ERF 2020
26TH Annual
Conference

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N. Nergiz Dincer and Ayça Tekin-Koru

ECONOMIC RESEARCH FORUM
منتدى البحوث الاقتصادية

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N. Nergiz Dincer* and Ayça Tekin-Koru†

November 2019

Abstract

In this paper, we revisit the question of how firm-level sourcing decisions affect export performance by specifically studying the export quality impact of the recent shift of Turkish exporters to China in their capital inputs sourcing in the 2003-2015 period using a unique and highly disaggregated firm-product level data from the Turkish Statistical Institute (TurkStat). The first part of our analysis provides a thorough exploration of this rich data set to put forth a number of stylized facts that inform the empirical analysis. In the second part, we estimate the impact of increased sourcing of capital inputs from China on export quality upgrading. Our results identify and emphasize that both the source country and the time of sourcing have very tangible export quality effects. In the case of Turkey, switching from high-quality European producers of capital goods to China has negatively affected export quality. This negative effect was apparent in the first part of the sample where China was a novelty in the WTO and did not have enough time to upgrade its quality. However, in time, China upgraded its quality and only then the shift to China produced positive quality effects for a developing country like Turkey. In the third and last part, we show that these results hold under a number of robustness checks.

Keywords: export quality upgrading, input sourcing, firm heterogeneity, China
JEL Codes: F14, D22

* Department of Economics, TED University, Ziya Gokalp Bul. No:48, Kolej, Ankara, Turkey. Phone: +90(312)585-0038. E-mail: nergiz.dincer@tedu.edu.tr

† Department of Economics, TED University, Ziya Gokalp Bul. No:48, Kolej, Ankara, Turkey. Phone: +90(312)585-0034. E-mail: ayca.tekinkoru@tedu.edu.tr and Scientific Research Center, Australian College of Kuwait, West Mishref, Mubarak Al-Abdullah Al-Jaber Area, Block 5 - Al Aqsa Mosque Street, Building 4, Kuwait City.

1 Introduction

This paper looks into the impact of foreign sourcing of inputs on export quality upgrading in a developing country setting. In these countries, export promotion is still viewed as an important path to economic growth and thus quality standards demanded by developed export markets push policymakers to shift their focus from cost efficiency to capability of producing high quality products for export markets (Sutton, 2012). In other words, quality upgrading begets export success in these countries by allowing suppliers of higher quality products to attain higher levels of exports and faster export growth (Grossman and Helpman, 1991; Hausmann and Rodrik, 2003; Manova and Yu, 2017).

In addition, a number of recent policy debates have renewed the interest in the drivers of export quality movements. The most recent World Development Report (World Bank, 2020), the flagship publication of the World Bank, is devoted to developmental impact of global value chains. The main lesson is that the impact of better access to a greater variety of high-quality inputs helps growth and ensures productivity gains.

On the academic side, there is a plethora of evidence pointing out these benefits. Access to a wider variety of inputs and/or higher quality foreign inputs empowers firms to expand their scope, productivity and quality of exports (Amiti and Konings, 2007; Goldberg, Khandelwal, Pavcnik and Topalova, 2010; De Loecker, Goldberg, Khandelwal and Pavcnik, 2016; Antras, Fort and Tintelnot, 2017). More often than not, the key to this access is import liberalization. However, liberalization may not always trigger this positive effect and precise evidence on the channels through which there may be a negative effect remains elusive.

In this paper, we revisit the question of how firm-level sourcing decisions affect export performance by specifically studying the export quality impact of the recent shift of Turkish exporters to China in their capital inputs sourcing in the 2003-2015 period. To be precise, China's share in the capital goods imports of Turkey increased from 7 percent in 2003 to 25 percent in 2015. This rather large shift is prompted by China's accession to the WTO in December 2001.

Among other things, WTO membership guarantees the most-favored nation status, which gave China a plethora of trade advantages such as lower tariff and non-tariff barriers. All around the globe, for firms that source their inputs from abroad, this event - which is exogenous at the firm level- marked the beginning of a new era that tilted the scales in foreign sourcing towards China. Consequently, owing also to the sheer size of Chinese economy, the use of Chinese inputs in the production lines of many countries has increased. Turkey was no exception.

In this context, Turkey lends itself as an excellent developing country example. Firstly, Turkey's traditional trade partners were mostly the developed countries of Europe that supplied high quality inputs to Turkish producers. The shift to China tilted the scales towards a low-quality source country. Secondly, the sample period of this paper, 2003-2015, coincides with an era of rapid increases in the import dependency of Turkish exports. Terzioğlu and Subaşat (2018) report that in the first decade of 2000s -among 62 countries they analyzed- Turkey was ranked fourth in terms of increases in import dependency. In fact, Erduman, Eren and Gül (2019) put forth compelling evidence that import dependency of Turkish exports shot up to 32 percent in 2017 from 22 percent in 2002. Therefore, any

major change in capital inputs sourcing in Turkey is expected to have major export-related effects.

Furthermore, China's entry into the WTO is an exceptional opportunity for us to identify the casual impact of resulting liberalization on export quality movements. Firstly, it is outside the control of Turkish exporters and thus constitutes an exogenous change. Secondly, China is a very large economy and liberalization of trade with China is vastly different from that with a small- or medium-size country.

In the forthcoming analysis in this paper, we use a unique and highly disaggregated firm-product level data from the Turkish Statistical Institute (TurkStat) based on the Annual Industry and Service Statistics database (AISS) and the Foreign Trade Statistics database (FTS) of Turkey. Since there is evidence for export quality upgrading on the side of China in the duration of our sample span, we divide our sample into two periods. Access to higher quality inputs at cheaper rates in the aftermath of the WTO accession enabled China to gradually upgrade its export quality (Fan, Li and Yeaple, 2015 and 2018). This is a change that needs to be accounted for in our analysis. Henceforth, our early period is 2003-2007 and the late one is 2011-2015. We avoid the Global Financial Crisis years to ensure that our results are not purely driven by crisis related changes.

The first part of our analysis provides a thorough exploration of this rich data set to put forth a number of stylized facts that inform the empirical analysis. Firstly, we begin with export quality estimation. There is a vast literature on quality upgrading of produced goods.[1] These studies highlight the importance of understanding why product quality differs between countries and over time and how policy affects it. The main challenge in the literature is that quality is not observable. In order to overcome this problem, international trade literature used prices (unit values) to represent quality. However, this approach has been criticized on the grounds that price differences may result from differences in cost and mark-ups and hence quantity should be included in quality measurement (Hummels and Klenow, 2005 and Khandelwal, 2010). Recent studies in the literature utilize quality measures based on price and quantity derived from structural models.[2] In this paper, we follow Khandelwal, Schott and Wei (2013) in our quality estimation.

We find that in the 2003-2007 period, export quality declined for all firms in Turkey. However, the drop was more pronounced for low-productivity firms. In the 2011-2015 period, while low productivity firms upgraded their export quality, high-productivity firms experienced quality downgrades.

Secondly, we explore the capital inputs sourcing from China. In this paper, capital inputs refer to producers' goods that are a part of fixed capital formation and include (i) machinery and equipment used by the industry such as electrical generators and computers, and other manufactured goods such as medical furniture, which are used by

[1] The demand sided explanation initiated by Linder (1961) was supported by Hallak (2006) and Verhoogen (2008). Schott (2004) as well as Hummels and Klenow (2005) contributed to this line of research by showing that rich countries export higher quality products. Later, the role of product quality on production and trade was investigated by Kugler and Verhoogen (2008), Hallak and Sivadasan (2009), Baldwin and Harrigan (2011) and Johnson (2012).

[2] See Verhoogen (2008), Khandelwal (2010), Hallak and Schott (2011), Manova and Zhang (2012), Khandelwal, Schott and Wei (2013), Feenstra and Romalis (2014), Fan, Li and Yeaple (2015) and Fan, Li and Yeaple (2018).

the industry; (ii) transport equipment used by the industry such as finished ships, road vehicles, aircraft, railway and tramway rolling stock.

We concentrate on the capital inputs that are already sourced from abroad and ignore capital inputs that have never been used in production before or the ones that are sourced just domestically. As such, we measure increased sourcing from China in two main veins: (i) *New sourcing* applies to the cases where a firm starts sourcing a particular capital input from China for the first time. We dissect new sourcing into its extensive and intensive margin components. On the extensive margin we investigate the impact of the decision to source from China whereas on the intensive margin we study the effect of imported quantity of this newly sourced capital input on export quality. (ii) *Increase in the ongoing sourcing* applies to the cases where a firm increases the amount of a capital input that it sourced from China previously.

We find that the capital inputs sourcing from China both on the extensive and intensive margin has been on an ascending trajectory in the sample period both at the firm and firm-product level. Even though both the number and the quantity of capital inputs that were continuously sourced from China increased vastly, these increases were smaller in the 2011-2015 period.

In the second part, we go beyond descriptive statistics and estimate the impact of increased sourcing of capital inputs from China on export quality upgrading. Our empirical strategy is inspired by the works of Fan, Li and Yeaple (2015, 2018) that investigate the impact of China's accession to the WTO on quality upgrading of Chinese exporters. They first develop a structural model and then test it using disaggregated Chinese data. Their results show that quality upgrading of high productivity firms is less responsive to the tariff reductions after the WTO accession. In other words, it is the low productivity Chinese firms that benefit from the WTO accession in terms of export quality upgrading.

In the case of Turkey, the tables turn. Now, we are in the realm of firms that start importing or increasing their existing imports from a source country with relatively low quality inputs. The trigger is the same event: source country's accession to a club which brings about bilateral reductions in tariffs between the two countries. Under these circumstances, we expect quality changes of low productivity firms to be more responsive to increased capital goods sourcing from China. In other words, when Turkish exporters start sourcing low-cost/low-quality inputs from China, we anticipate that the low productivity firms are hurt more in terms of export quality upgrading.

Our results, firstly, show that for an average productivity firm, the decision of starting to source a particular capital input from China (extensive margin of new sourcing) reduces export quality at the product level by 16.7 percent in the 2003-2007 period. For a 10 percent less productive firm this effect deepens and reaches 24.6 percent export quality downgrading. These findings are in contrast to the existing literature postulating that trade liberalization has a positive role in export quality upgrading. In the 2011-2015 period, which is known to be the period that China noticeably increased its production and export quality, there is no significant export quality impact of choosing China over another country in terms of capital goods sourcing.

Secondly, the level of new sourcing (intensive margin of new sourcing) wields no effect on export quality in the 2003-2007 period. However, in the 2011-2015 period, there is a significant positive effect that is declining in productivity. Specifically, for an average

productivity firm, a 10 percent increase in the quantity level at which the firm starts sourcing a particular capital input from China increases its export quality at the product level by 5.4 percent. For a 10 percent less productive firm it is 6.7 percent.

