Real Exchange Rate and Export Behavior: Firm Level Evidence

Anıl Dönmez Refik Erzan Tolga Umut Kuzubaş

Bogaziçi University

Motivation

- Real exchange rate elasticity of exports for Turkey is estimates using bilateral aggregate trade flows ranging from 0.2 to 1.1. (OECD Economic Surveys-2013)
- Asymmetric effects of real exchange rate movements at the firm level
  - Different sectors
  - Exporting to a number of destinations/single destination
  - Imported inputs
  - Different sizes/productivity

This Paper

- Decompose aggregate export supply of Turkey to extensive and intensive margins using firm level data
  - Extensive margin: Changes in export volume due to entry/exit
  - Intensive margin: Changes in the export volume due to existing exporters
- Estimate the effects of real exchange rate movements on these margins
- Determine the components of aggregate elasticity of exports relative to real exchange rates

Theoretical Framework

- Models the micro-decision of export market participation by decomposing it to entry-exit and quantity decisions (Roberts and Tybout (1997), Campa (2004))
- Firms are heterogeneous and in each period choose to supply to the export market given the fixed cost of entry to maximize discounted value of profits
- Conditional on being an exporter firm chooses the export quantity

Theoretical Framework

$$V_{it} = \max_{I_{it}, Q_{it}} E_t \left[\sum_{j=t}^{\infty} \delta^{j-t} R_{ij}(I_{ij}) \right]$$

where the revenue function R_{it} is given by:

$$R_{it}(I_{it}) = I_{it} \left[\pi_{it}(Q_{it}, e_{it}) - F_i(1 - I_{i,t-1}) \right]$$

$$\begin{cases} I_{it} = 0 & \text{if do not export} \\ I_{it} = 1 & \text{if export} \end{cases}$$

Theoretical Framework

I_{it} satisfies:

$$V_{it} = \max_{I_{it}} \left[R_{it}(I_{it}) + \delta E\left[V_{i,t+1} \mid I_{it} \right] \right]$$

Firm chooses to export if:

$$\pi(Q_{it}, e_{it}) + E\left[V_{i,t+1} \mid I_{it} = 1 \right] - E\left[V_{i,t+1} \mid I_{it} = 0 \right] \geqslant F_i - F_i I_{i,t-1}$$

Conditional on $I_{it} = 1$, firm chooses the export quantity

$$\max_{Q_{it}} \pi(Q_{it}, e_{it}) \mid I_{it} = 1)$$

Theoretical Framework

- Firms are heterogeneous, conditional on this heterogeneity characterize the export market participation decision and aggregate
- For a given level of exchange rate, expected export supply is given by:

$$E_t(Q_{it}) = \hat{Q}_{it} Pr(I_{i,t} = 1)$$

- Elasticity of export supply relative to the real exchange rate:

$$\eta_e = \frac{\partial E_t(Q_{it})}{\partial e_{it}} = \frac{\partial \hat{Q}_{it}}{\partial e_{it}} Pr(I_{i,t} = 1) + \hat{Q}_{it} \frac{\partial Pr(I_{i,t} = 1)}{\partial e_{it}}$$

Empirical Methodology

- Reduced form estimation
- Estimate exchange rate elasticity and decompose to intensive and extensive margins
- Estimate the export participation decision using a dynamic probit model
- Conditional on being an exporter, estimate the relationship between real exchange rate and export volume

Data

- Data is taken from Turkish Statistical Institute
- Monthly bilateral trade data and annualy industry data covering the period 2003-2013
- Trade data includes:
  - Firm ID, year and month
  - Amount of import and export in terms of relevant measures (kg, meters etc.)
  - Import and export value in TL, US Dollar and Euro terms
  - Destination country
- Industry data includes:
  - Firm ID and year
  - NACE2 classification of products
  - Firm specific information (number of workers, weekly working hours etc.)
  - Revenue and cost items in TL terms

Data

- Real exchange rate (RER) data is taken from OECD database.
- For exporting firms, individual RER is calculated by multiplying destination country's export share in that firm's overall export value with destination country's RER to get the weighted RER.
- For non-exporting firms, RER is the weighted average of the five largest destination markets (Germany, France, Italy, England and USA)

Firm Distribution

Table 3: Number of Total Firms by Industry and Size 2013 (Number of Employees=x)

