New and Improved: FDI and the Building Blocks of Complexity

Beata Javorcik[*], Alessia Lo Turco[†], Daniela Maggioni[‡§]

Abstract

This paper examines the relationship between the presence of foreign affiliates and product upgrading by domestic firms in a sample of manufacturing firms operating in Turkey over the period 2006-2009. We exploit information on the evolution of firms' product baskets and find that Turkish firms in sectors and regions more likely to supply foreign affiliates are also more likely to introduce more complex products, where complexity is captured using a measure developed by Hausmann and Hidalgo (2009). The results are robust to controlling for omitted variables, sample selection and potential simultaneity bias. This evidence is in line with the view that inflows of foreign direct investment stimulate upgrading of indigenous production capabilities in host countries.

JEL: *JEL: F23, D22, L20*

Keywords: *Product Innovation, FDI, Production Upgrading, Backward Linkages, Turkey*

---

[*]University of Oxford and CEPR. Department of Economics, Manor Road Building, Manor Road, Oxford OX1 3UQ, United Kingdom. Email: beata.javorcik@economics.ox.ac.uk.

[†]Università Politecnica delle Marche, Department of Economics and Social Sciences, Piazzale Martelli 8, 60121 Ancona, Italy. Email: a.loturco@univpm.it.

[‡]Università di Catania and Università Politecnica delle Marche. Via Vittorio Emanuele II n.8, 95131 Catania, Italy. Corresponding Author: d.maggioni@unict.it.

[§]We thank Giorgio Barba Navaretti, Italo Colantone, Matthijs De Zwaan, Massimo Del Gatto, Maria Luisa Mancusi, Bruno Merlevede and participants of the INFER Workshop on "Regions, Firms and FDI" as well as seminars participants at the Studi Luca d'Agliano and the University of Pescara for their useful comments and suggestions. We are particularly grateful to Paolo Fabbricatore from Indesit Company and Emre Adinc from Pfizer for providing valuable information on their companies' cooperation with local suppliers in Turkey. The data used in this work are from the Foreign Trada Data, the Annual Business Statistics and the Production Surveys provided by Turkish Statistical Office (TurkStat). The analysis has been conducted at the Microdata Research Centre of TurkStat in accordance with the law on the statistical confidentiality and personal data protection. The results and the opinions expressed in this article are those of the authors and do not represent the official statistics. We are grateful to Bülent Tungul, Mahmut Öztürk, Kenan Orhan and Erdal Yildirim from TurkStat for their help with foreign trade data. We also thank Vedat Metin, Ülkü Ünsal and Oğuzhan Türkoğlu from the dissemination department.

1 Introduction

The academic debate on the process of economic development has recently focused on whether countries' specialisation matters for their future growth pattern (Lucas, 1988; Hausmann et al., 2007). While a large literature has investigated the drivers of the national production structure at the macro level, little is known about the determinants of product upgrading at the micro level. As aggregate production is the result of micro-level choices and behaviours of individual firms, it is important to understand what allows firms to upgrade their production by introducing more sophisticated products or improving the existing ones.

Innovation and product upgrading in developing countries may be hindered by appropriability issues. In an influential paper, Hausmann and Rodrik (2003) argued that a firm that attempts to introduce a new product into the country faces uncertainty about the underlying cost structure of the economy. If the project is successful, other firms learn that the product in question can be profitably produced and follow the incumbent's footsteps. In this way, the returns to the pioneer investor's cost discovery become socialized. If the incumbent fails, the losses remain private. This knowledge externality means that investment levels in cost discovery are suboptimal.

This paper argues that inflows of foreign direct investment (FDI) may stimulate innovation and product upgrading in the host country. Multinational firms are creators of innovation, being responsible for the majority of global R&D spending (UNCTAD, 2003). Moreover, there is evidence suggesting that multinationals transfer knowledge to their foreign affiliates (Arnold and Javorcik, 2009) and that foreign affiliates are more likely to introduce new products than their indigenous competitors (Brambilla, 2009; Guadalupe et al., 2012). As new products may require new inputs, multinationals might encourage and support their local suppliers' efforts to develop new inputs and to improve the existing ones.[1] By sharing product information and production-related know-how, multinationals may lower the costs of innovation and product upgrading on the part of the local suppliers. The vast experience gathered from operating around the globe may mean that multinationals possess superior knowledge on the suitability of the host country as the production location for a particular product.[2]

[1] According to the Business Environment and Enterprise Performance Survey conducted jointly by the World Bank and the European Bank for Reconstruction and Development in 25 transition countries, 41.8% of suppliers to multinational firms received pressure from their customers to develop new products or services. The corresponding figure for non-suppliers was only 36.8% (Godart and Görg, 2013). According to the same data source, the corresponding figures for the Turkish sample were 90% for domestic suppliers to multinationals and 80% for non-suppliers.

[2] By directly engaging in cost discovery in host countries, multinationals may also stimulate subsequent innovation by domestic rivals. For instance, in a World Bank survey, 24% of local firms in the Czech Republic and 15%

Our analysis is based on **firm-product** level data available from the Turkish Statistical Office for the period 2006-2009. We examine the link between the sophistication of new products introduced by Turkish firms and the presence of foreign affiliates in the input sourcing (downstream) sectors in the same region. Turkey represents a suitable setting for our analysis. It is one of the few countries that have transformed their productive structure dramatically in the last decades (Hidalgo, 2009). It has also experienced a spectacular surge in FDI inflows during the 2000s. Being an emerging economy, Turkey is likely to have been significantly affected by the knowledge transfer taking place through FDI inflows. Finally, the large size of the country and the availability of information on the location of plants belonging to each firm allow us to exploit a geographical dimension of the data.

The object of our analysis is the sophistication level of products newly introduced by Turkish firms. We capture product sophistication using a measure proposed by Hausmann and Hidalgo (2009) who relate the concept of complexity to the extent and exclusivity of capabilities needed to produce a given product. These capabilities, which are neither directly observable nor measurable, are inferred by exploiting the information on the prevalence of a given product in the countries' export baskets and export diversification of countries that export it.[3]

The existing literature investigating the determinants of product upgrading tends to equate upgrading with an increase in unit values (Hallak, 2006; Manova and Zhang, 2012; Harding and Javorcik, 2012; Bas and Strauss-Kahn, 2015). Unit values are highly imperfect as (in addition to reflecting quality) they may be capturing production costs, market power, or noise due to both aggregation and measurement error.[4] A notable exception is the work of Khandelwal (2010) and Khandelwal et al. (2013) who estimate quality by exploiting information on unit values and quantities, based on the insight that higher quality products are those with higher market shares conditional on price.

In all these existing studies, however, the concept of quality refers to product differentiation, vertical in the former case and also horizontal in the latter case and is measured within strictly defined products. In contrast, the aim of the Hausmann and Hidalgo (2009) indicator is to rank products according to the sophistication of their production process. Although this measure can still in part capture a higher quality level of products (when higher quality

in Latvia reported that they have learned about the availability of new technologies by observing multinationals operating in their country and sector (Javorcik, 2008).

[3] In the paper, we use the words "complexity" and "sophistication" interchangeably.

[4] Hallak and Schott (2011) develop a method for decomposing countries' observed export prices into quality versus quality-adjusted components under the assumption that, holding observed export prices constant, countries with trade surpluses offer higher quality than countries running trade deficits. They find that observed unit value ratios can be a poor approximation for relative quality differences.

translates in a higher number of capabilities needed in the production process), its scope is wider since it allows to compare products that may be very different in terms of use and cannot be compared in terms of quality in its traditional sense. Moreover, our focus on the complexity indicator is related to our interest in examining the impact of FDI on the development of firms' new and exclusive production skills and their ability to combine them in new or more complex goods.

Our explanatory variable of interest is the presence of multinational firms in the downstream (input sourcing) sectors. We also allow for the impact of FDI in the same and the upstream sectors, though neither will turn out to matter in the analysis. These variables are defined at the level of NUTS2 Turkish regions, based on the assumption that physical proximity both increases the likelihood of engaging in contractual relationships and eases the technology and knowledge transfers from foreign affiliates to domestic firms.

Our focus on new products means that we need to address the selection bias resulting from the fact that only some Turkish producers choose to introduce new products. Our approach thus relies on the estimation of a two-step selection model. In the first step, we model the determinants of introduction of a new product, and in the second step, we focus on the determinants of the complexity of the newly introduced product(s). As the exclusion restriction, we use the lag of industry concentration at the regional level (excluding the firm in question). We believe that industry concentration should be closely linked to the probability of product innovation, as highlighted by the existing literature (Nickell, 1996; Blundell et al., 1999), but should not affect the sophistication of newly introduced products.

We find that while the presence of foreign affiliates does not affect the likelihood of a new product being introduced, it does affect the complexity of new products. More specifically, sophistication of the products newly introduced by domestic firms is positively correlated with the presence of multinational firms in the downstream sectors (i.e., sectors which the innovating Turkish firms are likely to supply). This finding is consistent with the view that interactions between multinationals and their Turkish suppliers may boost the latter's ability to upgrade their production structure.

Our results are robust to a number of sensitivity checks and identification tests. In particular, we control for a host of unobservables by including region-year and industry-year fixed effects. We also control for a set of time-varying covariates both at firm and sector-region level. Furthermore, our findings hold when we exploit an alternative proxy, the well-known measure called PRODY developed by Hausmann et al. (2007), which captures the income level of countries typically exporting a given product. Finally, to address a potential simultaneity bias, we show that our results are robust to using an instrumental variable approach.

Our IV approach is based on three pillars. The first pillar is the view that international competition for FDI matters and that Turkey may find it harder to attract FDI in sectors where its neighbours concentrate their investment promotion efforts. Second, we anticipate that Turkish regions offering lower wages and employment subsidies tend to be more attractive to foreign investors. Third, we believe that initial presence of foreign investors in the Turkish region matters for future FDI inflows. The IV results confirm our baseline finding of a positive relationship between the presence of multinationals in downstream sectors and the complexity of products newly introduced by local firms.

When we allow for heterogeneous effects on different types of Turkish firms, the data suggest that multinational customers represent a convergence force. The most beneficial effects stemming from their presence are absorbed by indigenous innovators that are smaller and endowed with a lower pre-existing sophistication level.

Our work is related to two strands of the economic literature. First, we contribute to the literature investigating the role of FDI in stimulating economic growth (Borenzstein et al., 1998; Alfaro et al., 2004) and transformation of the production and export structure. Recent work has shown that multinationals' activity affects the quality and the sophistication of exports in the host countries (Harding and Javorcik, 2012; Swenson and Chen, 2014), though other studies (Wang and Wei, 2010) have failed to find such a relationship. However, the exact channel through which this phenomenon may be taking place still needs to be investigated in detail. On the one hand, multinationals could themselves produce more technology- and knowledge-intensive goods and could initiate production of goods that have not been produced before in host countries, thus directly contributing to the sophistication of the country's production structure. On the other hand, their presence could encourage local firms to introduce more sophisticated goods. Knowing which channel is at work matters hugely for policy. Our results give support to the latter channel.[5]

Second, we contribute to the extensive literature on FDI spillovers. To date, this literature has almost exclusively focused on the link between the presence of foreign affiliates and the total factor productivity of domestic firms (Aitken and Harrison, 1999; Javorcik, 2004; Goerg and Greenaway, 2004; Havranek and Irsova, 2011).[6] By considering another outcome, the sophistication of newly introduced products, we help shed light on the complex ways through which FDI inflows affect the host economy.

[5]The former channel is not the focus of our study.

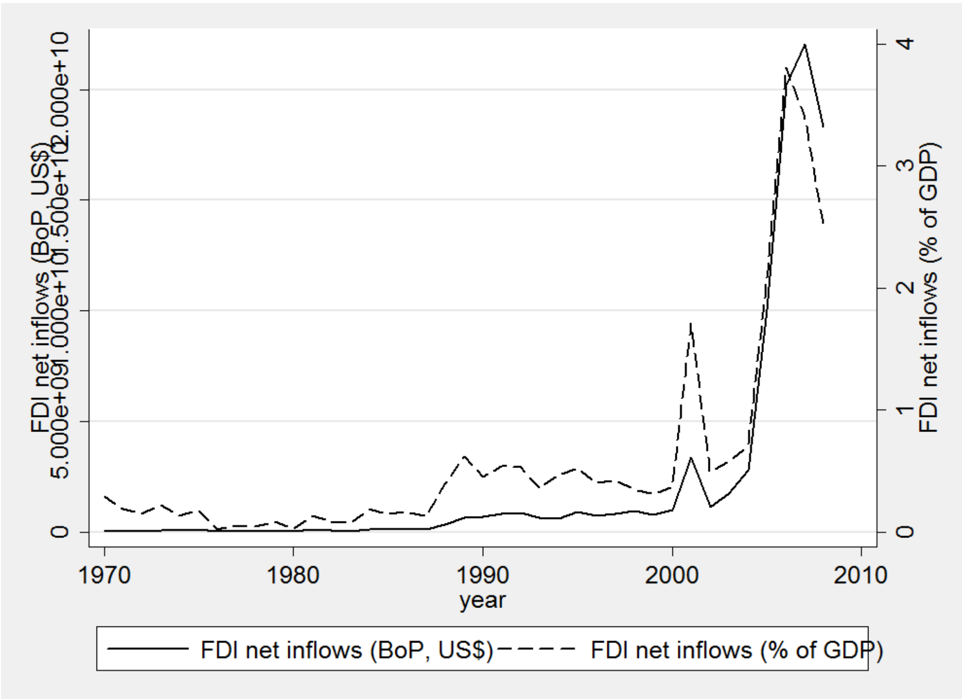
[6]A notable exception is the work of Branstetter (2006) which focused on knowledge flows reflected in patent citations.

This paper is structured as follows: the next section introduces the background for our analysis and briefly discusses anecdotal evidence related to our research question; section 3 presents the data sources and discusses measurement issues; section 4 lays out the empirical model and discusses estimation issues; section 5 presents the results, robustness and extensions of our empirical model; section 6 concludes the work.

2 Background and anecdotal evidence

In the 1980s, after about 20 years of import substitution, Turkey moved to an outward-oriented development strategy based on liberalising capital account, attracting FDI and promoting exports. Liberalisation policies and important investments in telecommunications infrastructure created a more favourable environment for FDI throughout the 1980s. Nevertheless, as shown in Figure 1, a decisive change in the pace of FDI inflows occurred only after the entry into force of the new Foreign Capital Law in 2003, which removed several important restrictions on operations of foreign affiliates.