The findings related to the choice and quantity of sourcing from China for the first time in 2011-2015 period indirectly supports the findings of Fan et al. (2018) in terms of China's quality upgrading after the WTO accession. Our difference from Fan et al. (2018) is that we do not observe this effect immediately after the WTO accession. If anything, there is a negative effect of starting to source from China in that period and it severely deteriorates the export quality of low productivity firms. However, a decade later, the higher the level of capital inputs that were newly sourced from China, the larger the export quality upgrading, particularly for low productivity firms.

Finally, our results also point to the importance of quality differentiation in terms of export quality upgrading. Firms that started sourcing or increased their ongoing sourcing from China and export highly differentiated products increase their export quality at higher rates than firms that do not. This effect is more pronounced for low productivity firms.

In the third and last part, we show that these results hold under a number of robustness checks. To address endogeneity between the recent shift to China in capital inputs sourcing and quality upgrading, we offer two instrumental variables, namely changes in firm-level tariffs due to accession of China to the WTO and capital intensity changes of China in capital inputs production. Most of our results hold.

The results of this paper contribute to the literature in a number of ways. Firstly, they complement a recent line of literature that concludes that trade liberalization increases the access to (a greater variety of) high-quality inputs and thus positively affects growth and productivity (Amiti and Konings, 2007; Goldberg, et al. 2010; De Loecker et al. 2016; Fan et al. 2015; Antras et al. 2017). In this paper, we show that there is another side of the medallion. A switch in the foreign sourcing to low-quality producers in the aftermath of trade liberalization reduces export quality. In other words, import liberalization may not always work in the ways that benefit all parties involved. More specifically, China's accession to the WTO may have had a great role in its export quality upgrading; however, the highly import-dependent exporters of developing countries that switched their sourcing of foreign inputs to China in the introductory years of China's WTO accession may have suffered in terms of deteriorations in their export quality.

Secondly, our results relate to a growing literature on firm heterogeneity and export quality (See Khandelwal, 2010 and multitudes of studies inspired by it). In this paper, we estimate quality for a developing country at a great level of disaggregation benefiting from the methodological findings of this literature. We show that quality upgrading is heterogenous across low and high productivity firms even at this disaggregation level.

Thirdly, our results identify and emphasize that both the source country and the time of sourcing have very tangible export quality effects. In case of Turkey, switching from high-quality European producers of capital goods to China has negatively affected export quality. This negative effect was apparent in the first part of the sample where China was a novelty in the WTO and did not have enough time to upgrade its quality. However, in time, China upgraded its quality and only then the shift to China produced positive quality effects for a developing country like Turkey.

The remainder of the paper is organized as follows: Section 2 provides macro-level evidence followed by data assembly and stylized facts in Section 3. The empirical strategy and baseline regression results are presented in Section 4. We provide robustness (endogeneity) analyses in Section 5 and conclude in Section 6.

2 Macro Evidence

In this section, we document macro-level evidence about the shift in the Turkish firms' capital inputs sourcing to China and the evolution of volume and value of exports in Turkey for the 2003-2015 period.

When Turkey's import structure is analyzed, it is seen that China's share in the capital goods imports increased from 7 percent in 2003 to 25 percent in 2015 (Figure 1a). In other words, as of 2015, a quarter of Turkish firms' foreign capital inputs was sourced from China. This rather large shift is without a doubt thought-provoking in terms of its effect on the production and export structure of the country. It is also noteworthy that the share of China in Turkish intermediate and consumer goods imports increased during the same period; however, the increase in the former considerably slowed down after 2007 and the rise in the latter is still a relatively small share of consumer goods imports. Therefore, in this paper, we concentrate on the shift in capital inputs sourcing only.

Next, we look into the main trends in the capital goods imports of Turkey from its major trading partners to understand the nature of this shift (Figure 1b). In the beginning of the sample, Germany led the pack (23 percent) followed by Italy (13 percent) and Japan (8 percent), while China was hovering around a 7 percent share in the Turkish capital goods imports. When we reached year 2008, this picture started showing radical differences: China caught up with Germany (18 percent) while the shares of all other countries were declining at different rates. By 2015 the picture was almost upside down. With an insatiable appetite, China has already captured one-quarter of Turkish capital goods imports. Except for the US and France, all other major trading partners continued to have declining shares.

[Insert Figure 1 here]

At this point, a natural line of inquiry is to question whether the import structure of Turkey has gone through a significant change in terms of Broad Economic Categories (BEC) classifications for the period of 2003-2015. Figure 2 shows that the shares of capital, intermediate and consumer goods in Turkish imports remained almost the same throughout the period, indicating that patterns of production/technology/consumption in terms of foreign product use did not experience a noteworthy change. Therefore, we can conjecture that Turkish firms' shift to China in their foreign sourcing of capital inputs did not stem from a forgoing major production technology shift. Instead, it was mostly caused by price dynamics that have changed significantly after the China's accession to the WTO in December 2001.

[Insert Figure 2 here]

Next, we look into the main trigger of shift to China in capital inputs sourcing (Table 1). In the 2003-2007 period the trade-weighted duties (applied MFN tariffs) on Turkish imports from China declined for capital, intermediate and final goods at the rates of 41 percent, 24 percent and 14 percent, respectively. The largest decline was experienced in capital goods which we conjecture as the main culprit behind the large shift to China in this particular product category. If we set aside the Global Financial Crisis years and concentrate on the last part of the sample, the 2011-2015 period, we can see that the duties levied by Turkey on Chinese capital goods did not change much while the duties on intermediate and final goods imports from China have been on the rise. These two tariff-related developments might be behind the observation that while the Chinese share in the capital goods imports of Turkey continued to rise even after the Global Financial Crisis, there was a tapering of intermediate goods imports from China in the 2011-2015 period as shown in Figure 1.

[Insert Table 1 here]

Finally, we provide a broad-brush view of the major developments in the Turkish exports since the central thrust of this paper is to investigate the impact of the recent large shift to China in capital inputs sourcing on export quality. Figure 3 shows the evolution of volume and value of exports. Even though there was a continuous growth both in the volume and the value of exports in the 2003-2015 period, the growth rates of these aggregates have changed drastically. Figure 3 also illustrates data on annualized changes in volume, value and unit value of exports. When the sample period of 2003-2015 is decomposed into three sub-periods (2003-2007, 2008-2010 and 2011-2015) in line with the observed effects of Global Financial Crisis on Turkey, we witness that the 2003-2007 period went down in history as the golden years of exporting in Turkey as evidenced by an increase of 24.36 percent in the value of exports while the volume has increased by 12.05 percent. This differential between value and volume points out to a 10.20 percent annual increase in the unit value of exports in 2003-2007. Later, in 2008-2010 period, the effects of the Global Financial Crisis were felt in Turkey heavily and growth rates of both value and volume of exports slowed down to 2.01 percent and 3.08 percent, respectively. In the same period, unit value of exports remained stable. In 2011-2015 period, there has been a gradual increase in the growth rates of export volume and value (5.66 percent and 4.78 percent, respectively).

The striking observation for this period is the sign flip in the growth rate of unit value of exports from large positive figures in the 2003-2007 period to negative figures in the 2011-2015 period. Obviously, unit values of exports at this aggregation level cannot be interpreted as a quality indicator. Yet, it is clear that the strong growth in the unit value of exports has reversed and turned to negative in the sample period. That alone is intriguing enough to trigger a more in-depth analysis of the impact of the recent shift to China in capital inputs sourcing on export quality upgrading, which is provided in the forthcoming sections.

[Insert Figure 3 here]

3 Data Assembly and Stylized Facts

In this section, we describe the main datasets, provide the details of data assembly and offer five stylized facts that emerge after an exploratory analysis of the merged data.

3.1 Description of Main Data

In this paper, we focus on the 2003-2015 period and use two different micro datasets: The Annual Industry and Service Statistics database (AISS) and the Foreign Trade Statistics database (FTS) of Turkey. Appendix A presents the detailed tables related to our data.

3.1.1 Annual Industry and Services Statistics Database (AISS)

The AISS is based on surveys covering firms in manufacturing as well as services sectors. These surveys were carried out on a yearly basis by TurkStat between 2003-2015. In the recent years, TurkStat started compiling this data from administrative records that are generally completed by obtaining data from relevant sources such as the Revenue Administration and the Social Security Institution. This new data goes back only until 2009 and lack the detail of the AISS. Therefore, we are forced to use the survey-based data to cover the early-2000s.

The database contains information on a wide array of firm characteristics such as production, employment, wages, investment, taxes, profits, foreign ownership, information on different local units as well as a plethora of different sub-categories of revenue and cost items. Firms are classified within 4-digit NACE Rev2 sectors.

The data for firms with 20+ employees are collected using the full enumeration method while the data for firms with 19 or less employees come from a random sample of firms. In this paper, we use firms with 20+ employees to avoid sampling issues particularly in the micro-scale firms (1-9 employees). At this point, let us note that although firms with 20+ employees compose only 3 percent of the firm population in Turkey; their sales, output and value added shares are 77 percent, 82 percent and 85 percent, respectively (Table A1).

When we investigate the distribution of manufacturing and services firms on an annual basis, we observe that the number of firms with 20+ employees in these sectors went up from 15,528 to 74,853 from 2003 to 2015. In these 13 years, the share of manufacturing firms declined from 61 percent to 34 percent, which is a sign of ongoing de-industrialization process in Turkey in the last decade. Note that there were significant increases in the number of firms in 2005 and 2010, which is not based on economic fundamentals but survey-related adjustments by TurkStat (Table A2).

Furthermore, the data exhibit a very high degree of entry-exit of firms (Table A3). More than one-fifth of the firms appear only once in the sample. The share of firms that survive throughout the entire sample period is only 4 percent while it decreases to less than 2 percent for the services sector. More generally, less than 50 percent of the firms have 4+ years of life-span within the sample period.

3.1.2 Foreign Trade Statistics Database

The FTS covers the entire universe of goods traders in Turkey as the source of the data is customs declarations. The data are available for the period between 2002-2018 and supplied to the final-user by TurkStat, which uses the administrative records of the Ministry of Trade to compile the data. The database covers cross border trade in goods between Turkey and other countries. International trade in services is not covered. Among a wealth of information in this database, we particularly use quantity and value (export f.o.b./import c.i.f.) of goods flows, the reference period, product code, partner country, nature of transaction and type of payment in this paper. For currency conversion, daily exchange rates of the Central Bank of Turkey are used by the TurkStat.

