as well as control variables that account for the potential effects of other factors on firm-level labour productivity.

First, several alternative *horizontal* spillover variables are constructed such as the share of foreign firms in the number of employees, in value added and in investment expenditures at the four-digit sector level (ISIC, revision 2) as well as at the province level (this allows us to test separately whether spillovers occur at the industrial or spatial level). We also check whether the impact of majority-owned affiliates differ from that of minority-owned affiliates fully as far as FDI spillovers are concerned. Secondly, we use input-output tables of the Turkish economy in order to construct indicators of backward and forward technology spillovers.

Control variables account for other determinants of firm-level productivity such as the extent of product-market competition⁵, firm size, capital intensity, share of skilled

⁴ See Pamukçu, T. (2003), "Trade liberalization and innovation decisions of firms: Lessons from post-1980 Turkey", *World Development*, 31(8), 1443-1458.

⁵ Three indicators of product-market competition are used alternatively: industry concentration (*Herfindahl index*), import penetration at the sector level (*imports as share of domestic production*) and market share (*firm output as a proportion of industry output*). Separating out the effects of competition

employees in the labour force (indicator of absorptive capacity) and an indicator of technological backwardness for the firm. In a second stage, interaction variables are added to the labour productivity equation in order to test whether FDI-related technology spillovers are conditional on the aforementioned control variables⁶. A full set of firm-specific dummy variables as well as sector and time dummies are also added to the regressions.

While testing for the impact of FDI-related spillovers on firm-level labour productivity, we implement the estimation procedure so as to take into account possible problems related to the endogeneity of control variables, to lags in the impact of spillover variables on productivity and to the existence of unobservable variables correlated with the dependent variable that might bias the parameters estimates⁷.

Preliminary findings

We summarize below the preliminary findings of our work where firm-level data are used in order to test for the presence of FDI-related technology spillovers in the Turkish manufacturing sector over the period 1980-1994, i.e. during the first 15 years that followed its transition from a import substitution based development strategy to a more outward oriented one.

Coefficients associated with the indicators of horizontal spillovers constructed at the sector level are always negative and statistically significant. This finding is robust and do not depend on the degree of ownership (majority- or minority-owned enterprises) or on the variables used to calculate spillover indicators (employment, value added or investment).

However, if spillovers indicators calculated at the spatial level – i.e. province level – are introduced in the productivity equation rather than those calculated at the sector level, aforementioned findings are modified since the coefficients associated with spillover indicators are now either statistically not different from zero or statistically positive – albeit only at the 5% significance level.

As for the vertical technology spillovers, preliminary findings point to a positive impact of backward linkages of foreign firms on the productivity levels of domestic firms whereas forward linkages do not seem to exert any statistically significant positive effect on the dependent variable. An input-output table constructed by the Turkish Institute of Statistics and relating solely to the intersectoral transaction within the manufacturing sector will be available soon. We will use this table in order to check the validity of the aforementioned findings.

on firm productivity from those due to technology spillovers is another way to test for “pure” FDI-related spillovers.

⁶ Interaction terms enable us to test, for instance, whether any positive impact of FDI-related spillovers on productivity is conditional upon the absorptive capacity of firms, or again whether such an impact depends on the extent to which a firm is close to the technology leader in its sector of activity – the degree of closeness being an indicator of technological backwardness.

⁷ See Haskel, J.E., S.C. Pereira and M.J. Slaughter (2002), *Does Inward Foreign Direct Investment boost the productivity of domestic firms?* NBER Working Paper No 8724, NBER, Washington DC.