Capital Inputs Sourcing from China and Export Quality Upgrading

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Why quality?

- Export promotion is an important path to economic growth
  - Quality upgrading begets export success 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; Sutton, 2012; Manova and Yu, 2017).

- Recent policy debates have renewed the interest in the drivers of export quality movements. (World Bank, 2020)
  - 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).

What exactly do we do in this paper?

- More often than not, the key to better quality inputs 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.

- As a result, 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.

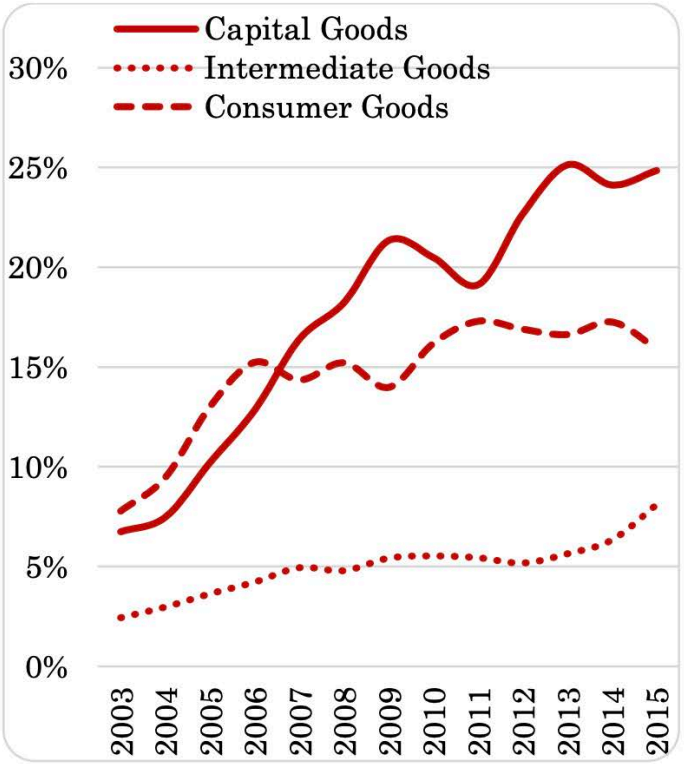
Why Turkey?

1. 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 source country that supplies lower quality inputs.

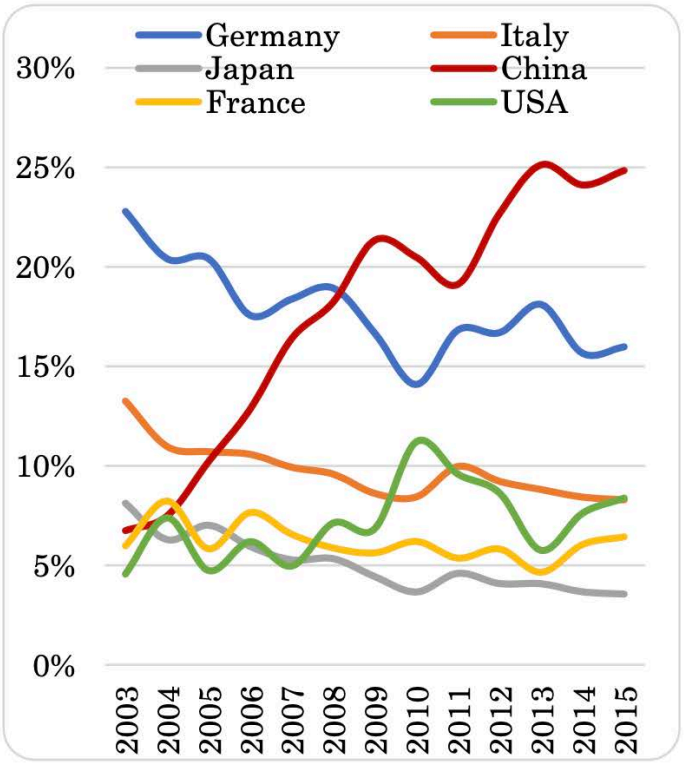
2. The sample period of this paper, 2003-2015, coincides with an era of rapid increases in the import dependency of Turkish exports. (Terzioğlu and Subaşat, 2018; Erduman, Eren and Gül, 2019)

Why capital inputs sourcing and why China?