Figure 1: Turkish Inward FDI Flows, 1970-2010



Source: World Development Indicators 2012.

Foreign affiliates operating in Turkey have recently become quite reliant on the local supplier base. According to the World Bank Enterprise Survey, 65% of total inputs used by foreign affiliates located in Turkey were of domestic origin in 2002. By 2008, this share increased to

76%. The surge in FDI inflows and the increase in the reliance of foreign affiliates on local sourcing have coincided with an increasing sophistication of the Turkish production structure (Hidalgo, 2009).

Anecdotal evidence suggests that the two phenomena may be related, thus supporting the view that buyer-supplier relationships between multinational enterprises (MNEs) and their Turkish suppliers may have stimulated the transformation of the Turkish manufacturing sector. Consider the case of Indesit Turkey.[7] Indesit is an Italian white good producer - recently acquired by Whirlpool - active in Turkey since the 1990s. Its plant located in Manisa produces refrigerators. Although initially Indesit entered the Turkish economy exclusively to save on labour costs, over time, Indesit has increased its reliance on the Turkish supplier base. In the beginning of its operations in Turkey, Indesit imported most of the components needed for production of the final products. Now Indesit sources locally almost all of the main components, and more than half of its supplier base is currently located in Turkey, mostly in the same industrial district as its Manisa plant. Geographical proximity to suppliers is indeed crucial for keeping down the transport costs and allowing for a more efficacious collaboration with the suppliers. Indesit regularly conducts audits of its suppliers. It also helps suppliers with starting production. The vast pool of engineering know-how and experience stemming from previous experiences of working with local suppliers in other parts of the world is then shared with Turkish business partners.

Indesit's relationship with a stainless steel sheet pressing (SSSP) company located in Manisa is an example of how foreign affiliates stimulate upgrading of production complexity in their local suppliers.[8] In 2012, Indesit built a new plant producing washing machines. In order to become a supplier of this new plant, the SSSP company purchased new presses and automated its production process. This allowed it to start producing a new and more sophisticated product, increase efficiency and the production volume. More specifically, the SSSP company became the only Turkish supplier of Indesit capable of producing the flange of a washing machine basket which is a steel component with deep drawing illustrated in Figure A.1.

The complexity of steel components with deep drawing is not uniform and strictly depends on their aesthetic and physical characteristics.[9] Stainless steel components like a flange need to be produced with no aesthetic defects by 800-1000 tons presses. The compo-

[7] This information is based on the interview one of the authors conducted with the company's Sourcing Manager on December 3, 2014.

[8] The name of the company has been omitted during the interview because of confidential reasons.

[9] As illustrated in Figure A.1, the flange of a washing machine basket is a much more complex product than a sink. The sink's complexity in turn exceeds that of a pot scourer.

nent's drawings are statistically controlled to allow for a correct assembly with the rest of the washing machine basket. They also need to withstand a 1000-1400 revolutions per minute stress while remaining within a certain range of vibration and noisiness.

The flange is not a new component for Indesit. Indesit sources flanges from Italy and Poland for its plants in Italy, Poland and Russia. However, this type of a flange had not been previously produced in Turkey. Besides investing in automation, the SSSP company has introduced new control and maintenance tools and processes and is currently collaborating with Indesit on a system to improve the primary input usage by employing scraps. Indesit has shared essential tacit knowledge, information processes, instructions and control procedures with the SSSP company, thus stimulating and supporting the supplier's complexity upgrading.

Similar anecdotal evidence can be found in other sectors.[10] For instance, Pfizer, a pharmaceutical company active in Turkey since the late 1950s, has also developed a large network of local suppliers. Two years ago a Turkish logistics company, which is a partner of Pfizer, invested into new cold-chain logistics systems in order to increase the volume of its business with Pfizer. Thanks to this additional investment and to the know-how it had received from Pfizer on the cold-chain logistic requirements needed to comply with the Pfizer Quality Management system, the supplier has widened its portfolio and has been able to strengthen and stabilise its contractual relationship with Pfizer.

Another example is represented by an on-going Pfizer's project aiming to upgrade a product it uses in its transportation system. The current supplier cannot meet the additional requirements but another Turkish firm is willing to make the necessary investment in highly complex machines in order to become a Pfizer's supplier. This investment is very costly, especially when compared to the supplier's regular operational equipment.

Motivated by this anecdotal evidence, in what follows we formally examine the relationship between the presence of foreign affiliates and the complexity of products newly introduced by Turkish firms in the supplying industries.

3 Data Sources and Measurement Issues

3.1 Data Sources

Our sample covers all manufacturing firms with more than 20 employees operating in Turkey in the period 2006-2009. It was created by merging the Turkish Annual Industrial Product

[10] This information has been obtained by means of email interviews conducted by one of the authors with a Pfizer manager in October/November 2014.

Statistics (AIPS) with the Structural Business Statistics (SBS). Both data sources are available from the Turkish National Statistical Office. The former source allows for the identification of each firm's product scope and newly introduced products, while the latter provides information on a wide number of firm characteristics. We exploit the AIPS to get information on firms' 10-digit PRODTR level products, their volume, value of production and sales for the years 2005-2009 for all manufacturing firms with more than 20 employees.[11] As a consequence, new products can only be identified starting from 2006 on the basis of firms' product baskets in 2005 and 2006. Then, we use the SBS to retrieve information on firms' output, input costs, employment, foreign ownership and the NUTS2 region of location over the same period. The SBS also provide information on a firm's plants, such as, their number, location, employment, turnover and NACE sector. This data source allows us to assess the presence of foreign firms in each region-sector combination in terms of employment and output. The SBS provide information on firm foreign ownership only from 2006 onwards.

Our analysis is performed on the sample of all domestically owned manufacturing firms with more than 20 employees, which was created by merging the datasets described above.[12] As the focus of our investigation is the sophistication level of firms' newly introduced products, we will pay most attention to the sub-sample of innovators. Tables A.1 and A.2 in the Appendix describe the regional and sectoral distributions of all firms and innovators (i.e., firms introducing new products) in our sample.[13]

In terms of the sectoral distribution, firms are mainly concentrated in traditional comparative advantage sectors, such as, Food&Beverages (NACE 15), Textiles (NACE 17), and Apparel (NACE 18). They are also well represented in Manufacture of Non-Metallic Mineral Products (NACE 26), Metal Products (NACE 28), and Manufacture of Machinery and Equipment (NACE 29). As for the geographical distribution (Table A.1), we find that Istanbul accounts for about 43% of all firms in our sample and Izmir, Bursa and Ankara account for a further 23% of the total number of firms. This is consistent with the country's development stage which implies that the relatively recently developed manufacturing sector is quite concentrated in a few regions. Turning to the importance of product innovators, as visible in the tables, they

[11]The PRODTR is a national product classification whose first 6 digits correspond to CPA codes and which includes about 3,700 different products.

[12]We follow the OECD definition and classify as domestic those firms whose foreign capital asset share is lower than 10% (OECD, 2008).

[13]We exclude from our analysis firms operating in NACE sector 16 (Manufacture of tobacco products) and 23 (Manufacture of coke, refined petroleum products and nuclear fuel) because of the nature of the activities they perform. We also drop sector 25 "Rubber and Plastics" because of suspected mis-measurement of foreign presence. This sector represents less than 5% of the original sample. Including this sector in the analysis would not affect the significance of the results and the main insights of the analysis. We trim the top and the bottom percentile of the size and the productivity distributions, though not doing so would not affect the conclusions of our study.

constitute a non-negligible share of firms across mostly all regions and sectors, and their distribution across both dimensions mimics the distribution observed for the total sample.

The focus on product innovation in Turkey is motivated by our interest in shedding light on the country's manufacturing evolution. It is supported by Figure A.4 in the Appendix. Here, Panel A shows the spatial distribution of industrial production in Turkey in the year 2005 and documents an important divide between the laggard Eastern regions and the industrial Western ones, in line with the evidence from Table A.1. More noteworthy, Panel B and C reveal that new products are an important driver of regional industrial growth, especially in the laggard Eastern regions.[14] These patterns are in line with the view that new products represent an important factor behind the industrial evolution of Turkey.

The final data source we use is the BACI database(Gaulier and Zignago, 2010). It is compiled by CEPII and covers product-level bilateral export flows. We use the information on the trade network contained in this dataset in order to create a product level measure of sophistication. To match firm-product-level production data with the product-level information obtained from BACI, we first converted 6-digit HS flows (1996 version of the classification) into the CPA classification codes by means of the HS-CPA correspondence table provided by Eurostat. Then we constructed a harmonised classification that is slightly more aggregated than the CPA classification (we refer to it as HCPA). The HCPA classification contains 1,297 products of which 1,030 are actually produced in Turkey. Hereafter, a product code refers to a product as defined in the HCPA classification.

3.2 Measuring Product Complexity

We measure the sophistication of Turkish firms' production by means of the complexity measure proposed by Hausmann and Hidalgo (2009). Before we explain the measure in detail, it is helpful to illustrate it with an analogy mentioned by Hausmann and Hidalgo (2009) and Felipe et al. (2012).

Imagine that a country is represented by a bucket of Lego pieces with each piece representing the capabilities available in the country. The set of products (i.e., Lego models) a country can produce depends on the kind, diversity, and exclusiveness of the Lego pieces in the bucket. A Lego bucket that contains pieces that can only be used to build a toy bicycle probably does not contain the pieces to create a toy car. However, a Lego bucket that contains pieces that can build a toy car may also have the necessary pieces needed to build a toy

[14] The evidence from Panel B is strongly supported by official data on the spatial distribution of average annual export growth. As considering exports is beyond the scope of our analysis, the corresponding map is not shown for brevity, but it is available from the authors upon request.

bicycle.

While two Lego buckets may be capable of building the same number of models, these may be completely different sets of models. Thus, determining the complexity of an economy by looking at the products it produces amounts to determining the "diversity and exclusivity" of the pieces in a Lego bucket by simply looking at the Lego models it can build.

Hausmann and Hidalgo (2009) start from the assumption that the bipartite - country-product - network of world trade originates from a larger tripartite network. This tripartite network links countries to the capabilities they are endowed with and products to the capabilities they require in their production process. Using the information retrieved from the world trade data, they first define diversification as the number of products in which a country has a revealed comparative advantage (RCA), and ubiquity as the number of countries with an RCA in that product.[15] These can be considered the simplest measures of complexity of a country and a product, respectively, and are calculated as:

$$\begin{aligned} Diversification:\ K_{c,0} &= \sum_p dRCA_{cp} \\ Ubiquity:\ K_{p,0} &= \sum_c dRCA_{cp} \end{aligned} \tag{1}$$

where $dRCA_{cp}$ is a dummy denoting whether country c enjoys a comparative advantage position in product p. In the Lego analogy, the former is expected to represent the number of models a Lego bucket can create, while the latter should reflect the exclusivity of the Lego pieces in the bucket. The intuition is that a less ubiquitous product requires more exclusive capabilities. Nonetheless, the extent of diversification and ubiquity are only imprecise measures of complexity, as not only the availability and usage of a wide variety of capabilities, but also the level of their exclusivity is important in the definition of sophistication countries and products. Then, hinging on the basic notions of product ubiquity and country diversification, Hausmann and Hidalgo (2009) apply the Method of Reflections which consists in refining these rough complexity indicators by calculating jointly and iteratively the average value of the measure computed in the preceding iteration. After n iterations, these are given by:

$$K_{c,n} = \frac{1}{K_{c,0}} \sum_p dRCA_{cp} * K_{p,n-1}$$

[15]The index of revealed comparative advantage is defined as the ratio of the export share of a given product in the country's export basket to the share of the product in the world's exports. A country is considered to have a RCA in a given product if the value of the ratio exceeds one.

$$K_{p,n} = \frac{1}{K_{p,0}} \sum_c dRCA_{cp} * K_{c,n-1}$$

Thus, the two indicators iteratively identify a country's complexity by means of its specialisation in products that are not only less ubiquitous but also exported by complex countries. Complex countries are defined as those exporting a larger number of less ubiquitous products. And a product's complexity is defined based on its presence in the export basket of fewer complex countries. Iterations stop when no more information can be drawn from the world trade map, that is, there is a perfect rank correlation between iterations *n* and *n+1*. Even numbered iterations for $K_{c,n}$ give measures of countries' diversification, while odd numbered iterations for $K_{p,n}$ give measures of products' complexity.

As in our analysis we are interested in products' complexity we focus on $K_{p,n}$ and we stop iterations at $n = 13$. Thus, we employ the $K_{p,13}$ index.[16] It is worth stressing that the iteration procedure provides a more detailed and more precise ranking of products in terms of their complexity. This can be illustrated by comparing the product ranking based on the simple ubiquity measure, $K_{p,0}$, to the one based on our complexity measure $K_{p,13}$. While $K_{p,0}$ is able to identify only 73 different rank positions, $K_{p,13}$ ranks differently each of the 1,297 goods in the HCPA classification. For example, in 2002 the HCPA products "Spacecraft (including satellites) and spacecraft launch vehicles" (35.30.40) and "Tin tubes, pipes and tube or pipe fittings" (27.43.29) share the same ranking in terms of product ubiquity, $K_{p,0}$, that is they share the 69th position as only seven countries have a RCA in exporting them. According to the refined product complexity indicator $K_{p,13}$, the former product is ranked 29th and the latter 848th, which is clearly a more intuitive ranking.[17]

Furthermore, the complexity indicator is highly correlated (correlation of 0.74) with another sophistication indicator used in literature (Hausmann et al., 2007), the $PRODY$ index. The latter relates a product's complexity to the average income level of its exporters, by weighing each country's income with its RCA index in the product. Indeed, after removing the information on per capita income, $PRODY$ collapses to $K_{p,1}$. This implies that the $PRODY$ indicator relies more on the structure of the network connecting countries to the products they export than on the income of countries. This suggests that the explanatory power that this measure of sophistication and its country level counterpart, $EXPY$, have

[16] We standardise the complexity indicator $K_{p,13}$ by subtracting its mean and dividing it by its standard deviation.