Industry	x<100	100≤x<500	x>500
Food	3925	416	68
Beverage	319	18	4
Tobacco	17	9	2
Textile	3136	579	96
Clothing	5641	604	70
Leather	1125	52	4
Wood Products	1152	48	2
Paper Products	837	93	7
Press Printing	1105	34	2
Refined Petroleum	166	4	1
Chemicals	1123	85	8
Medicines	167	37	12
Plastics	2325	246	20
Minerals	2841	368	41
Base Metal	1080	156	36
Fabrication Metal	4463	365	19
Computer-Optic	417	38	3
Electrical Equipment	1606	151	27
Unclassified Machineries	3019	208	24
Motor Land Vehicles	1062	161	53
Other Vehicles	403	31	4
Furniture	2284	162	18
Other Manufacturing	1240	54	3
Machine Setup	1393	47	3

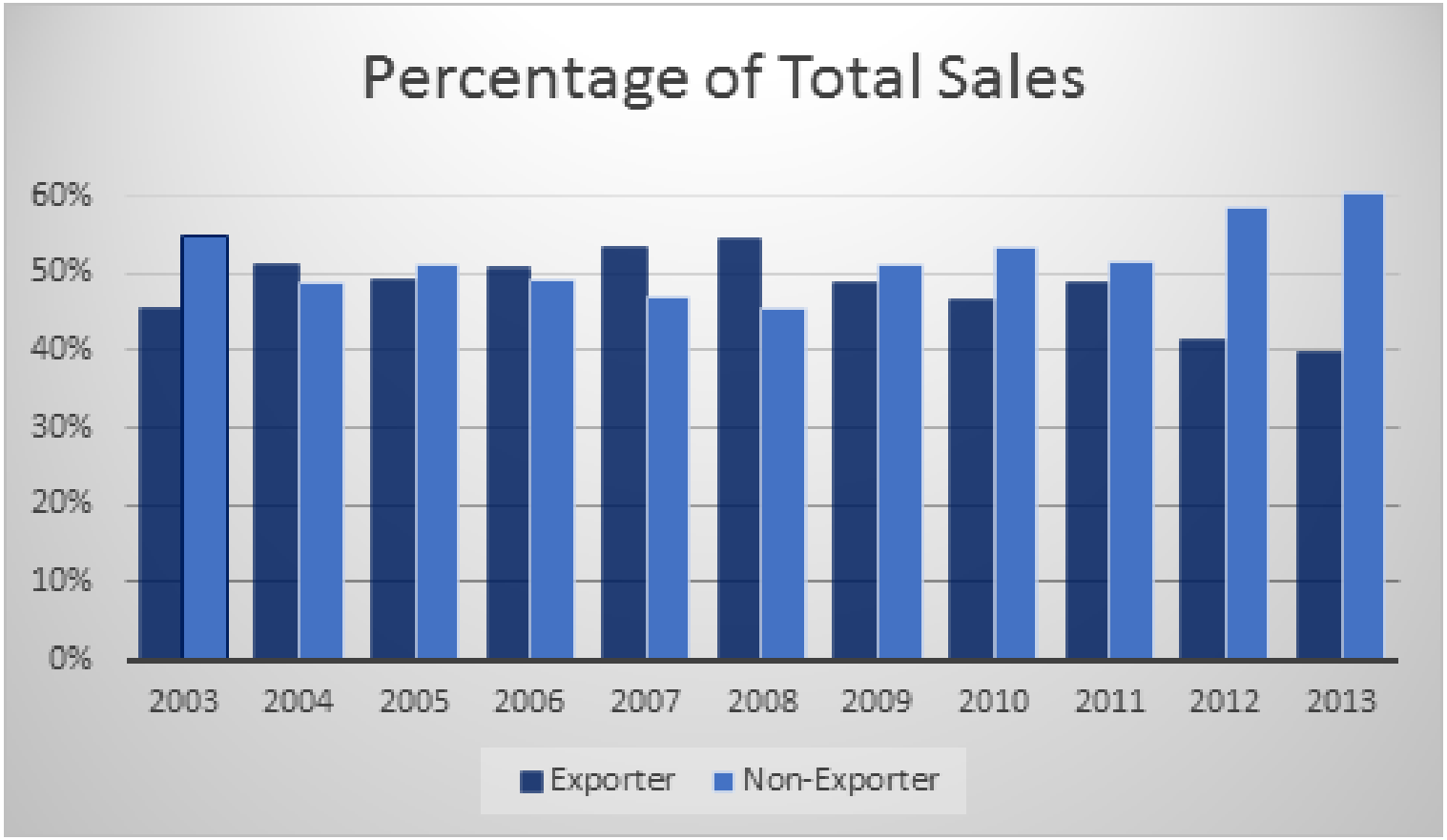
Firm Distribution

Table 4: Number of Exporters by Industry and Size 2013 (Number of Employees=x)

