Servicification of Manufacturing and Boosting Productivity through Services Sector Reform in Turkey

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Abstract

There is a global trend toward more production, use, and sale of services by manufacturing firms. This phenomenon is known as the servicification of manufacturing. Services inputs as well as services activities within manufacturing firms account for over half of the value of manufacturing exports. This paper uses a unique firm-level data set to analyze the link between servicification and productivity in Turkey. Although servicification has the potential to boost firm performance, the opposite appears to be the case in Turkey: manufacturing firms with service affiliates tend to be less productive. The type of services produced matters. For instance, firms that have post-manufacturing (transport and distribution) service affiliates are particularly less productive. Regulatory restrictions in services are explored as an explanatory factor. Productivity gaps appear in the same areas where services are more restricted, such as in post-manufacturing services.

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Servicification of Manufacturing and Boosting Productivity through Services Sector Reform in Turkey

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Acronyms

ACF Ackerberg, Caves, and Frazer (2015)
EIS Entrepreneurial Information System database
EU European Union
FDI Foreign direct investment
GDP Gross domestic product
GVCs Global value chains
ICT Information and communications technologies
MoSIT Ministry of Science, Industry, and Technology (Turkey)
NACE Nomenclature des Activités Économiques dans la Communauté Européenne (the European industry standard classification system)
OECD Organisation for Economic Co-operation and Development
PMR Product Market Regulation database
R&D Research and development
STRI Services Trade Restrictiveness Index
TFP Total factor productivity
TiVA Trade in Value-Added database
TL Turkish Lira
USD United States Dollars
VA Value-added
WDI World Development Indicators (World Bank)
WTO World Trade Organization
Executive Summary

Services account for over 60 percent of GDP in Turkey and are critical drivers of employment and exports. Yet, there are signs that services may not be living up to their potential in Turkey, for instance when looking at productivity and the growth of services value-added.

Services are also an increasingly important component of manufacturing and global value chains. Services inputs as well as services activities within manufacturing firms account for over half of the value of manufacturing exports. This global trend toward more use of services within manufacturing firms is known as servicification. For countries to be competitive, appropriately regulated and productive services are necessary, both for the services sector itself and for manufacturing.

Thanks to a unique firm-level data set from the Turkish Ministry of Science, Industry, and Technology, this paper looks at a previously unexplored area—the production of services by manufacturing firms and links to productivity. While servicification has the potential to increase firm performance, this does not appear to be happening in Turkey: manufacturing firms with services tend to be less productive. For instance, non-exporter manufacturing firms with a services affiliate are 18 percent less productive than firms without a services affiliate. Exporters with a services affiliate are 9 percent less productive than those without one.

To better understand the lower productivity, the paper breaks down services by stages of the production process. Productivity differences between manufacturing firms that provide services in each stage are then highlighted. For instance, firms that have post-manufacturing (e.g. transport and distribution) service affiliates are found to be particularly less productive in Turkey.

Regulatory restrictions are explored as a potential explanatory factor, given that removing regulatory restrictions on services has increased their contribution to productivity growth in other countries. Three regulatory areas are briefly examined: i) FDI restrictions in services; ii) domestic regulatory barriers in services that affect both Turkish and foreign firms; and iii) discriminatory services trade barriers that prevent foreign service providers from entering and operating in the Turkish economy.

The analysis finds that productivity gaps appear in the same areas where services are more restricted, e.g. in post-manufacturing services. Restrictions on competition in services, particularly from foreign firms, may lead Turkish manufacturing firms to provide more services in-house than would be optimal from a productivity perspective. Removing restrictions could boost the productivity of Turkish manufacturing firms. Professional services and transport appear particularly ripe for reform, and reforms could lead to increased firm entry, competition, growth, and, productivity.
1. The Importance of Services in the World Economy and Global Value Chains

Services account for the majority of GDP and employment globally, and they are growing faster than manufacturing. The services sector ranges from traditional areas such as construction, utilities, transport, and real estate, to business services such as R&D, design, engineering, sales, marketing, finance, insurance, and accounting. Services represented around 61 percent of global GDP (in terms of value-added) and 63 percent of employment in 2015, while manufacturing accounted for only 13 percent of GDP and 23 percent of employment. Additionally, between 25 and 60 percent of employment in manufacturing firms can be found in service support activities. Worldwide, annual growth of services value-added over the last five years has been about 3.7 percent, compared to 2.3 percent in manufacturing. Research has shown that developments in services explain divergent economic growth performance across countries (Timmer et al., 2008, 2007).

Services also account for a large and growing share of exports in value-added terms. Services exports measured in gross terms as a share of total world gross exports have remained at around 20 percent since 1980. However, in value-added terms (which is more indicative of their true importance), services have increased from below 30 percent to above 40 percent (see Figures 1.1 and 1.2). One important factor behind this growth in value added is services’ role as inputs into other economic activities, mainly manufacturing.

Adding services embodied in manufacturing exports brings the overall contribution of services to exports to close to two-thirds. Services exports can be decomposed into services directly exported (i.e. exports of service companies) and those embodied as inputs. Services have a double role of being a final good for direct export or an input, which is therefore exported indirectly through other (manufacturing) sectors. According to Miroudot and Cadestin (2017), services inputs, whether domestic or foreign, account for about 37 percent of the value of manufacturing exports (based on a sample of OECD countries). However, services inputs can also be produced by manufacturing firms besides being bought externally.

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2 Such as R&D, engineering, transport, logistics, distribution, marketing, sales, after-sale services, IT, management, and back-office support (Miroudot and Cadestin, 2017).
By adding service activities that are produced within manufacturing firms, the share of indirect services value-added in manufacturing exports increases to 53 percent. When combined with stand-alone direct service exports by services exporters, this brings the total contribution of services to exports to two-thirds.

**Services are an increasingly important driver of global value chains (GVCs).** Without many input services, such as transport and distribution, value chain trade would not exist. Many service inputs are also re-exported by third countries as part of GVCs. Some measures of services can therefore serve as indicators of GVC trade, including both domestic services inputs (indirect domestic services value-added in exports) and foreign services inputs (foreign services value-added in exports). While direct exported services increased substantially between 1995–2011, more than 65 percent of the growth of services value added in exports was due to an increase in services embodied in other exports (Figure 1.3). Both domestic and foreign embodied services grew, but the foreign services value-added component grew the most over the period (Heuser and Mattoo, 2017). The growth of services inputs and foreign services value-added is an indication of global value chains at work.³ Finally, services have been shown to be a driver of economic diversification (Cattaneo et al, 2017).

**Figure 1.3: Share of direct, indirect, and foreign services value added in world gross exports, mln USD**

![Figure 1.3: Share of direct, indirect, and foreign services value added in world gross exports, mln USD](image)

Source: Miroudot (2016) and Heuser and Mattoo (2017), based on OECD-WTO TIVA 2015.

**Service sector reform leads to productivity growth.** Firm-level studies such as Arnold et al. (2015; 2011), Van der Marel et al. (2016) and Fernandes and Paunov (2012) show that regulatory reform in services has a positive impact on downstream manufacturing and services firms’ productivity. The reason for this productivity effect is that when services as inputs are effectively supplied, this has a knock-on effect on industries that use services. In other words, services sector deregulation can lead to a more productive allocation of resources, thereby generating economy-wide productivity effects. Yet, to optimize benefits

³ According to Heuser and Mattoo (2017), the reasons for these developments are variants of the older arguments for why the share of services in GDP tends to grow: the splitting or outsourcing of services activities from manufacturing firms; the growing importance in a GVC world of connecting services like telecommunications and transport; the growing services component in sophisticated manufacturing goods, such as software in cars; and the increase in the prices of services tasks relative to manufacturing tasks because manufacturing tasks are easier to offshore to lower cost locations. However, there is little empirical evidence for these arguments.
from deregulation of services, good institutions are needed to guide this process of services liberalization (Beverelli, et al., 2015; Van der Marel, 2016).

This evidence suggests that appropriate regulation of services facilitates productivity growth in manufacturing and strengthens GVC’s which in turn increases the competitiveness of countries.