[17] The number of exporters with RCA in a given product ranges from 3 to 97 with a median value of 23 and the first and last deciles of 12 and 43.

demonstrated (Hausmann et al., 2007; Rodrik, 2006) stems from the information on the diversification of countries and on the ubiquity of products (Hidalgo, 2009). Both diversification and ubiquity are exploited in our product complexity indicator.

Finally, going back to our anecdotal evidence, it is interesting to notice that the washing machine component (flange), which corresponds to the HCPA 29.54.42, has a complexity level of $K_{p,13} = 1.034$, which is higher than the complexity level of another - relatively simpler - steel product with deep drawing, namely a sink (HCPA 28.75.11) whose complexity level is $K_{p,13} = 0.529$. Finally, both products are more complex than other stainless steel products which do not require deep drawing, such as pot scourers (HCPA 28.75.12) whose complexity level is $K_{p,13} = -0.197$. See Figure A.1 in the Appendix.

Figure 2 contrasts the evolution of domestic firms' average production complexity (left axis) with the path of foreign firms' average complexity (right axis) and with the overall country production sophistication evolution (right axis).[18] More specifically, we aggregate production of domestic firms at the product level. We do the same for foreign firms. Then we calculate the weighted average of the complexity of products produced by domestic and foreign firms, respectively. The country-level complexity indicator is computed on the basis of aggregate trade flows. The picture shows the superior product sophistication level of foreign firms vis-$\grave{a}$-vis the domestic ones. The latter, nonetheless, experience a significant upgrading of their product sophistication which drives the overall pattern observed for the Turkish manufacturing sector.

Since the aim of our analysis is to shed light on determinants of product upgrading, for each firm i in our sample we calculate the simple average, $K_{it}^{New_s}$, the weighted average, $K_{it}^{New_w}$, and the maximum, $K_{it}^{New_m}$, complexity level of new products introduced by the firm at time t as:

$$K_{it}^{New_s} = \frac{\sum_{p=1}^{P_{it}^{New}} K_{p,13}}{P_{it}^{New}} \quad (2)$$

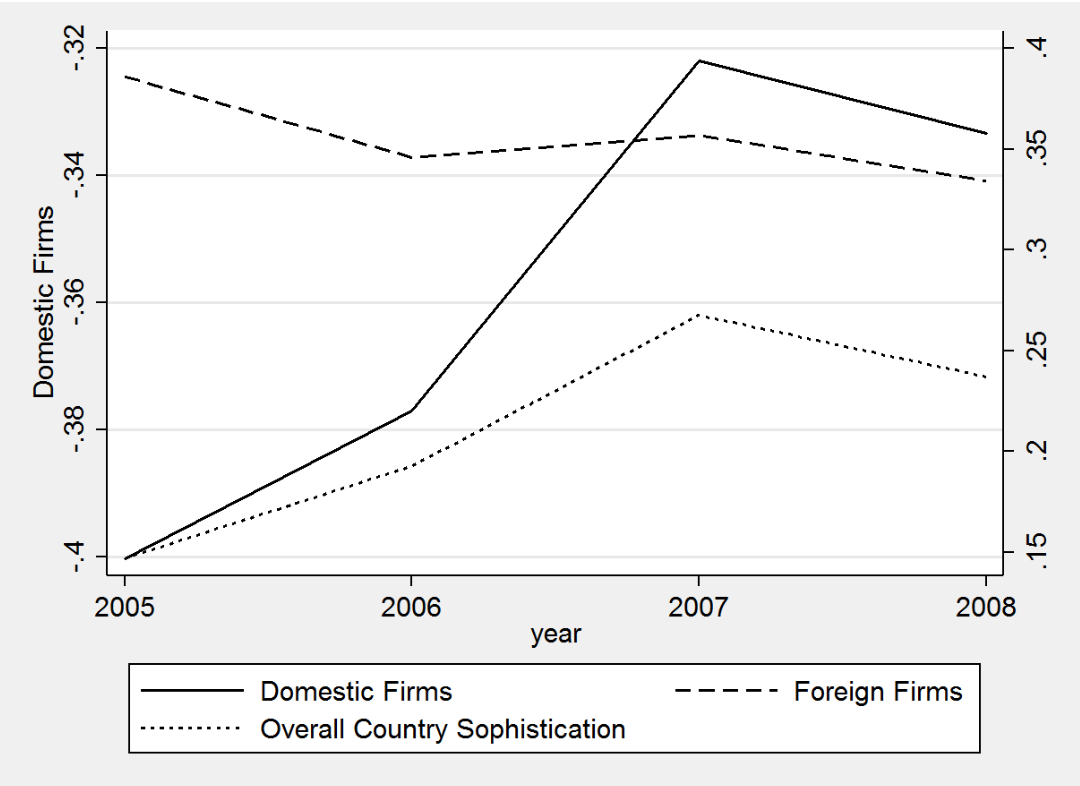
$$K_{it}^{New_w} = \sum_{p=1}^{P_{it}^{New}} K_{p,13} * \frac{output_{ipt}}{\sum_{p=1}^{P_{it}^{New}} output_{ipt}} \quad (3)$$

$$K_{it}^{New_m} = max_p[K_{p,13}]\; with\; p = 1, .., P_{it}^{New} \quad (4)$$

where P_{it}^{New} is the number of new goods introduced by firm i at time t, while $output_{ipt}$ is

[18] Country level production complexity for Turkey refer to $K_{c,20}$, which is computed on the basis of equation 2 by exploiting BACI trade data. We stop iterations at n = 20, when no more information can be gathered from the world trade network, that is there is a perfect rank correlation between iterations 20 and 21.

Figure 2: Product Sophistication Evolution in Turkey



Sources: TurkStat SBS. Own Calculations.
The left axis measures product sophistication of domestically-owned manufacturing firms, while right axis measures product sophistication of foreign firms operating in Turkish manufacturing and the country level complexity computed on the basis of aggregate world trade flows.

its production value of good p.

3.3 Measuring FDI Spillovers

To capture the impact of foreign firms' presence on the sophistication of products newly introduced by Turkish firms, we use the standard proxies for horizontal and vertical spillovers employed by the literature (see, e.g., Javorcik (2004)). We compute these proxies at the region-sector-year level, thus exploiting both regional and cross-industry variation in the presence of foreign owned firms over time. Regions are defined at the NUTS2 level, with a total of 26 regions, whereas sectors are defined at the 2-digit NACE level, with a total of 21 manufacturing sectors.

Our spillovers proxies are compiled based on the information on foreign owned firms with more than 20 employees, their sector of activity, location and employment/output available from the SBS.[19]

A proxy for horizontal (intra-industry) spillovers in sector j and region r at time t is defined as the average foreign equity share, $ForeignShare$, in firms in the sector-region cell weighted by each firm $i's$ share in the cell's output in a given year:

$$Horizontal^{FDI}_{jrt} = \frac{\sum_{i=1}^{N_{jrt}} Y_{it} * ForeignShare_{it}}{\sum_{i=1}^{N_{jrt}} Y_{it}} \tag{5}$$

with N_{jrt} indicating the number of firms in region r which are active in sector j and year t, and Y_{it} denotes the output of firm i in year t. Since we consider the regional dimension, in order to build our spillover indicator we employ plant-level information on output and we attribute to each foreign plant the corresponding foreign equity share declared at the firm level.[20]

To create a proxy for the foreign presence in downstream (input sourcing) and upstream (input supplying) sectors, and thus investigate potential vertical spillovers, we combine the $Horizontal^{FDI}$ indicator in equation 5 with the national Input-Output table (capturing domestic output) for Turkey in the year 2002. We, then, build the following proxies for spillovers through backward and forward linkages, respectively:

[19] Since the SBS collect information for just a rotating sample of firms with fewer than 20 employees, we focus on the population of firms with more than 20 employees. We believe that the exclusion of small firms from the calculation does not represent a severe problem due to the small share of output accounted for by this part of firms' population and due to the evidence that most of foreign owned firms are large.

[20] We also compute weights on the basis of firms' employment shares and we test the robustness of our findings to the use of spillover measures based on employment.

$$Downstream_{jrt}^{FDI} = \frac{\sum_{s=1,s\neq j}^{S} Horizontal_{srt} * sales_{js}}{\sum_{s=1}^{T} sales_{js}} \tag{6}$$

$$Upstream_{jrt}^{FDI} = \frac{\sum_{s=1,s\neq j}^{S} Horizontal_{srt} * purchases_{js}}{\sum_{s=1}^{T} purchases_{js}} \tag{7}$$

where $sales_{js}$ and $purchases_{js}$ are respectively the total sales and purchases of sector j to/from a manufacturing sector s. $1,..,S$ denote the manufacturing sectors, while $S,..,T$ denote the remaining non-manufacturing sectors. Sector j is a firm's main sector of activity. Note that in order to separate intra-industry and inter-industry effects, we exclude sourcing and supplying relationships taking place within the sector.

Figures A.2 and A.3 in the Appendix show the evolution of horizontal, downstream and upstream variables by region and sector, respectively. We can observe the existence of a large variation across regions, across sectors and across time in the presence of foreign multinationals. Although the highest shares of foreign output are recorded in the country's most industrialised regions, e.g. Istanbul, Ankara, Izmir and Manisa, foreign presence is also non-negligible in less developed Eastern regions, such as Malatya and Mardin. Foreign firms are responsible for a significant share of output (more than 10%) in Chemicals (24), Metal Products (28), Electrical Appliances (31) and Motor Vehicles (34). Their presence is also considerable (7% of total output) in more traditional sectors, where Turkey enjoys comparative advantage, such as Food Manufacturing (15) and Clothing (18). A large variation is also visible, albeit to a lesser extent, in the presence of foreign firms in upstream and downstream industries.

In sum, we conclude that the presence of foreign affiliates in Turkish manufacturing is substantial enough to influence the activities of local producers. It also exhibits large enough variation to warrant an analysis at the sector-region level.

To get a sense of the correlation between the sophistication level of new products and the spillover measures, Table 1 reports the value of complexity indicator of newly introduced products by quartile of spillovers' measures. It is straightforward to notice that firms more exposed to the presence of foreign firms in the same sector or in upstream or downstream sectors start, in general, producing goods characterised by a higher sophistication level, though the relationship is not monotonic. The pattern is, however, particularly striking when the presence of MNEs in downstream sectors is considered.[21]

Table 1: Sophistication of newly introduced products along the spillovers' distribution

Quartile	K^{New_s}	K^{New_w}	$K^{New_{max}}$	K^F_{t-1}
$Horizontal^{FDI}$				
$q1$	-0.341	-0.344	-0.226	-0.397
$q2$	-0.999	-1.015	-0.845	-1.122
$q3$	-0.485	-0.485	-0.341	-0.555
$q4$	0.239	0.244	0.360	0.273
$Downstream^{FDI}$				
$q1$	-0.989	-0.997	-0.846	-1.088
$q2$	-0.736	-0.743	-0.576	-0.799
$q3$	0.108	0.114	0.225	0.086
$q4$	0.079	0.075	0.197	0.054
$Upstream^{FDI}$				
$q1$	-0.330	-0.328	-0.215	-0.309
$q2$	-1.160	-1.178	-1.000	-1.327
$q3$	-0.104	-0.100	0.019	-0.130
$q4$	0.061	0.061	0.195	0.023

Sources: TurkStat AIPS and SBS. Own calculations

4 Empirical Strategy

4.1 Baseline specification

As our analysis aims to investigate the complexity of newly introduced products, we need to deal with the selection issue. Not all firms introduce new products, and it is not random which firms do so. We address this issue by estimating an Heckman selection model by maximum likelihood. To model the probability of innovation we use the extent of competition faced by domestic firms in the region-industry cell as an exclusion restriction. The level of competition is proxied by the Herfindahl index computed based on the total output in the region-industry cell (excluding the firm in question). In other words, we argue that innovation activity is affected by the extent of competition (Nickell, 1996; Blundell et al., 1999) but that the extent of competition has no effect on the complexity level of newly introduced goods.[22]

We then examine the impact of foreign firms' presence on the complexity of products newly introduced by domestic firms by estimating the following specification:

[21] t-tests show that firms that operate in sector-region cells where the presence of potential foreign competitors, suppliers and customers exceeds the median value introduce products that are significantly more complex than the ones introduced by firms located in other sector-region cells. This piece of evidence is not shown here for the sake of brevity, but it is available upon request.

[22] We tested directly the latter assumption and could not reject it in our data.

$$K^{New}_{ijrt} = \alpha_1 Downstream^{FDI}_{it-1} + \alpha_2 Upstream^{FDI}_{it-1} + \\ + \alpha_3 Horizontal^{FDI}_{it-1} + \beta' X_{it-1} + \gamma_{jt} + \delta_{rt} + \lambda_{ijrt} + \epsilon_{ijrt} \tag{8}$$

where K^{New}_{ijrt} represents the product complexity across all new goods introduced by firm i located in area r and whose main sector of activity is sector j. All the explanatory variables enter the specification with a one-year lag in order to mitigate simultaneity issues. As a consequence, our left hand side variable is observed in the 2007-2009 time span and our right hand side variables range between 2006 and 2008. The impact of foreign firms operating in the same sector j and the same region is captured by $Horizontal^{FDI}$. To further mitigate endogeneity concerns, we compute the $Horizontal^{FDI}$ indicator for each firm by excluding its output level from the denominator of equation 5.[23] The effect of foreign presence in upstream sectors in the same region is captured by $Upstream^{FDI}$, while $Downstream^{FDI}$ captures the regional presence of foreign firms in downstream sectors and represents our main variable of interest. As firms may have plants in more than one region, for each firm we take the simple average of the above proxies over all regions of operation. Thus, spillover measures vary at the firm level and we will cluster standard errors at the firm level.[24]

In our empirical model, we control for a number of relevant firm-level characteristics (X). This set includes the average complexity of the firm's product basket in $t-1$, K^F_{ijrt-1}. We expect that firms that produced more sophisticated products in the past have the resources and capabilities to introduce new products with a higher level of complexity. We also control for other potential determinants of the complexity level of new products: firm size $(Size)$ measured as the log of the number of people employed in a firm, labour productivity $(Labour\ Productivity)$ defined as the log value-added per worker, the share of employees engaged in R&D activities $(R\&D\ Employment\ Share)$ and the firm's average wage $(Wage)$. λ represents the selection term. Finally, we add sector-year, γ_{jt}, and region-year, δ_{rt}, fixed effects. We, thus, account for the possibility that multinationals pick up specific sectors and regions when entering Turkey because of their attractiveness, especially in terms of their dynamics of product sophistication. Table A.3 in the Appendix presents the descriptive statistics for our complexity measures and explanatory variables.