One of the differentiating features of our database is the level of detail available to us. The classification used for compiling Turkey's foreign trade statistics is Gümrük Tarife İstatistik Pozisyonu (GTİP) at 12-digit detail. The definition of traded goods in Turkey is made by the World Customs Organization (WCO) in 1988 according to the "Harmonized System". The first 2 digits of these codes are called chapters, the first 4 digits are called headings and the first 6 digits are sub-headings (HS code). With the addition of digits 7th and 8th, the CN codes used in the EU countries are formed. The last 4 digits are the national codes added by Turkey. Our export and import measures are therefore at 12-digit (from now we call it HS12) and contain a wealth of detail that is very rare in the literature.

Another strength of the database is its standardized quantity measure, which is elemental for us to have consistent unit values of exports. Normally, different measurement units are used according to properties of goods. With a system established in 1996 in Turkey, the net weights of the goods subject to external trade (the weight of the goods excluding packaging material) are recorded in the statistics in kilograms. If the supplementary unit of measure is specified in the Turkish Customs Tariff Schedule in addition to the kilograms, the amount of the goods is also monitored according to the specified unit of measure. In this paper, we use the net weight in kilograms as our export quantity indicator.

Detailed information on exporters, destinations, products and destination-product pairs are provided in Tables A4-A7 in Appendix A.

3.1.3 Sample of Analysis

Starting from the universe of Turkish firms with 20+ employees, we merge firm level data from the AISS database with the firm-product level trade data from the FTS database. Our sample period is dictated by the available years in the AISS, namely 2003-2015. The unit of observation of each cross-section in the merged data is firm-product. Both the AISS and the FTS databases have a common firm identifier, which makes our merge process consistent and effective with a 78 percent merge rate. The remaining 22 percent is due to exporters with 1-19 employees that are not in the AIIS and purely domestic firms with no exports in the AISS database.

In this paper, we investigate the impact of the recent shift to Chinese capital inputs on export quality upgrading of Turkish firms from 2003 to 2007 and from 2011 to 2015. As a result, we need to work with firm-product pairs that existed both in 2003 and 2007 for the first time period and both in 2011 and 2015 for the second time period. From now on, if

not stated otherwise, firm refers to the exporter and product refers to the exported good. Considering the high degree of entry-exit discussed in Section 3.1.1, this leaves us with 29,929 and 102,925 firm-product pairs for the 2003-2007 and 2011-2015 time periods, respectively. This is before the removal of outliers, which will be explained in the next section.

3.2 Stylized Facts

3.2.1 Export Quality

Due to difficulties in directly measuring the quality of a product, in this paper we use *effective quality* (quality perceived by the consumer using limited information on prices and market shares). We follow Khandelwal, Schott and Wei (2013) in our quality estimation and make use of observable export price and quantity data. This way we obtain an "effective" quality measure $\left(q_{fhct}\right)^{\eta}$ for product h exported to destination country c by firm f in year t based on the following empirical demand equation:

$$x_{fhct} = q_{fhct}^{\eta} p_{fhct}^{-\sigma} P_{ct}^{\sigma-1} Y_{ct} \tag{5}$$

where x_{fhct} and p_{fhct} are the demand for and unit price of firm f's exports of product h in destination country c in time t while P_{ct} and Y_{ct} are the destination country price level and the total income in destination country c, respectively. Furthermore, σ denotes elasticity of substitution across products and η stands for the scope of quality differentiation. In this framework, the residuals obtained from the OLS estimation of the following log-transformed version of equation (5) is used to infer quality:

$$\log\left(x_{fhct}\right) + \sigma_s \log\left(p_{fhct}\right) = \varphi_h + \varphi_{ct} + \epsilon_{fhct} \tag{6}$$

where destination-year fixed effects, φ_{ct}, are used to capture Y_{ct} and P_{ct}. Product fixed-effects, φ_h, are employed to account for price and quantity differences across products, originating from the inherent characteristics of the products.

The quality measure, $\log\left(\hat{q}_{fhct}\right) = \hat{\epsilon}_{fhct}$, inferred from the estimation of equation (6) harbors $\hat{q}_{fhct} \equiv q_{fhct}^{\eta}$ in it. The intuition of estimating quality using this method is as follows: Conditional on price, a product variety produced in higher quantities is assigned a higher quality level. This argument is based on deducing quality from demand-sided models as in Khandelwal (2010) and Hallak and Schott (2011). In short, quality includes all other factors that affect consumer demand for a variety other than price and consumer income. In other words, the quality measurement approach we adopt in this paper is very similar to the measurement of TFP using the Solow residual.

Our next step is to discuss the measures to be used for σ and η for the estimation of equation (6). Elasticity of substitution, σ, has been estimated using different methods in the literature. In the conclusion of their broad survey of this literature, Anderson and van Wincoop (2004) has concluded that $\sigma \in [5,10]$ comes up as a reasonable range. In this paper we use $\sigma = 5$ and $\sigma = 10$ as well as sector specific σ_i values from Broda and Weinstein (2006). For brevity only the estimates that use the latter is reported and the rest are

available upon request. To proxy for quality differentiation, η, (under the assumption that higher variations in quality are observed in sectors where the scope of product differentiation is higher), we employ the widely-used Rauch (1999) index.

After estimating effective quality as described above, we clean our data of outliers in the bottom and top 5th percentiles of our quality measure to prevent our results to be driven by extreme observations.

Export quality and productivity– Table 2 shows that export quality experiences significant drops in the 2003-2007 period in Turkey. There is a concerning and deep decline in the average quality approaching 30 percent mark. Notice that in the 2003-2007 period, firms that possess a lower productivity level in 2003 reduced their export quality more than firms that are more productive initially. This worrisome decline is also apparent in Panel A of Figure 4 where the graph on the left illustrates the distribution of our quality-estimate (at firm-HS12 product detail) for firms with lower initial productivity and the graph on the right for firms with higher initial productivity. As observed clearly, the distributions for 2007 move to left but more so for low-productivity firms.

In the 2011-2015 period, Table 2 shows modest improvements (6 percent) in the export quality of firms with lower-productivity in 2011 while there is further quality downgrading (5 percent) of the higher- productivity firms. These magnitudes are much less pronounced compared to the 2003-2007 period nevertheless not any less interesting. Panel B of Figure 4 supports these findings.

[Insert Table 2 here]
[Insert Figure 4 here]

Stylized Fact 1: *In the 2003-2007 period, export quality declined for all firms. However, the drop was more pronounced for low-productivity firms. In the 2011-2015 period, while low productivity firms upgraded their export quality, high-productivity firms experienced quality downgrades.*

3.2.2 Sourcing from China

In this paper, we use BEC classification of the United Nations to separate capital goods from the others. Categories 41 (machinery and equipment used by the industry) and 521 (transport equipment used by the industry) are the basis for our capital inputs definition in our sample.

We measure increased sourcing from China in two main veins: new sourcing and increase in the ongoing sourcing. New sourcing refers to the case where firm f (exporter) has no imports of the capital inputs input k from China in period $t = 1$ and starts sourcing k from China in period $t = 2$. Increase in ongoing sourcing, however, refers to the case where firm f sources k from China in $t = 1$ and increases its sourcing of this particular good from China in period $t = 2$.

A more formal definition of firm-level increase in the sourcing from China is as follows:

$$\Delta SC_f = \sum_k w_{fk} SC_{fk} > 0 \qquad (1)$$

where k is the imported capital inputs at HS12 detail as explained in Section 3.1.2. The first component w_{fk} is the share of k in all imported capital inputs of firm f in $t = 1$. We use this weight to gage the importance of a particular capital good in the entire capital inputs imports of the firm. Note that, by adopting this weighting scheme, we de facto concentrate on the capital inputs that are already sourced from abroad and ignore capital inputs that have never been used in the production before or the ones that are sourced just domestically.

The second component, SC_{fk}, in equation (1) is used to signify sourcing from China either in the form of new sourcing or increase in ongoing sourcing. We further dissect new sourcing into its extensive and intensive margin counterparts:

New Sourcing (extensive margin)– a dummy variable signifying the situation where firm f that does not have any k purchases from China in $t = 1$ and shifts some or all of its purchases of k to China in period $t = 2$.

$$SC_{fk} = \begin{cases} 1, & if\ k_{f,CHN,t=1} = 0 \text{ and } k_{f,CHN,t=2} > 0 \\ 0, & otherwise \end{cases} \quad (2)$$

New Sourcing (intensive margin)– the quantity of capital good k that firm f newly sources from China. Recall that this firm does not have any k purchases from China in $t = 1$ and shifts some or all of its purchases of k to China in period $t = 2$.

$$SC_{fk} = \log(k_{f,CHN}) \qquad if\, k_{f,CHN,t=1} = 0 \text{ and } k_{f,CHN,t=2} > 0 \quad (3)$$

Increase in ongoing sourcing– the increase in the quantity of capital good k that firm f has already been sourcing from China. Note that this firm sources k from China both in $t = 1$ and $t = 2$.

$$SC_{fk} = \Delta \log(k_{f,CHN}) \qquad if\ k_{f,CHN,t=2} > k_{f,CHN,t=1} > 0 \quad (4)$$

Number of firms sourcing capital inputs from China– The top panel of Table 3 shows that from 2003 to 2007 (right after China's accession to the WTO) among 3,736 firms that imported a particular capital good from some other country around the world 16.6 percent started sourcing this input from China. The same ratio shot up to 20.7 percent among 9,249 firms from 2011 to 2015. Put it another way, one-fifth of Turkish exporters that have not sourced from China in 2011 switched their capital inputs sourcing to China by 2015. This is a rather large shift. When we examine the firm-product pairs (here a firm-product pair signifies an exporter-imported capital input pair indeed), we observe that from 2003 to 2007 among 26,696 firm-product pairs 13.3 percent were sourced from China rather than elsewhere. The equivalent for 2011-2015 stretch is 22.6 percent of 92,242 or to be precise 20,847 firm-product pairs that were switched to China.

[Insert Table 3 here]

Stylized Fact 2: *The capital inputs sourcing from China on the extensive margin has been on an ascending trajectory in the sample period both at the firm and firm-product level.*

Intensity of and trend in capital input sourcing from China– The bottom panel of Table 3 shows that among 445 firms that imported a capital input from China both in 2003 and 2007, 60.7 percent increased their level of sourcing whereas among 3610 firms that imported a capital input from China both in 2011 and 2015, 42.8 percent increased their level of sourcing. When investigated at the firm-product level, these shares are much smaller. While only 4.4 percent of firm-product pairs point to an increase in the amount of capital inputs that were already sourced from China in 2003, this share was more than doubled and reached 10.3 percent in 2011-2015 period. In other words, 1175 firm-product pairs exhibited an increase in the level of ongoing sourcing in 2003-2007 while this number went up to 9501 in 2011-2015, an eight-fold increase.

Two remarks are in order: (i) At the firm-level, quite a large share of firms that already sourced their capital inputs from China chose to increase the level of their sourcing, with a tapering off in this share in the second period. (ii) Between 2003-2007 and 2011-2015 periods the number of firms that continued sourcing a particular capital input from China increased eight-fold from 445 to 3610 which is also hinted in the firm-product pairs that exhibited increased ongoing sourcing.