2. The Role of Services in the Turkish Economy

Productivity in Turkey has stagnated in recent years. Total factor productivity (TFP) is one of the most important long-term determinants of growth. Although Turkey has seen impressive GDP growth achievements in the last several decades as it approaches high-income status, average TFP growth has been negligible since 2000. Moreover, TFP seems to be trending downward more recently (left-hand panel of Figure 2.1). Although ailing TFP growth is a worldwide phenomenon (Adler, 2017; Eichengreen et al., 2015), particularly after the global financial crisis, it is of concern for Turkey given that several comparator countries, such as China, India, the Russian Federation, and Poland had substantially higher TFP growth during this period (right-hand panel of Figure 2.1). Given that services account for over half of GDP in Turkey, it is important to understand the performance of the services sector and how it can become an engine for future productivity growth.

![Figure 2.1: Productivity (TFP) performance of Turkey and comparators (2000-2014)](image)

Source: Penn World Tables; author’s calculations. Note: the TFP numbers from the Penn World Tables may not reflect the most recent GDP figures for Turkey, since they were recently revised by the government.

Productivity in services seems to be low for Turkey, especially compared to manufacturing. Although productivity, and particularly TFP, is hard to compute for services, a rough indication of labor productivity is possible by looking at revenue per worker (left-hand panel of Figure 2.2), as well as the ratio of revenue to the wage bill (right-hand panel of Figure 2.2), for services firms. Turkey performs below most

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4 TFP refers to the portion of output not explained by the amount of inputs used in production, including capital and labor. It measures how efficient capital and labor are used with the help of new technologies.

5 Due to the lack of variables such as value-added to compute labor productivity or TFP, revenue per worker serves as a crude indicator of productivity. Usually this measure is correlated with labor productivity or TFP.
comparator countries on both measures. The low revenue to wage bill ratio reflects both comparatively low revenue per worker and high labor costs (World Bank, 2017).\(^6\)

**Figure 2.2: Labor productivity and revenue to labor costs ratio in services (2009)**

![Labor productivity and revenue to labor costs ratio in services (2009)](image)

*Source: World Bank Enterprise Surveys; World Bank (2017). Turkey_micro consists of firms with five or fewer full-time employees. All other figures include firms with five employees or more.*

**Turkey’s services sector has seen little growth over the past 15 years, contrary to global trends.** Services value-added has hovered at around 60 percent of GDP since 2000. The top panel of Figure 2.3 shows the positive association worldwide between the share of services value-added in GDP and the real GDP per capita over time, where each dot represents a country in a given year. In other words, as countries get richer, they tend to increase the share of services in the economy. However, Turkey has largely shifted horizontally to the right—instead of upwards and to the right—indicating that the share of services in GDP has not been growing much since 2000. Manufacturing, which represented about 19 percent of GDP in 2015 (which is higher than the world average) has been declining slightly (shown by a shift to the bottom right in the bottom panel of Figure 2.2).

**Figure 2.3: World value-added shares for Turkey (2000-2015)**

![World value-added shares for Turkey (2000-2015)](image)

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\(^6\) In Turkey, the manufacturing sector also faces high labor costs, but it is able to use labor more productively.
Turkey’s service sector growth falls behind many comparator countries. The top panel of Figure 2.4 shows the shares of services, manufacturing and agriculture in GDP for Turkey and comparator countries. Turkey falls roughly in the middle of the comparator group. However, the bottom panel of Figure 2.4 shows that the 2000-2015 growth of Turkey’s services economy was much lower than many of its comparators.

**Figure 2.4: Value-added shares and growth of shares for Turkey and peers (2000-2015)**
International integration and GVC participation of Turkish firms is low. The percentage of firms that both export and import—which is a rough proxy of GVC participation—is relatively low in Turkey (left-hand side of Figure 2.5). Turkish firms also have low levels of foreign ownership and use fewer foreign inputs than comparator countries (right-hand side of Figure 2.5). This suggests that Turkey may be missing opportunities that FDI and GVC participation bring in terms of new technologies and positive productivity spillovers, including in services.

Figure 2.5: Trade and foreign ownership (2015)

Turkey’s trade in services appears relatively small and declining, with falling sophistication. Trade in services has gone from over 10 percent of GDP in 2000 to only 7 percent in 2016, with a small uptick seen after the global financial crisis (left-hand panel of Figure 2.6). Trade in manufacturing, on the other hand, increased from about 30 percent in 2000 to 45 percent in 2011, followed by a decline to 40 percent in 2016. Services trade as a percentage of GDP is also lower in Turkey than in many comparator countries.
Countries like Hungary, Bulgaria, Czech Republic and Poland had substantially higher services trade shares, although they are smaller economies that are part of the EU. Export sophistication also appears to be falling. Turkey has specialized increasingly in services exports typical for middle-income countries, such as transport and tourism. It has developed fewer exports of financial, IT or professional services, which are considered more modern services with higher levels of value-added (World Bank, 2014).

**Figure 2.6: Trade in GDP shares for Turkey and peers (2000-2015)**

When taking services as inputs into account, Turkey performs in line with its peers. Services are not only exportable in their own right, but also are critical inputs to manufacturing and GVCs, as seen above. The importance of services as inputs can be seen by examining the value added from domestic service inputs (domestic indirect) and foreign services inputs (foreign) in exports. The left-hand panel of Figure 2.7 shows domestic indirect services value-added together with the exports of services firms (domestic direct, which is what is shown in Figure 2.6, but in value-added terms). Overall, Turkey is in the middle of the pack, although the domestic indirect share is well below the OECD average. The share of foreign value-added is also relatively smaller (see right-hand panel in Figure 2.7). Turkey’s low rate of participation in GVCs and foreign inputs (Figure 2.5) is reflected in the relatively low foreign services value-added in exports. However, one critical omission in the data is that it does not include services produced in-house by manufacturing firms, which is the focus of the following section.

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7 Based on statistics from the OECD-WTO Trade in Value-Added (TiVA) database.
8 To be precise, the exports picked up in Figure 2.6 cover in large part trade in services on a cross-border basis, which is called Mode 1 services supply in WTO parlance. It also covers Mode 2 (i.e. consumption abroad) and part of Mode 4 (i.e. temporary movement of labor), but does not cover Mode 3 (sales of foreign affiliates). Mode 3 trade however is covered in Figure 2.7 under domestic services value-added in gross exports, directly or indirectly when used as inputs into downstream industries’ exports. The TiVA database does not (yet) make a distinction between foreign and domestic affiliates from FDI.
Over time, the direct services value-added share in gross exports has fallen (left-hand panel of Figure 2.8), coming close to the OECD average. Turkey’s indirect share of services value-added has increased somewhat, but has not significantly caught up with the OECD level. On the other hand, the foreign value-added share of services is increasing toward OECD levels (right-hand panel of Figure 2.8).

The manufacturing sectors that use and indirectly export the most services in Turkey are textiles, chemicals, non-metallic minerals, and wood, but service usage is low compared to the OECD. As shown in the left-hand panel of Figure 2.9, most OECD industries have more than 30 percent indirect services value added as a share of gross exports. In Turkey, the average is closer to 20 percent (right-hand panel of Figure 2.9). The sectors with higher services inputs are also somewhat different in the OECD.
The bulk of services inputs in Turkish manufacturing exports come from transport and distribution; OECD firms, in contrast, rely on a much higher share of business services. In Turkey, distribution and transport each account for about one-third of services value added in manufacturing exports, while business services account for about 13 percent. The reverse is true in the OECD: business services account for about one-third while transport services are much smaller. Distribution services account for a similar share in both Turkey and the OECD, as do financial services. As shown in Figure 2.10, the breakdown of types of services is roughly similar across manufacturing industries in Turkey.

Source: OECD TiVA 2015; author’s calculations.
In summary, the findings that a) Turkey’s service sector appears to have lower labor productivity and slower growth than some comparators, b) Turkey has a lower share of indirect services value-added in exports than other OECD countries, and c) the composition of indirect services VA is skewed toward transport and distribution services (unlike OECD members where business services are the largest share of exporting value-added for manufacturing), suggest that there could be some inefficiencies related to service markets in Turkey. One way to investigate this further is to look at how manufacturing firms in Turkey approach the provision of services.

