The Impact of Minimum Wages on Import Intensity: Evidence on Firms and Supply Networks

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Motivation

Relative wages as a determinant of trade balance:

- Decline in trade costs made it easier to move production across countries.
- See the rapid international outsourcing in both manufacturing and services.

For developing countries labor cost is particularly important:

- Stiffer competition on labor intensive products.
- Currency risks associated with import dependence.
- Strong role of policy through minimum wage in determining labor costs.

Purpose of this paper: link labor costs to import behavior of firms.

Research question

What is the impact of the 2016 minimum wage increase in Turkey on firm imports?

- Real increase of minimum wages.
- Very large bite compared to other countries

Direct shock on labor cost:

- Firms own labor costs increase.
- Substitute labor with imports.

Indirect shock through the suppliers:

- Suppliers labor costs increase.
- Substitute domestic suppliers with imports.

Academic motivations - contributions

Impact of minimum wages on firm outcomes:

- Recent studies on productivity, profits, exports and firm value.
- See Draca, Machin & Van Reenen (2011); Gan, Hernandez & Ma (2016); Akgunduz, Aldan, Bagir & Torun (2018).

Imports and employment outcomes:

- Effects of increased import competition on employment outcomes of domestic firms.
- See Autor, Dorn & Hanson (2013); Acemoglu, Autor, Dorn, Hanson & Price (2016).

**Trade and domestic network shocks:**

- Propogation of shocks in trade on domestic networks (and vice versa).
- See Acemoglu, Akcigit & Kerr (2016); Mogstad, Dhyne, Kikkawa & Tintelnot (2017)
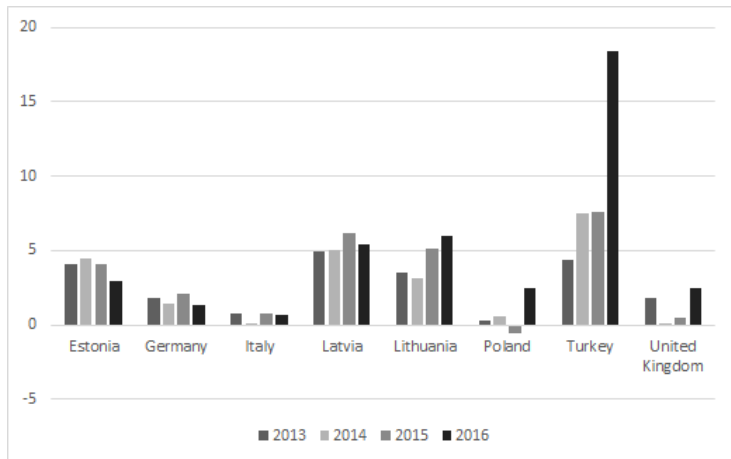
Minimum wage increase of 2016

- Raised minimum wages from 1000 to 1300 TL.
- CPI adjusted increase is around 20%.
- Motivated by the campaign promises between June and November 2015 elections.
- Legislation was passed at the end of December 2015 and became effective January 2016.
- To avoid excessive burden on employers a 100 TL reduction in social security payments for up to twice the minimum wage was passed.
- Even with the 100 TL cut the net increase in the cost to employers is around 350 TL.