(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

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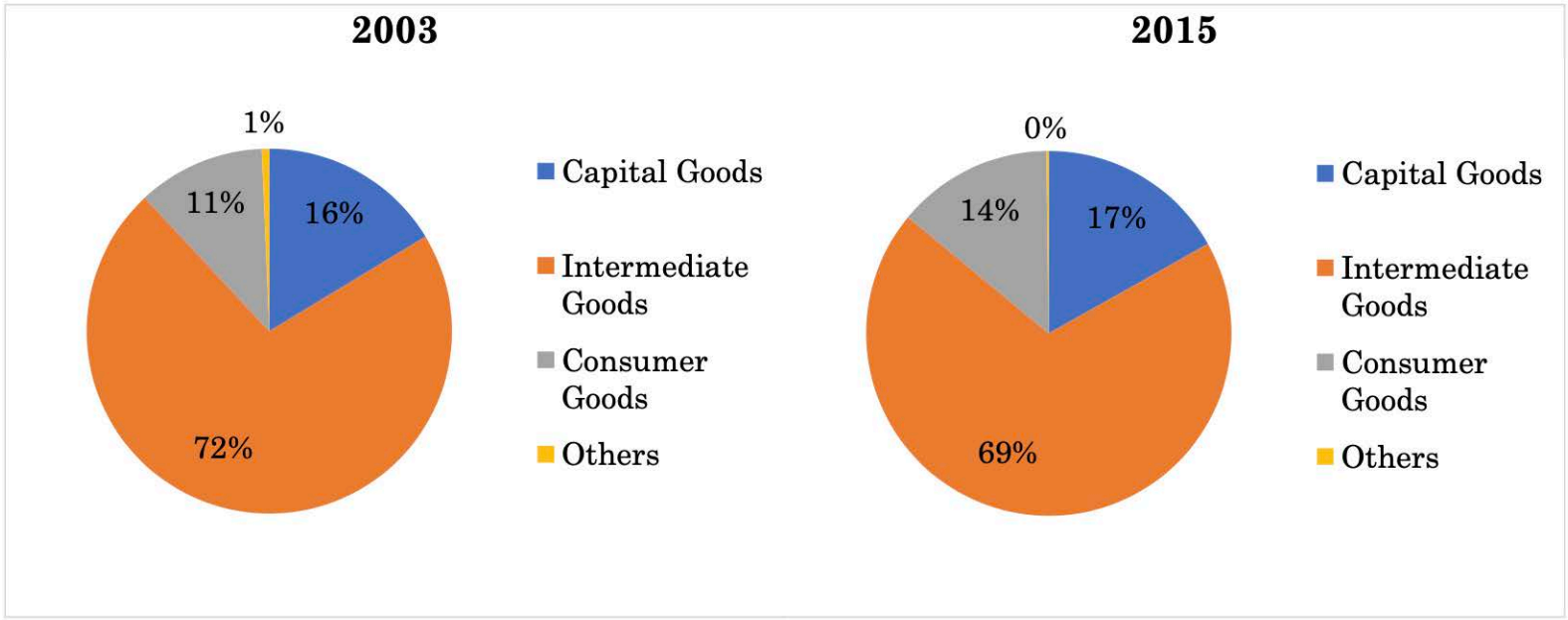
Major BEC shares in total imports of Turkey