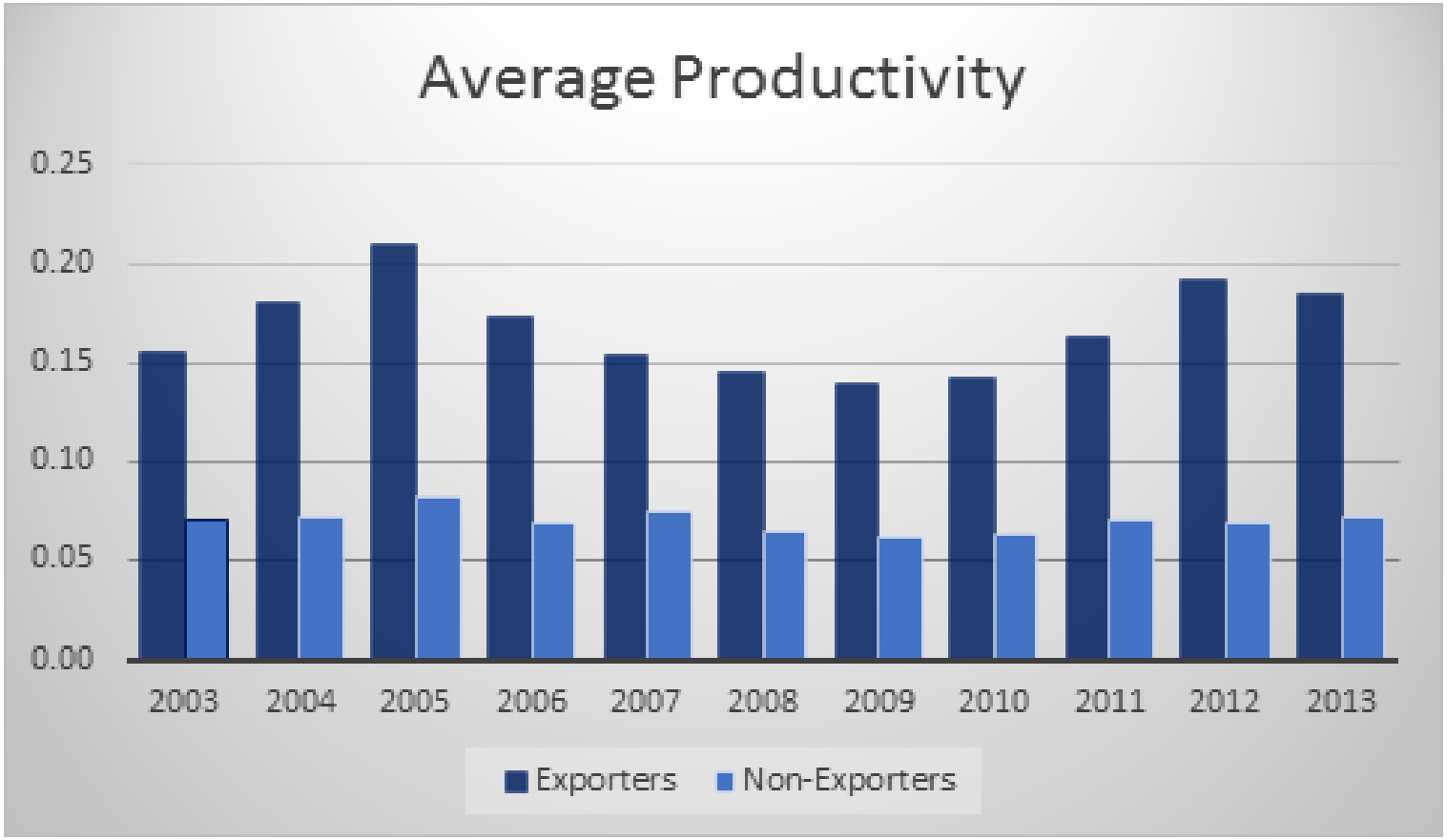
Industry	x<100	100≤x<500	x>500
Food	46	54	14
Beverage	1	0	0
Tobacco	0	7	2
Textile	19	31	34
Clothing	58	93	19
Leather	4	4	2
Wood Products	0	1	1
Paper Products	0	7	3
Press Printing	0	1	0
Refined Petroleum	0	0	1
Chemicals	10	11	4
Medicines	1	2	9
Plastics	6	19	15
Minerals	8	15	10
Base Metal	14	45	22
Fabrication Metal	11	31	10
Computer-Optic	2	1	2
Electrical Equipment	10	27	20
Unclassified Machineries	13	20	17
Motor Land Vehicles	7	18	30
Other Vehicles	2	20	2
Furniture	0	0	1
Other Manufacturing	17	10	1
Machine Setup	1	1	1