Minimum wage increases over time
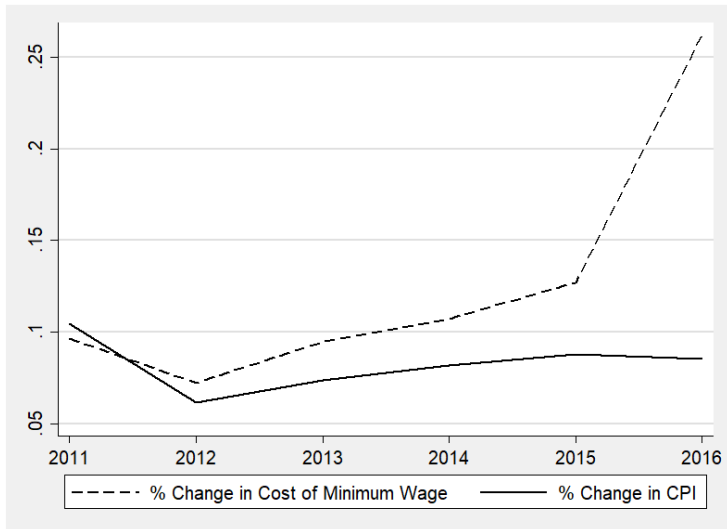
Unit labor costs (OECD)
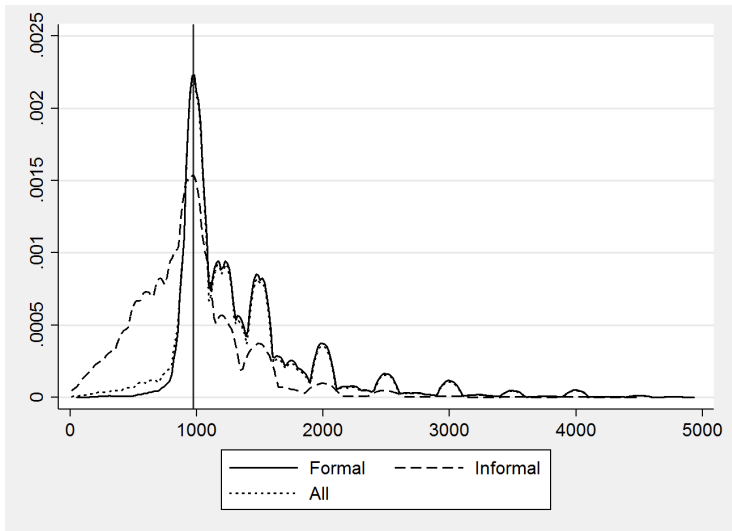
Minimum wage bite

- Minimum wages are binding in Turkey, around 30% of formal manufacturing employees at the minimum wage level in 2015.
- The increase of January 2016 had a major effect on the labor market.
- Social security data indicates both an effect on wages and employment.
- Misreporting and informality are clearly options that we try to take into account in estimations.

Self-reported LFS wages in 2015: Formal employees

Average wages and employment over time
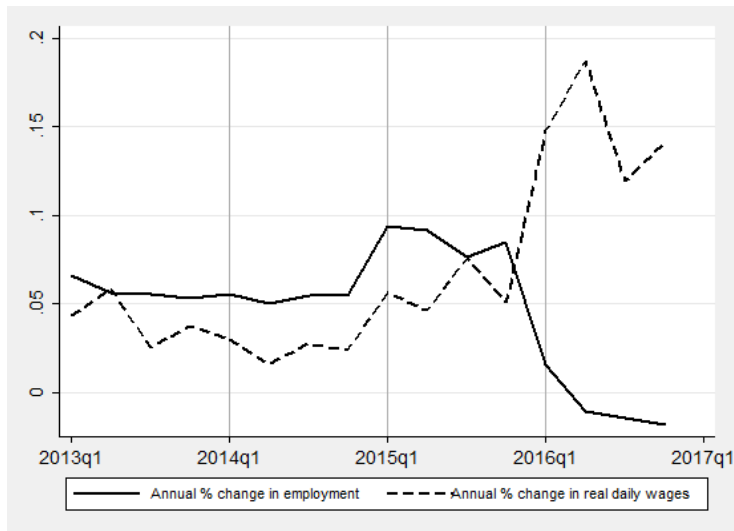
Source of the effect:

Consider a production function given by:

$$y_{it} = f(k_{it}, l_{it}, d_{ist}, m_{it}) \tag{1}$$

- The cost of l_{it} and d_{ist} will go up depending on the exposure to minimum wages.
- Their substitutability with m_{it} and the cost of m_{it} will determine the impact on imports.

Impact on imports:

- When firm i labor cost increases.
- When firm s labor cost increases.

Defining the treatment variable

Impact of minimum wages on firms' labor cost consists of two parts:

- Mechanical effect of the minimum wage imposition that is proportional to the minimum wage increase.
- Labor demand effect on firm employment and wage distribution.