[23] However, results are very similar when this correction is not implemented.

[24] We also experimented with a weighted average where the regional output shares were used as weights. Using this alternative approach does not change the main findings of this paper. Furthermore, the same insights emerge when we consider only the main region of activity. Finally, we will show later that our results are robust to alternative clustering.

4.2 Instrumental variable approach

One may be concerned that the location of foreign affiliates in Turkey is chosen strategically based on future expectations of sourcing options, thus introducing a reverse causality problem. We believe that this is unlikely to be the case in practice as this would require foreign investors to possess very detailed information, they are unlikely to have. Moreover, we believe that this concern is mitigated by the inclusion of region-year and sector-year fixed effects as well as by the use of lagged proxies for MNE presence. Nonetheless, we take this potential concern seriously and implement an IV approach by instrumenting for the three spillover proxies.[25]

Our IV approach is based on three pillars. First, we believe that international competition for FDI matters for Turkey's success in attracting foreign investment. Second, we anticipate that less developed regions offering lower wages and employment subsidies tend to be more attractive to foreign investors. Third, we believe that initial presence of foreign investors in the region matters for future FDI inflows.

Starting with the first pillar, to proxy for international competition for FDI we consider actions of national Investment Promotion Agencies in countries neighbouring Turkey. We take advantage of the fact that, according to investment promotion professionals, targeting particular sectors in investment promotion efforts is considered to be best practice since it is a more effective strategy than trying to attract FDI across the board (Loewendahl, 2001; Proksch, 2004). We create a sector-specific variable capturing the share of neighbouring countries considering a given sector as a priority sector in their investment promotion efforts.[26] This variable, $Targeting_{2004}^{Neighbours}$ is defined at the 2-digit NACE sector and pertains to 2004, a pre-sample year. It has been obtained from the 2005 World Bank Census of Investment Promotion Agencies.[27] As visible in Table A.6, there is quite a lot of heterogeneity across countries in investment promotion efforts.

The second pillar of our IV strategy rests on identifying low wage regions within Turkey. To do so we use information on the pre-sample level of Socio-Economic Development Index (SEDI) from the Turkish State Planning Organization (now Ministry of Development). We create a dummy, D^r, for underdeveloped 2-digit NUTS regions, which are defined as those including at least one 3-digit NUTS province with the SEDI level below the median. These

[25] As we will find no evidence of a bias due to firms self selecting into introduction of new products, we will apply the IV approach just to the model explaining the complexity of newly introduced products.

[26] The neighbouring countries engaged in sector targeting include: Armenia, Bulgaria and Greece. Later we will consider all countries, not just Turkey's neighbours. According to the data, Turkey did not engage in sector targeting in its own investment promotion efforts.

[27] For more information on the Census, see Harding and Javorcik (2011).

provinces benefited from the subsidies introduced by the Law 5084/2004 which were aimed at supporting newly created firms and existing firms expanding their workforce, by means of reductions in social security contributions, credits on income taxes on wages, subsidies for electricity consumption and land subsidies (Betcherman et al., 2010). These measures were likely to be attractive to foreign investors, but because they were very general in nature and mostly focused on employment creation, they were unlikely to directly affect innovation activity at the firm level.

The third pillar of our IV strategy is to capture the initial presence of FDI at the region-sector level, as the existing stock of FDI is likely to attract further foreign investment. To do so, we use the values of our usual spillover proxies in the first year available, 2006. We exclude this year from the subsequent analysis.

Based on these three pillars we build two sets of instruments. Our first set of instruments interacts the sector-specific measure of international competition for FDI with the region-specific indicator of low cost regions and a time trend T: $Targeting^{Neighbours\ Hor} * D^r * T$. The second set of instruments interacts the region-sector-specific measure of FDI presence in 2006 with the indicator for low cost regions and the time trend: $Horizotal_{06}^{FDI} * D^r * T$. effects. To create an IV for the upstream and downstream FDI, we weigh these two proxies by the appropriate input-output coefficients, as in equations 6 and 7.

Due to the use of FDI values in 2006 in the computation of the second IV, we drop year 2006 from the sample on which the IV approach is performed. All of the IV estimations include the same set of firm level variables, sector-year and region-year fixed effects as the baseline specification. Inclusion of these extensive fixed effects means that we do not need to include the subcomponents of our IVs.

We will experiment with several alternative definitions of the instruments (described later in the text), all of which will lead to the same conclusions.

5 Results

5.1 Baseline Results

We start by ignoring the selection and simultaneity issues and estimate an OLS version of specification (8) (ignoring the λ term) on the subsample of innovating firms. This will give us some basis against which we will compare our findings from the selection model. The estimation results are presented in the left hand side panel of Table 2. Three specifications are presented, as we employ three different ways of aggregating complexity at the firm level.

The results suggest a positive relationship between the foreign presence in the downstream sectors and the complexity of new products introduced by Turkish firms. This finding is consistent with Turkish firms benefiting from their relationships with multinational customers and these benefits manifesting themselves in the sophistication of their new products. Foreign presence in the same or the upstream sectors does not appear to be significantly related to the complexity of new products. Among firm-level controls, only the past sophistication of the production structure and the firms' average wage appear to be statistically significant.[28] As expected, both variables are positively correlated with the complexity of new products.

The main message emerging from the OLS estimates is confirmed by the results of the Heckman selection model presented in the right hand side panel of Table 2. In the first stage, we model the probability of introducing a new product, while the second stage focuses on the factors determining the sophistication of newly introduced products. The estimated coefficients of interest and their significance levels remain virtually unchanged relative to the OLS. The selection term, λ , is never statistically significant. Thus, the results suggest that selection bias does not seem to be a serious issue in our model. As far as the exclusion restriction is concerned, the concentration level in the region-sector bears a negative and statistically significant coefficient, thus corroborating part of the literature suggesting a positive impact of competition on innovation (Nickell, 1996; Blundell et al., 1999).

We find that, while the presence of foreign affiliates in the downstream (input buying) sectors is positively correlated with the sophistication of new products, it does not seem to affect the firm's propensity to introduce a new product. This is true in all specifications presented.[29] The link between the FDI presence in downstream sectors and new product complexity is statistically significant at the one percent level in all specifications. FDI presence in the same or the upstream sector does not seem to matter in either stage.

Moving on to the firm level controls, new products tend to be introduced by firms with a less complex production structure, smaller firms and firms paying lower wages. The past firm complexity turns out to be very relevant in driving the level of complexity of new products, while labour productivity does not seem to affect the sophistication of new products. Higher wages are also positively associated with the complexity of newly introduced goods. Table A.4 in the Appendix displays the findings when spillover proxies are included one by one, thus confirming that the above results are not driven by the correlation existing between the

[28] Note that this variable pertains to all products produced by the firm, while the dependent variable pertains only to the newly introduced products. Thus our specification does not contain a lagged dependent variable.

[29] However, we will see in the next table that such a link exists when we restrict our definition of new products to those accounting for at least 3% of revenues.

variables tested.

Is the estimated effect economically meaningful? Taking as a reference point the results from column 4 of Table 2, our evidence implies that a 10 percentage point increase in foreign presence in downstream sectors is associated with an increase in the average complexity of newly introduced products K^{New_s} by 0.302 points. This corresponds to about 30% of its standard deviation in our sample. Continuing with the example of steel components, this estimate implies moving about half of the way from the production of pot scourers to producing stainless steel products with deep drawing, such as stainless sinks. An increase of about 17 percentage points, instead, would be necessary in order to move from the production of stainless sinks to the production of the washing machine flanges.

In the remainder of this paper, in the interest of brevity, we present only the results for the first measure of complexity calculated as the simple mean of complexity of newly introduced products (K^{New_s}). However, the evidence below is robust to using the measures based on the weighted mean and the maximum complexity.

5.2 Robustness checks

We subject our findings to a plethora of robustness checks. We first show that our results are not affected by using a different definition of the dependent variable. In columns 1-2 of Table 3, we replace our complexity measure with the well-known measure called PRODY developed by Hausmann et al. (2007). This is not surprising because our preferred measure and PRODY are highly correlated and leads to a similar ranking of products, even if the iteration procedure used to create the preferred measure is more convincing. In columns 3-4, we redefine the dependent variable to be the firm's production share accounted for by newly introduced products whose complexity level is higher than that of all goods produced in $t-1$ by the firm. We confirm that the presence of foreign firms in downstream sectors is positively related to the introduction of more complex goods.

In columns 5-6, we change the definition of our dependent variable in the selection equation. We define as innovators firms that introduce new products which (in total) account for a significant share of the firm's total production. We use the threshold of 3%, which approximately corresponds to the 25th percentile of the distribution. When compared to the original definition of innovators, the new definition excludes relatively large firms that produce many products. As such firms possess the internal resources, knowledge and skills to innovate by their own without taking any advantage of their linkages with foreign firms, it is not surprising that excluding them makes the link between downstream FDI and product innovation

Table 2: Baseline Results

	OLS			HECKMAN SELECTION MODEL					
	K^{New_s}	K^{New_w}	$K^{New_{max}}$	K^{New_s}	$Innovation$	K^{New_w}	$Innovation$	$K^{New_{max}}$	$Innovation$
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
$Downstream_{t-1}^{FDI}$	3.009***	2.965***	3.335***	3.017***	0.621	2.971***	0.622	3.347***	0.621
	[0.753]	[0.765]	[0.820]	[0.745]	[0.772]	[0.756]	[0.772]	[0.811]	[0.772]
$Upstream_{t-1}^{FDI}$	-0.155	-0.493	-0.136	-0.164	-0.717	-0.5	-0.717	-0.151	-0.717
	[0.773]	[0.816]	[0.805]	[0.764]	[0.793]	[0.807]	[0.793]	[0.797]	[0.793]
$Horizontal_{t-1}^{FDI}$	0.056	0.101	0.032	0.056	0.046	0.101	0.046	0.033	0.046
	[0.101]	[0.102]	[0.105]	[0.099]	[0.111]	[0.101]	[0.111]	[0.104]	[0.111]
K_{t-1}^{F}	0.265***	0.270***	0.254***	0.264***	-0.071***	0.269***	-0.071***	0.252***	-0.071***
	[0.018]	[0.018]	[0.018]	[0.017]	[0.017]	[0.018]	[0.017]	[0.018]	[0.017]
$Size_{t-1}$	-0.018*	-0.017	-0.016	-0.019*	-0.048***	-0.018*	-0.048***	-0.017	-0.048***
	[0.010]	[0.010]	[0.011]	[0.010]	[0.012]	[0.010]	[0.012]	[0.011]	[0.012]
$Labour\_Productivity_{t-1}$	0.002	-0.005	-0.003	0.002	0.034**	-0.005	0.034**	-0.002	0.034**
	[0.013]	[0.013]	[0.014]	[0.013]	[0.015]	[0.013]	[0.015]	[0.014]	[0.015]
$R\&D\_Employment\_Share_{t-1}$	0.002	0.003	0.004	0.002	0.000	0.003	0.000	0.004	0.000
	[0.003]	[0.003]	[0.004]	[0.003]	[0.001]	[0.003]	[0.001]	[0.004]	[0.001]
$Wage_{t-1}$	0.092***	0.099***	0.090***	0.090***	-0.168***	0.097***	-0.168***	0.087***	-0.168***
	[0.024]	[0.025]	[0.027]	[0.024]	[0.028]	[0.025]	[0.028]	[0.026]	[0.028]
$Herfindhal_{t-1}^{Reg}$					-0.406**		-0.405**		-0.409**
					[0.183]		[0.183]		[0.183]
λ				0.015		0.011		0.023	
				[0.010]		[0.011]		[0.014]	
FE									
Sector*Year	y	y	y	y	y	y	y	y	y
NUTS2*Year	y	y	y	y	y	y	y	y	y
Observations	5,674	5,674	5,674	5,674	36,633	5,674	36,633	5,674	36,633
R-squared	0.711	0.702	0.666						

* Significant at 10% level; ** significant at 5% level; *** significant at 1% level.
All variables are at the firm level and robust standard errors are clustered by firm and displayed in brackets.

stronger.

In the baseline model, we cluster standard errors at the firm level because our spillover proxies are averages across all regions where a firm owns facilities. Thus, the spillover measures are firm specific variables. However, due to the limited share of firms located in more than one regions, a large part of variation in the variables of our interest pertains to the region-sector level. Therefore, in columns 7-8, we change clustering of standard errors from the firm level to the region-sector level. Our results are robust to this change. The variable of interest remains statistically significant at the one percent level.

In the final two columns, we present the results from a cross-sectional analysis. In this exercise, we define the firm's probability of introducing a new product on a 3-year-long interval (2007-2009). The complexity of new products is then measured as an average over the same period. The explanatory variables pertain to the pre-sample year, 2006. Our findings remain mostly unchanged and we confirm the significance of backward spillovers on both the probability of innovation and the complexity of the new products.[30]

A further set of robustness checks is presented in Table 4. For the sake of brevity we do not report the estimates from the selection equation. In column 1, we consider only single-region firms and, then, use spillover proxies that vary at the region-sector-year level. In this specification, we cluster standard errors at the region-sector level. The estimated coefficient on FDI in downstream sectors is slightly higher, thus hinting at a possible downward bias stemming from averaging spillover measures across a firm's locations.

In columns 2-5, we show that our results are robust to inclusion of additional covariates which vary at the region-sector-time level and are observed in $t-1$, such as value added ($VA_{Reg,Sector,t-1}$), labour productivity ($Labour\ Productivity_{Reg,Sector,t-1}$), output ($Output_{Reg,Sector,t-1}$), and employment ($Employment_{Reg,Sector,t-1}$).

Finally, in column 6, we show that our findings are not affected when spillover proxies are built using employment shares rather than output shares.

5.3 Allowing for heterogeneous effects of foreign presence in downstream sectors

In Table A.5 in the Appendix, we allow for heterogenous effects of foreign presence in downstream sectors on product sophistication depending on domestic firms' pre-existing characteristics and on the nationality of foreign investors.

[30]When we substitute the average values of regressors for the lagged value, the results are very similar to the ones presented in the text.

