Exchange Rates and Export Behavior: Firm-level Evidence from Turkey*

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Abstract

This paper investigates the heterogeneity in the responses of export volumes to real exchange rate changes using firm-level data from Turkey for the period 2007-2014. We find that, consistent with the literature, high productivity firms were also large exporters and importers. Our results confirmed the positive effect of a depreciation on export volumes for Turkey, on average. However, firms with relatively high import intensities, measured as the ratio of imports to total trade at the firm-level, reacted significantly differently compared to low import intensity firms. Our empirical analysis suggested that for firms relying predominantly on imported inputs, the positive effect of a depreciation could be offset by the corresponding negative effect through the cost channel and might even lead to a reduction in exports. Our results are consistent with the conventional belief that exchange rate depreciation benefits exporters, but this average effect might be misleading as it hides a significant amount of heterogeneity.

Keywords: Exchange rates, export response, heterogenous firms

JEL Classification: D31, I24, R20

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1 Introduction

Bilateral exchange rates have consequential effects on export and import dynamics of a country. Various firms enter and exit the export market every year and the composition of exporters shows differences across sectors. Furthermore, the amounts supplied by new entrants and incumbent firms differ, hence, in order to explain the effects of exchange rates on exporting behaviour of a country, firm level responses have to be investigated. There could be different explanations to the changing patterns of exporters, yet we are going to focus solely on the effect of exchange rate changes on export supply decisions.

Turkey liberalized its foreign trade in the early 1980's. Its Custom Union with the EU in 1996 further opened up the economy and imports in all sectors increased dramatically. Intermediate inputs of all kinds, which constitute the bulk of Turkish imports, became an increasingly important determinant of firms' performance. Firms became players in the export markets through imported inputs since these goods provided quality and allowed for product differentiation - often essential for competition. Bigger exporters were also bigger importers, they were more productive and had larger firm sizes.This implied a positive relation between the amount of exports and imports of firms.

There is a two-way relation between the import status of a firm ad its exports as a result of changes in the exchange rate. Costs of imported inputs increase while exporting its output becomes more attractive.

There is a vast literature that has studied the export supply dynamics of firms. Using a detailed firm level dataset of English firms, Greenaway et al.(2007) investigated the effects of real exchange rate changes on exporting behavior in both participation and supply decision. They found a small effect of exchange rate on firms' decisions to enter and exit markets, yet they claimed that it significantly affected export shares: one percentage point increase in the real exchange rate depreciation increased the export share by 1.28%. Berman et al.(2012) examined the heterogeneous reaction of exporters to real exchange rate changes. More productive exporters tended to react to a depreciation in the local currency

by increasing their markups at a greater rate than increasing their volume. Both high and low productive firms increased their volumes after a depreciation of the domestic currency, yet less productive firms did that a a greater extent. Eaton et al. (2008) found low costs of shipping for small volumes of exports and no significant cost of entry to export markets. Decomposing Colombian trade data into two groups with extensive and intensive margins to measure the contribution of both existing and new exporters to country's export volume, they discovered only a small fraction of new exporters managed to survive. After a decade, these survivors constituted nearly half of the export expansion. Halpern et al. (2015) , on the other hand, investigated the effect of imported inputs on productivity. Their results implied that increasing the fraction of imported goods from zero to hundred percent would increase quantity productivity by 24%. Although they did not examine the relation between exchange rates and trade directly, their results help understanding the multidimensional relationship between exchange rates and trade using import status of exporters. Yazici and Klasra (2008) investigated the response of the trade balance to exchange rate changes controlling for the imported inputs in the exported goods production. They found no evidence for the existence of the J-curve effect for Turkish manufacturing industry.Furthermore, their results indicated that the violation of the J-curve hypothesis was stronger as the import content of exported goods was higher.