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

Main trigger of shift to China in capital inputs sourcing

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

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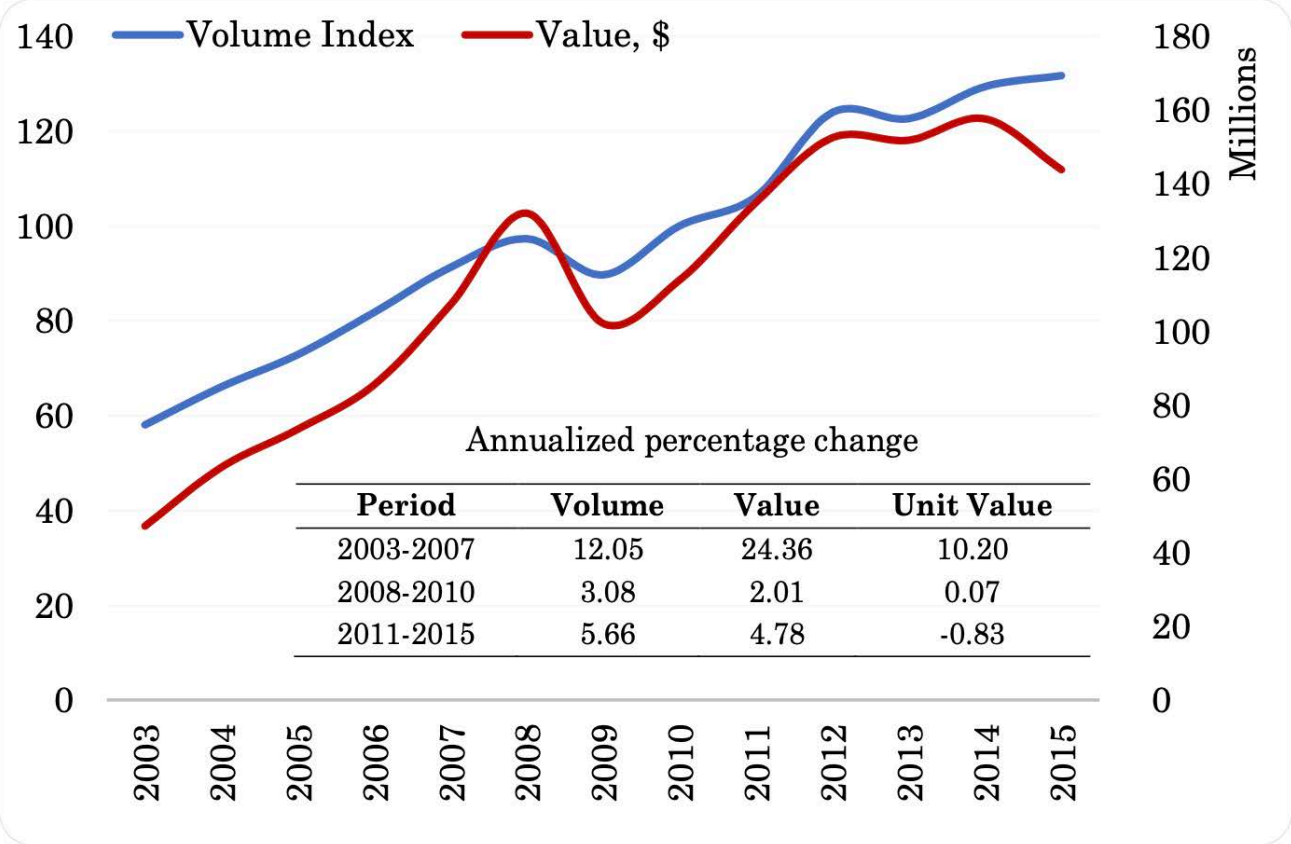
Major developments in the Turkish exports



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

Evaluation so far…

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

Data

- Annual Industry and Service Statistics database (AISS)
  - Yearly data for the period 2003-2015
  - TurkStat surveys that cover firms in manufacturing and services sectors
  - All firms with 20+ employees in Turkey
  - A subsample of firms with less than 20 employees
  - Information on a wide variety of firm characteristics such as employment, wages, investment, value added, sales, foreign ownership and the number of domestic plants of the firms.

- Foreign Trade Statistics database (FTS)
  - Monthly data for the period 2003-2018
  - Data source is the customs declarations covering the entire universe of goods traders in Turkey.
  - Information on statistical value (export f.o.b./import c.i.f.), quantity of exports and imports in kilograms, the reference period, product code, partner country, nature of transaction and type of payment.
  - GTIP 12-digit, a variant of Harmonized System

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

Source: Authors' calculations using the AISS database

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

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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

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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

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Table A6. Share of firms by number of products exported

# of products	2003		2007		2011		2015	
	% 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

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FTS Database

Table A7. Share of firms by number of destinations

# of destinations	2003		2007		2011		2015	
	% 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

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Data Assembly

- 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.
- Firm refers to the exporter and product refers to the exported good.
- 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.
- We work with two time periods: 2003-2007 and 2011-2015.
  - 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.
  - We end up with 29,929 and 102,925 firm-product pairs for the 2003-2007 and 2011-2015 time periods, respectively.