3. The Servicification of Manufacturing and Productivity in Turkey

The sections above highlighted the increasing importance of services, including within manufacturing and GVCs, in the global economy, as well as some indications that services in Turkey are not living up to their potential. This section looks in detail at a dimension of services that has been largely unexplored in the literature due to data limitations: services that are performed in-house by manufacturing firms. Thanks to a unique firm-level data set of the Ministry of Science, Industry, and Technology in Turkey, the section analyzes the relationship between the in-house provision of services by manufacturing firms and productivity.

Services and manufacturing are becoming increasingly intertwined through the “servicification” of manufacturing. In recent years, there has been a trend in manufacturing toward more purchase, production, sale, and export of services as integrated or accompanying parts of manufacturing firms’ products (Kommerskollegium, 2013). This trend is called “servicification”, as shown in Figure 3.1. Services can support the manufacturing process as well as be bundled and sold along with the manufactured good (Cusumano et al., 2015). Servicification has been particularly prevalent in developed economies, and it is important for supporting value chain activities. Developing economies have experienced a similar trend. For instance, Van der Marel and Sàez (2013) show that almost all country income groups have seen an increase of domestic services value-added embodied in supply chains, with the exception of the lowest income group of countries.

Figure 3.1: What does servicification mean?

Source: Miroudot and Cadestin (2017).
In Turkey, the servicification of manufacturing firms is happening, albeit slowly. Turkish firm-level data\(^9\) allow for an analysis of which manufacturing firms show servicification and which only produce goods. It does so by recording the secondary services activities for each manufacturing firm using the revenue generated from services affiliates. The data therefore give a good indication of the degree of servicification of Turkish goods firms, particularly the production and output of services (see the center and right-hand elements in Figure 3.1). Services inputs in manufacturing, which is the left-hand element of Figure 3.1, are partially captured through the indirect domestic services value added in exports discussed in the previous section. (In other words, while service inputs are an important element of the servicification phenomenon, they are not covered by the analysis in this section due to data limitations.) The services affiliates are recorded using their 4-digit NACE code, as is the manufacturing activity of the firm. A share of the revenue of the entire firm is assigned to each affiliate based on the number of employees in that affiliate. Over time, manufacturing firms in Turkey have seen a slow shift away from generating revenue from goods toward more services (Figure 3.2). When only manufacturing firms with a services affiliate are considered, average revenue from the services affiliate increased from about 20 percent in 2006 to 21.5 percent in 2014.

**Figure 3.2: Servicification of manufacturing firms: 2006-2014**

![Graph showing the share of revenue generated from services and goods for in-house servicification of manufacturing firms from 2006 to 2014.](image)

Source: EIS data from Turkey; author’s calculations.

**Box 3.1: Where does servicification take place?**

Servicification involves all kind of services activities such as R&D, design, and marketing, as well as construction and transportation services. Depending on where in the supply chain the manufacturing firm is located, it adds or sells different services to downstream users (or consumers). Studies using aggregated value-added of exports data show that industries such as chemicals and motor vehicles use the most services value-added while coke and petroleum use the least (Miroudot and Candestin, 2017).

Across countries, business services and distribution services are most prominent in terms of services activities by manufacturing industries. Across sectors, however, capital-intensive industries seem to be

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\(^9\) From the Ministry of Science, Industry and Technology (MoSIT) Enterpreneurial Information System (EIS) database.
the most prone to servicification, as generally these manufacturing firms have the most services activities. Industries such as motor vehicles, chemicals, plastics or even transport equipment tend to have a higher services content in the supply chain. Traditional low-tech companies have lower services content. However, the mix of service inputs is similar across sectors.

Firm-level studies also indicate that there is variation in the level of servicification across industries. Crozet and Milet (2015) show that the industry with the lowest share of services sold is food, beverage and tobacco while the highest is chemicals and plastic products. Kelle (2013) finds that manufacturing firms in Germany that also export services tend to provide R&D, engineering and construction services. In Belgium, Ariu et al. (2016) find that many goods from the transportation, chemical and machinery/electrical industries exhibit high shares of services exports.

**Servicification can increase firm performance.** The increased use, production and export of services by manufacturing firms is associated with increased economic performance. The few country-specific firm-level studies on this subject show that the servicification process of downstream manufacturing firms is tightly associated with positive economic gains. For instance, Crozet and Millet (2015) show that selling services by French manufacturing firms increases their profitability from 3.7 to 5.3 percent and is correlated with increased levels of employment. Servicification can also support the trade performance of firms. Lodefalk (2014) shows that in Sweden manufacturing firms that are involved in services have better performance in terms of exports. Firms that servicify receive an export premium, and the trade literature shows that firms that command an export premium tend to be more productive (Barnard et al., 2006; Eaton and Kortum, 2002).

**However, the opposite seems to be true in Turkey: manufacturing firms with services tend to be less productive.** Benchmark regressions show that firms with a services affiliate in Turkey perform worse than those without a services affiliate. This outcome holds for both exporters and non-exporters. Box 3.2 contains an explanation of the benchmark regressions and results. TFP is calculated using a state-of-the-art measure following Ackerberg et al. (2015), henceforth ACF. Figure A1 in Annex 1 shows similar results graphically using the TFP distributions for four categories of firms: non-exporters with no service affiliates, non-exporters with services, exporters with no services, and exporters with services.

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10 The recent firm-level literature takes the heterogeneous characteristics of firms in terms of their productivity into account (e.g. Melitz, 2003; Eaton and Kortum, 2002; Bernard et al., 2006). This literature shows, for instance, that exporters are generally more productive (Eaton et al., 2004), bigger, more skilled, and more capital endowed than non-exporters. This helps explain their self-selection into export markets, as they can cover the fixed upfront costs of entering a new market abroad. Moreover, firms that have foreign investment appear to be even more productive than the ones that only engage in exports (Helpman et al., 2004).

11 The TFP measure from Ackerberg et al. (2015) is an advanced productivity measure that improves the previous approaches to TFP due to their collinearity problem. The TFP measure in this report is a weighted average across firms with the firm's size used as a weight. In addition, Figure A1 in Annex 1 shows that when using alternative TFP measures such as Hsieh and Klenow’s (2009; 2014) TFPQ or TFP from Olley and Pakes (1996) and Levin and Petrinsohn (2003), as well as labor productivity, the patterns are largely sustained.
Box 3.2: Benchmark regressions on servicified and non-servicified firm performance

To perform a more formal analysis of whether some types of firms are more productive than others in Turkey, the EIS firm-level data set was used to perform benchmark regression analysis. By applying dummy variables for all but one category that is omitted in the regression equation, an empirical conclusion can be reached on whether the included categories are positively or negatively (non) significant against the omitted variable category. The following equation was used:

\[
\ln(\text{TFP})_{ikt} = \alpha + \beta_1 \text{CAT}_{ikt} + \beta_2 \text{FIRM}_{ikt} + \gamma_k + \delta_t + \varepsilon_{ikt}
\]

(1)

in which TFP stands for the productivity measure as defined by Ackerberg et al. (2015). CAT denotes the vector of types of firms separated by four categories, namely goods firms, servicified goods firms (i.e. both non-exporters), goods exporters, and servicified goods exporters. Based on which category is omitted, the other three categories are included in the regression equation (1).

Since we are dealing with firm-level data, but cannot include firm-fixed effects as this would wipe out the variable of interest as well as the dependant variable, we include firm-level control variables in the vector FIRM, which are the size of the firm, whether the firms is a “Kurum” (which is a bigger type of enterprise), and whether the firm is more capital-intensive. Moreover, we also apply sector (γ) as well as time (δ) fixed effects while standard errors (ε) are clustered by sector-year.

Figure B3.1: Results of benchmark regression analysis (2007-2014)

The results are demonstrated in the two panels of Figure B3.1, while the extended output regression tables can be found in Table A1a and b in Annex 1. The left-hand panel shows the results where goods firms (i.e. non-exporters) are omitted. It shows that servicified domestic firms in Turkey are 18 percent less productive than non-servicified goods firms. In line with the trade literature, exporters are more productive than non-exporters. The right-hand panel shows the results when goods exporters (with no services affiliate) are omitted, and therefore these results should be interpreted against this category. The panel shows that servicified exporters are 9 percent less productive than non-servicified exporters. In short, firms with a services affiliate are less productive, whether they are exporters or not.