In the exchange rate-export volume literature, there is little evidence that links import structure of firms with export supply decision of firms. To our knowledge, this work is the first to examine the import effect on the export volume of exported goods using a detailed Turkish firm-level data. In this paper, we estimate the effect of real exchange rate changes on export volume. As decomposing exporting firms into different groups considering firm size measured as the number of workers, and export volume, we analyzed both separate and joint effects of real exchange rate and import status on the export supply decision. We estimated an econometric model using a detailed firm level dataset of manufacturing firms in Turkey. Destination specific export volumes and firm characteristics were documented for the 2007-2014 period at annual frequency. In our baseline specification, we found that one

percentage point depreciation in the domestic currency led to 0.3 percentage point increase in the export volume. Furthermore, we showed that high productivity is associated with a larger export volume -1 percentage point higher productivity implied 1.1 percentage point higher export volume. High productivity firms reacted more to exchange rate depreciation by increasing their export volume relatively more compared to low productivity firms. Finally, we investigated import and export behavior of firms and found that being an importer was associated with a higher export volume. Also, following a depreciation, export volumes of importing firms increased less compared to firms which were not importers.

The remainder of our study is as follows: In Section II, we summarize our sample construction process and provide descriptive statistics. In Section III, parametric estimation model of export supply decision is provided. Section IV presents our results. Section V gives the conclusions.

2 Data and Descriptive Results

Turkish Statistical Institute (TURKSTAT) provided comprehensive panels of Turkish trade flows and firm level characteristics. We tested the predictions of our model with export supply decision using a large dataset on Turkish firms constructed using two sources:

1. Transactional level Foreign Trade Statistics containing the volume(in kilograms) and value(in Turkish Lira, USD and Euro) of exports by destination countries and imports by source countries for each twelve-digit Harmonized System product. We put a threshold for export value: all flows greater than 1000 Turkish Liras are recorded. This threshold only eliminates a very small proportion of total exports.

2. Firm-level annual dataset that contains information about firm characteristics including firms' turnover, employment, sector of main activity in 4 digit NACE2 classification, expense-revenue items and other balance-sheet variables.

Our sample includes data for the period 2007-2014. We focused on export destinations of 31 OECD and 7 non-OECD countries that account for about 70% of the total export

value of Turkey in the sample period. Annual bilateral exchange rates (between Turkey and destination countries) were obtained from the OECD database. We combined trade data with firm-level characteristics using a unique firm identifier to match export information with firm-level estimates including total cost and productivity measures.

We constructed our estimate of firm productivity as hourly production value at period t for firm i:

$$\varphi_{i,t} = \frac{\text{Production Value}_{i,t}}{\text{Total Hours Worked}_{i,t}}$$

For export supply estimation, we used a sample which combined industry and trade datasets. This sample included firm-destination-year level observations of all manufacturing firms that had export records in the trade data.

In the industry dataset, we restricted observations to firms for which the declared main activity belonged to the manufacturing sector, classified according to the two digit NACE2 (Nomenclature of Economic Activities) codes constituting 24 manufacturing industry sub-groups.[1] We deflated the variable of interests with two digit Producer Price Indexes provided by TURKSTAT.[2] and dropped observations with zero or missing values. Furthermore, we only included firms with at least five employees for each year of the sample period. This procedure gave us a balanced panel covering the period 2007-2014 with 8,933 firms in each year in the industry dimension.

Trade data were available at the transactional level. In order to track the effect of destination-specific real exchange rates, we aggregated transaction values aggregated into firm-destination-year level for the destination countries in our sample. Also, in this dataset, we kept only the manufacturing goods. Furthermore, we included firms with a value of exports that exceeded 1,000 Turkish Liras and an annual export volume higher than 100 kilos for manufacturing goods.

Trade data also contained import records of firms. In order to measure the effect of being an importer on export supply decisions, we only considered imports declared as intermediate

[1]Note that, industry codes between 10 and 33 correspond to manufacturing sector.
[2]2007 was taken as the base year for all monetary variables.

Table 1: Change in the Number of Firms in Sample Construction

	2007	2008	2009	2010	2011	2012	2013	2014
Industry								
# of Firms	83,961	82,660	99,920	106,713	138,013	147,915	168,676	159,426
# of Manufacturing Firms	33,559	32,938	35,059	33,890	41,194	43,281	47,024	45,316
# of Firms in the Balanced Dataset	8,933	8,933	8,933	8,933	8,933	8,933	8,933	8,933
Trade								
# of Firms	72,503	70,647	67,690	71,252	76,880	76,352	78,994	80,426
# of Manufacturing Firms*	69,475	68,022	65,132	68,373	73,359	73,144	75,809	77,258
# of Exporter Firms	22,491	22,491	21,574	21,366	22,677	23,416	24,396	25,450
Sample								
# of Firms	2,747	2,792	2,920	2,834	2,808	2,893	2,845	2,893

* Non-manufacturing tradable goods were dropped.

inputs - otherwise assigned zero to import values. [3] Hence, we merged import and export datasets so that we had export records and the import status of firms in the sample.