The exogenous firm-level exposure is defined as the mechanical effect given 2015 Q4 employment and wages:

$$Exposure_i = \frac{\sum_{e=1}^{E}(min_{2016} - W_{e<min_{2016}}^{2015}) - N_{i,w<2*minW} * 100}{TotCost_i^{2015}} \quad (2)$$

Adjustment for expected increase in minimum wages:

- Take the average increase in the past three years in minimum wages.
- Substract it from equation 2 to arrive at the final treatment variable.

DD specification - own labor cost increase

We use a standard DD model estimated using OLS based on the continuous exposure variable.

- The outcomes of interest are:
  - $\cdots$ Import intensity (imports over cost of sales - own and aggregate)
  - $\cdots$ Import value
  - $\cdots$ Probability to import
  - $\cdots$ Different types of imports (i.e. intermediate, capital, own)

$$Y_{it} = \beta_0 + \beta_1 Exposure_i * Year_{2016} + f_i + S_{it} + e_{it} \tag{3}$$

A number of fixed effects:

- f_i - firm
- S_{it} - two digit sector-year

All estimates are clustered at the firm level.

DD specification - labor cost increase of suppliers

Cleaner identification of substitution: We know what the suppliers are selling!

- Does firm i import more of product category j when the domestic supplier s of j to firm i is affected more by the minimum wage increase?

A firm may have multiple suppliers for product category j

- $Exposure_{ij}$ is the weighted exposure of the suppliers in 2015.

$$Exposure_{ij} = \sum_{s=1}^{S} w_{sij} Exposure_{sij} \qquad (4)$$

DD specification - labor cost increase of suppliers 2

Interested in three outcomes:

- Impact on imports of product category j
- Impact on domestic purchases of product category j
- Impact on share of imports in total purchases of product category j

DD specification can be written as:

$$Y_{ijt} = \beta_0 + \beta_1 Exposure_{ij} * Year_{2016} + f_{it} + P_{jt} + e_{ijt} \qquad (5)$$

A number of fixed effects:

- f_{it} - firm-year
- P_{jt} - four digit supplier product category-year

The f_{it} fixed effects control for firm level shocks including the minimum wages. The variation is entirely dependent on the difference in exposure in goods purchased by firm i.

Data sources and sampling

EIS datasets (2013-2016):

- Firm balance sheets - cost of sales and firm sector
- Customs data - import value, product variety
- Social security data - wages and employment
- Firm-to-firm trade data - trade value in the domestic network
- NACE - HS concordance at the 4 digit level.

Sample choice:

- All manufacturing firms with more than 10 employees in 2015.
- Import intensity cannot exceed 1.

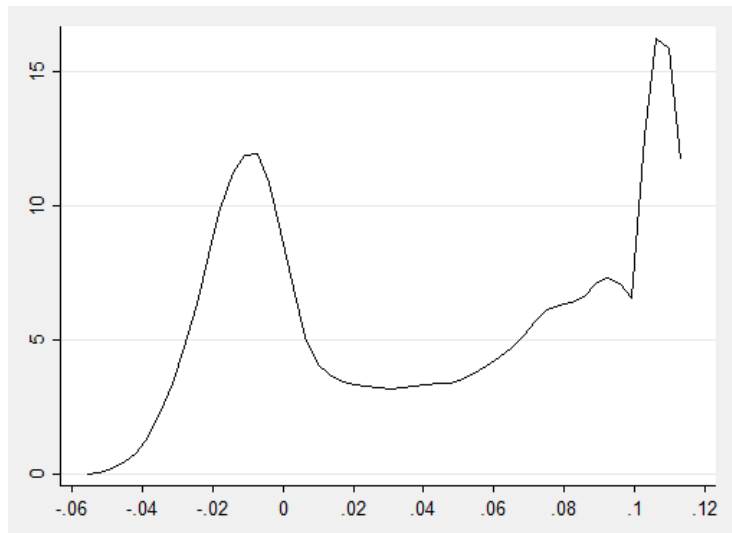**Further clean-up in firm-to-firm trade data:**

- Purchases made from other manufacturing firms with at least 10 employees.
- Purchases made of product category j each year between 2013 and 2015.
  - $\cdots$ We want to keep actual intermediate inputs used in production.
  - $\cdots$ Number of observations falls by 40% while the value of trade falls only by 8%.