[Insert Table 4 here]

Table 4 shows the level of capital inputs sourcing from China in logs in 2003, 2007, 2011 and 2015 and the percentage changes in the 2003-2007 and 2011-2015 stretches. Ongoing importers of a particular capital input from China increased their level of imports at a rate of 147 percent in the first period. In the second period this rate was halved yet still very high; 88 percent. Put it differently, if there is an ongoing sourcing relationship with China for a firm-product pair, rather large increases in the magnitude of sourcing were experienced in both periods.

Stylized Fact 3: *The capital* inputs *sourcing from China on the intensive margin has been on an ascending trajectory in the sample period with nuances between 2003-2007 and 2011-2015. Even though both the number and the quantity of capital inputs that were continuously sourced from China increased vastly, these increases were smaller in the 2011-2015 period.*

4 Empirical Strategy and Baseline Results

In this section, we go beyond the stylized facts highlighted in the previous section and estimate the impact of increased capital inputs sourcing from China on export quality upgrading. We discuss our identification strategy in section 4.1 and in Section 4.2 we provide our baseline results.

4.1 Empirical Strategy

Similar to Fan et al. (2015, 2018) we build our identification on the assumption that firms differ in productivity and choose quality to maximize profits. One must also note that exporting provides access to larger markets and thus enables firms to fund development costs of innovation that leads to productivity enhancements at the firm level (Bustos, 2011; Lileeva and Trefler, 2010). Against this background, assuming that a firm needs access to higher quality inputs to produce and export higher quality output, exporters with lower productivity become more sensitive to changes in costs of inputs. As a result, we expect quality changes of low productivity firms to be more responsive to increased capital goods sourcing from China that is triggered by WTO accession. In other words, when exporters start sourcing low-cost/low-quality inputs from China, then it is the low productivity firms that is hurt more in terms of export quality upgrading.

Since there is evidence for export quality upgrading on the side of China in the duration of our sample span, we divide our sample into two periods. Access to higher quality inputs at cheaper rates in the aftermath of WTO accession enabled China to gradually upgrade its export quality (Fan et al., 2015 and 2018). This is a change that needs to be accounted for in our analysis. Henceforth, our early period is 2003-2007 and the late one is 2011-2015. We avoid the Global Financial Crisis years to ensure our results are not purely driven by crisis related changes.

In this light, we offer the following estimating equation for our identification of the export quality upgrading effects of the recent increases in the capital inputs sourcing of Turkish exporters from China:

$$\Delta \log(\hat{q}_{fhc}) = \beta_1 \Delta SC_f + \beta_2 (\Delta SC_f \times L.log\emptyset_f) + \beta_3 \Delta \log \phi_f + \beta_f \Delta \boldsymbol{\chi_f} + \beta_4 \Delta HHI_i + \varphi_s + \varphi_c + \varphi_{hc} + \epsilon_{fhc} \quad (7)$$

In the estimations, two different time spans are used: 2003-2007 and 2011-2015. In other words, for any x variable, we repeat our estimations using $\Delta x \equiv x_{2007} - x_{2003}$ and $\Delta x \equiv x_{2015} - x_{2011}$ to account for quality upgrading in China in the aftermath of the WTO accession in 2001. The period 2003-2007 is a time span when the quality of Chinese capital goods is lower than that in 2011-2015 period. We use these long-differences to account for slower adjustment of export quality to shifts in capital inputs sourcing and to avoid autocorrelation issues.

We use three different samples in the estimations: All products, homogeneous products, and differentiated products.

Dependent Variable

$\Delta \log(\hat{q}_{fhc})$ denotes quality upgrading at the firm-product-country level. The details of construction of $\hat{q}_{fhc}$ is explained in Section 3.2.2. Here, *f* represents all exporting firms of Turkey; *h* is exported products at 12-digit detail and *c* covers all exporting partners of Turkey.

Core Independent Variables

ΔSC_f represents the weighted average of the increase in firm *f*'s sourcing of different capital inputs from China. We measure this variable as new sourcing (extensive and intensive margin) and increased ongoing sourcing from China as explained in Section 3.2.1.

Furthermore, we use the interaction term $\Delta SC_f \times log\emptyset_f$ to understand the differential impact of increased sourcing from China across different firm productivity levels. Here $log\emptyset_f$ denotes the logarithm of initial productivity level of firm *f*.

We use both labor productivity and total factor productivity (TFP) as two alternative measures of productivity, $\emptyset_f$. Labor productivity is the ratio of value added to employment. Results presented in the upcoming sections are based on TFP for brevity.

Our productivity measure is revenue TFP (TFPR) rather than physical TFP (TFPQ) due to data limitations. There is no input quantity data at the product level. Estimating TFPQ for a sample of single-product firms is another alternative but that option limits the observations numbers at a great extent. As a result, we provide a TFPR measure based on value-added figures using the augmented Olley-Pakes method offered by Ackerberg, Caves and Frazer (2015). Data for capital stock is not readily available at the firm-level in Turkey. Therefore, we construct capital stock values via the Perpetual Inventory Method and use 2-digit PPI (2003-based) values to deflate the nominal variables in line with national accounts statistics provided by TurkStat.

Other Controls

There are various studies in the literature in regards to the determinants of quality, among which productivity, size and capital intensity are the ones that come to the fore. These variables are found to be positively correlated with quality in Schott (2004), Verhoogen (2008), Kugler and Verhoogen (2008), Bastos and Silva (2010), Antoniades (2015) and in the works of the references therein. In line with the literature, logarithmic difference of TFP of firm *f*, $\Delta \log \phi_f$, is used to control for the well-known positive impact of productivity improvements on quality upgrading. Other firm-level controls are embedded in $\boldsymbol{\chi_f}$, a vector composed of log-differences of employment and capital-labor ratio to account for size and capital intensity of the firm.

We control for competition in sector i (4-digit NACE level) using the difference of the Herfindahl-Hirschman Index, ΔHHI_i. Finally, we include 2-digit sector fixed effects φ_s, destination fixed effects φ_c, and destination-product fixed effects φ_{hc} in the estimations. Table 5 presents a compact picture of variable definitions and their sources while Table 6 reports summary statistics for our key variables.

[Insert Table 5 here]
[Insert Table 6 here]

4.2 Baseline Results

4.2.1 All Sample

Our first objective is to understand the impact of new sourcing from China on export quality upgrading using the estimating equation (7). Table 7a shows the baseline results corresponding to the definition of ΔSC_f in equation (2). Columns (1)-(3) present results for the 2003-2007 period while columns (4)-(6) report the 2011-2015 results.

Recall that new sourcing refers to the case where the firm has no imports of the capital input from China in period $t = 1$ and starts sourcing it from China in period $t = 2$. Also recall that in this paper we concentrate on the capital inputs that are already sourced from abroad and ignore capital inputs that have never been used in the production before or the ones that are sourced just domestically. Under these circumstances $\Delta SC_f = 1$ translates into the existence of a firm that was sourcing a particular capital input from another country and then shifting its sourcing of this particular input to China.

[Insert Table 7a here]

Column (1) in Table 7a reports the coefficient estimate of new sourcing (at the extensive margin) where there is a negative yet insignificant effect. However, when we introduce the interaction with initial productivity, $\Delta SC_f \times log\emptyset_{2003}$ in columns (2) and (3), we observe a significant negative effect of ΔSC_f which is alleviated by higher level of productivity in the beginning. Column (2) is without and column (3) is with firm level variables. Specifically, in column (3), for an average firm with $mean(log\emptyset_{2003}) = 3.90$, the decision of starting to source a particular capital input from China reduces this firm's export quality at the product level by 16.7 percent ($e^{-1.180}e^{0.256\times3.90} - 1$). For a slightly more productive firm (10 percent more so than the average firm), the quality downgrading is less pronounced, 7.9 percent ($e^{-1.180}e^{0.256\times4.29} - 1$). If the firm is 10 percent less productive than the average firm, then the effect deepens and reaches 24.6 percent ($e^{-1.180}e^{0.256\times3.51} - 1$). Put another way, a firm with higher initial productivity weathers well the negative impact of switching to a low quality input provider.

Columns (4)-(6) report the equivalent regressions for the 2011-2015 period, which is known to be the period when China noticeably increased its production and export quality. There is no significant export quality impact of choosing China over another country in terms of capital goods sourcing. If anything, the coefficients flip signs.

[Insert Table 7b here]

When we investigate the effect of new sourcing (at the intensive margin), ΔSC_f, as defined in equation (3), there is no effect of level of new sourcing on export quality in 2003-2007 period (Columns (1)-(3) of Table 7b). However, when we turn to the regression results related to the 2011-2015 period in columns (4)-(6) of this table, we observe that there is a significant positive effect of ΔSC_f that is declining in firm productivity. If we concentrate on column (6), for an average firm with $mean(log\emptyset_{2003}) = 3.90$, a 10 percent increase in the quantity of new sourcing increases export quality at the product level by 5.4 percent.

For a 10 percent more productive firm this effect drops to 4.1 percent whereas for a 10 percent less productive firm it rises to 6.7 percent. In other words, Turkish firms with lower initial productivity benefits more from importing a higher quantity of their capital goods from China compared to the ones with higher productivity levels.

The findings related to the choice and quantity of sourcing from China for the first time in 2011-2015 period indirectly supports the findings of Fan et al. (2018) in terms of China's quality upgrading after the WTO accession. Furthermore, as in their paper, lower productivity firms benefit more in the case of Turkey. Our difference from Fan et al. (2018) is that we do not observe this effect immediately after the WTO accession. If anything, there is a negative effect of starting to source from China in that period and it severely deteriorates the export quality of low productivity firms. However, a decade later, the higher the level of capital inputs that were newly sourced from China, the larger the export quality upgrading, particularly for low productivity firms.

[Insert Table 7c here]

Finally, we move to Table 7c where we report our results in terms of the impact of ongoing sourcing from China, ΔSC_f as defined in in equation (4), on export quality. Recall that we concentrate only on the increases. In other words, increased ongoing sourcing refers to the case where the firm sources the capital input from China in $t = 1$ and increases its sourcing of this particular input from China in period $t = 2$. In the 2003-2007 period, there is no significant effect at all, as shown in columns (1)-(3). However, in the 2011-2015 period there is a faint statistical effect, significant only at 10 percent level. The signs and the size of coefficients are very similar to the ones in Table 7b.