In order to link firm characteristics with customs records, industry and trade datasets were merged using a unique firm identifier. This provided 8-year panel data of manufacturing firms with export records. Hence, we arrived at our final sample with industry characteristics and trade records including value and volume of the transactions.

Table 1 presents the annual change in the number of manufacturing firms and exporters. It also gives the changes in the number of firms in our main sample. Note that the number of manufacturing firms and exporters follow an increasing trend during the sample period. In 2007, our dataset contained 33,559 manufacturing firms while this number went up to 45,316 in 2014. Also, the number of exporters which export manufacturing goods were 22,491 in 2007, and 25,450 in 2014. We aimed to construct a balanced sample for the industry dataset for the sample period with firms that had declared their industrial activities in each year. To do that, we started with the manufacturing firms in 2007 as our base group and tracked them until the end of the sample period. This procedure gave us a balanced sample with 8,933 firms where each firm was presented in the industry dataset which we merged with trade

[3] In order to determine that a product is an intermediate input, we use BEC codes provided by dataset.

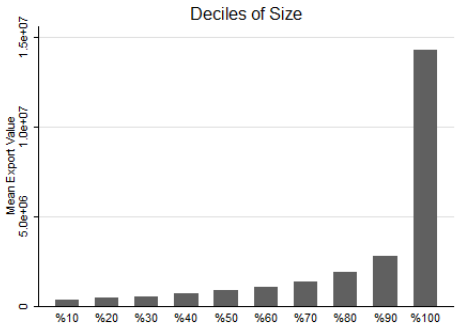
data to obtain a sample containing firm-destination-year level trade records and firm-level characteristics. This created a sample containing firm-destination-year level observations of only exporting manufacturing firms with export records and total the number of observations were reduced to 121,880.

Figure 1 depicts the pattern of the trade values for each decile of firm size.[4]. We observe that export values are positively related to the firm size. Furthermore, as firms get larger, their intermediate input import values increased. Indeed, in the first decile of the firm size, average import share in total trade value was approximately 10%. And this number approached to 30% when moved to the last decile. This suggests that larger firms were both importers and exporters as observed in Panel (c).

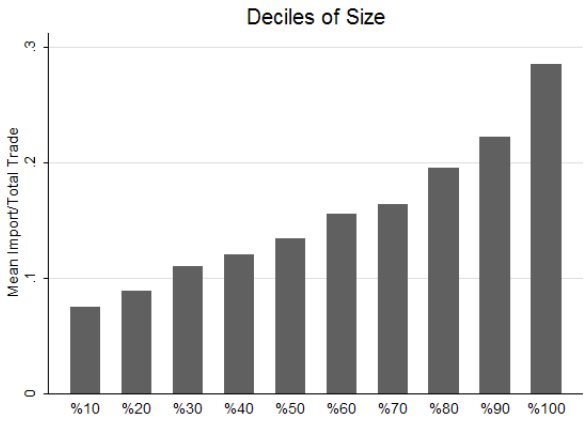
In Figure 2, the import content of Turkish export goods is presented. Import content of exports is defined as the share of imported inputs in the overall exports of a country, and reflects the extent to which a country is a user of foreign inputs.[5] There was an upward trend in the import share of export goods implying that the importance of imported inputs for exports was steadily increasing. In 1995, the share of imported inputs was less 10% while this share rose to more than 25% in 2011. Increasing the share of imported inputs brings a two-way relationship between the exchange rate and exports: first is the direct effect of the exchange rate on exports, and the second is the indirect effect through its effect on imports. Thus, the export response of firms to exchange rate movements would be different for importing and non-importing firms. Therefore, for a thorough analysis of the reaction for export volume to the exchange rate movements, we need to account for the share of imported inputs.