Table 3: Selection Model - K^{News} - Robustness I

	$Prody^{News_s}$		$Share^{News_s}_{HighK}$		Relevant Product Innovations		Clustering Region-Sector		Cross-Section Estimates	
	K^{News_s}	$Innovation$	K^{News_s}	$Innovation$	K^{News_s}	$Innovation$	K^{News_s}	$Innovation$	K^{News_s}	$Innovation$
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
$Downstream^{FDI}_{t-1}$	1.182***	0.618	1.129***	0.114	3.162***	1.670**	3.017***	0.621	3.668***	1.728*
	[0.413]	[0.771]	[0.436]	[0.155]	[0.825]	[0.796]	[0.819]	[0.887]	[0.797]	[1.040]
$Upstream^{FDI}_{t-1}$	-0.626	-0.742	-0.519	-0.184	-0.519	-0.456	-0.164	-0.717	0.268	-0.98
	[0.473]	[0.793]	[0.466]	[0.146]	[0.840]	[0.788]	[0.845]	[0.856]	[0.881]	[1.146]
$Horizontal^{FDI}_{t-1}$	0.061	0.025	-0.027	-0.004	0.044	0.14	0.056	0.046	0.04	-0.021
	[0.054]	[0.112]	[0.055]	[0.023]	[0.108]	[0.114]	[0.100]	[0.137]	[0.108]	[0.146]
K^F_{t-1}	0.107***	-0.070**	-0.135***	-0.017***	0.257***	-0.024	0.264***	-0.071	0.284***	-0.062***
	[0.020]	[0.029]	[0.019]	[0.004]	[0.019]	[0.018]	[0.041]	[0.047]	[0.020]	[0.023]
$Size_{t-1}$	-0.013**	-0.047***	-0.027**	-0.010***	-0.021*	-0.066***	-0.019*	-0.048***	-0.019	-0.037**
	[0.006]	[0.012]	[0.012]	[0.003]	[0.012]	[0.012]	[0.011]	[0.011]	[0.012]	[0.016]
$Labour\_Productivity_{t-1}$	0.004	0.034**	-0.003	0.008**	0.005	0.02	0.002	0.034*	-0.003	0.035*
	[0.007]	[0.015]	[0.011]	[0.003]	[0.014]	[0.016]	[0.016]	[0.021]	[0.016]	[0.021]
$R\&D\_Employment\_Share_{t-1}$	0.002**	0	0.001	0	0.002	0	0.002	0	0.003	0.002
	[0.001]	[0.001]	[0.002]	[0.000]	[0.003]	[0.001]	[0.003]	[0.001]	[0.003]	[0.003]
$Wage_{t-1}$	0.012	-0.168***	-0.03	-0.033***	0.081***	-0.207***	0.090***	-0.168***	0.073***	-0.253***
	[0.013]	[0.028]	[0.037]	[0.006]	[0.028]	[0.030]	[0.028]	[0.035]	[0.028]	[0.039]
$Herfindhal^{Reg}_{t-1}$		-0.402**		-0.071**		-0.394**		-0.406**		-0.525**
		[0.183]		[0.033]		[0.196]		[0.196]		[0.238]
λ	0.004		0.857		0.047		0.015		0.009	
	[0.004]		[1.02]		[0.027]		[0.017]		[0.009]	
FE										
Sector*Year	y	y	y	y	y	y	y	y	y	y
NUTS2*Year	y	y	y	y	y	y	y	y	y	y
Observations	5,674	36,633	5,674	36,633	4,255	36,633	5,674	36,633	3,720	12,354

* Significant at 10% level; ** significant at 5% level; *** significant at 1% level.
All variables are at the firm level and robust standard errors are clustered by firm and displayed in brackets in specifications 1-7. In column 8, instead, robust standard errors are clustered by region and sector, as for single region firms FDI spillover measures vary by region-sector-year.

Table 4: Selection Model - K^{News_s} - Robustness II

	Single Region	*Regional Controls*				*Employment Based FDI Measure*
	[1]	[2]	[3]	[4]	[5]	[6]
$Downstream^{FDI}_{t-1}$	3.211***	2.902***	2.859***	2.929***	2.987***	4.599***
	[0.832]	[0.832]	[0.835]	[0.825]	[0.824]	[1.120]
$Upstream^{FDI}_{t-1}$	-0.674	-0.057	-0.116	-0.093	0.01	-0.167
	[1.008]	[0.841]	[0.843]	[0.844]	[0.839]	[0.851]
$Horizontal^{FDI}_{t-1}$	0.107	0.051	0.019	0.055	0.063	0.009
	[0.101]	[0.109]	[0.112]	[0.109]	[0.109]	[0.124]
K^{F}_{t-1}	0.264***	0.244***	0.243***	0.245***	0.245***	0.264***
	[0.048]	[0.020]	[0.020]	[0.020]	[0.020]	[0.017]
$Size_{t-1}$	-0.021	-0.025**	-0.025**	-0.025**	-0.024**	-0.019*
	[0.016]	[0.011]	[0.011]	[0.011]	[0.011]	[0.010]
$Labour\_Productivity_{t-1}$	0.007	0.005	0.005	0.005	0.006	0.002
	[0.019]	[0.014]	[0.014]	[0.014]	[0.014]	[0.013]
$R\&D\_Employment\_Share_{t-1}$	0	0	0	0	0	0.002
	[0.004]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]
$Wage_{t-1}$	0.105***	0.102***	0.101***	0.103***	0.103***	0.089***
	[0.033]	[0.027]	[0.027]	[0.027]	[0.027]	[0.024]
λ	0.001	0.014	0.014	0.013	0.014	0.016
	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]	[0.011]
$Value\ Added_{Reg,Sector,t-1}$		0.016				
		[0.013]				
$Labour\ Productivity_{Reg,Sector,t-1}$			0.054			
			[0.036]			
$Output_{Reg,Sector,t-1}$				0.018		
				[0.013]		
$Employment_{Reg,Sector,t-1}$					0.012	
					[0.016]	
FE						
Sector*Year	y	y	y	y	y	y
NUTS2*Year	y	y	y	y	y	y
Observations	4,312	5,674	5,674	5,674	5,674	5,674

* Significant at 10% level; ** significant at 5% level; *** significant at 1% level.
All variables are at the firm level and robust standard errors are clustered by firm and displayed in brackets in specifications 2-6. In column 1, instead, robust standard errors are clustered by region and sector, as FDI spillover measures vary by region-sector-year for single region firms.

The indigenous firms' pre-existing complexity and productivity Benefits that indigenous firms enjoy from their interactions with foreign investors could depend on their existing capabilities. On the one hand, domestic players with greater absorptive capacity may be better positioned to take advantage of knowledge spillovers. On the other hand, larger benefits may accrue to firms with a larger need for external support and aid in the process of production upgrading. Which of these effects dominates is an empirical question. To shed light on this issue we extend our baseline specification (equation 8) by adding the interaction between spillovers from foreign customers, $Downstream_{it-1}^{FDI}$, and a dummy denoting domestic firms with a pre-existing sophistication level, K_{it-1}^{F}, above the sample median. The results, presented in the first column of Table A.5, suggest that firms with a lower initial level of product sophistication derive greater benefits from FDI presence in downstream sectors. These benefits are roughly three times higher in magnitude than the benefits accruing to more sophisticated firms. In other words, the presence of multinationals seems to contribute to the convergence of sophistication among firms, at least among innovators.

Whereas the pre-existing firm complexity level appears to shape the magnitude of the spillover effect, firms' pre-existing labour productivity levels do not seem to matter for the way spillovers from FDI in downstream sectors operate. As visible in column 2 of Table A.5, the coefficient on the interaction term between spillovers from foreign customers and a dummy denoting domestic firms with the above median labour productivity level does not appear to be statistically significant.

The firm size Next, we test for the possible moderating role of another dimension of firm heterogeneity: the firm size. We interact the downstream FDI measure with a dummy denoting firms with a number of employees above the median in the sample (42 employees, see column 3) or above 100 employees (see column 4). The estimated coefficients on the interaction terms are negative and statistically significant, thus suggesting that vertical linkages with foreign affiliates tend to stimulate complexity upgrading among smaller firms in downstream sectors. This result could stem from a higher flexibility of small firms' technology which allows them to adjust to better match the needs of the foreign customers.

FDI country origin So far, we have assumed that knowledge spillovers from foreign affiliates are independent of their country of origin. It is possible, however, that multinationals from high and low income economies are characterised by different levels of technological sophistication and, thus, present different potential to serve as a source of knowledge externalities. We examine this hypothesis by exploiting the information on investor countries available in our data. We split foreign spillover proxies into two groups according to the foreign investor's origin: high income and low income country.[31]. We expect that spillovers from high income countries play a more relevant role in stimulating the production upgrading of Turkish firms. This indeed appears to be the case. The results in column 5 of Table A.5 suggest that the positive link between the foreign presence in downstream sector and product upgrading is driven by MNEs from high income countries. FDI from low income countries does not appear to exert a statistically significant effect.

5.4 Instrumental variable approach results

Our previous findings point to the importance of multinationals in spurring product complexity upgrading in Turkish manufacturing. Our estimates are consistent with evidence from case studies and prove robust to a number of checks. However, as previously discussed, the causal interpretation of these findings could be threatened by possible endogeneity. Then, we implement an IV approach by instrumenting for the three spillover proxies, as described earlier. Since our results indicated that accounting for selection of firms into innovation does not matter for our findings, we restrict our attention only to the link between product complexity and foreign presence.

The results are presented in Table 5. In the upper panel, we report the estimates from the second stage and in the lower panel the estimates from the first stage. The second stage results confirm a significant effect of FDI presence in downstream sectors on the complexity of products newly introduced by Turkish firms. The magnitude of the effect is very similar to the one obtained from the corresponding OLS regression (recall that we lose one year of data in the IV approach), even if its significance is now reduced.

Turning to the first stage results, they reveal that the past stock of FDI is, in general, a good predictor for the subsequent stock of FDI in areas benefiting from subsidies. They are also suggestive of a catching up process of backward regions with respect to the developed ones in terms of FDI inflows. As expected, competition for FDI inflows from neighbouring countries negatively affects the presence of multinationals in less developed Turkish regions. The F-statistics indicate that our instruments are good predictors of FDI presence in Turkey. Partial R^2 suggests that the instruments work particularly well in predicting foreign presence in downstream sectors. The Hansen test does not cast doubt on the suitability of our instruments.

To test the robustness of our IV results, we experiment with slight modifications of our in-

[31] Countries' income level is from the 2011 World Bank classification

Table 5: IV Estimation

Second Stage Results

	K^{New_s}	
	IV - 2^{nd} stage	OLS
$Downstream_{t-1}^{FDI}$	3.301*	3.168***
	[1.691]	[0.930]
$Upstream_{t-1}^{FDI}$	-8.516	-0.944
	[8.212]	[1.000]
$Horizontal_{t-1}^{FDI}$	0.525	0.0005
	[0.638]	[0.126]
Obs	3,530	3,530
Hansen - P-value	0.229	
Weak identification test	4.829	

First Stage Results

	$Downstream_{t-1}^{FDI}$	$Upstream_{t-1}^{FDI}$	$Horizontal_{t-1}^{FDI}$
Downstream$_{2006}^{FDI}$*T*D^{Reg}	0.002***	-0.0001	0.0014
	[0.0002]	[0.0001]	[0.0009]
Upstream$_{2006}^{FDI}$*T*D^{Reg}	0.0007***	0.0015***	0.004*
	[0.0003]	[0.0003]	[0.0027]
Horizontal$_{2006}^{FDI}$*T*D^{Reg}	-0.0001***	0.0001***	0.002***
	[0.00002]	[0.00004]	[0.0003]
Targeting$_{2d\ 2004}^{Neighbours\ Down}$*T*D^{Reg}	-0.1336***	0.0084	-0.017
	[0.010]	[0.0052]	[0.0456]
Targeting$_{2d\ 2004}^{Neighbours\ Up}$*T*D^{Reg}	-0.0149	-0.0286***	-0.1913***
	[0.012]	[0.0098]	[0.0711]
Targeting$_{2d\ 2004}^{Neighbours\ Hor}$*T*D^{Reg}	0.0032*	0.0019	-0.089***
	[0.0019]	[0.0019]	[0.014]
Obs	3,530	3,530	3,530
Test F	46.56	9.81	21.34
Partial R^2	0.264	0.0327	0.0711

* Significant at 10% level; ** significant at 5% level; *** significant at 1% level.
Firm level controls, sector-year and region-year fixed effects are included in both stages but not reported.
Robust standard errors are clustered by firm and displayed in brackets.
Horizontal$_{06}^{FDI}$, Downstream$_{06}^{FDI}$ and Upstream$_{06}^{FDI}$ capture the presence of FDI in 2006 in a firm's sector, and in dowmstream and upstream sectors respectively.
Targeting$^{Neighbours\ Hor}$, Targeting$^{Neighbours\ Down}$ Targeting$^{Neighbours\ Up}$ denote the number of neighbouring countries targeting the sector where the firm operates, downstream sectors and upstream sectors, respectively.
T represents a time trend, while D^{Reg} is dummy denoting the underdeveloped regions as explained in the text.

struments. We introduce four different sets of instruments by exploiting different definitions of the variables capturing FDI targeting practices: (i) we consider the number of years neighbouring countries target FDI in a given sector prior to 2004, instead of exploiting just the information on the share of neighbouring countries which target the sector in 2004; (ii) we substitute year dummies for the time trend, thus replacing each proxy listed above with two variables, one for each year 2008 and 2009; (iii) we focus on targeting activities of all countries instead of just the neighbouring ones and we split them according to their income level into high and low income economies; to capture the relevance of each country to Turkey we weight the country's investment promotion activity by its distance to Turkey; (iv) we modify the last instrument by considering the number of years the promotion activity has been performed prior to 2004. The first stage results are shown in Appendix in Table A.7 and Table A.8. The second stage results, based on these different combinations of instruments, are shown below in Table 6. Despite the existence of mild differences in the magnitude and significance of the coefficient associated to backward spillovers, they closely mimic the previous results. The slight increase in the magnitudes in some specifications is in line with the presence of measurement error in spillover proxies and, thus, an attenuation bias being present in the OLS regressions.