Turkish firms with service affiliates have more sluggish TFP performance over time. Although manufacturing firms in Turkey have seen some improved firm productivity performance, particularly from 2009 to 2014 (after the global financial crisis), the productivity trend for servicified firms is less optimistic.
(Figure 3.3). The left-hand panel shows that for non-exporters the productivity gap between servicified firms and non-servicified firms initially increased then partially rebounded. When looking at exporters in the right-hand panel, the TFP gap between the servicified and non-servicified exporters has grown over time. Goods exporters (without service affiliates) recovered quickly after the crisis, while servicified exporters have struggled to do so.

![Figure 3.3: Firm-level TFP developments in Turkey (2007-2014)](image)

Source: EIS data from Turkey; author’s calculations. Note: TFP based on Ackerberg et al. (2015)

While most industries show negative “productivity premiums” for firms with service affiliates, some show positive performance. Underperformance and overperformance can be measured by the extent to which servicified firms have a higher or lower productivity level than non-servicified firms. This productivity premium is computed for each manufacturing sector and plotted in Figure 3.4 for non-exporting (top panel) and exporting (bottom panel) firms. A positive (i.e. higher than zero) productivity premium means that servicified firms in that industry have a higher productivity level than non-servicified firms. The opposite is true for negative values. The dashed lines separate sectors with positive versus negative productivity premiums. For both exporters and non-exporters, pharmaceuticals, printing and publishing, other transport equipment, motor vehicles, furniture, and leather show a negative productivity premium. Basic metals, chemicals and electrical machinery show positive premiums, meaning that servicified firms in these sectors are doing better than non-servicified firms. More industries have negative productivity premiums across both categories.
**Figure 3.4:** TFP growth by manufacturing sectors between exporters and non-exporters (2014)

Types of services that Turkish manufacturing firms perform and productivity

To better understand why servicified firms have lower productivity in Turkey, this section decomposes services into stages of the production process. It then highlights productivity differences between manufacturing firms that provide services in each stage. This is intended to shed light on where services sector regulatory reform is likely to have more impact.
For analytical purposes, services can be categorized into six production process stages. Figure 3.5 provides a breakdown of the manufacturing production stages and the services associated with each stage (based on Low and Pasadilla, 2015). The production stages and examples of services are: (1) establishment (including construction services and real estate); (2) pre-manufacturing (R&D and special design services); (3) manufacturing (testing and engineering services); (4) post-manufacturing (distribution and transport); (5) post-sales (repair and maintenance services); and (6) back-office (other business services such as accounting, insurance, legal and management services).

Figure 3.5: Production stages of the value chain where services are added

Source: author’s elaboration based on high-level categorization from Low and Pasadilla (2015). Note: for a full list of detailed services sector by NACE 3-digit for production stages, see Table A2 in Annex 1.

Most service activities within Turkish manufacturing firms are in the post-manufacturing stage. Turkish services affiliate activity can be analyzed in terms of the number of affiliates as well as the revenue associated with each affiliate (Figure 3.6). (The Turkish firm-level data distribute the revenue of the firm to the affiliates based on their employment share inside the firm. In other words, the revenue share is equivalent to the employment share of the services affiliate within the entire firm.) The left-hand panel shows the breakdown based on the number of affiliates and the right-hand panel gives the breakdown based on the employee-weighted share of revenue that these services affiliates generate. Both breakdowns show that post-manufacturing services are the largest type of services produced by Turkish manufacturing firms. This category includes transportation and distribution services. Back-office services and establishment services are the next largest categories.

Figure 3.6: Share of number of affiliates and revenue of manufacturing firms (2014)

Source: EIS data from Turkey; author’s calculations.

A full categorization of all services into production stages by their 3-digit NACE code is presented in Table A2 in Annex 1.
Both establishment services and post-manufacturing services are in large part comprised of more traditional services. Traditional services include transport, logistics, storage, and distribution, while modern services include telecom, computer, R&D, intellectual property, banking, insurance, etc. The so-called modern services tend to be more prevalent in the pre-manufacturing, post-sales and back-office stages. A key difference between traditional and modern services is that modern services can be delivered at arm’s length (e.g. using the internet), without simultaneous production and consumption in the presence of producers and consumers. As a result, modern services often are associated with higher levels of value added and hence productivity (see Ghani et al., 2012; Ghani 2010). Moreover, traditional services are often in sectors that many countries have found difficult to reform, e.g. transportation services which still face many restrictions globally.

The type of services that manufacturing firms perform is correlated with firm productivity. Overall, manufacturing firms engaged in post-manufacturing and establishment services are the least productive in Turkey, whereas those engaged in pre-manufacturing and back-office services are relatively more productive. Figure 3.7 shows the TFP distribution for manufacturing firms in Turkey separated by the six production stages. Firms that produce more than one type of GVC services are included as well, but picked up separately in the distribution plots. The distribution plot shows that manufacturing firms with an establishment or post-manufacturing services affiliate are least productive as the bell-shaped curves are shifted to the left. These firms are also relatively smaller in Turkey – although much bigger than non-servicified firms. Manufacturing firms that integrate back-office services and manufacturing services seem to be most productive. They also tend to be larger.13 Similar results are obtained when using four alternative TFP measures (Figure A2 in Annex 1).

Figure 3.7: Distribution of firm-level TFP by service category (2014)

Source: EIS data from Turkey; author’s calculations. The vertical axis of this shows the frequency of firms that have a certain level of TFP. The level of TFP is shown on the horizontal axis.

A higher share of post-manufacturing services produced in-house is correlated with lower levels of firm productivity. Figure 3.8 shows the negative relationship between firm-level TFP and post-manufacturing

13 Note that manufacturing firms engaged in pre-manufacturing services and post-sales services are the largest in Turkey. All servicified firms are much bigger compared to the non-servicified goods-only firms. (The benchmark regression analysis controls for firm size.)
services affiliates. The left panel shows the breakdown based on the number of affiliates and the right panel shows it by share of revenue. This relationship holds for both exporters and non-exporters. Examples of sectors with high shares of post-manufacturing services and low productivity include wearing apparel, leather, and manufacturing nec. No relationship is found for establishment services, while back-office services are positively correlated with productivity. The back-office finding indicates that sectors that produce more in-house back-office services such as chemicals, pharmaceuticals, and coke and petroleum, tend to have higher levels of productivity.

**Figure 3.8: Productivity and Post-manufacturing affiliates and revenue (2014)**

Benchmark regression analysis yields similar results: manufacturing firms with establishment, post-manufacturing, and post-sales affiliates are less productive than their non-servicified peers. This holds for both non-exporters and exporters. The results come from benchmark regressions of productivity as outlined in Box 3.2, where non-servicified firms are the omitted category (i.e. the benchmark). The left-hand panel of Figure 3.9 shows the results for all non-exporting goods firms as the omitted category, while exporters only are shown in the right-hand panel. Only coefficients with a significant effect are displayed. A full account of the benchmark results, including the control variables, is shown in Table A3a and b in Annex 1. Both panels show that firms with establishment services are around 20 percent less productive than non-servicified firms. Similarly, manufacturing firms that also produce post-manufacturing services are on average 13.8 percent and 18.7 percent less productive in the case of exporters and non-exporters respectively compared to their servicified peers.
4. Regulatory Restrictions on Services

The previous sections have shown that services are not living up to their potential in Turkey. The services sector and the interaction between services and the manufacturing sector fall short of what can be expected from an economy like Turkey that is approaching high-income status. Peer countries tend to have larger services economies and more trade in services both in gross terms and value-added. An ailing services sector has widespread consequences, since services are used as inputs throughout the economy. Moreover, manufacturing firms today do not only produce goods; they are increasingly also producing and selling services. Turkey also shows signs of this servicification process, but very slowly. While servicification has the potential to increase firm performance, this does not appear to be happening in Turkey: manufacturing firms with services tend to be less productive, particularly the ones that produce establishment and post-manufacturing services. This section looks at regulatory restrictions as a potential explanatory factor.