[4]Employment level was used as a proxy for firm size. Import value in the import/total trade variable includes only intermediate input imports.

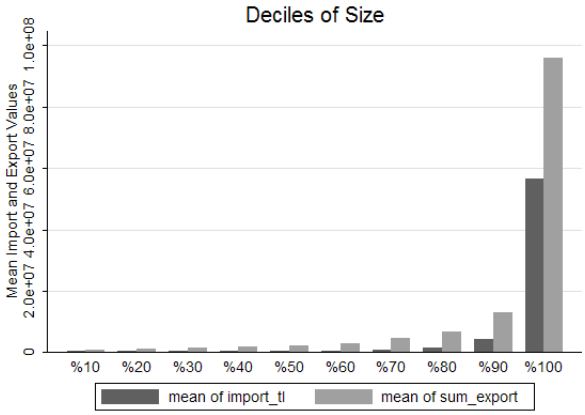
[5]Imported input share of Turkish exports provided in the Figure 2 is taken from the OECD Database.



(a) Export Value



(b) Import/Total Trade Value



(c) Export & Import Values

Figure 1: Trade values according to size

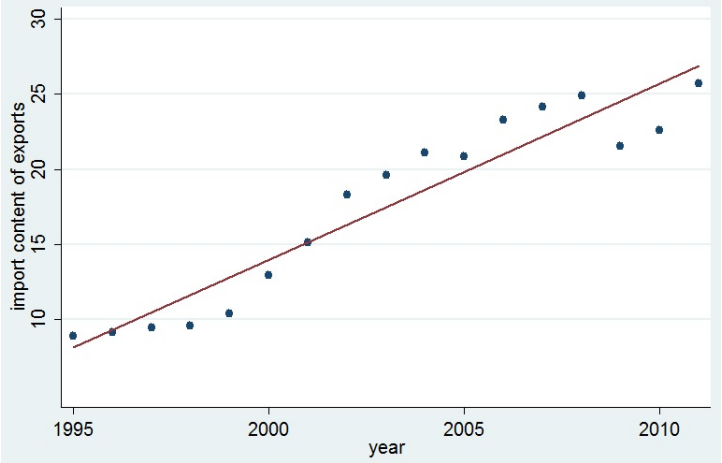


Figure 2: Import Content of Exports

Table 2 shows descriptive statistics for the sample. On average, both importer and exporter firms were more productive and trade values were higher compared to only exporter firms. For both importer and exporter firms, the average value of the imported inputs to total value of trade (import+export) was to 0.26.

Table 2: Descriptive Statistics

Only Exporter	Employment	Log(productivty)	Production Value	Export Value	Log(Volume)	Import/Total Trade
# of Obs	26362	26362	26362	26362	26362	26362
Mean	97.54855	3.85257	15902.2	623.0499	9.494391	0
Sd	105.6412	.7842631	31112.52	2715.773	2.192777	0
p10	30	2.963856	1948.193	16.92349	6.633318	0
p50	57	3.750422	6625.202	100.8672	9.482731	0
p90	207	4.952687	32020.11	1249.576	12.3949	0
Both Exporter and Importer	**Employment**	**Log(productivty)**	**Production Value**	**Export Value**	**Log(Volume)**	**Import/Total Trade**
# of Obs	95518	95518	95518	95518	95518	95518
Mean	481.3631	4.291628	159719.7	2920.451	10.24733	.2548241
Sd	913.4152	.7754051	659712.4	24843.68	2.492224	.1925162
p10	47	3.385518	5809.632	22.77841	7.04316	.0172136
p50	200	4.185881	31854.64	220.3072	10.12093	.2295749
p90	1150	5.383222	253062	3814.96	13.53922	.543382

Note: Production and Trade Values are in Thousands. All of the monetary values are in terms of 2007 values. Importer refers to the firms which imported intermediate inputs in .