Table 6: Alternative Sets of Instruments: 2^{nd} Stage Results

	K^{New_s}				
	Set (i)	Set (ii)	Set (iii)	Set (iv)	OLS
$Downstream^{FDI}_{t-1}$	3.569**	3.982**	3.148**	3.123**	3.168***
	[1.668]	[1.642]	[1.580]	[1.592]	[0.930]
$Upstream^{FDI}_{t-1}$	-6.556	-0.804	-5.271	-4.847	-0.944
	[6.688]	[6.025]	[4.583]	[4.554]	[1.000]
$Horizontal^{FDI}_{t-1}$	0.364	-0.170	0.441	0.307	0.0005
	[0.536]	[0.533]	[0.479]	[0.475]	[0.126]
Obs	3,530	3,530	3,530	3,530	3,530
Hansen - P-value	0.207	0.297	0.188	0.116	
Weak identification test	7.765	3.898	6.763	6.527	
F-Test $Downstream^{FDI}_{t-1}$	45.43	31.51	23.13	21.99	

* Significant at 10% level; ** significant at 5% level; *** significant at 1% level.
Firm level controls, sector-year and region-year fixed effects are included in both stages but not reported.
Robust standard errors are clustered by firm and displayed in brackets.
See the text for a description of the IV sets.

6 Conclusions

Governments of developing countries and emerging markets often strive to find policies to stimulate upgrading of the national production structure. This paper argues that attracting inflows of foreign direct investment can help them achieve this goal.

We examine whether multinational activity can boost the sophistication of the host country's production structure. More specifically, we use firm-product level data from the Turkish manufacturing sector for the period 2006-9 to study the link between the complexity of products newly introduced by Turkish firms and the regional presence of foreign affiliates in the input sourcing sectors. We find evidence consistent with interactions between multinational firms and their Turkish suppliers facilitating product upgrading by the latter group. The effects seem to be more pronounced for smaller and less sophisticated Turkish firms. They are also primarily driven by multinationals from industrialized countries.

Our findings support the view that attracting inflows of FDI may serve as a catalyst for upgrading the national production structure in an emerging economy. They also suggest that FDI can be a force for intra-national convergence as smaller and less sophisticated firm appear to benefit more from knowledge brought by foreign investors.

References

Aitken, B.J., Harrison, A.E., 1999. Do domestic firms benefit from direct foreign investment? evidence from venezuela. American Economic Review 89, 605–618.

Alfaro, L., Chanda, A., Kalemli-Ozcan, S., Sayek, S., 2004. FDI and economic growth: the role of local financial markets. Journal of International Economics 64, 89–112.

Arnold, J.M., Javorcik, B.S., 2009. Gifted kids or pushy parents? foreign direct investment and plant productivity in indonesia. Journal of International Economics 79, 42–53.

Bas, M., Strauss-Kahn, V., 2015. Input Trade Liberalization, Export Prices and Quality Upgrading. Journal of International Economics 95, 250–262.

Betcherman, G., Daysal, N.M., Pagés, C., 2010. Do employment subsidies work? Evidence from regionally targeted subsidies in Turkey. Labour Economics 17, 710–722.

Blundell, R., Griffith, R., van Reenen, J., 1999. Market Share, Market Value and Innovation in a Panel of British Manufacturing Firms. Review of Economic Studies 66, 529–54.

Borenzstein, E., De Gregorio, J., Lee, J.W., 1998. How does foreign investment affect economic growth? Journal of International Economics 45, 115–135.

Brambilla, I., 2009. Multinationals, technology, and the introduction of varieties of goods. Journal of International Economics 79, 89 – 101.

Branstetter, L., 2006. Is foreign direct investment a channel of knowledge spillovers? evidence from japan's fdi in the united states. Journal of International Economics 68, 325–344.

Felipe, J., Kumar, U., Abdon, A., Bacate, M., 2012. Product complexity and economic development. Structural Change and Economic Dynamics 23, 36 – 68.

Gaulier, G., Zignago, S., 2010. BACI: International Trade Database at the Product-Level. The 1994-2007 Version. Working Paper, 2010-23. CEPII.

Godart, O., Görg, H., 2013. Suppliers of Multinationals and the Forced Linkage Effect: Evidence from Firm Level Data. Journal of Economic Behavior and Organization 94, 393–404.

Goerg, H., Greenaway, D., 2004. Much ado about nothing? do domestic firms really benefit from foreign direct investment? World Bank Research Observer 19, 171–197.

Guadalupe, M., Kuzmina, O., Thomas, C., 2012. Innovation and foreign ownership. American Economic Review 102, 3594–3627.

Hallak, J.C., 2006. Product Quality and the Direction of Trade. Journal of International Economics 68, 238–265.

Hallak, J.C., Schott, P., 2011. Estimating Cross-Country Differences in Product Quality. Quarterly Journal of Economics 126, 417–474.

Harding, T., Javorcik, B.S., 2011. Roll out the red carpet and they will come: Investment promotion and fdi inflows. Economic Journal 121, 1445–1476.

Harding, T., Javorcik, B.S., 2012. Foreign direct investment and export upgrading. The Review of Economics and Statistics 94, 964–980.

Hausmann, R., Hidalgo, C.A., 2009. The building blocks of economic complexity. Proc. Natl. Acad. Sci. 106, 10570–10575.

Hausmann, R., Hwang, J., Rodrik, D., 2007. What you export matters. Journal of Economic Growth 12, 1–25.

Hausmann, R., Rodrik, D., 2003. Economic development as self discovery. Journal of Development Economics 72, 603–633.

Havranek, T., Irsova, Z., 2011. Estimating vertical spillovers from fdi: Why results vary and what the true effect is. Journal of International Economics 85, 234–244.

Hidalgo, C., 2009. The dynamics of economic complexity and the product space over a 42 year period. Working Papers 189. Center for International Development, Harvard University.

Javorcik, B., 2008. Can survey evidence shed light on spillovers from foreign direct investment? World Bank Research Observer 23, 139–159.

Javorcik, B.S., 2004. Does Foreign Direct Investment Increase the Productivity of Domestic Firms? In Search of Spillovers Through Backward Linkages. American Economic Review 94, 605–627.

Khandelwal, A., 2010. The Long and Short (of) Quality Ladders. Review of Economic Studies 77, 1450–1476.

Khandelwal, A., Schott, P., Wei, S.J., 2013. Trade Liberalization and Embedded Institutional Reform: Evidence from Chinese Exporters. American Economic Review 103, 2169–2195.

Loewendahl, H., 2001. A Framework for FDI Promotion. Transnational Corporations 10, 1–42.

Lucas, R.J., 1988. On the mechanics of economic development. Journal of Monetary Economics 22, 3–42.

Manova, K., Zhang, Z., 2012. Export Prices Across Firms and Destinations. Quarterly Journal of Economics 127, 379–436.

Nickell, S.J., 1996. Competition and Corporate Performance. Journal of Political Economy 104, 724–46.

OECD, 2008. OECD Benchmark Definition of Foreign Direct Investment. Fourth Edition. OECD.

Proksch, M., 2004. Selected Issues on Promotion and Attraction of Foreign Direct Investment in Least Developed Countries and Economies in Transition. Investment Promotion and Enterprise Development Bulletin for Asia and the Pacific 2, 1–17.

Rodrik, D., 2006. What's So Special about China's Exports? China & World Economy 14, 1–19.

Swenson, D.L., Chen, H., 2014. Multinational exposure and the quality of new chinese exports. Oxford Bulletin of Economics and Statistics 76.

UNCTAD, 2003. FDI Policies for Development: National and International Perspectives. World Investment Report. United Nations Conference on Trade and Development.

Wang, Z., Wei, S.J., 2010. What Accounts for the Rising Sophistication of China's Exports?, in: China's Growing Role in World Trade. National Bureau of Economic Research, Inc. NBER Chapters, pp. 63–104.

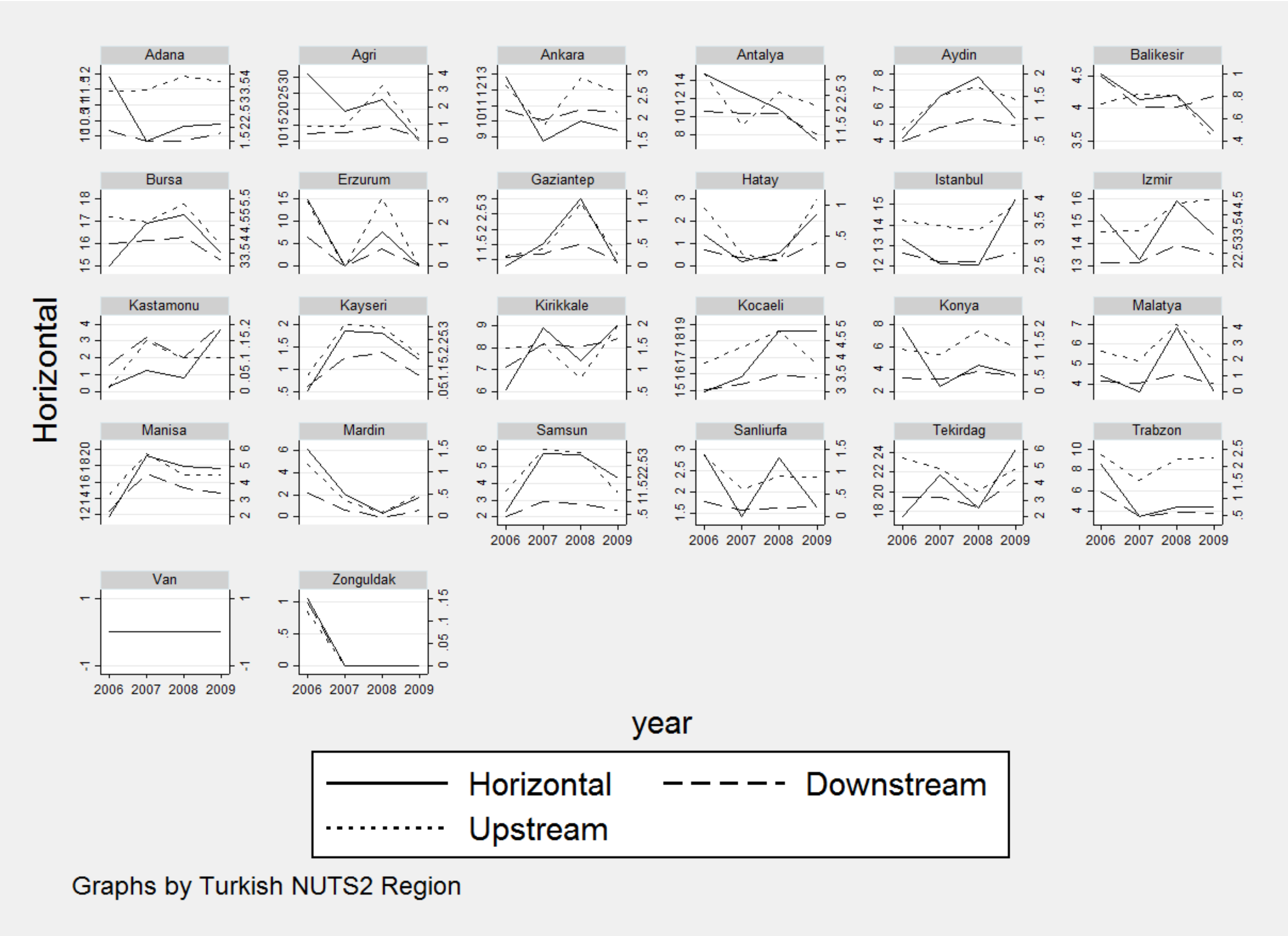
Appendix [for publication on line only]

A Additional Figures and Tables

Figure A.1: The complexity ranking of stainless steel products

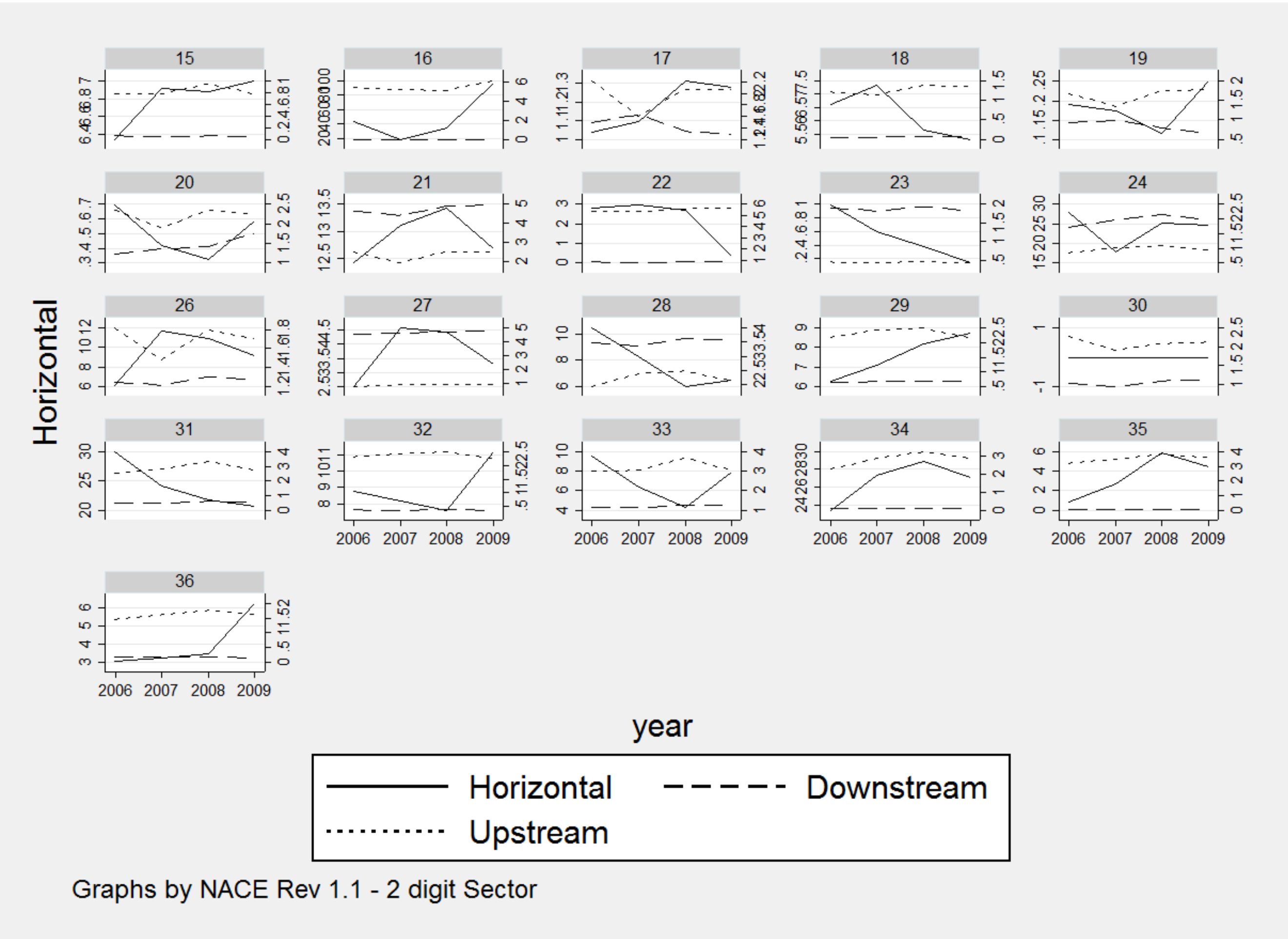
Source: Baci database. Own calculations.