Removing regulatory restrictions on services can increase the contribution of services to productivity growth. Services that are either used as inputs or performed internally by manufacturing firms can be a driver of downstream productivity when effectively enabled by policy reforms (Arnold et al., 2011; 2015). Moreover, whether input markets are well integrated with downstream industries and face relatively low policy distortions can partially explain cross-country differences in economic and productivity performance (Bartelme and Gorodnichenko, 2015). Regulatory restrictions on services input markets deserve special attention, as they have historically been subject to policy distortions.

Higher services restrictions are correlated with lower productivity of manufacturing firms. Previous firm-level studies across developed and developing countries show that removing obstacles in services markets has a direct impact on productivity in downstream industries. Arnold et al. (2011) found that increased foreign participation of firms in services sectors caused an improvement in downstream manufacturing sectors in the Czech Republic; Arnold et al. (2015) found a similar result for India. They also show that regulatory reform in services in India had a positive impact on downstream manufacturing firms.
Fernandes and Paunov (2012) demonstrate the causal impact of FDI penetration in services on manufacturing TFP in Chile. They find a positive impact of services FDI on TFP for Chilean manufacturing industries, which explained 7 percent of manufacturing’s contribution to total Chilean TFP growth. Duggan et al. (2013) provide evidence that reform of restrictions on FDI in services in Indonesia increased TFP of manufacturing firms.

A wide set of regulatory restrictions in services are important to consider for reform. Services restrictions usually take on different forms and encompass a wider set of barriers than in the case of goods. For example, services restrictions can prevent foreign investors from entering the domestic market. Regulatory policy barriers in services can be broken down into those that affect entry of firms into a market and barriers that have an impact on the operations of firms. Barriers to entry restrict foreign and domestic service providers from bringing competition to the market. If entry barriers are high, domestic incumbents will be sheltered from competition and less incentivized to perform better, eventually leading to higher prices. Barriers to operations, on the other hand, are barriers that firms encounter after entry has taken place. Both types of barriers can be discriminatory or non-discriminatory for foreign service providers. Table 4.1 shows examples of each type of regulatory barrier.

Table 4.1: Typology of services regulatory barriers

| Discriminatory | Firm entry | Firm operations (conduct) |
|----------------|------------|---------------------------|
| E.g., nationality quotas for managers of affiliates; minimum equity stake required for national investors; economic needs tests | E.g., foreign insurance firms not permitted to offer certain types of coverage or product innovations; price controls |

| Non-discriminatory | Firm entry | Firm operations (conduct) |
|--------------------|------------|---------------------------|
| E.g., A limit of three mobile phone providers permitted to operate in the country | E.g., all retail banks required to maintain a minimum level of capital, independent of type of legal entity |

Both entry and conduct regulations in services have a knock-on effect on the economy. As Figure 4.1 shows, both types of barriers are negatively correlated with firm-level TFP. A recent study by Van der Marel et al. (2016), using data from millions of European firms, shows that reducing service restrictions to the level of the three least regulated EU member states (UK, Denmark, Sweden) would increase the productivity of firms operating in both services and manufacturing by up to 5.3 percent within two years of implementation. While removing both entry and conduct barriers in services increases firm productivity, the effect is larger for conduct barriers. Barriers to operations prevent services firms from growing in the post-entry phase and therefore prevent the Schumpeterian dynamic of ‘creative destruction’.
Strict services regulations relate to lower GDP per capita. Through lower TFP performance, services restrictions have a dampening effect on overall economic output and welfare. A second particularly strong result from Van der Marel et al. (2016) and World Bank (2017) is that services reforms can have a large impact on overall welfare. For instance, the two reports found that the reform of services generally, as well as professional services in particular, would have a significant effect on improving economic performance, including for Turkey. Figure 4.2 shows the inverse relationship between GDP per capita and professional services barriers across a set of countries. Turkey appears at the bottom right of the sample, with relatively low GDP per capita and high professional services barriers.

Turkey has scope to further reduce services regulatory restrictions. This scope for reform relates to professional services, such as accounting and legal services, as well as transport and logistics services. The sections below cover three regulatory areas for Turkey: i) FDI restriction in services; ii) domestic regulatory barriers in services that affect both Turkish and foreign firms; and iii) discriminatory services trade barriers that prevent foreign service providers from entering and operating in the Turkish economy.
**FDI restrictions**

Turkey generally has an open policy regime regarding FDI in services, although there are restrictions in some services within the establishment and post-manufacturing stages of production. The left-hand panel of Figure 4.3 shows that across all manufacturing and services sectors, Turkey has a relatively open FDI policy regime, scoring close to the OECD average. However, high FDI restrictions still exist in services sectors such as maritime and air transport, which are part of the post-manufacturing stage (right-hand panel of Figure 4.3). Although FDI for construction services (establishment stage) is not restricted, the real estate sector has high FDI barriers. Similarly, while there are few restrictions for FDI in overall business (back-office) services, accounting services face high barriers.

**Figure 4.3: FDI services restrictions for Turkey and production stages (2014)**

Source: OECD; authors’ calculations. The scale of the regulatory restriction index is 0-1.

FDI restrictions in the post-manufacturing and establishment stages can have a negative impact on the productivity of manufacturing firms. Generally, high FDI barriers prevent countries from reaping productivity spillover effects upstream and downstream in the economy (Javorcik, 2004a; 2004b; Javorcik and Spatareanu, 2005) since foreign know-how and technology do not flow to local firms. Such spillovers tend to be felt by local suppliers (i.e. vertically) rather than in the same sector where the FDI takes place (i.e. horizontally), although results depend on the country of analysis. FDI barriers in Turkey thus not only limit the entry of more productive foreign service providers, but also productivity-enhancing spillovers to local suppliers of those service providers. This could have a negative productivity impact on manufacturing firms, particularly those that rely more heavily on efficient establishment and post-manufacturing services.

**Domestic regulatory barriers**

Services suppliers, whether foreign or domestic, are affected by domestic regulatory barriers. For instance, state-owned enterprises, monopolies or other forms of state-ownership can limit the entry of private firms, both domestic and foreign (Van der Marel, 2012). In this case, domestic regulatory barriers also become a trade barrier. This section examines Turkey’s domestic regulatory measures based on the OECD’s Product Market Regulation (PMR) database as well Turkey’s services trade policy regime using the OECD Services Trade Restrictiveness Index (STRI).

Higher levels of domestic regulatory restrictions in Turkey are mainly in post-manufacturing and back-office services. Figure 4.4 shows the level of domestic regulatory restrictions of selected services in different production stages. The largest restrictions are in rail and road transport (post-manufacturing
stage), as well as accounting and legal services (back-office stage). These sectors may be indicative of the broader restrictiveness of services within each production stage, as many more services fall under each stage as shown in Table A2 in Annex 1. However, the regulatory databases used for this analysis only include a subset of the entire range of services.

**Figure 4.4: Domestic regulatory restriction in services for Turkey and production stages (2014)**

![Bar charts showing regulatory restriction in services for Turkey and production stages (2014)](image)

Source: OECD PMR; authors’ calculations. The scale of the regulatory restriction index is 0-1.

**Turkey shows a mix of entry and conduct barriers.** Rail transport services are completely restricted, affecting both firm entry and conduct. Air transport services mainly have restrictions related to public ownership, which affects the entry of foreign firms, but some conduct barriers also exist. The road transport sector has high entry barriers, while operations regulations are significantly lower. Gas and electricity services (manufacturing stage) have high conduct regulations, such as vertical integration policies, public ownership regulations, and uncompetitive market structures, whereas they are fairly open to firm entry. Architectural and engineering services (manufacturing stage) have high entry barriers while accounting and legal services (back-office services) have both restrictive entry and conduct regulations.