3 Estimation Methodology and Results

We now turn to the empirical estimation of the relationship between the export supply decision and exchange rate movements. We estimate the following specification for the firm-

destination-year level data:

$$\begin{aligned}\ln(\text{Volume})_{i,j,t} = \alpha_0 + \alpha_1 \ln(\text{RER})_{j,t} + \alpha_2 \ln(\varphi)_{i,t} + \alpha_3 \ln(\text{RER})_{i,t} * \ln(\varphi)_{i,t} \\ + \alpha_4 \theta_{i,t} + \alpha_5 \ln(\text{RER})_{i,t} * \theta_{i,t} + \mu_t + \epsilon_{i,j,t}\end{aligned} \tag{1}$$

where $\ln(\text{Volume})_{i,j,t}$ denotes the logarithm of volume [6] exported by firm i to destination j at period t, $\ln(\text{RER})_{j,t}$ is the bilateral real exchange rate between Turkey and destination country j at period t [7], $\ln(\varphi)_{i,t}$ is the productivity of a firm i at period t defined as the hourly production value of a firm, $\theta_{i,t}$ is the id-year specific variable indicating import share of firm in total trade value for a given year and μ_t denotes year dummies. Lastly, we introduce sector-destination fixed effects to control for the time-invariant sector (or destination) characteristics that may have an effect on export supply of firms such as trade costs or trade habits that may have strengthening or weakening impact on the sector-destination specific relations.

Conventionally, the expected sign of α_1 is positive. Since depreciation in the value of the domestic currency makes exports of the home country cheaper yielding a higher demand. Exporting firms react to the increased demand by boosting their export volume.

In our estimations, we controlled for the sector-destination fixed effects. We included firm productivity ($\log(\varphi)$), import share variable indicating the weight of imports in total trade values (θ), bilateral real exchange between Turkey and destination country ($\ln(\text{RER})$) and its interactions as covariates.

Table 3 reports our baseline results. Coefficient of the real exchange rate variable was positive in all specifications. Column (i)suggested that a 1% depreciation increased export volume by 0.3% on average and this coefficient was significant at the 1% level. In columns (ii) and (iii), it is observed that export volume increases with firm productivity. The positive coefficient on the interaction variable (exchange rate and firm productivity) implies that export volume responds more to the real exchange rate in firms with higher productivity.

[6] Export volume is expressed in kilograms

[7] Increase in exchange rate means domestic currency depreciation.

Table 3: Baseline Results

	Log(Export Volume)		
	(i)	(ii)	(iii)
log(real GDP)	0.315***	0.620***	0.523***
	(0.103)	(0.0974)	(0.103)
log(real exch.rate)	0.314***		0.277***
	(0.100)		(0.105)
log(productivity)		1.058***	1.068***
		(0.0559)	(0.0568)
log real exch.rate#log(productivity)			0.0215***
			(0.00564)
Constant	8.616***	2.455***	3.114***
	(0.569)	(0.594)	(0.626)
Observations	121,880	121,880	121,880
R-squared	0.261	0.356	0.356
Fixed Effects	Ind.-Dest.& Year	Ind.-Dest.& Year	Ind.-Dest.& Year
Cluster	Ind.-Year	Ind.-Year	Ind.-Year

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 4: Estimation Results with Imports/Total Trade

	Log(Export Volume)		
	(i)	(ii)	(iii)
log(real GDP)	0.526***	0.529***	0.528***
	(0.103)	(0.103)	(0.103)
log(real exch.rate)	0.276***	0.277***	0.279***
	(0.105)	(0.105)	(0.105)
log(productivity)	1.053***	1.055***	1.068***
	(0.0559)	(0.0559)	(0.0568)
log(real exch.rate) #log(productivity)	0.0214***	0.0246***	0.0264***
	(0.00559)	(0.00573)	(0.00588)
import/total trade	0.264***	0.235***	
	(0.0862)	(0.0859)	
log real exr #import/total trade		-0.0600***	-0.0938***
		(0.0215)	(0.0244)
Constant	3.102***	3.087***	3.088***
	(0.624)	(0.624)	(0.626)
Observations	121,880	121,880	121,880
R-squared	0.356	0.356	0.356
Fixed Effects	Ind.-Dest.& Year	Ind.-Dest.& Year	Ind.-Dest.& Year
Cluster	Ind.-Year	Ind.-Year	Ind.-Year