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) a la Khandelwal, Schott and Wei (2013):

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

x_{fhct} : Demand for firm f's exports of product h to destination country c and time t

p_{fhct}: Price of firm f's exports of product h to destination country c and time t

P_{ct}: Destination country price level

Y_{ct}: Destination country income

Quality Estimations

Khandelwal et al. (2013) estimate quality using observable export price and quantity data to obtain an "effective" quality measure

$$log(x_{fhct}) + \sigma_s \, log(p_{fhct}) = \varphi_h + \varphi_{ct} + \epsilon_{fhct}$$

x_{fhct} : Demand for firm f's exports of product h to destination country c and time t

p_{fhct}: Price of firm f's exports of product h to destination country c and time t

φ_{ct}: Destination-year fixed effects

φ_h: Product fixed-effects

σ_s: Elasticity of substitution; $\sigma = 5$ and $\sigma = 10$ as well as sector specific σ_i values from Broda and Weinstein (2006).

$\ln(\hat{q}_{fhct}) = \hat{\epsilon}_{fhct}$: quality measure

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Export quality levels and changes

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.

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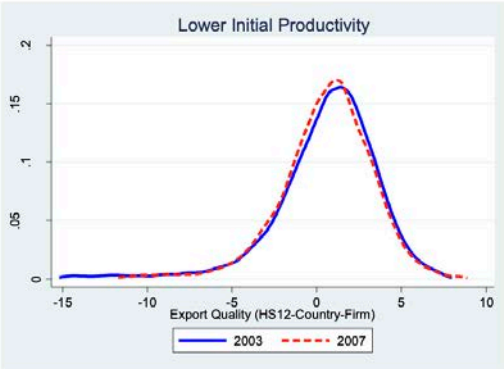
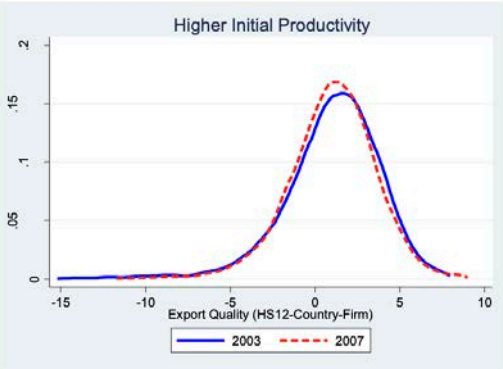
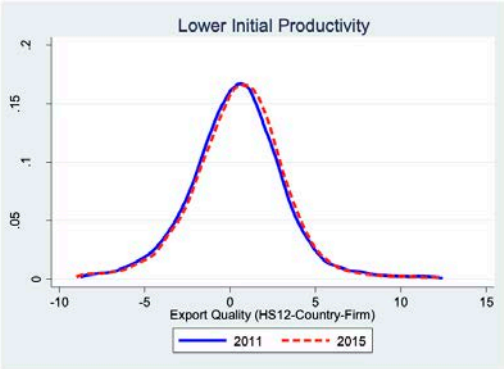
Kernel density of export quality

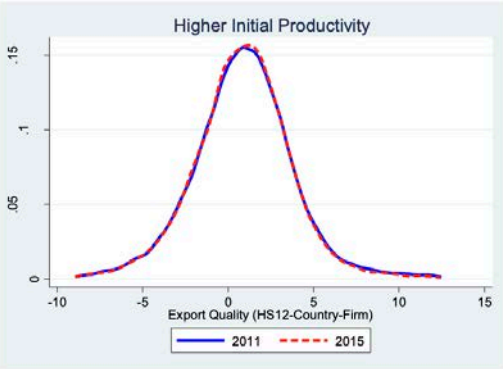
Panel A: 2003 vs. 2007





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).

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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.

Sourcing from China

$$SC_f = \sum_k w_{fk} SC_{fk}$$

k : imported capital goods input at HS 12-digit detail.

w_{fk}: share of k in all imported capital goods inputs by firm f in the initial year.