4.2.2 Differentiated vs Homogenous Products

In this section, we repeat the regressions for homogenous and differentiated goods exports to further dissect our data to cultivate the changes in the impact of sourcing from China on export quality when there are differences in the scope of quality differentiation. This decomposition is common-place in trade-quality literature and the underlying explanation is that homogenous products do not allow for much quality differentiation, while differentiated products does provide the basis for a wider range of quality differentiation. The homogenous-differentiated classification is based on Rauch (1999).

Tables 8 and 9 report the summary results for differentiated and homogenous goods samples, respectively. Panels A, B and C are used to separate the three different way we measure sourcing from China, namely, new sourcing at the extensive margin, new c-sourcing at the intensive margin and increased ongoing sourcing.

[Insert Tables 8-9 here]

The regressions that we run for the differentiated goods sample result in similar to the baseline regressions, however the effects are much less pronounced in the 2003-2007 period while the opposite happens for the 2011-2015 period. Specifically, columns (4)-(6)

in Panels A, B and C exhibit significant and bigger coefficients than the baseline equivalents.

In the homogenous goods sample the coefficients in regressions in Panels A and B are hardly significant for both periods. In Panel C results are regrettably unreliable do to very low level of observations. Note that homogenous goods constitute only 15 percent of the firm-product pairs in our sample.

Combined, these results point to the importance of quality differentiation in terms of export quality upgrading. Firms that started sourcing or increased their ongoing sourcing from China and export highly differentiated products increase their export quality at higher rates than firms that do not. This effects is more pronounced for low productivity firms.

5 Endogeneity

To address endogeneity between the recent shift to China in capital inputs sourcing and quality upgrading, we offer two instrumental variables that are correlated with ΔSC_f but not with the error term.

Changes in tariffs due to accession of China to the WTO– Upon accession of China to WTO in December 2001, there has been a substantial increase in China's trade with the world. The significance of this situation for Turkey is that the gradual decrease in the tariffs and other trade restrictions applied to China paved the way for higher amounts of capital inputs sourcing from China among Turkish producers. In other words, China's accession to the WTO lends itself as a high-quality instrument considering that it is highly unlikely that the quality upgrading of Turkish exporters has any effect on the China's accession to the WTO and the following tariff reductions.

Therefore, we use tariffs imposed to Chinese capital goods by Turkey at the firm level as an instrumental variable. The IV is constructed by employing tariff data in the HS6 detail due to data constraints. We assign the same HS6-level applied MFN tariff rate (obtained from the World Integrated Trade Solution website of the World Bank) to the corresponding HS12-level capital inputs imports from China. Then, we construct our firm-level IV as follows:

$$\Delta Duty_f = \sum\nolimits_k w_{fk} \Delta Duty_k \tag{8}$$

where k represents capital inputs imports at HS12-level. The first component of this variable, w_{fk}, is the share of capital inputs imports of k at the initial year to total capital inputs imports of firm f. The second term, $\Delta Duty_k$, is the 2003-2007 or the 2011-2015 difference is the change in tariffs of capital goods.

Capital intensity changes of China– Changes in China's capital intensity in the capital goods production is correlated with ΔSC_f and not with the error term because of the fact that Turkish exporter's quality upgrading is most probably exogenous to China's own quality dynamics. China started to import high quality machinery and equipment at

cheaper prices upon accession to the WTO and thus increased its capital intensity in most of its production lines. This is a catalyzer for Turkish producers for increasing their sourcing from China. Therefore, we use the change in capital/labor ratio of China in capital goods production at two digit industry level, $\Delta(K/L)_i$, as an instrumental variable. This variable is constructed by using data from World Input Output Database (WIOD) Socio Economic Accounts (SEA), Release 2016, which is available in 2 digit NACE Rev2 industry classification. The real capital stock, K, of China is calculated by using the nominal capital stock of China available in WIOD in millions of national currency, transformed to millions of US dollars by using the average annual currency obtained from World Development Indicators of the World Bank and then deflated by average annual producer price index (PPI) of US from FRED database. Labor, L, is the number of persons engaged (EMP) under the labor input variables of WIOD SEA. Then we construct our firm-level IV as follows:

$$\Delta\left(\frac{K}{L}\right)_f = \sum\nolimits_k w_{fk}\Delta\left(\frac{K}{L}\right)_k \tag{9}$$

where k represents capital inputs imports at HS12-level. The first component of this variable, w_{fk}, is the share of capital inputs imports of k at the initial year to total capital inputs imports of firm f. The second term, $\Delta(K/L)_k$, is the 2003-2007 or the 2011-2015 difference is the change in capital labor intensity of China for imported capital goods.

We use both c*hanges in tariffs due to accession of China to the WTO* and *capital intensity changes of China* and their interaction with lagged initial TFP as instrumental variables. Columns 1-2 and 3-4 of Table 10 report the results for instrumenting *new sourcing from China at the extensive margin* and *the intensive margin*, respectively, while columns 5-6 is for the results of instrumented *ongoing sourcing* variable. To save space, we only report full specification results, i.e., estimations with the firm level control variables.

[Insert Table 10 here]

In order to verify the quality of instruments that we employ, we conduct several tests. As we have two instruments for one variable, we use Hansen's J statistics based on Chi square to assess the over identification of all instruments. In all specifications, the null hypothesis that instruments are valid cannot be rejected. We also use the Kleinbergen and Paap (2006) rk-statistics test for the under identification of the instruments, specifically to see whether the instrument is relevant to the endogenous variable, based on a Langrange-Multiplier (LM) test. We reject the null hypothesis that the model is under identified in all specifications except the last one. We test weak instruments by using Kleinbergen and Paap (2006) Wald-statistics and the test results mostly reject the null hypothesis of weak identification except the last specification.

The instrumental variable estimation results presented in Table 10 are very similar to baseline estimations in Table 7a-7c. In the first period, 2003-2007, there is a negative effect of starting to source from China and it severely deteriorates the export quality of low productivity firms. However, in the second period, 2011-2015, the higher the level of capital inputs that were newly sourced from China, the larger the export quality upgrading, particularly for low productivity firms.

6 Concluding Remarks

This paper is inspired by the recent shift of Turkish exporters to China in their capital inputs sourcing. In 2003, among the trade partners of Turkey, Germany led the pack followed by Italy and Japan, while China was hovering around a 7 percent share in the Turkish capital goods imports. By 2015 the picture was almost upside down: One-quarter of foreign origin capital inputs of Turkish firms was supplied by Chinese producers.

Motivated also by a long line of inquiry in the trade literature in terms of quality effects of foreign sourcing, in this paper, we studied the export quality impact of this massive shift of Turkish exporters to China in their capital inputs sourcing in the 2003-2015 period using a unique and highly disaggregated firm-product level data from TurkStat.

In the first part of our analysis we provided a thorough exploration of the rich TurkStat data set to put forth a number of stylized facts that informed our empirical analysis. In the second part, we went beyond descriptive statistics and estimated the impact of increased sourcing of capital inputs from China on export quality upgrading.

Our results identify and emphasize that both the source country and the time of sourcing have very tangible export quality effects. In the case of Turkey, switching from high-quality European producers of capital goods to China has negatively affected export quality. This negative effect was apparent in the first part of the sample where China was a novelty in the WTO and did not have enough time to upgrade its quality. However, in time, China upgraded its quality and only then the shift to China produced positive quality effects for a developing country like Turkey. In the third and last part, we show that these results hold under a number of robustness checks.

In terms of policy implications, our estimates show that trade liberalization may not always have a favorable impact on quality growth. There is a channel which facilitates reductions in export quality through increased access to cheap yet low-quality producers in the aftermath of trade liberalization. For countries with highly import-dependent exports, these results reaffirm the need for policymakers to shift their focus in policy design from cost efficiency to capability of producing high quality products for export markets, particularly in the aftermath of trade liberalization that opens their borders to low-quality inputs.

Our analysis and results open interesting avenues for future research, that we could tackle in this paper to keep it focused. Firstly, in our current work, due to data constraints we consider the capital inputs that are already sourced from abroad and ignore capital inputs that have never been used in production before or the ones that are sourced just domestically. It would be particularly valuable in a developing country setting to understand the quality impact of crowding out of domestic sourcing by low quality foreign inputs that may surface in the aftermath of trade liberalization.

Secondly, we are oblivious to the exact nature of the shift in capital inputs in our analysis; we implicitly infer from macro evidence that the shift must have been from high-quality European producers. From which countries indeed were these capital inputs sourced before? And exactly what variety of capital inputs were sourced? The answers to these questions require to go into the details of previous sourcing decisions both in terms of origin and product variety. As labor intensive as it is, we believe an extension in this direction would result in crisper identification and much detailed policy implications.

Thirdly, we did not explore the export destination shifts that might be the trigger or the outcome of the recent shift of Turkish exporters to China in their capital inputs sourcing. In other words, our analysis needs to be complemented by the changes in the export side of the equation to have a more complete picture. These are the three directions that we are planning to go in order to broaden our recent research agenda on the topic of export quality upgrading in a developing country.

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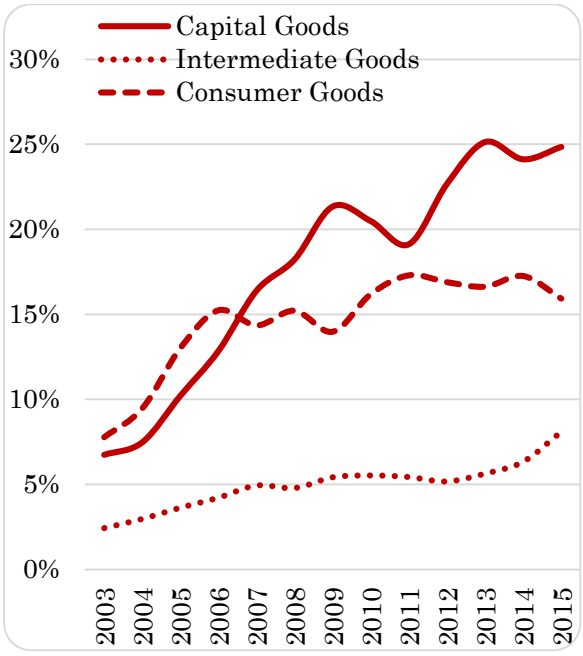
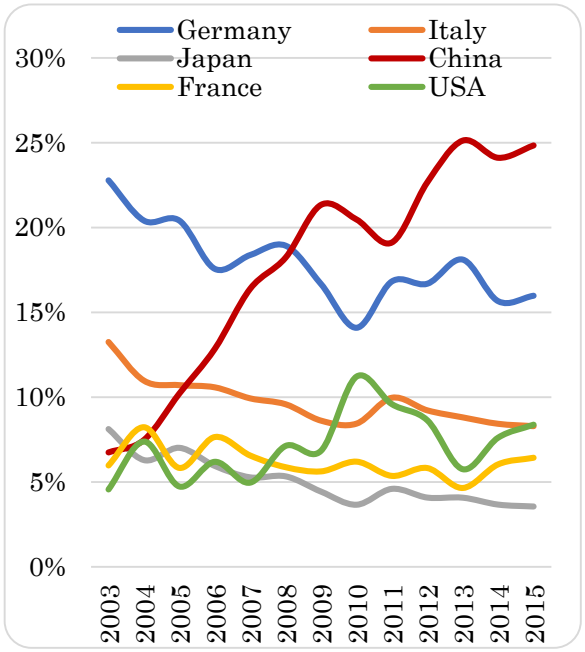
Figure 1. An aerial view of the composition of Turkish imports