Exposure distribution

Summary Statistics

	Mean	P10	P50	P90	SD
Number of employees	68	11	25	124	245
Wage per employee (TL)	1,771	1,105	1,516	2,769	847
Min.wage exposure (adjusted)	0.04	-0.02	0.05	0.11	0.05
Min.wage exposure (unadjusted)	0.12	-0.01	0.14	0.23	0.09
Import exposure (own imports only)	0.06	0.00	0.00	0.21	0.14
Import exposure (aggregate)	0.21	0.02	0.14	0.50	0.20
Import probability (own)	0.35	0.00	0.00	1.00	0.48
Number of import varieties (HS-6)	5.41	0.00	0.00	12.00	21.65
Import value ($)	2,261,718	0	0	929,656	70,400,000
Import value (intermediate goods)	1,503,563	0	0	403,402	63,300,000
Import value (capital goods)	757,199	0	0	194,622	24,300,000
Import value (final goods)	955	0	0	0	827,055
Cost of sales ($)	7,698,042	223,093	1,184,006	10,400,000	97,000,000

Note: Authors' calculations using EIS. The sample consists of manufacturing firms only and covers the period 2013-2016. There are 46,245 firms and 172,793 observations.

Summary Statistics - Suppliers' Minimum Wage Exposure

	Mean	P10	P50	P90	SD
Number of suppliers per sector	2.38	1.00	1.00	5.00	2.92
Min.wage exposure (adjusted)	0.01	-0.02	0.00	0.08	0.04
Min.wage exposure (unadjusted)	0.05	-0.01	0.01	0.18	0.07
Import value ($)	353,588	0	0	35,039	9,042,063
Purchases from suppliers	1,449,001	11,935	142,169	1,985,901	20,000,000
Share of imports in total sector purchase	0.07	0.00	0.00	0.21	0.21

Note: Authors' calculations using EIS. The sample consists of manufacturing firms only and covers the period 2013-2016. There are 24,149 firms in the sample that buy from 6.05 4 digit sectors on average.
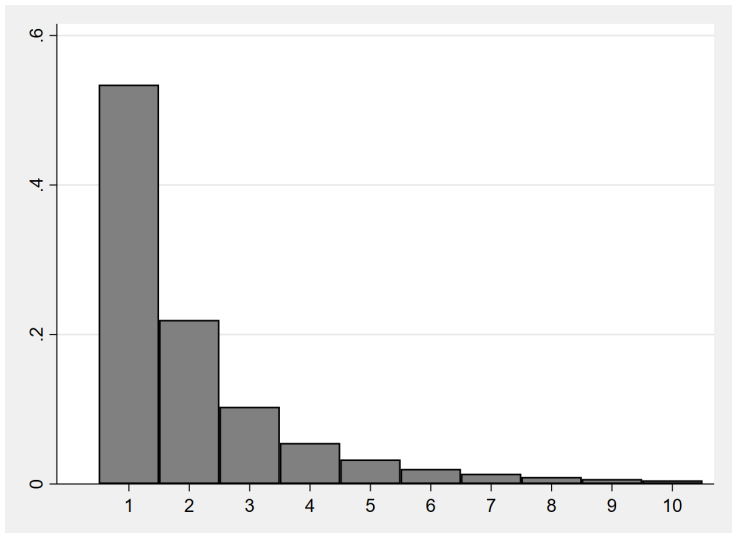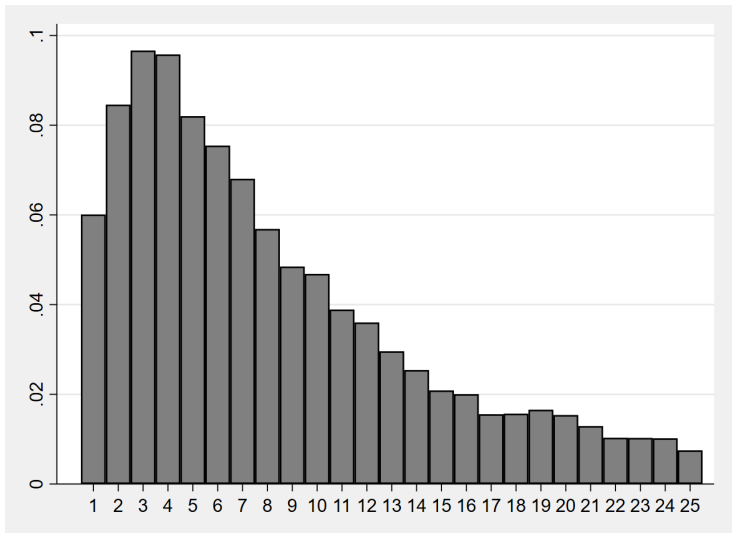
Number of suppliers per 4-digit product categories at the firm level