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Column (i) of Table 4, presents estimation results including only the level of the import share variable. We observe that firms with a higher share of imported intermediate goods in the their total trade activity tend to import more compared to firms with relatively low import shares, and the effect vanishes for non-importing firms. This finding is consistent with the observation that import content of exports in Turkey exhibit an upward trend. The reliance of exporting firms on imported intermediate inputs increased in the last decade as depicted in Figure 2. The coefficients of the other covariates remain consistent with the baseline specification. Our aim is to examine the effect of a currency depreciation on the export volume react to the import share variable. To do that, in Column (ii) we include an interaction variable - real exchange rate and import share - along with the level of the

import share at the firm level. We observed a negative coefficient on the interaction term implying that exchange rate depreciation reduced export volume for the firms with higher import shares. This effect can be explained by the bi-directional relationship between the exchange rate and exports due to import dependency. While depreciation increases export potential, higher production costs associated with imported inputs have an intermediate impact affecting firms unfavorably. This is why we observed an adverse effect of importation on export volumes in the depreciation periods. That is, for exporting firms relying relatively more on imported inputs, the effect of real exchange rate depreciation on the export volume may be smaller. Firms importing intermediate inputs increase their volumes less than firms which do not participate in importing activities. In column (ii), the level effect of real exchange rate suggest that 10% depreciation increases export supply by 2.8% on average. Also, a firm will decrease its export volume by 0.6% if it increases the share of imports in total trade by 10% percentage. Column(iii) presents results by only including the interaction variable.

Following Berman et al. (2012), , we estimate our model using lagged values of the productivity variable. Results are presented in Table 5. We observe that our results are robust with respect to the alternative specification using lagged productivity levels.[8]

[8] Note that since we use lag productivities, the total number of observations are reduced.

Table 5: Baseline Results with Imports/Total Trade with Lag Productivities

	Log(Export Volume)		
	(i)	(ii)	(iii)
log(real GDP)	0.681***	0.684***	0.685***
	(0.113)	(0.113)	(0.113)
log(real exch.rate)	0.323**	0.321**	0.321**
	(0.140)	(0.140)	(0.140)
lag of log(productivity)	1.027***	1.029***	1.041***
	(0.0593)	(0.0593)	(0.0602)
log(real exch.rate)#lag of log(productivity)	0.0208***	0.0238***	0.0255***
	(0.00635)	(0.00648)	(0.00665)
import/total trade	0.242**	0.216**	
	(0.0940)	(0.0934)	
log(real exch.rate) #import/total trade		-0.0548**	-0.0856***
		(0.0235)	(0.0270)
Constant	2.482***	2.466***	2.454***
	(0.696)	(0.695)	(0.698)
Observations	104,854	104,854	104,854
R-squared	0.353	0.353	0.353
Fixed Effects	Ind.-Dest.& Year	Ind.-Dest.& Year	Ind.-Dest.& Year
Cluster	Ind.-Year	Ind.-Year	Ind.-Year

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

4 Conclusion

In this paper, we investigated the effects of real exchange rate movements on export behavior of Turkish manufacturing firms using a detailed panel of customs data matched with firm characteristics. In our analysis, we use firm-year-destination level dataset with bilateral exchange rates and firm characteristics such as firm productivity and import share - indicating the weight of imported intermediate inputs in the firm's total trade.Our results reveal a positive relation between exchange rate depreciation and export volume in all specifications. Interactions of the firm level variables with the real exchange rate yielded a better understanding of export dynamics of manufacturing firms in Turkey. More productive firms, for

instance, reacted to exchange rate depreciation by increasing export volume more than less productive ones. The import share variable indicated that increasing the value of imported inputs led to a higher export supply. Following a depreciation, however, we observed a negative effect of being an importer on the export volume. This finding is consistent with the bi-directional effect of real exchange rates on exports and the increasing imported input usage of Turkish firms. Depreciation periods, while decreasing labor costs in foreign currency units, increase the imported input costs in terms of domestic currency and affect export supply decision of firms. As a test for robustness, we explored the heterogeneous volume reaction of firms to exchange rate changes by using lag productivities. The results suggested that higher productivity firms increased their export volume more, and firms with higher import shares in total trade increased their export supply less relative to non-importing ones.

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