(a) China's share in Turkish imports

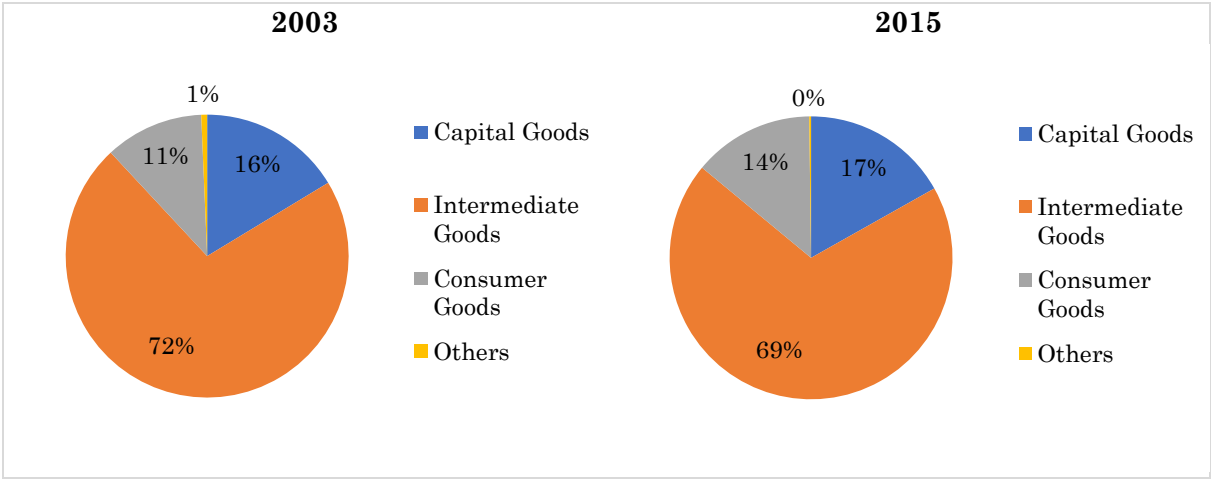


(b) Turkish capital goods imports, main partners



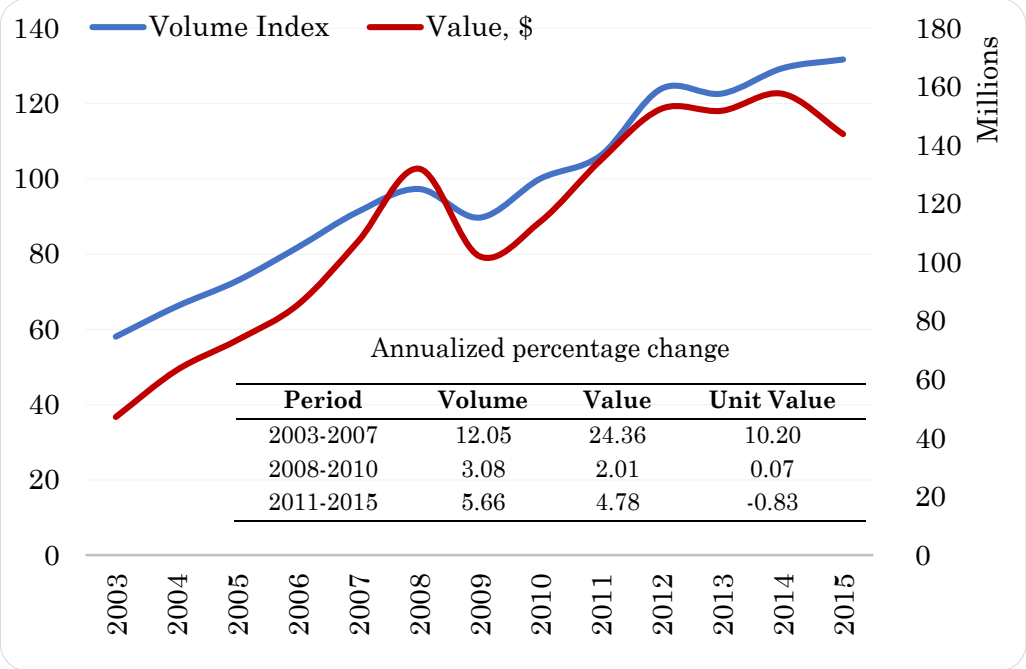
Source: Authors' calculations using TurkStat Foreign Trade Indices and Foreign Trade Statistics databases

Figure 2. Major BEC category shares in total imports of Turkey



Source: Authors' calculations using TurkStat Foreign Trade Indices and Foreign Trade Statistics databases

Figure 3. Export volume and value in Turkey



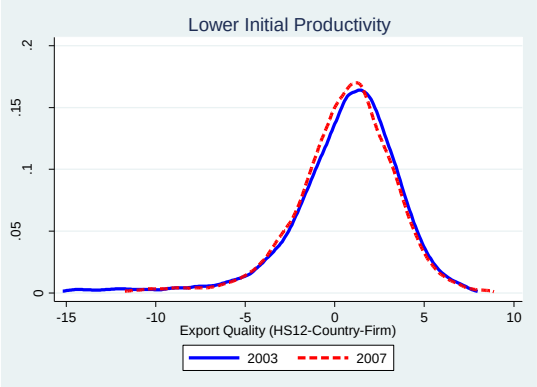
Annualized percentage change

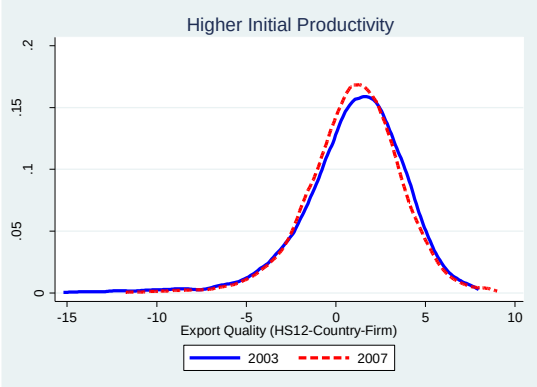
Period	Volume	Value	Unit Value
2003-2007	12.05	24.36	10.20
2008-2010	3.08	2.01	0.07
2011-2015	5.66	4.78	-0.83

Source: Authors' calculations using TurkStat Foreign Trade Indices and Foreign Trade Statistics databases

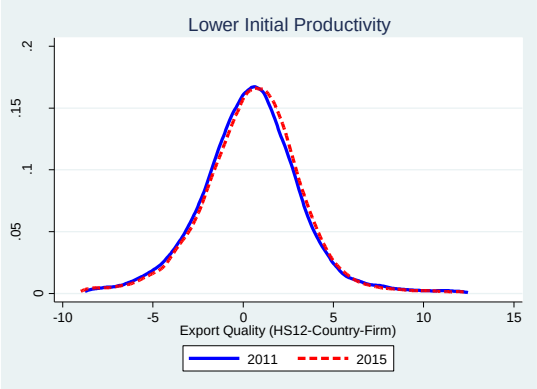
Figure 4. Kernel density of export quality and initial TFP

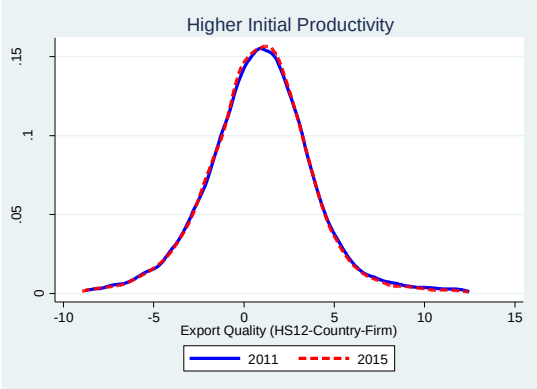
Panel A: 2003 vs. 2007





Panel B: 2011 vs. 2015





Notes: Panels A and B illustrate the kernel density diagrams of estimated quality, $\log(\hat{q}_{fhct})$ using elasticities from Broda and Weinstein (2006) for continuing firm-product-country triplets for years "2003 and 2007" and "2011 and 2015", respectively. There is no cropping of the tails. Firm is the exporter. Product is the exported goods at HS12 detail. Diagrams on the left refer to firms with lower initial productivity (firms at the bottom 50th percentile) and diagrams on the right refer to firms with higher initial (firms at the top 50th percentile).

Table 1. Trade-weighted MFN changes of on imports from China

	2003-2007	2011-2015	All Sample
Capital goods	-41%	-1%	-43%
Intermediate goods	-24%	20%	-5%
Consumer goods	-14%	12%	-11%

Source: WITS Database

Table 2. Export quality levels and changes

	Low Productivity			High Productivity		
	2003	2007	Δ	2003	2007	Δ
Mean	0.23	-0.05	-28%	0.50	0.25	-25%
Median	0.33	-0.03	-36%	0.61	0.31	-30%
	Low Productivity			High Productivity		
	2011	2015	Δ	2011	2015	Δ
Mean	-0.23	-0.17	6%	0.15	0.10	-5%
Median	-0.23	-0.16	7%	0.19	0.12	-7%

Notes: Firm is the exporter. Product is the exported good at HS12 detail. Export quality is estimated by using Khandelwal et al (2013) at firm-product detail and expressed in logarithms. Changes (Δ) in quality are log-differences. Low productivity indicates firms at the bottom 50th percentile and high productivity indicates firms at the top 50th percentile.

Table 3. Capital inputs sourcing from China

	2003-2007		2011-2015	
	number	share	number	share
	New sourcing			
firm-product pairs	26,696	13.3%	92,242	22.6%
firms	3,736	16.6%	9,249	20.7%
	Increased ongoing sourcing			
firm-product pairs	26,696	4.4%	92,242	10.3%
firms	445	60.7%	3,610	42.8%

Notes: Firm is the exporter. Product is the imported capital input from China at HS12 detail. Number signifies the firms or firm-product pairs that exist both in t=1 and t=2 (continuing firms or firm-product pairs). New sourcing refers to the case where the firm has no imports of the capital input from China in period $t = 1$ and starts sourcing it from China in period $t = 2$. Increased ongoing sourcing, however, refers to the case where the firm sources the capital input from China in $t = 1$ and increases its sourcing of this particular input from China in period $t = 2$. Share shows the ratio of new sourcing and increased ongoing sourcing among all continuing firms or firm-product pairs.