Number 4-digit product categories purchased from at the firm level

Impact through firm exposure

	(1) All	(2) Min.share<1	(3) 0<Min.share<1	(4) Alt.Exposure
A- Direct import exposure				
Exposure	0.0311***	0.0238***	0.0285***	0.0190***
	(0.0071)	(0.0089)	(0.0096)	(0.0041)
B- Aggregate import exposure				
Exposure	0.0264***	0.0168	0.0182	0.0138**
	(0.0099)	(0.0123)	(0.0132)	(0.0056)
C- Import probability				
Exposure	0.0994***	0.0735**	0.0668*	0.0536***
	(0.0283)	(0.0370)	(0.0397)	(0.0157)
D- Log import value				
Exposure	1.6977***	1.4298***	1.4779***	0.9521***
	(0.3003)	(0.3912)	(0.4212)	(0.1681)
N	172,793	138,778	121,665	172,793

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Note: All models include firm, year, and year-sector fixed effects. Standard errors are clustered at the firm level in all regressions. The sample consists of manufacturing firms only and covers the period 2013-2016.

Impact through firm exposure - placebo tests

	All	Min.share<1	0<Min.share<1	Alt.Exposure
A- Direct import exposure				
Exposure	0.0040	0.0076	0.0050	0.0168
	(0.0071)	(0.0092)	(0.0099)	(0.0345)
B- Aggregate import exposure				
Exposure	0.0005	0.0037	-0.0034	0.0015
	(0.0100)	(0.0125)	(0.0134)	(0.0503)
C- Import probability				
Exposure	-0.0358	0.0024	0.0140	-0.2631*
	(0.0307)	(0.0400)	(0.0431)	(0.1504)
D- Log import value				
Exposure	0.0691	0.4973	0.5670	-0.4081
	(0.3195)	(0.4166)	(0.4498)	(1.5607)
N	125,192	101,289	88,807	125,192

*** p<0.01, ** p <0.05, * p<0.1

<u>Note</u>: All models include firm, year, and year-sector fixed effects. Standard errors are clustered at the firm level in all regressions. The sample consists of manufacturing firms only and covers the period 2013-2016.

Impact through firm exposure - product categories

	All	Min.share<1	0<Min.share<1	Alt.Exposure
A- Intermadiate good imports				
Exposure	0.0262***	0.0263***	0.0298***	0.0159***
	(0.0048)	(0.0062)	(0.0067)	(0.0027)
B- Capital good imports				
Exposure	-0.0070	-0.0177*	-0.0094	-0.0015
	(0.0081)	(0.0097)	(0.0094)	(0.0052)
C- Final good imports				
Exposure	0.0119*	0.0152**	0.0082	0.0046
	(0.0065)	(0.0076)	(0.0069)	(0.0043)
D- Imports in own sector imports				
Exposure	0.0135***	0.0127***	0.0149***	0.0081***
	(0.0029)	(0.0037)	(0.0040)	(0.0017)
N	172,793	138,778	121,665	172,793

*** p<0.01, ** p <0.05, * p<0.1

Note: All models include firm, year, and year-sector fixed effects. Standard errors are clustered at the firm level in all regressions. The sample consists of manufacturing firms only and covers the period 2013-2016.