**Trade barriers in services**

**Services trade barriers are more prevalent in the post-manufacturing and back-office stages.** Regulatory policies can have an explicit discriminatory nature preventing entry from foreign services suppliers. These

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14 Although regulatory services barriers can be *de jure* non-discriminatory, some non-discriminatory regulatory barriers may still have an effect on the operating costs of the foreign entrant, making them *de facto* discriminatory
can be distinct from restrictions on foreign firms investing in a host country. Figure 4.5 breaks down the OECD STRI indicators by production stage.\(^{15}\) Trade-related restrictions in services in the post-manufacturing stage are particularly high for air transportation, followed by logistics cargo handling. In the post-sales stage, courier services appear to be the most restrictive. Back-office restrictions are led by accounting services (where Turkey is still completely closed), followed by legal services.

Figure 4.5: Services trade restrictions in GVC stages in Turkey (2016)

(Francois and Hoekman, 2010). This is because complying with specific domestic regulations might be costlier for foreign suppliers than for local ones who have better access to information and lower red tape costs (Crozet and Milet, 2016).

\(^{15}\) Again, while there are more services sectors under each production stage, as shown in Table A2 in Annex 1, only 22 services sectors are covered by the OECD's STRI.
The most restrictive components of trade barriers in air transport and cargo-handling services are related to foreign entry and competition. In air transport, there are still equity restrictions (which are also reflected in the OECD’s FDI restrictions shown in Figure 4.3). Turkey also has some restrictions on mergers and acquisitions by foreign firms and nationality restrictions on boards of directors. Regarding competition policies, Turkey has regulations related to slots (i.e. no auction takes place to give away slots, all carriers are allowed to retain slots from one season to another, and no administrative slot system is in place) and minimum capital requirements, all of which affect foreign service suppliers. In logistics cargo handling services, there are barriers to competition, such as price and fee regulations, contracts awarded without competitive bidding processes, and minimal capital requirements.

Services trade barriers tend to affect firm operations more than entry, with a mix of discriminatory and non-discriminatory elements. The top panel of Figure 4.6 shows the percentage division of services trade restrictions in Turkey that are classified as entry barriers versus barriers on the operations (i.e. conduct) of firms; the bottom panel shows the percentage of restrictions that are assessed as discriminatory versus non-discriminatory. Although entry barriers are still present in services markets, more restrictions affect firm operations. On the other hand, no clear pattern arises when looking at the differences between discriminatory and non-discriminatory barriers. In most services sectors (apart from air transport and insurance or logistics freight and maritime services), restrictions affect both foreign and domestic firms.
Restrictions on firm operations can dampen growth. Cross-country differences in the post-entry performance of all firms tend to be more marked than differences in entry and exit patterns (Bartelsman et al., 2003), which suggests an important role for services conduct regulations (Van der Marel et al., 2016). Furthermore, the OECD (2016) finds that post-entry growth patterns between countries explain firms’ ability to achieve sufficient scale to reach global markets, and the share of small firms that are relatively old negatively affects aggregate productivity and employment growth. Put differently, in countries with
high restrictions on firm operations, there are not sufficient selection mechanisms or up-or-out dynamics. Regulations on the operations of the firm are in effect barriers to up-scaling after firm entry.

In Turkey, services firms are relatively small, and there is little evidence of post-entry firm growth in both goods and services. The recent Turkey enterprise survey (World Bank, 2017) shows that services firms are overwhelmingly small on average, with a few stand-out large firms. This reflects the general patterns in Turkey that both goods and services firms tend to be smaller than in comparator countries. More importantly, the vast majority of firms in Turkey start with very few employees and show no significant pattern of growth. No matter the age group, about three-quarters of firms in Turkey that start small remains small. Only a handful of Turkish firms see a substantial growth pattern. Moreover, medium-sized firms (20-99 employees) do not show signs of scaling-up over time. Reducing conduct regulation could therefore help young firms to grow or exit (i.e. “up-or-out”).

5. Policy Implications

Productivity gaps appear in the same areas where services are more restricted. Section 3 found that manufacturing firms with an establishment, post-manufacturing, or post-sales affiliate are less productive than their non-servicified peers (Figure 3.9). This is true for both exporters and non-exporters. Exporters with a back-office service affiliate were also found to be less productive than non-servicified exporters. Section 4 presented evidence that FDI restrictions, domestic regulatory restrictions, and services trade barriers are most prevalent in the establishment (e.g. FDI in real estate), post-manufacturing (maritime, road, rail, and air transport) and back-office (accounting, legal) stages. These include barriers to firm entry and, to a greater extent, firm operations (which affect the ability of firms to grow).

These findings suggest that restrictions on competition in services, particularly from foreign firms, may lead Turkish manufacturing firms to provide more services in-house than would be optimal from a productivity perspective. In other words, while it may be more efficient to outsource certain services (e.g. logistics, transport, accounting), Turkish firms may instead perform them in-house due to lack of high quality, reasonably priced external service providers. This could help explain the high shares of revenue associated with post-manufacturing and establishment services activities within manufacturing firms (Figure 3.8), which could divert these companies from their core manufacturing activities and dampen productivity. Similarly, manufacturing industries use and export levels of transport and real estate services value-added that well-exceed OECD averages. The high revenue and exported value-added shares of these services also suggest that regulatory restrictions may be inflating prices, creating market inefficiencies.

Given the negative relationship between services restrictions and firm performance, removing restrictions could boost the productivity of Turkish manufacturing firms. Increased competition could improve the quality and reduce prices of services inputs, boosting Turkey’s performance in GVCs and the economy more broadly. Yet, increased competition is not a given. As the recent literature has shown (e.g. World Bank, 2016 and Van der Marel et al., 2016), regulatory reform processes work best when institutions are strong and promote effective competition in services. Some types of services can lag due to market failures, requiring special attention from competition agencies and domestic regulators. OECD competition policy indicators show that Turkey performs well vis-à-vis peer countries (left panel of Figure 5.1), suggesting that future service reforms could be effectively enforced. Another institutional factor that has proven to have a strong impact on the effectiveness of services reform is rule of law. Turkey shows room for improvement in this area, as seen in the right-hand panel of Figure 5.1.
More intense competition in service sectors could lead to 1 percentage point of additional growth in value added in all service-intensive sectors (World Bank, 2013). Increasing competition in services would have positive spillover effects downstream on nearly all sectors of the economy. Conservative estimates indicate that reducing regulatory and competition constraints on professional and transport services would result in benefits of over TL 1 billion in additional value added to the economy per year.16

Professional services should be opened to competition. Turkey’s regulatory framework governing the liberal professions (professions requiring special training in the liberal arts or sciences, such as notaries, lawyers, engineers, or accountants) does not comply with international best practices. Both the regulatory framework and the regulations imposed by professional associations lessen competition by either restricting entry (such as stipulating a fixed number of suppliers, exclusivity in the provision of services, and restrictions to practice) or aiding members in coordinating prices (such as establishing minimum prices). Minimum prices are in place for accounting, architecture, legal, and engineering services, while notaries regulate the exact level of pricing. Limitations on advertising apply to some professions and access to several professions is closed to foreign nationals. Fees for key professional services, such as legal and notaries, are among the highest in the OECD and the EU for comparable transactions (World Bank, 2013).

Reforms would have three main objectives: increasing productivity by allowing entry and competition across professional services; incentivizing competitive and efficient pricing; and lowering costs to users of professional services across the economy. These same principles should apply to restrictions on entry and price competition imposed by business associations and professions in other key sectors (such as road freight) (World Bank, 2013).