Figure A.2: Foreign Output Evolution by Turkish NUTS2 Region



Sources: TurkStat SBS. Own Calculations
Percentage figures from the calculations of equations 5-7 are shown.

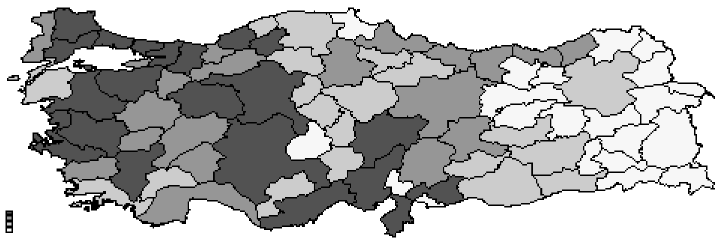
Figure A.3: Foreign Output Evolution by 2 digit Sector



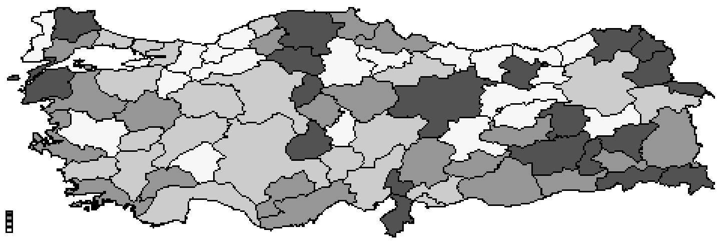
Sources: TurkStat SBS. Own Calculations
Percentage figures from the calculations of equations 5-7 are shown.

Figure A.4: Turkish Manufacturing Production, 2005/2009

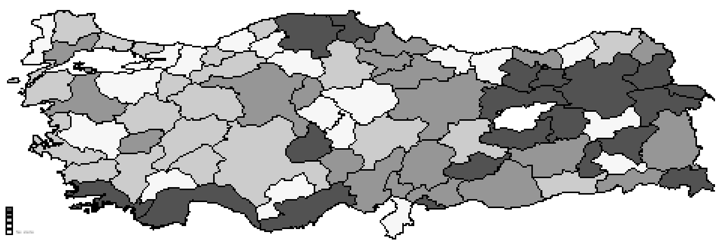
A - Production Value in 2005



B - Average Production Value Growth - 2005/2009



C - Average weight of New Products in Production Value - 2005/2009



Quartiles of variables distribution are represented by means of different grey tonalities, with the darker ones identifying upper quartiles.
The top panel displays the NUTS 3 spatial distribution of Turkish manufacturing production value. The middle panel chart displays the NUTS 3 spatial distribution of Turkish manufacturing production value average growth. The lower panel chart displays the NUTS 3 spatial distribution of the 2005-2009 average weight of new products in manufacturing production value.
Source: TurkStat SBS and AIPS. Own calculations.

Table A.1: Sample Composition - By NUTS2 Region

Region	**NUTS2 Code**	**Innovators**		**All Firms**		**Innovators**(%)
		Freq.	Percent	Freq.	Percent	
Istanbul	10	3,006	52.98	15,800	43.12	19.03
Tekirdag	21	59	1.04	477	1.3	12.37
Balikesir	22	29	0.51	387	1.06	7.49
Izmir	31	457	8.05	2,972	8.11	15.38
Aydin	32	121	2.13	1,263	3.45	9.58
Manisa	33	179	3.15	1,231	3.36	14.54
Bursa	41	300	5.29	3,250	8.87	9.23
Kocaeli	42	166	2.93	1,609	4.39	10.32
Ankara	51	307	5.41	2,307	6.3	13.31
Konya	52	135	2.38	1,131	3.09	11.94
Antalya	61	92	1.62	614	1.68	14.98
Adana	62	111	1.96	813	2.22	13.65
Hatay	63	75	1.32	564	1.54	13.30
Kirikkale	71	28	0.49	253	0.69	11.07
Kayseri	72	192	3.38	954	2.6	20.13
Zonguldak	81	22	0.39	237	0.65	9.28
Kastamonu	82	21	0.37	163	0.44	12.88
Samsun	83	127	2.24	736	2.01	17.26
Trabzon	90	54	0.95	427	1.17	12.65
Erzurum	A1	2	0.04	48	0.13	4.17
Agri	A2	3	0.05	26	0.07	11.54
Malatya	B1	22	0.39	276	0.75	7.97
Van	B2	4	0.07	61	0.17	6.56
Gaziantep	C1	132	2.33	802	2.19	16.46
Sanliurfa	C2	20	0.35	205	0.56	9.76
Mardin	C3	10	0.18	35	0.1	28.57
		5,674	100	36,641	100	15.49

Sources: TurkStat AIPS and SBS. Own calculations

Table A.2: Sample Composition - By NACE Sector

Sector	**NACE Rev 1.1 Code**	**Innovators**		**All Firms**		**Innovators**(%)
		Freq.	Percent	Freq.	Percent	
Food	15	520	9.16	4,631	12.64	11.23
Textile	17	689	12.14	5,525	15.08	12.47
Apparel	18	1,581	27.86	4,950	13.51	31.94
Footwear	19	102	1.8	1,061	2.9	9.61
Wood	20	133	2.34	769	2.1	17.30
Paper	21	95	1.67	906	2.47	10.49
Publishing	22	81	1.43	658	1.8	12.31
Chemicals	24	193	3.4	1,271	3.47	15.18
Non-Metallic Minerals	26	225	3.97	2,919	7.97	7.71
Basic Metals	27	141	2.49	1,261	3.44	11.18
Metal Products	28	368	6.49	2,836	7.74	12.98
Machinery	29	615	10.84	3,841	10.48	16.01
Office Machinery	30	6	0.11	29	0.08	20.69
Electrical Machinery	31	147	2.59	1,164	3.18	12.63
Radio, Tv and Communications	32	42	0.74	209	0.57	20.10
Professional Instruments	33	62	1.09	341	0.93	18.18
Transport Equipment	34	166	2.93	1,393	3.8	11.92
Other Transport Equipment	35	14	0.25	133	0.36	10.53
Furniture and manufacturing n.e.s.	36	494	8.71	2,744	7.49	18.00
Total		5,674	100	36,641	100	15.49

Sources: TurkStat AIPS and SBS. Own calculations

Table A.3: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
K^{New_s}	5,674	-0.397	1.000	-2.600	2.600
K^{New_w}	5,674	-0.400	1.013	-2.556	2.601
$K^{New_{max}}$	5,674	-0.263	1.012	-2.556	2.601
$Horizontal^{FDI}_{t-1}$	5,674	0.062	0.095	0.000	0.999
$Downstream^{FDI}_{t-1}$	5,674	0.009	0.016	0.000	0.140
$Upstream^{FDI}_{t-1}$	5,674	0.017	0.013	0.000	0.121
K^{F}_{t-1}	5,674	-0.450	1.025	-2.303	2.137
$Size_{t-1}$	5,674	3.883	0.755	2.197	6.851
$Labour\_Productivity_{t-1}$	5,674	9.488	0.681	7.230	11.587
$R\&D\_Employment\_Share_{t-1}$	5,674	0.434	2.787	0.000	75.556
$Wage_{t-1}$	5,674	8.791	0.364	6.301	11.068

Sources: TurkStat AIPS and SBS. Own calculations

Table A.4: Testing for Spillovers: One by One

	OLS			SELECTION MODEL					
	K^{News}	K^{News}	K^{News}	K^{News}	$Innovation$	K^{News}	$Innovation$	K^{News}	$Innovation$
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
$Downstream^{FDI}_{t-1}$	2.999***			3.007***	0.605				
	[0.754]			[0.746]	[0.772]				
$Upstream^{FDI}_{t-1}$		-0.164				-0.173	-0.682		
		[0.765]				[0.757]	[0.790]		
$Horizontal^{FDI}_{t-1}$			0.042					0.042	0.033
			[0.100]					[0.099]	[0.111]
K^F_{t-1}	0.265***	0.267***	0.266***	0.264***	-0.071***	0.266***	-0.071***	0.265***	-0.072***
	[0.018]	[0.018]	[0.018]	[0.017]	[0.017]	[0.017]	[0.017]	[0.017]	[0.017]
$Size_{t-1}$	-0.018*	-0.018*	-0.018*	-0.018*	-0.048***	-0.019*	-0.048***	-0.019*	-0.048***
	[0.010]	[0.010]	[0.010]	[0.010]	[0.012]	[0.010]	[0.012]	[0.010]	[0.012]
$Labour\_Productivity_{t-1}$	0.001	0.001	0.002	0.002	0.034**	0.002	0.035**	0.002	0.035**
	[0.013]	[0.013]	[0.013]	[0.013]	[0.015]	[0.013]	[0.015]	[0.013]	[0.015]
$R\&D\_Employment\_Share_{t-1}$	0.002	0.002	0.002	0.002	0	0.002	0	0.002	0
	[0.003]	[0.003]	[0.003]	[0.003]	[0.001]	[0.003]	[0.001]	[0.003]	[0.001]
$Wage_{t-1}$	0.092***	0.096***	0.096***	0.090***	-0.168***	0.094***	-0.167***	0.094***	-0.168***
	[0.024]	[0.024]	[0.024]	[0.024]	[0.028]	[0.024]	[0.028]	[0.024]	[0.028]
$Herfindhal_{Reg2d}$					-0.406**		-0.408**		-0.420**
					[0.181]		[0.180]		[0.182]
λ				0.015		0.014		0.015	
				[0.010]		[0.010]		[0.010]	
Constant	-0.642***	-0.661***	-0.656***	-0.516	1.326***	-0.617*	1.313***	-0.613*	1.316***
	[0.204]	[0.205]	[0.205]	[0.351]	[0.412]	[0.336]	[0.411]	[0.337]	[0.412]
FE									
Sector*Year	y	y	y	y	y	y	y	y	y
NUTS2*Year	y	y	y	y	y	y	y	y	y
Observations	5674	5674	5674	36633	36633	36633	36633	36633	36633
R-squared	0.711	0.71	0.71						

* Significant at 10% level; ** significant at 5% level; *** significant at 1% level.
All variables are firm level and robust standard errors are clustered by firm and displayed in brackets.

Table A.5: Selection Model - Firm Heterogeneity

	$Complexity$	$LabourProductivity$	$Size$		$FDIOrigin$
			L $>$ 42 Employees	L $>$100 Employees	
	[1]	[2]	[3]	[4]	[5]
$Downstream^{FDI}_{t-1}$	7.561***	2.901***	3.464***	3.296***	
	[1.371]	[0.832]	[0.804]	[0.763]	
$Upstream^{FDI}_{t-1}$	0.309	-0.166	-0.181	-0.207	
	[0.774]	[0.765]	[0.766]	[0.764]	
$Horizontal^{FDI}_{t-1}$	0.054	0.056	0.055	0.053	
	[0.099]	[0.100]	[0.099]	[0.099]	
$Downstream^{FDI}_{t-1} * D^{K\ High}$	-5.184***				
	[1.332]				
$Downstream^{FDI}_{t-1} * D^{LP\ High}$		0.181			
		[0.647]			
$Downstream^{FDI}_{t-1} * D^{Size\ High}$			-1.028*	-1.724**	
			[0.623]	[0.828]	
$Downstream^{FDI\ High}_{t-1}$					3.834***
					[1.324]
$Downstream^{FDI\ Low}_{t-1}$					12.664
					[33.713]
$Upstream^{FDI\ High}_{t-1}$					-1.695
					[1.580]
$Upstream^{FDI\ Low}_{t-1}$					-16.975
					[22.775]
$Horizontal^{FDI\ High}_{t-1}$					0.049
					[0.154]
$Horizontal^{FDI\ Low}_{t-1}$					-8.062
					[18.755]
K^F_{t-1}	0.273***	0.264***	0.264***	0.265***	0.263***
	[0.018]	[0.017]	[0.017]	[0.017]	[0.018]
$Size_{t-1}$	-0.018*	-0.019*	-0.016	-0.026	-0.020**
	[0.010]	[0.010]	[0.015]	[0.016]	[0.010]
$Labour\_Productivity_{t-1}$	0.003	-0.009	0.003	0.003	0.003
	[0.013]	[0.018]	[0.013]	[0.013]	[0.013]
$R\&D\_Employment\_Share_{t-1}$	0.002	0.002	0.002	0.002	0.002
	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]
$Wage_{t-1}$	0.086***	0.089***	0.090***	0.091***	0.089***
	[0.024]	[0.024]	[0.024]	[0.024]	[0.024]
λ	0.015	0.015	0.015	0.015	0.014
	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]
FE					
Sector*Year	y	y	y	y	y
NUTS2*Year	y	y	y	y	y
Observations	5,674	5,674	5,674	5,674	5,674

* Significant at 10% level; ** significant at 5% level; *** significant at 1% level.
All variables are at the firm level and robust standard errors are clustered by firm and displayed in brackets.