Impact through firm exposure - firm size categories

	All	Employees>19	Employees>49	Employees>249	All - WLS
A- Import exposure					
Exposure	0.0311***	0.0253***	0.0363**	0.0236	0.0345***
	(0.0071)	(0.0096)	(0.0175)	(0.0782)	(0.0076)
B- Import Probability					
Exposure	0.0994***	0.0755*	0.0536	0.0175	0.0853***
	(0.0283)	(0.0401)	(0.0761)	(0.2032)	(0.0288)
N	172,793	104,462	42,452	7,512	172,793

*** p<0.01, ** p <0.05, * p<0.1

Note: All models include firm, year, and year-sector fixed effects. Standard errors are clustered at the firm level in all regressions. The sample consists of manufacturing firms only and covers the period 2013-2016.

Impact on the supply chain

	All	Exclude tail exposure	Alt.Exposure	Placebo
A- Import share				
Exposure	0.0254**	0.0231*	0.0168***	0.0117
	(0.0111)	(0.0124)	(0.0059)	(0.0093)
B- Log of imports				
Exposure	0.1073	0.0876	0.1036	-0.0652
	(0.1738)	(0.1984)	(0.0909)	(0.1764)
C- Log of domestic purchases				
Exposure	-1.9956***	-0.9969***	-1.2209***	-0.0773
	(0.3253)	(0.3484)	(0.1661)	(0.0889)
N	584,620	563,246	584,620	438,465

*** p<0.01, ** p <0.05, * p<0.1

<u>Note</u>: All models include firm-sector, firm-year, and year-sector fixed effects. Standard errors are clustered at the firm level in all regressions. The sample consists of manufacturing firms only and covers the period 2013-2016.

Impact on the supply chain - importers only

	All	Exclude tail exposure	Alt.Exposure
A- Import share			
Exposure	0.3121***	0.3253***	0.1482***
	(0.0930)	(0.0989)	(0.0459)
B- Log of imports			
Exposure	1.4884***	1.7337***	0.7685***
	(0.5203)	(0.5627)	(0.2559)
C- Log of domestic purchases			
Exposure	-1.6427	-0.9491	-0.7421
	(1.1139)	(1.1450)	(0.5377)
N	56,996	56,360	56,996

*** p<0.01, ** p <0.05, * p<0.1

<u>Note</u>: All models include firm-sector, firm-year, and year-sector fixed effects. Standard errors are clustered at the firm level in all regressions. The sample consists of manufacturing firms only and covers the period 2013-2016.

Impact on the supply chain - rest

	All	Exclude tail exposure	Alt.Exposure
A- Import share			
Exposure	0.0006	-0.0032	0.0047
	(0.0101)	(0.0112)	(0.0053)
B- Log of imports			
Exposure	0.0074	-0.0326	0.0539
	(0.1855)	(0.2135)	(0.0977)
C- Log of domestic purchases			
Exposure	-2.0178***	-1.0399***	-1.2462***
	(0.3449)	(0.3708)	(0.1767)
N	515,524	494,842	515,524

*** $p<0.01$, ** $p <0.05$, * $p<0.1$

<u>Note</u>: All models include firm-sector, firm-year, and year-sector fixed effects. Standard errors are clustered at the firm level in all regressions. The sample consists of manufacturing firms only and covers the period 2013-2016.

Conclusions - summing up

Minimum wage exposure of the firm leads to:

- Higher import probability - elasticity 0.07
- More imports - elasticity 1.5
- The effects are driven by small - medium manufacturing firms who import more intermediate goods.

Minimum wage shock in the supply chain of a firm leads to:

- A higher ratio of imports to domestic purchases within a product category.
- Less purchases from that product category - elasticity 1 to 2.
- More imports by firms that already import from the product category with high exposure.
- No impact on the imports of firms that do not.