Table 4. Capital inputs sourcing from China, level and changes

	mean of $\log(k_{f,CHN})$					
	2003	2007	Δ	2011	2015	Δ
New sourcing	0	0.53	-	0	0.42	-
Increased ongoing sourcing	9.43	10.90	147%	9.64	10.52	88%

Notes: Firm is the exporter. Product is the imported capital input from China at HS12 detail. Quantity of capital inputs imports from China for firm-product pairs is expressed in logarithms. Changes (Δ) in import quantity are log-differences and in parenthesis. New sourcing refers to the case where the firm has no imports of the capital input from China in period $t = 1$ and starts sourcing it from China in period $t = 2$. Increased ongoing sourcing, however, refers to the case where the firm sources the capital input from China in $t = 1$ and increases its sourcing of this particular input from China in period $t = 2$.

Table 5. Variable definitions and sources of data

Variable	Definition	Data Source
x_{fhc}	Export value, $	FTS
q_{fhc}	Export quantity, kg	FTS
σ_s	Elasticity of substitution	Broda and Weinstein (2006)
η	Indicator of product differentiation	Rauch (1999)
k_{fc}	Value of capital inputs imports, $	FTS
SC_{fk}	- New sourcing (extensive) - New sourcing (intensive-(log)) - Δlog(ongoing sourcing)>0	FTS
$\emptyset_f$	TFP calculated using ACF (2015)	AISS
HHI_i	Herfindahl-Hirschman Index	AISS
χ_f	Employment Capital-Labor Ratio (K/L)	AISS
$Duty_k$	Tariffs on Chinese capital goods imports by Turkey	WITS
$\Delta\left(\frac{K}{L}\right)_s^{CHN}$	Capital labor ratio in Chinese capital goods sectors	WIOD-SEA Database

Notes: f, h, c, s, and i denote firm, export good at HS12 detail, partner country, 2-digit NACE sector and 4-digit NACE sector.

Table 6. Summary statistics of key variables

Variable	Mean	S.D.	Min	Max
Sample: 2003-2007				
$\Delta\log(\hat{q})$	-0.082	2.727	-32.244	30.288
New sourcing (extensive)	0.016	0.092	0.000	1.000
New sourcing (intensive-(log))	0.172	0.995	0.000	12.808
$\Delta\log$(ongoing sourcing)>0	0.640	0.644	0.000	2.083
$log\emptyset_{2003}$	3.900	1.554	-23.365	7.503
$\Delta\log(\emptyset)$	0.157	1.266	-17.890	9.722
ΔHHI	-0.001	0.007	-0.447	0.078
$\Delta\log$(employment)	0.177	0.518	-2.677	3.300
$\Delta\log(K/L)$	-0.172	0.626	-6.259	5.903
Sample: 2011-2015				
$\Delta\log(\hat{q})$	0.065	2.676	-68.183	27.920
New sourcing (extensive)	0.039	0.138	0.000	1.993
New sourcing (intensive-(log))	0.373	1.395	0.000	26.637
$\Delta\log$(ongoing sourcing)>0	0.241	0.371	0.000	6.115
$log\emptyset_{2011}$	3.992	1.445	-24.081	16.678
$\Delta\log(\emptyset)$	0.158	0.977	-21.559	32.781
ΔHHI	0.000	0.004	-0.211	0.849
$\Delta\log$(employment)	0.194	0.479	-4.337	3.448
$\Delta\log(K/L)$	-0.140	0.494	-3.414	4.344

Notes: The summary statistics are for the continuing firm-HS12-country triplets. Top panel reports the 2003-2007 sample while the bottom panel reports 2011-2015 sample.

Table 7a. Baseline results: Effects of new capital inputs sourcing on quality, extensive

	Dependent Variable: *Δlog(quality)*					
	2003-2007			2011-2015		
	(1)	(2)	(3)	(4)	(5)	(6)
	New Sourcing (Extensive)			*New Sourcing (Extensive)*		
ΔSC_f	-0.169	-1.066***	-1.180***	0.020	0.676	1.002*
	(0.301)	(0.413)	(0.457)	(0.193)	(0.558)	(0.578)
$\Delta SC_f \times L.log\emptyset_f$		0.248**	0.256**		-0.159	-0.243
		(0.117)	(0.123)		(0.156)	(0.156)
$\Delta \log\emptyset_f$		0.088	0.092*		0.038	0.038
		(0.056)	(0.055)		(0.026)	(0.025)
ΔHHI_i			-2.668			-7.402**
			(2.167)			(3.193)
$\Delta log(K/L)_f$			0.073			0.079
			(0.088)			(0.107)
$\Delta logL_f$			0.194			0.311**
			(0.135)			(0.132)
Observations	26,695	23,982	23,982	92,240	91,517	91,517
R-squared	0.029	0.027	0.027	0.009	0.010	0.011

Notes: *** p < 0.01, ** p < 0.05, * p < 0.1. Robust standard errors corrected for clustering at the firm level are in parentheses. The dependent variable in specifications (1)-(3) and (4)-(6) is the (log) quality change for continuing firms at the firm-HS12-country level, computed as the log quality difference of the same firm-HS12-country triplet from 2003 to 2007 and from 2011 to 2015, respectively. New sourcing refers to the case where the firm has no imports of the capital input from China in period $t = 1$ and starts sourcing it from China in period $t = 2$. Herfindahl index (HHI) is computed at the 4-digit NACE level in Turkey. All regressions include industry fixed effects at 2-digit NACE level.

Table 7b. Baseline results: Effects of new capital inputs sourcing on quality, intensive

	Dependent Variable: *Δlog(quality)*					
	2003-2007			2011-2015		
	(1)	(2)	(3)	(4)	(5)	(6)
	New Sourcing (Intensive-log)			*New Sourcing (Intensive-log)*		
ΔSC_f	0.024	-0.008	0.013	0.047***	0.154***	0.183***
	(0.040)	(0.112)	(0.127)	(0.016)	(0.056)	(0.062)
$\Delta SC_f \times L.log\emptyset_f$		0.008	0.002		-0.025*	-0.033**
		(0.028)	(0.032)		(0.014)	(0.015)
$\Delta \log\emptyset_f$		-0.151	-0.161		-0.202*	-0.205**
		(0.134)	(0.136)		(0.109)	(0.103)
ΔHHI_i			17.481			-9.921
			(16.288)			(6.195)
$\Delta log(K/L)_f$			0.183			0.355
			(0.714)			(0.219)
$\Delta logL_f$			0.361			0.638***
			(0.801)			(0.238)
Observations	3,540	3,379	3,379	20,882	20,751	20,751
R-squared	0.023	0.023	0.024	0.018	0.020	0.023

Notes: *** p < 0.01, ** p < 0.05, * p < 0.1. Robust standard errors corrected for clustering at the firm level are in parentheses. The dependent variable in specifications (1)-(3) and (4)-(6) is the (log) quality change for continuing firms at the firm-HS12-country level, computed as the log quality difference of the same firm-HS12-country triplet from 2003 to 2007 and from 2011 to 2015, respectively. New sourcing refers to the case where the firm has no imports of the capital input from China in period $t = 1$ and starts sourcing it from China in period $t = 2$. Herfindahl index (HHI) is computed at the 4-digit NACE level in Turkey. All regressions include industry fixed effects at 2-digit NACE level.

Table 7c. Baseline results: Effects of increased ongoing capital inputs sourcing on quality

	Dependent Variable: *Δlog(quality)*					
	2003-2007			2011-2015		
	(1)	(2)	(3)	(4)	(5)	(6)
	Δlog(ongoing sourcing)>0			*Δlog(ongoing sourcing)>0*		
ΔSC_f	0.305	-0.636	0.718	-0.058	1.112*	1.032*
	(0.640)	(1.202)	(1.212)	(0.112)	(0.582)	(0.609)
$\Delta SC_f \times L.log\emptyset_f$		0.426	-0.020		-0.267*	-0.246*
		(0.323)	(0.343)		(0.136)	(0.143)
$\Delta \log\emptyset_f$		-0.219	-0.281		0.083	0.088
		(0.181)	(0.190)		(0.092)	(0.092)
ΔHHI_i			8.142			-11.961
			(21.477)			(11.149)
$\Delta log(K/L)_f$			1.507			0.078
			(2.134)			(0.257)
$\Delta logL_f$			2.217			0.208
			(1.709)			(0.278)
Observations	1,178	1,133	1,133	10,376	10,340	10,340
R-squared	0.014	0.041	0.045	0.031	0.034	0.034

Notes: *** p < 0.01, ** p < 0.05, * p < 0.1. Robust standard errors corrected for clustering at the firm level are in parentheses. The dependent variable in specifications (1)-(3) and (4)-(6) is the (log) quality change for continuing firms at the firm-HS12-country level, computed as the log quality difference of the same firm-HS12-country triplet from 2003 to 2007 and from 2011 to 2015, respectively. Increased ongoing sourcing refers to the case where the firm sources the capital input from China in $t = 1$ and increases its sourcing of this particular input from China in period $t = 2$. Herfindahl index (HHI) is computed at the 4-digit NACE level in Turkey. All regressions include industry fixed effects at 2-digit NACE level.

Table 8. Differentiated goods: Effects of capital inputs sourcing on quality

	Dependent Variable: *Δlog(quality)*					
	2003-2007			2011-2015		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: New Sourcing (Extensive)						
ΔSC_f	-0.383	-1.066*	-1.087*	0.094	1.189**	1.644***
	(0.371)	(0.615)	(0.617)	(0.193)	(0.587)	(0.522)
$\Delta SC_f \times L.log\emptyset_f$		0.179	0.169		-0.265	-0.371**
		(0.146)	(0.145)		(0.165)	(0.145)
Observations	19,951	18,171	18,171	68,256	67,726	67,726
R-squared	0.037	0.041	0.042	0.008	0.009	0.010
Panel B: New Sourcing (Intensive-log)						
ΔSC_f	-0.011	0.045	0.059	0.055***	0.246***	0.279***
	(0.048)	(0.165)	(0.177)	(0.017)	(0.065)	(0.072)
$\Delta SC_f \times L.log\emptyset_f$		-0.010	-0.014		-0.044***	-0.053***
		(0.039)	(0.042)		(0.016)	(0.017)
Observations	2,932	2,807	2,807	17,392	17,302	17,302
R-squared	0.015	0.024	0.025	0.018	0.021	0.024
Panel C: Δlog(ongoing sourcing)>0						
ΔSC_f	0.506	0.384	0.912	-0.030	1.693**	1.715**
	(0.729)	(1.281)	(1.453)	(0.150)	(0.836)	(0.843)
$\Delta SC_f \times L.log\emptyset_f$		0.274	0.083		-0.404**	-0.405**
		(0.304)	(0.392)		(0.200)	(0.202)
Observations	1,048	1,003	1,003	7,186	7,158	7,158
R-squared	0.012	0.062	0.067	0.036	0.039	0.040

Notes: *** p < 0.01, ** p < 0.05, * p < 0.1. Robust standard errors corrected for clustering at the firm level are in parentheses. The dependent variable in specifications (1)-(3) and (4)-(6) is the (log) quality change for continuing firms at the firm-HS12-country level, computed as the log quality difference of the same firm-HS12-country triplet from 2003 to 2007 and from 2011 to 2015, respectively. New sourcing refers to the case where the firm has no imports of the capital input from China in period $t = 1$ and starts sourcing it from China in period $t = 2$. Increased ongoing sourcing, however, refers to the case where the firm sources the capital input from China in $t = 1$ and increases its sourcing of this particular input from China in period $t = 2$. Herfindahl index (HHI) is computed at the 4-digit NACE level in Turkey. All regressions include industry fixed effects at 2-digit NACE level.