Table A.6: FDI promotion activities: Sector Targeting

nace2d	ARM [1]	BGR [2]	GRC [3]	# Neighbours [4]	# HICs [5]	# LICs [6]
15	0	0	1	1	5	21
16	0	0	1	1	5	21
17	0	0	0	0	0	25
18	0	0	0	0	0	25
19	0	0	0	0	0	25
20	0	0	0	0	3	14
21	0	0	0	0	3	14
22	0	0	1	1	2	8
23	1	0	0	1	7	15
24	1	1	1	3	17	18
25	1	0	0	1	7	15
26	1	0	0	1	7	15
27	0	1	0	1	5	12
28	0	1	0	1	5	12
29	0	1	1	2	4	13
30	1	1	1	3	9	20
31	1	1	1	3	9	20
32	1	1	1	3	9	20
33	1	1	1	3	9	20
34	0	1	1	2	8	13
35	0	1	1	2	8	13
36	0	1	0	1	8	18

Source: 2005 World Bank Census of Investment Promotion Agencies. Descriptive Statistics on the sector targeting activities are reported. Columns 1-3 reports the targeting strategies performed by Investment agencies of Turkey's neighbour countries: Armenia, Bulgaria and Greece. Azerbaijan, Georgia, Iran, Iraq and Syria do not implement any sector targeting. Columns 4, 5 and 6 reports the total number of neighbouring countries, high income countries (HIC) and low income countries (LIC) targeting each sector.

Table A.7: Alternative sets of Instruments: 1^{st} Stage Results (I)

	Set (i)				Set (ii)		
	$Horizontal^{FDI}_{t-1}$	$Downstream^{FDI}_{t-1}$	$Upstream^{FDI}_{t-1}$		$Horizontal^{FDI}_{t-1}$	$Downstream^{FDI}_{t-1}$	$Upstream^{FDI}_{t-1}$
$\text{Horizontal}^{FDI}_{06} * \text{T} * \text{D}^{Reg}$	0.002***	-0.0001***	0.0001***	$\text{Horizontal}^{FDI}_{06} * \text{D}^{08} * \text{D}^{Reg}$	0.005***	-0.0001**	0.0007***
	[0.0003]	[0.00002]	[0.00003]		[0.001]	[0.00007]	[0.0002]
$\text{Downstream}^{FDI}_{06} * \text{T} * \text{D}^{Reg}$	0.001	0.002***	-0.0001	$\text{Horizontal}^{FDI}_{06} * \text{D}^{09} * \text{D}^{Reg}$	0.006***	-0.0002***	0.0002*
	[0.0009]	[0.0002]	[0.0001]		[0.001]	[0.00006]	[0.0001]
$\text{Upstream}^{FDI}_{06} * \text{T} * \text{D}^{Reg}$	0.004	0.0006**	0.0017***	$\text{Downstream}^{FDI}_{06} * \text{D}^{08} * \text{D}^{Reg}$	0.0002	0.007***	-0.0013**
	[0.003]	[0.0003]	[0.0003]		[0.003]	[0.0006]	[0.0006]
				$\text{Downstream}^{FDI}_{06} * \text{D}^{09} * \text{D}^{Reg}$	0.006*	0.006***	0.0001
					[0.003]	[0.0005]	[0.0003]
				$\text{Upstream}^{FDI}_{06} * \text{D}^{08} * \text{D}^{Reg}$	0.013	-0.0005	0.0009
					[0.008]	[0.0006]	[0.001]
				$\text{Upstream}^{FDI}_{06} * \text{D}^{09} * \text{D}^{Reg}$	0.011	0.004***	0.0056***
					[0.010]	[0.0012]	[0.0011]
$\text{Y\_Targeting}^{Neighbours\ Hor} * \text{T} * \text{D}^{Reg}$	-0.042***	0.0008	0.0016**	$\text{Targeting}^{Neighbours\ Hor} * \text{D}^{08} * \text{D}^{Reg}$	-0.397***	0.01045	0.0007
	[0.005]	[0.0006]	[0.00076]		[0.070]	[0.0098]	[0.010]
$\text{Y\_Targeting}^{Neighbours\ Down} * \text{T} * \text{D}^{Reg}$	-0.018	-0.0419***	0.003*	$\text{Targeting}^{Neighbours\ Hor} * \text{D}^{09} * \text{D}^{Reg}$	-0.177***	0.0184***	0.0018
	[0.014]	[0.0031]	[0.0017]		[0.058]	[0.0067]	[0.0057]
$\text{Y\_Targeting}^{Neighbours\ Up} * \text{T} * \text{D}^{Reg}$	-0.070**	0.0009	-0.014***	$\text{Targeting}^{Neighbours\ Down} * \text{D}^{08} * \text{D}^{Reg}$	0.136	-0.5387***	0.066*
	[0.028]	[0.0047]	[0.004]		[0.219]	[0.0492]	[0.035]
				$\text{Targeting}^{Neighbours\ Down} * \text{D}^{09} * \text{D}^{Reg}$	-0.289	-0.5345***	0.0247
					[0.241]	[0.0539]	[0.0217]
				$\text{Targeting}^{Neighbours\ Up} * \text{D}^{08} * \text{D}^{Reg}$	-0.396	-0.0738	-0.0164
					[0.368]	[0.062]	[0.0663]
				$\text{Targeting}^{Neighbours\ Up} * \text{D}^{09} * \text{D}^{Reg}$	-1.004***	-0.1085	-0.1697***
					[0.363]	[0.0664]	[0.042]
Obs	3530	3530	3530	Obs	3530	3530	3530
Test F	24.99	45.43	10.72	Test F	12.75	31.51	5.7
Partial R^2	0.0757	0.2558	0.0363	Partial R^2	0.0747	0.2877	0.0499

* Significant at 10% level; ** significant at 5% level; *** significant at 1% level.
Firm level controls, sector-year and region-year fixed effects are included in both stages but not reported.
Robust standard errors are clustered by firm and displayed in brackets.
$\text{Horizontal}^{FDI}_{06}$, $\text{Downstream}^{FDI}_{06}$ and $\text{Upstream}^{FDI}_{06}$ capture the presence of FDI in 2006 in a firm's sector, and in dowmstream and upstream sectors, respectively.
$\text{Targeting}^{Neighbours\ Hor}$, $\text{Targeting}^{Neighbours\ Down}$ $\text{Targeting}^{Neighbours\ Up}$ denote the number of neighbouring countries targeting the sector where the firm operates, downstream sectors and upstream sectors. $Y\_Targeting$ denotes that the information on the number of years a sector is targeted by countries is used instead of the share of countries involved in targeting strategies.
T represents a time trend, while D^{Reg} is dummy denoting the underdeveloped regions as explained in the text.

Table A.8: Alternative sets of Instruments: 1^{st} Stage Results (II)

	Set (iii)				Set (iv)		
	$Horizontal^{FDI}_{t-1}$	$Downstream^{FDI}_{t-1}$	$Upstream^{FDI}_{t-1}$		$Horizontal^{FDI}_{t-1}$	$Downstream^{FDI}_{t-1}$	$Upstream^{FDI}_{t-1}$
$\text{Horizontal}^{FDI}_{06} * D^{08} * D^{Reg}$	0.005***	-0.0002***	0.0007***	$\text{Horizontal}^{FDI}_{06} * D^{08} * D^{Reg}$	0.0051***	-0.0002**	0.0007***
	[0.001]	[0.0001]	[0.0002]		[0.0011]	[0.0001]	[0.0002]
$\text{Horizontal}^{FDI}_{06} * D^{09} * D^{Reg}$	0.006***	-0.0002***	0.0002**	$\text{Horizontal}^{FDI}_{06} * D^{09} * D^{Reg}$	0.0058***	-0.0002**	0.0002**
	[0.001]	[0.00007]	[0.0001]		[0.0009]	[0.00007]	[0.0001]
$\text{Downstream}^{FDI}_{06} * D^{08} * D^{Reg}$	0.003	0.0069***	-0.0007	$\text{Downstream}^{FDI}_{06} * D^{08} * D^{Reg}$	0.0017	0.0067***	-0.0008
	[0.003]	[0.0006]	[0.0006]		[0.0031]	[0.0006]	[0.0006]
$\text{Downstream}^{FDI}_{06} * D^{09} * D^{Reg}$	0.005	0.0055***	0.0004	$\text{Downstream}^{FDI}_{06} * D^{09} * D^{Reg}$	0.0033	0.0056***	0.00017
	[0.003]	[0.0006]	[0.0003]		[0.0037]	[0.0006]	[0.0004]
$\text{Upstream}^{FDI}_{06} * D^{08} * D^{Reg}$	0.013*	-0.0007	0.0023*	$\text{Upstream}^{FDI}_{06} * D^{08} * D^{Reg}$	0.0110	-0.0003	0.0015
	[0.008]	[0.0007]	[0.0013]		[0.0073]	[0.0007]	[0.0015]
$\text{Upstream}^{FDI}_{06} * D^{09} * D^{Reg}$	0.018*	0.0037***	0.0065***	$\text{Upstream}^{FDI}_{06} * D^{09} * D^{Reg}$	0.0111	0.0045***	0.0056***
	[0.0099]	[0.0013]	[0.0011]		[0.0097]	[0.0013]	[0.0010]
$\text{Targeting}^{HIC\ Hor} * D^{08} * D^{Reg}$	-1.025***	0.0740**	-0.1229***	$\text{Y\_Targeting}^{HIC\ Hor} * D^{08} * D^{Reg}$	-0.0747***	0.0018	-0.0054***
	[0.247]	[0.0362]	[0.033]		[0.0152]	[0.0024]	[0.0019]
$\text{Targeting}^{HIC\ Hor} * D^{09} * D^{Reg}$	-0.282	0.0718***	-0.065***	$\text{Y\_Targeting}^{HIC\ Hor} * D^{09} * D^{Reg}$	-0.0095	0.0013	-0.0005
	[0.208]	[0.0203]	[0.0148]		[0.017]	[0.0017]	[0.002]
$\text{Targeting}^{HIC\ Down} * D^{08} * D^{Reg}$	-5.184***	-1.928***	0.3805*	$\text{Y\_Targeting}^{HIC\ Down} * D^{08} * D^{Reg}$	-0.0986	-0.087***	0.027*
	[1.830]	[0.2769]	[0.2105]		[0.1079]	[0.0157]	[0.0163]
$\text{Targeting}^{HIC\ Down} * D^{09} * D^{Reg}$	-1.208	-2.232***	1.0539***	$\text{Y\_Targeting}^{HIC\ Down} * D^{09} * D^{Reg}$	0.1229*	-0.0925***	0.0455***
	[1.637]	[0.274]	[0.2586]		[0.0673]	[0.013]	[0.0117]
$\text{Targeting}^{HIC\ Up} * D^{08} * D^{Reg}$	-4.122***	-0.0162	-0.1653	$\text{Y\_Targeting}^{HIC\ Up} * D^{08} * D^{Reg}$	-0.077	-0.012	0.0098
	[1.425]	[0.1867]	[0.179]		[0.060]	[0.0110]	[0.011]
$\text{Targeting}^{HIC\ Up} * D^{09} * D^{Reg}$	-6.391***	0.0407	-0.6592***	$\text{Y\_Targeting}^{HIC\ Up} * D^{09} * D^{Reg}$	-0.1766***	-0.0205*	-0.0143
	[1.388]	[0.236]	[0.1316]		[0.0679]	[0.011]	[0.0089]
$\text{Targeting}^{LIC\ Hor} * D^{08} * D^{Reg}$	-0.139	-0.0235	0.0250	$\text{Y\_Targeting}^{LIC\ Hor} * D^{08} * D^{Reg}$	0.024	-0.0004	0.0051
	[0.291]	[0.0278]	[0.0394]		[0.0212]	[0.003]	[0.0042]
$\text{Targeting}^{LIC\ Hor} * D^{09} * D^{Reg}$	-0.268	0.005	0.0422	$\text{Y\_Targeting}^{LIC\ Hor} * D^{09} * D^{Reg}$	0.0109	-0.0021	0.0093
	[0.392]	[0.0399]	[0.0543]		[0.0499]	[0.0060]	[0.0088]
$\text{Targeting}^{LIC\ Down} * D^{08} * D^{Reg}$	1.091*	0.0858	-0.4399***	$\text{Y\_Targeting}^{LIC\ Down} * D^{08} * D^{Reg}$	-0.116*	0.0039	-0.049***
	[0.652]	[0.084]	[0.095]		[0.066]	[0.0108]	[0.0105]
$\text{Targeting}^{LIC\ Down} * D^{09} * D^{Reg}$	2.661***	-0.0569	-0.1373**	$\text{Y\_Targeting}^{LIC\ Down} * D^{09} * D^{Reg}$	0.1137	-0.004	-0.0257***
	[0.679]	[0.057]	[0.0621]		[0.0822]	[0.0077]	[0.0099]
$\text{Targeting}^{LIC\ Up} * D^{08} * D^{Reg}$	0.229	0.064**	-0.1278***	$\text{Y\_Targeting}^{LIC\ Up} * D^{08} * D^{Reg}$	-0.0292	0.0035	-0.0142***
	[0.246]	[0.029]	[0.0342]		[0.0260]	[0.0040]	[0.004]
$\text{Targeting}^{LIC\ Up} * D^{09} * D^{Reg}$	0.623**	0.0196	-0.1113***	$\text{Y\_Targeting}^{LIC\ Up} * D^{09} * D^{Reg}$	0.0367	0.00166	-0.0116***
	[0.244]	[0.0296]	[0.0326]		[0.0286]	[0.003]	[0.0044]
Obs	3530	3530	3530	Obs	3530	3530	3530
Test F	11.98	23.13	8.28	Test F	10.98	21.99	7.14
Partial R^2	0.0809	0.2797	0.0738	Partial R^2	0.0788	0.2779	0.0666

* Significant at 10% level; ** significant at 5% level; *** significant at 1% level.
Firm level controls, sector-year and region-year fixed effects are included in both stages but not reported.
Robust standard errors are clustered by firm and displayed in brackets.
$\text{Horizontal}^{FDI}_{06}$, $\text{Downstream}^{FDI}_{06}$ and $\text{Upstream}^{FDI}_{06}$ capture the presence of FDI in 2006 in a firm's sector, and in dowmstream and upstream sectors, respectively.
$\text{Targeting}^{HIC\ Hor}$, $\text{Targeting}^{HIC\ Down}$ $\text{Targeting}^{HIC\ Up}$ denote the number of High Income countries targeting the sector where the firm operates, downstream sectors and upstream sectors, respectively. The superscript ^{LIC} denotes that the variables refer to Low Income Countries, while $Y\_Targeting$ denotes that the information on the number of years a sector is targeted by countries is used instead of the share of countries involved in targeting strategies.
T represents a time trend, while D^{Reg} is dummy denoting the underdeveloped regions as explained in the text.