SC_{fk}: capital inputs *sourcing from China*

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New Sourcing
(for firm-product pairs that exist in t=2 but not in t=1)

- *Extensive margin* – a dummy variable

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

- *Intensive margin* – the quantity of capital good k

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

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Ongoing Sourcing
(for firm-product pairs that exist in t=1 and t=2)

- *Increase in ongoing sourcing* – the increase in the quantity of capital good k that firm f has already been sourcing from China.

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

Number of firms sourcing capital inputs from China

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.

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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

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 $t = 2$.

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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.*

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Empirical Strategy

- Built on the assumption that firms differ in productivity and choose quality to maximize profits (Fan, Yi and Yeaple, 2015; 2018).
- 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).
- 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.
  - 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.

$$\Delta \log\left(\hat{q}_{fh(c)}\right) = \beta_1 SC_f + \beta_2 (SC_f \times L.log\emptyset_f) + \beta_3 \Delta \log \phi_f + \beta_4 \Delta HHI_i + \boldsymbol{\beta_f} \Delta \boldsymbol{\chi_f} + \varphi_s + \varphi_c + \varphi_{h(c)} + \epsilon_{fh(c)}$$

- 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.

$$\Delta x \equiv x_{2007} - x_{2003}$$
$$\Delta x \equiv x_{2015} - x_{2011}$$

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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.

- $\Delta SC_f \times L.log\emptyset_f$ is used 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.

- Our productivity measure is revenue TFP (TFPR) rather than physical TFP (TFPQ) due to data limitations. Our TFPR measure is based on value-added figures using the augmented Olley-Pakes method offered by Ackerberg, Caves and Frazer (2015).

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.

- Schott (2004), Verhoogen (2008), Kugler and Verhoogen (2008), Bastos and Silva (2010), Antoniades (2015) .

- 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.
- We also include 2-digit sector fixed effects φ_s, destination fixed effects φ_c, and destination-product fixed effects φ_{hc} in the estimations.

Baseline Specification-All 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.

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Baseline Specification-All Sample

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.

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Baseline Specification-All Sample

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.

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Economic size of the effects

- 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.

- 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.

- 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.

Baseline Specification-Differentiated Products

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

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Baseline Specification-Homogenous Products

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

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Endogeneity I

- *Changes in tariffs due to accession of China to WTO:* Upon accession of China to WTO in December 2001, there has been a substantial increase in China's trade with the world. 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.

$$\Delta Duty_f = \sum_k w_{fk} \Delta Duty_k$$

  - k, capital goods imports at HS12 level.
  - w_{fk}, f is the share of capital goods imports of k at the initial year to total capital imports of the firm.
  - $\Delta Duty_k$ is the 2003-2007 or the 2011-2015 difference is the change in tariffs of capital goods.

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Endogeneity II

- *Changes in tariffs due to accession of China to WTO:* 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.

$$\Delta\left(\frac{K}{L}\right)_f = \sum_k w_{fk}\Delta\left(\frac{K}{L}\right)_k$$

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

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IV Specification

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.

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Conclusions I

- 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
- These results hold under a number of robustness checks.

Conclusions II

- 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.

Policy Implications

- For countries with highly import-dependent exports, our 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.

What's Next? –More Robustness

Sample selection bias issues

- Problem: In our estimations, we use data for exporters with 20+ employees only to be able to use firm-specific variables.

- Solution: Repeat the estimations for all of the FTS sample without firm-specific variables such as TFP, employment or capital-intensity (firm-FE will be used instead). The results are expected to be significant.

What's Next? –More Robustness

Are we truly picking up an effect on quality upgrading due to capital inputs sourcing from China?

- Problem: In, our estimations, we use data for exporters that use imported capital inputs in their production lines.

- Solution: A placebo test, i.e., repeat the estimations for exporters that do not use imported capital inputs assuming that they are not affected from shift to China. The results are expected to be insignificant.

Future Research

- 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.

- 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.

- Our analysis needs to be complemented by the changes in the export side of the equation to have a more complete picture.
  - It would be valuable to 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.

Thank you