Table 9. Homogenous goods: Effects of capital inputs sourcing on quality

	Dependent Variable: *Δlog(quality)*					
	2003-2007			2011-2015		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: New Sourcing (Extensive)						
ΔSC_f	0.926**	-1.523	-0.861	0.222	-1.149	-1.379
	(0.398)	(1.652)	(1.654)	(0.520)	(1.623)	(1.562)
$\Delta SC_f \times L.log\emptyset_f$		0.607	0.400		0.344	0.381
		(0.478)	(0.469)		(0.426)	(0.414)
Observations	4,133	3,471	3,471	13,618	13,527	13,527
R-squared	0.119	0.105	0.111	0.020	0.020	0.024
Panel B: New Sourcing (Intensive-log)						
ΔSC_f	0.118**	0.152	0.296	0.018	-0.034	-0.068
	(0.047)	(0.196)	(0.318)	(0.045)	(0.161)	(0.160)
$\Delta SC_f \times L.log\emptyset_f$		-0.021	-0.069		0.015	0.021
		(0.057)	(0.087)		(0.046)	(0.046)
Observations	311	275	275	1,721	1,719	1,719
R-squared	0.155	0.138	0.144	0.042	0.042	0.047
Panel C: Δlog(ongoing sourcing)>0						
ΔSC_f	-1.241	-30.826***	-30.826***	0.343	3.472***	3.193**
	(1.324)	(0.000)	(0.000)	(0.285)	(0.957)	(1.301)
$\Delta SC_f \times L.log\emptyset_f$		4.663***	4.663***		-0.791***	-0.662*
		(0.000)	(0.000)		(0.232)	(0.338)
Observations	60	60	60	671	664	664
R-squared	0.117	0.188	0.188	0.087	0.102	0.129

Notes: *** p < 0.01, ** p < 0.05, * p < 0.1. Robust standard errors corrected for clustering at the firm level are in parentheses. The dependent variable in specifications (1)-(3) and (4)-(6) is the (log) quality change for continuing firms at the firm-HS12-country level, computed as the log quality difference of the same firm-HS12-country triplet from 2003 to 2007 and from 2011 to 2015, respectively. New sourcing refers to the case where the firm has no imports of the capital input from China in period $t = 1$ and starts sourcing it from China in period $t = 2$. Increased ongoing sourcing, however, refers to the case where the firm sources the capital input from China in $t = 1$ and increases its sourcing of this particular input from China in period $t = 2$. Herfindahl index (HHI) is computed at the 4-digit NACE level in Turkey. All regressions include industry fixed effects at 2-digit NACE level

Table 10. Instrumental variable estimation

	Dependent Variable: *Δlog(quality)*					
	New Sourcing (Extensive)		*New Sourcing (Intensive-log)*		*Δlog(ongoing sourcing)>0*	
	2003-2007	2011-2015	2003-2007	2011-2015	2003-2007	2011-2015
ΔSC_f	-2.182***	1.042	0.087	0.279**	3.429	2.574
	(1.048)	(0.872)	(0.280)	(0.129)	(2.669)	(3.620)
$\Delta SC_f * L.log\emptyset_f$	0.240	-0.546**	-0.002	-0.077*	-0.793	-0.835**
	(0.247)	(0.251)	(0.063)	(0.040)	(0.578)	(0.421)
Firm-level Control Variables	YES	YES	YES	YES	YES	YES
Observations	23,982	91,157	3,379	20,751	1,133	9,531
R-squared	0.001	-0.001	0.001	0.000	0.012	-0.009
Prob>F	0.000	0.000	0.032	0.023	0.003	0.043
Hansen J statistics	3.242	2.242	0.905	1.393	1.977	0.547
Kleibergen-Paap rk LM χ^2 statistic	13.39	39.447	9.477	13.297	3.449	1.693
Kleibergen-Paap rk Wald F statistic	6.568	20.067	3.730	7.613	3.013	0.401

Notes: *** p < 0.01, ** p < 0.05, * p < 0.1. Robust standard errors corrected for clustering at the firm level are in parentheses. The dependent variable in specifications (1)-(2) is the (log) quality change for continuing firms at the firm-HS12-country level, computed as the log quality difference of the same firm-HS12-country triplet from 2003 to 2007 and from 2011 to 2015, respectively. New sourcing refers to the case where the firm has no imports of the capital input from China in period $t = 1$ and starts sourcing it from China in period $t = 2$. Increased ongoing sourcing, however, refers to the case where the firm sources the capital input from China in $t = 1$ and increases its sourcing of this particular input from China in period $t = 2$.Firm level control variables are the same as the ones used in Tables 7a-7c. All regressions include industry fixed effects at 2-digit NACE level.

Appendix A

AISS Database

Table A1. Nature of the firms covered (2015)

By firm size	*Percentages*	
	1-19	20+
#Firms	97	3
Sales	23	77
Output	18	82
Value Added	15	85

Source: Authors' calculations using the AISS database

Table A2. Annual distribution of manufacturing and services firms

Year	*# of firms*	*# of manufacturing firms*	*# of services firms*
2003	15,528	9,392	6,136
2004	17,002	10,509	6,493
2005	23,168	13,030	10,138
2006	26,014	14,492	11,522
2007	25,768	14,220	11,548
2008	35,125	16,287	18,838
2009	33,309	15,089	18,220
2010	51,359	19,815	31,544
2011	58,478	22,059	36,419
2012	65,336	24,031	41,305
2013	67,756	24,743	43,013
2014	73,678	25,858	47,820
2015	74,853	25,766	49,087
Total	*567,374*	*235,291*	*332,083*

Source: Authors' calculations using the AISS database

Table A3. Survival dynamics, 2003-2015

#Years a firm appears in the sample	*Manufacturing (%)*	*Services (%)*	*All (%)*
1	19.85	26.92	22.50
2	15.01	18.86	17.16
3	11.17	12.83	12.21
4	9.42	9.90	9.83
5	8.15	8.08	8.48
6	8.66	8.63	9.27
7	3.31	2.66	2.92
8	4.38	4.64	4.85
9	2.38	1.37	1.84
10	3.23	1.56	2.30
11	4.18	1.68	2.79
12	3.07	0.95	1.80
13	7.17	1.84	4.05

Source: Authors' calculations using the AISS database

FTS Database

Table A4. Number of exporters, destinations, products and destination-product pairs

Year	*# of exporters*	*# of destinations*	*# of HS12 products*	*# of destination-product pairs*
2003	11,030	228	10,713	128,532
2004	12,434	232	11,149	146,739
2005	14,242	226	11,249	161,180
2006	15,005	232	11,298	171,483
2007	14,547	230	11,146	179,827
2008	14,198	232	11,022	182,131
2009	14,231	232	10,371	174,372
2010	16,642	233	10,725	197,595
2011	18,168	233	10,715	210,369
2012	20,348	237	10,883	224,046
2013	22,154	235	10,981	235,755
2014	22,426	235	11,096	246,844
2015	22,857	237	11,128	260,703

Source: Authors' calculations using the FTS database

Table A5. Average number of exporters, destinations and destination-product pairs

Year	*# of HS12 products*	*# of destinations*	*# of destination-product pairs*
2003	12.6	5.7	25.4
2004	13.2	5.9	27.2
2005	13.5	6.1	27.9
2006	14.0	6.2	29.0
2007	15.0	6.5	31.5
2008	15.2	6.8	32.7
2009	14.5	6.8	31.0
2010	15.7	6.8	33.2
2011	15.4	6.8	33.1
2012	15.2	6.8	33.0
2013	15.0	6.8	32.4
2014	15.2	7.1	34.1
2015	15.5	7.5	36.6

Source: Authors' calculations using the FTS database

Table A6. Share of firms by number of products exported

	2003		2007		2011		2015	
# of products	*% of firms*	*% of exports*	*% of firms*	*% of exports*	*% of firms*	*% of exports*	*% of firms*	*% of exports*
1	22	2	19	2	19	3	19	3
2	13	2	12	2	12	3	12	3
3	9	3	9	2	9	3	9	3
4	7	2	7	2	7	3	7	3
5	5	2	6	3	5	3	5	2
6	5	2	4	2	4	2	5	3
7	4	2	4	2	4	2	4	3
8	3	1	3	3	3	2	3	2
9	2	1	3	1	3	2	3	2
10	2	2	2	1	3	2	3	2
11	2	1	2	2	2	4	2	1
12	2	1	2	1	2	2	2	2
13	2	2	2	1	2	1	2	1
14	2	1	2	2	1	1	1	2
15	1	2	1	2	1	1	1	2
16	1	1	1	1	1	2	1	1
17	1	2	1	2	1	5	1	1
18	1	3	1	1	1	1	1	1
19	1	3	1	1	1	1	1	1
20	1	1	1	1	1	1	1	1
>20	14	61	17	66	17	58	17	61
Total	100	100	100	100	100	100	100	100

Source: Authors' calculations using the FTS database

Table A7. Share of firms by number of destinations

	2003		2007		2011		2015	
# of destinations	*% of firms*	*% of exports*	*% of firms*	*% of exports*	*% of firms*	*% of exports*	*% of firms*	*% of exports*
1	33	2	30	3	30	3	29	4
2	16	3	14	2	15	3	14	3
3	10	2	10	2	10	2	9	2
4	7	2	7	2	7	2	7	2
5	5	2	5	2	5	2	5	2
6	4	2	4	2	4	2	4	2
7	3	2	3	2	3	2	3	2
8	3	2	3	2	3	2	3	2
9	2	2	3	2	2	1	2	1
10	2	2	2	2	2	2	2	2
>10	15	79	17	81	19	79	20	78
Total	100	100	100	100	100	100	100	100

Source: Authors' calculations using the FTS database