Exporting Firms

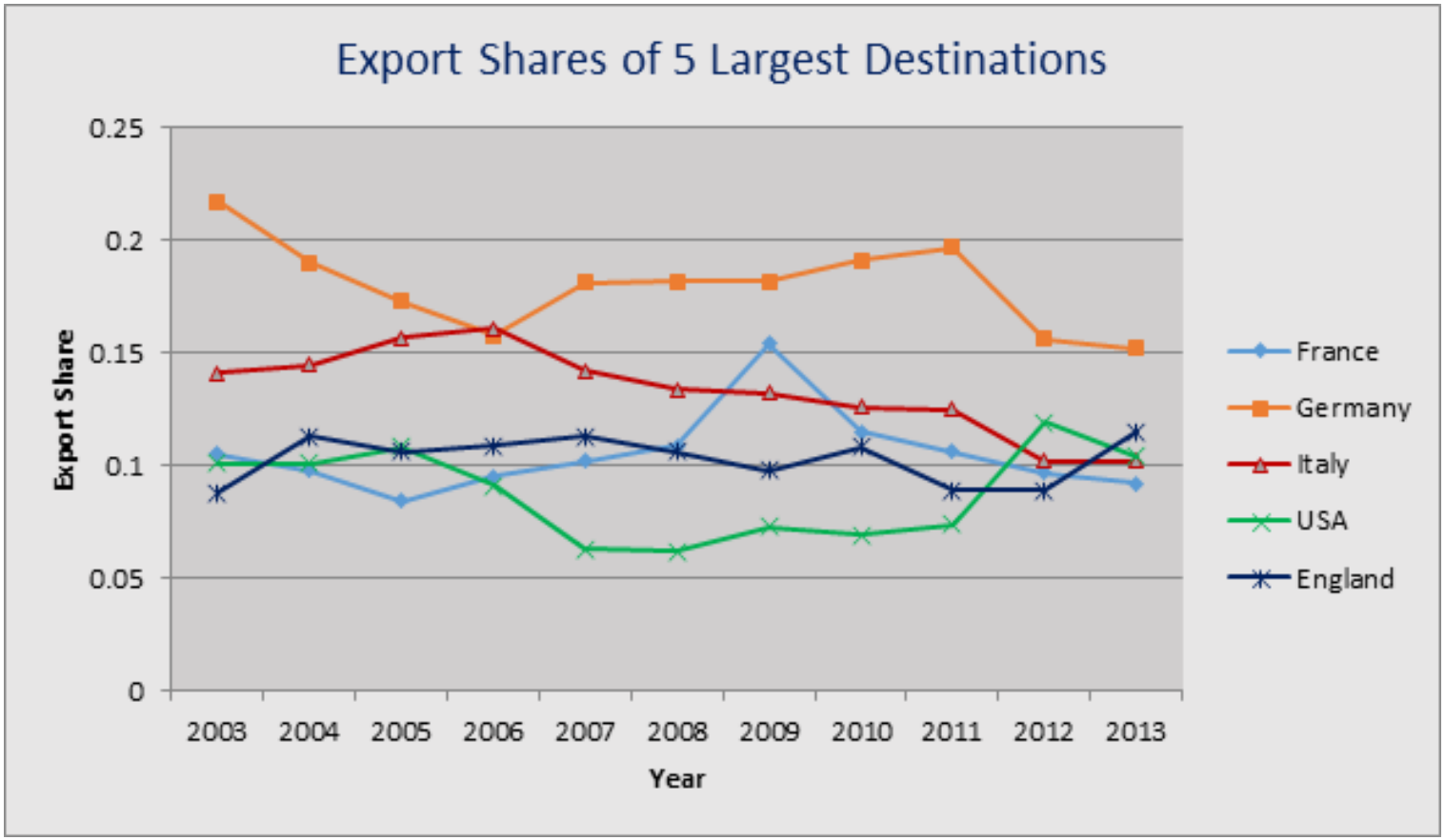
Total Sales: Exporting and Non-Exporting Firms