16 According to World Bank (2013), given that there are 19 Turkish sectors that use transport services intensively and 12 sectors that use business and professional services intensively, if all of these grow in value added by 0.75 percent, the additional value added generated from transport liberalization would be TL 1,002 million, and from professional service sector liberalization, it would be TL 877 million. The aggregate and cross-sector impact of all service sectors would presumably be much larger.
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Annex 1: Supporting Empirical Results and Documentation

Figure A1: TFP measures applied to Turkish EIS firm-level data (2014)

Source: EIS data from Turkey; author’s calculations. Note: TFP ACF is based on Ackerberg et al. (2015). TFPQ based on Hsieh and Klenow (2009; 2014); Olley and Pakes (1996) for OL; Levin and Petrinsohn (2003) for LP; and finally labour productivity is used for LabPr. The vertical axis shows the frequency of firms that have a certain level of TFP. The level of TFP is shown on the horizontal axis.
|                      | (1)               | (2)               | (3)               | (4)               | (5)               |
|----------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
|                      | TFP ACF           | TFPQ              | TFP OP            | TFP LP            | Lab Pr            |
| Servicified          | -0.195***         | -0.333***         | -0.035***         | -0.226***         | -0.226***         |
|                      | (0.008)           | (0.024)           | (0.003)           | (0.016)           | (0.016)           |
| Goods exporter       | 0.220***          | 0.620***          | 0.061***          | 0.411***          | 0.411***          |
|                      | (0.008)           | (0.017)           | (0.002)           | (0.011)           | (0.011)           |
| Servicified exporter | 0.127***          | 0.515***          | 0.051***          | 0.338***          | 0.338***          |
|                      | (0.008)           | (0.023)           | (0.002)           | (0.015)           | (0.015)           |
| ln(size)             | 0.023***          | 0.313***          | 0.004***          | 0.408***          | -0.426***         |
|                      | (0.004)           | (0.012)           | (0.001)           | (0.007)           | (0.007)           |
| Kurum                | 0.008             | 0.206***          | 0.020***          | 0.137***          | 0.137***          |
|                      | (0.005)           | (0.016)           | (0.002)           | (0.010)           | (0.010)           |
| ln(capital)          | -0.020***         | -0.082***         | -0.009***         | 0.071***          | 0.248***          |
|                      | (0.002)           | (0.006)           | (0.000)           | (0.003)           | (0.003)           |

| Observations         | 312,856           | 312,856           | 312,856           | 312,856           | 312,856           |
| R-squared            | 0.158             | 0.182             | 0.132             | 0.481             | 0.311             |
| RMSE                 | 0.489             | 1.260             | 0.124             | 0.819             | 0.819             |

Note: The benchmark chosen is the goods firms only (i.e. non-exporter); sector and year fixed effects are applied whilst standard errors are clustered by sector-year. TFP based on Hsieh and Klenow (2009; 2014) for TFPQ; Olley and Pakes (1996) for OL; Levin and Petrinsohn (2003) for LP; and finally labour productivity is used for LabPr.
|                | (1)            | (2)            | (3)            | (4)            | (5)            |
|----------------|----------------|----------------|----------------|----------------|----------------|
|                | TFP ACF        | TFPQ           | TFP OP         | TFP LP         | Lab Pr         |
| Goods          | -0.220***      | -0.620***      | -0.061***      | -0.411***      | -0.411***      |
|                | (0.008)        | (0.017)        | (0.002)        | (0.011)        | (0.011)        |
| Servicified    | -0.415***      | -0.952***      | -0.096***      | -0.637***      | -0.637***      |
|                | (0.008)        | (0.017)        | (0.002)        | (0.011)        | (0.011)        |
| Servicified exporter | -0.092***     | -0.105***      | -0.010***      | -0.073***      | -0.073***      |
|                | (0.007)        | (0.014)        | (0.001)        | (0.009)        | (0.009)        |
| ln(size)       | 0.023***       | 0.313***       | 0.004***       | 0.408***       | -0.426***      |
|                | (0.004)        | (0.012)        | (0.001)        | (0.007)        | (0.007)        |
| Kurum          | 0.008          | 0.206***       | 0.020***       | 0.137***       | 0.137***       |
|                | (0.005)        | (0.016)        | (0.002)        | (0.010)        | (0.010)        |
| ln(capital)    | -0.020***      | -0.082***      | -0.009***      | 0.071***       | 0.248***       |
|                | (0.002)        | (0.006)        | (0.000)        | (0.003)        | (0.003)        |

Observations 312,856 312,856 312,856 312,856 312,856
R-squared 0.158 0.182 0.132 0.481 0.311
RMSE 0.489 1.260 0.124 0.819 0.819

Note: The benchmark chosen is the goods exporters only; sector and year fixed effects are applied whilst standard errors are clustered by sector-year. TFP based on Hsieh and Klenow (2009; 2014) for TFPQ; Olley and Pakes (1996) for OL; Levin and Petrinsohn (2003) for LP; and finally labour productiviy is used for LabPr.
Table A2: Categorization of services into production stages

| NACE 3-digit Description | Description |
|--------------------------|-------------|
| 970 Activities of households | |
| 971 Agricultural and forestry activities | |
| 972 Fishing | |
| 973 Forestry and hunting | |
| 974 Leather manufacturing | |
| 975 Textile manufacturing | |
| 976 Clothing and related activities | |
| 977 Footwear manufacturing | |
| 978 Furniture manufacturing | |
| 979 Other manufacturing | |

| NACE 2-digit Description | Description |
|--------------------------|-------------|
| 91 | Healing and personal care activities |
| 92 | Repair and installation of machinery and equipment |
Figure A2: Alternative TFP measures applied to Turkish EIS firm-level data for GVC services (2014)

Source: EIS data from Turkey; author’s calculations. Note: TFP based on Hsieh and Klenow (2009; 2014) for TFPQ; Olley and Pakes (1996) for OL; Levin and Petrinsohn (2003) for LP; and finally labour productivity is used for LabPr.
### Table A3a: Results from benchmark regression analysis of production stages (2007-2014)

|                        | (1)         | (2)         | (3)         | (4)         | (5)         |
|------------------------|-------------|-------------|-------------|-------------|-------------|
|                        | TFP ACF     | TFPQ        | TFP OP      | TFP LP      | Lab Pr      |
| Establishment          | -0.226***   | -0.610***   | -0.064***   | -0.411***   | -0.411***   |
|                        | (0.007)     | (0.019)     | (0.002)     | (0.013)     | (0.013)     |
| Pre-man                | -0.045      | 0.286       | 0.016       | 0.125       | 0.125       |
|                        | (0.091)     | (0.199)     | (0.018)     | (0.123)     | (0.123)     |
| Manufacturing          | -0.055**    | -0.210***   | -0.024***   | -0.141***   | -0.141***   |
|                        | (0.026)     | (0.068)     | (0.007)     | (0.045)     | (0.045)     |
| Post-man               | -0.148***   | -0.148***   | -0.014***   | -0.102***   | -0.102***   |
|                        | (0.006)     | (0.021)     | (0.002)     | (0.014)     | (0.014)     |
| Post-sales             | -0.151***   | -0.246***   | -0.026***   | -0.167***   | -0.167***   |
|                        | (0.017)     | (0.040)     | (0.004)     | (0.027)     | (0.027)     |
| Back-office            | -0.015*     | 0.014       | 0.001       | 0.006       | 0.006       |
|                        | (0.009)     | (0.017)     | (0.002)     | (0.012)     | (0.012)     |
| Other                  | -0.345***   | -0.610***   | -0.063***   | -0.412***   | -0.412***   |
|                        | (0.016)     | (0.032)     | (0.003)     | (0.021)     | (0.021)     |
| Two types              | -0.156***   | -0.203***   | -0.022***   | -0.139***   | -0.139***   |
|                        | (0.013)     | (0.026)     | (0.003)     | (0.017)     | (0.017)     |
| In(size)               | 0.023***    | 0.313***    | 0.004***    | 0.408***    | -0.426***   |
|                        | (0.004)     | (0.012)     | (0.001)     | (0.007)     | (0.007)     |
| Exporter               | 0.236***    | 0.653***    | 0.064***    | 0.433***    | 0.433***    |
|                        | (0.008)     | (0.015)     | (0.001)     | (0.010)     | (0.010)     |
| Kurum                  | 0.006       | 0.199***    | 0.019***    | 0.132***    | 0.132***    |
|                        | (0.005)     | (0.016)     | (0.002)     | (0.010)     | (0.010)     |
| ln(capital)            | -0.020***   | -0.080***   | -0.009***   | 0.072***    | 0.249***    |
|                        | (0.002)     | (0.006)     | (0.000)     | (0.003)     | (0.003)     |

Observations: 312,856  312,856  312,856  312,856  312,856
R-squared: 0.159  0.185  0.135  0.483  0.313
RMSE: 0.489  1.258  0.124  0.817  0.817

Note: The benchmark chosen is the goods firms only (i.e. non-exporter); sector and year fixed effects are applied whilst standard errors are clustered by sector-year. TFP based on Hsieh and Klenow (2009; 2014) for TFPQ; Olley and Pakes (1996) for OL; Levin and Petrinsohn (2003) for LP; and finally labour productivity is used for LabPr.
Table A3b: Results from benchmark regression analysis of production stages (2007-2014)

|                | (1)       | (2)       | (3)       | (4)       | (5)       |
|----------------|-----------|-----------|-----------|-----------|-----------|
|                | TFP ACF   | TFPQ      | TFP OP    | TFP LP    | Lab Pr    |
| Establishment  | -0.206*** | -0.477*** | -0.048*** | -0.323*** | -0.323*** |
|                | (0.011)   | (0.024)   | (0.002)   | (0.016)   | (0.016)   |
| Pre-man        | 0.116     | 0.557***  | 0.043***  | 0.298***  | 0.298***  |
|                | (0.081)   | (0.186)   | (0.015)   | (0.108)   | (0.108)   |
| Manufacturing  | -0.068*   | -0.018    | -0.003    | -0.012    | -0.012    |
|                | (0.039)   | (0.095)   | (0.009)   | (0.063)   | (0.063)   |
| Post-man       | -0.207*** | -0.199*** | -0.019*** | -0.135*** | -0.135*** |
|                | (0.008)   | (0.015)   | (0.001)   | (0.010)   | (0.010)   |
| Post-sales     | -0.156*** | -0.190*** | -0.020*** | -0.131*** | -0.131*** |
|                | (0.020)   | (0.047)   | (0.005)   | (0.031)   | (0.031)   |
| Back-office    | -0.045*** | -0.018    | -0.002    | -0.017    | -0.017    |
|                | (0.010)   | (0.020)   | (0.002)   | (0.014)   | (0.014)   |
| Other          | -0.173*** | -0.394*** | -0.038*** | -0.269*** | -0.269*** |
|                | (0.026)   | (0.063)   | (0.006)   | (0.041)   | (0.041)   |
| Two types      | -0.161*** | -0.155*** | -0.017*** | -0.106*** | -0.106*** |
|                | (0.011)   | (0.022)   | (0.002)   | (0.015)   | (0.015)   |
| ln(size)       | 0.026***  | 0.320***  | 0.005***  | 0.413***  | -0.421*** |
|                | (0.004)   | (0.012)   | (0.001)   | (0.007)   | (0.007)   |
| Kurum          | 0.047***  | 0.371***  | 0.036***  | 0.248***  | 0.248***  |
|                | (0.008)   | (0.018)   | (0.002)   | (0.012)   | (0.012)   |
| ln(capital)    | 0.025***  | -0.026*** | -0.003*** | 0.108***  | 0.285***  |
|                | (0.002)   | (0.006)   | (0.000)   | (0.003)   | (0.003)   |

Observations: 98,273
R-squared: 0.182
RMSE: 0.483

Note: The benchmark chosen is the goods exporting firms; sector and year fixed effects are applied whilst standard errors are clustered by sector-year. TFP based on Hsieh and Klenow (2009; 2014) for TFPQ; Olley and Pakes (1996) for OL; Levin and Petrinsohn (2003) for LP; and finally labour productivity is used for LabPr.
Annex 2: Explanation of TFP methodology

The firm-level data for estimating our TFP measures were retrieved from the Ministry of Science, Industry and Technology (MoSIT) Entrepreneurial Information System (EIS) database. Data in this database are for the period 2007-2014 for manufacturing firms only. No data were available at the affiliate level to estimate their separate production functions.¹⁷

Firm-level TFP measures used in this paper are computed in different ways. Over the years, various methodologies have been developed in the international economics literature, with Olley and Pakes (2003) and Levinsohn and Petrin (2008) as the most commonly used ones. Several papers that are very close to our line of research, such as Fernandes and Paunov (2012) and Arnold et al. (2015), have used the TFP estimation developed by Ackerberg et al. (2006; 2015).

Although all three approaches correct for the endogeneity of input choices, including the choice of services as inputs, for the TFP estimates, the Ackerberg specification improves the former two TFP methods by correcting for potential collinearity problems, which could otherwise occur from a distorting factor with regards to the identification of the variable input coefficients. Ackerberg et al. (2006; 2015) also provide a correction for the timing of the input choice decision.

This paper also uses the Hsieh and Klenow (2009, 2014) way of estimating TFP, which is relatively new and follows a different structure. More precisely, in their methodology the authors follow a structural approach using a Cobb-Douglas estimate with commonly used labor shares to explicitly take into account policy distortions that would otherwise affect traditional TFP measures in their revenue as opposed to physical TFP.

We estimate all four approaches and use them in our regression output discussion. To do so, one needs to estimate sector-specific production functions. These production functions are sector-specific because industries differ in production technology. The main idea of estimating these production functions is that unobserved firm productivity shocks can be approximated by a non-parametric function of observable firm characteristics. We estimate these production functions for each 2-digit manufacturing sector.

To start estimating production functions we need firm-level data on value-added. We compute value-added as the real sales (deflated) minus the cost of sales (deflated). Generally, value-added at the firm is defined as sales minus the value of inputs, which includes materials, services and energy. In our case, we used only balance sheet information to perform this analysis and did not have the opportunity to separate different types of costs included in the cost of sales. The production functions themselves are estimated using the standard approach of Cobb-Douglas in logarithmic form, as shown in the following equation:

\[
\ln Y_{it} = \beta_K \cdot \ln K_{it} + \beta_L \cdot \ln L_{it} + \omega_{it} + \epsilon_{it}
\]

(A1)

In equation (A1), \( Y_{it} \) stands for output of a firm \( i \) in year \( t \) and represents value-added as explained above; \( K_{it} \) denotes the capital stock of a firm and is calculated as the two-period average of real fixed tangible capital for all four approaches in depreciated form; and \( L_{it} \) designates the labor input of a firm, which is

¹⁷ However, it remains unclear whether the variable reported at the manufacturing firm level also comprises activities of the affiliate, which may result that the productivity figures could include some services activities.
proxied by the number of employees.\textsuperscript{18} Furthermore, $\omega_{it}$ is the unobserved total factor productivity and $\epsilon_{it}$ is the random iid shock.

As explained above, we do not use OLS to estimate equation (A1) as this estimation strategy suffers from simultaneity bias in its inputs. Instead, we use the various approaches of TFP from Ackerberg et al. (2006, 2015), Olley and Pakes (1996), Levinsohn and Petrin (2003), and Hsieh and Klenow (2009, 2014). For the Ackerberg et al. and Levinsohn and Petrin specifications, we use material inputs as a proxy for unobserved time-varying productivity shocks. For the Olley and Pakes approach one needs investment instead, which is computed as the difference between capital stock of two subsequent years corrected for depreciation, i.e. $\text{Inv}_{it}$.

For Hsieh and Klenow (2009, 2014), TFPQ is estimated in relative terms compared to each 2-digit NACE classification sector code. As said, for this approach one needs to have common labor shares from one country which is most likely to serve as a reference point. This paper uses Germany, as it represents the most important economy for Turkey that is comparatively undistorted by policies. Labor market shares are defined as the wages and salaries for each 2-digit NACE sector divided by each of their sectoral value-added.

Proxy variables are deflated at the 2-digit NACE level. In case the data were missing, we used either a higher level of aggregation, or otherwise simple GDP deflators. For value-added, we used the value-added deflator from Turkstat for all years. For materials, we used the deflator for intermediate consumption, and for capital stock we used the consumption of fixed capital price index. Both are also taken from Turkstat.

The production functions contain 32 sectors.\textsuperscript{19} Note that the production functions were estimated for Ackerberg et al. (2006, 2015), Olley and Pakes (1996) and Levinsohn and Petrin (2003). For Hsieh and Klenow (2009, 2014) the production function was computed following standard practice. In all, based on the three unbiased sets of estimates plus the TFPQ measure, we obtain four firm-level time-varying logarithmic TFP specifications as residuals from equation (A1).

\textsuperscript{18} Note that subscripts for country and industry are suppressed for now as they are estimated for each of them.

\textsuperscript{19} An overview of this matrix with the number of firms in each of these cells is available, but would need to be retrieved from the Ministry of Science, Industry, and Technology with permission.