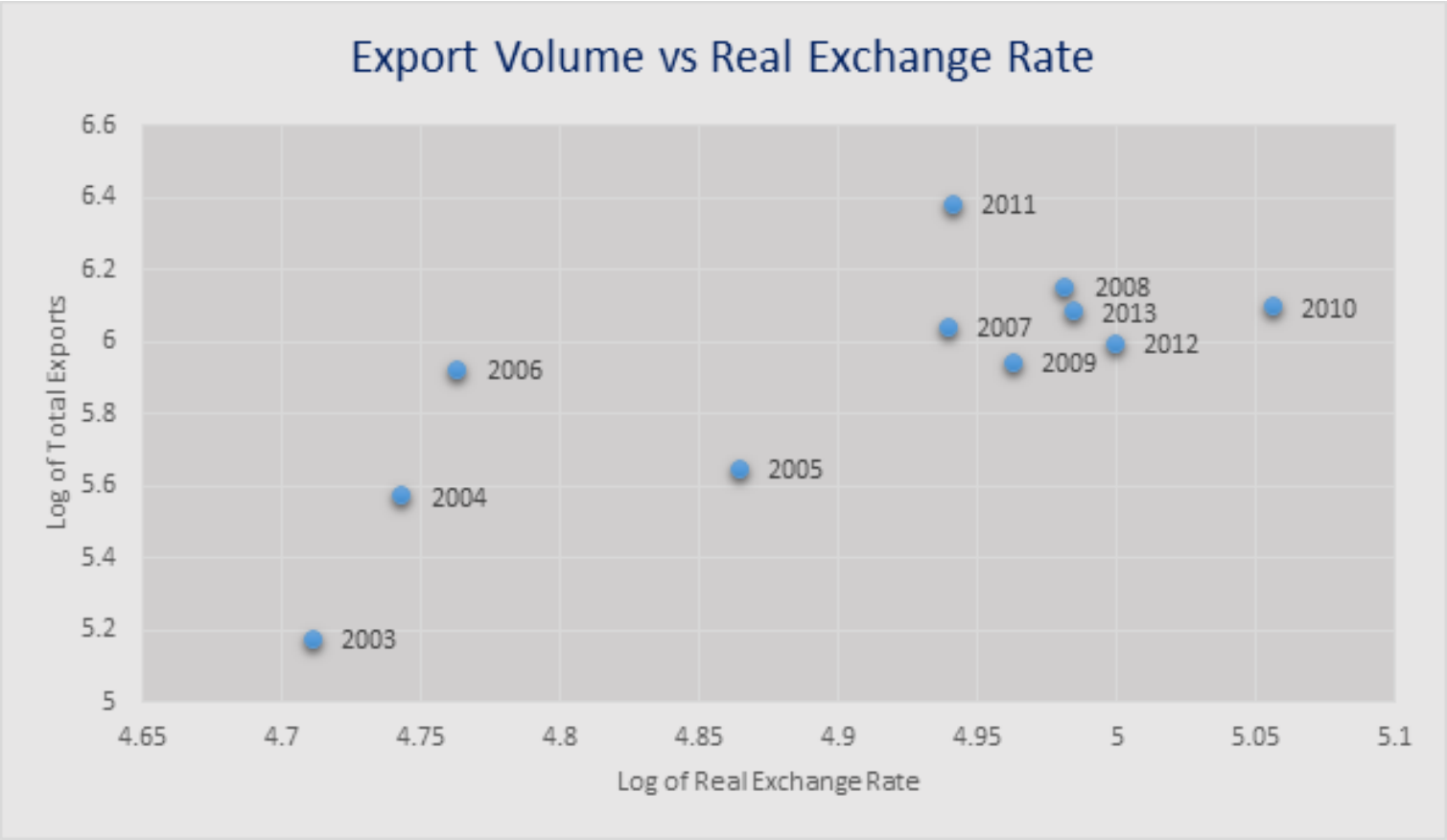
Average Productivity: Exporting and Non-Exporting Firms



Export Shares: Five Largest Destinations



Export Volume and Real Exchange Rate

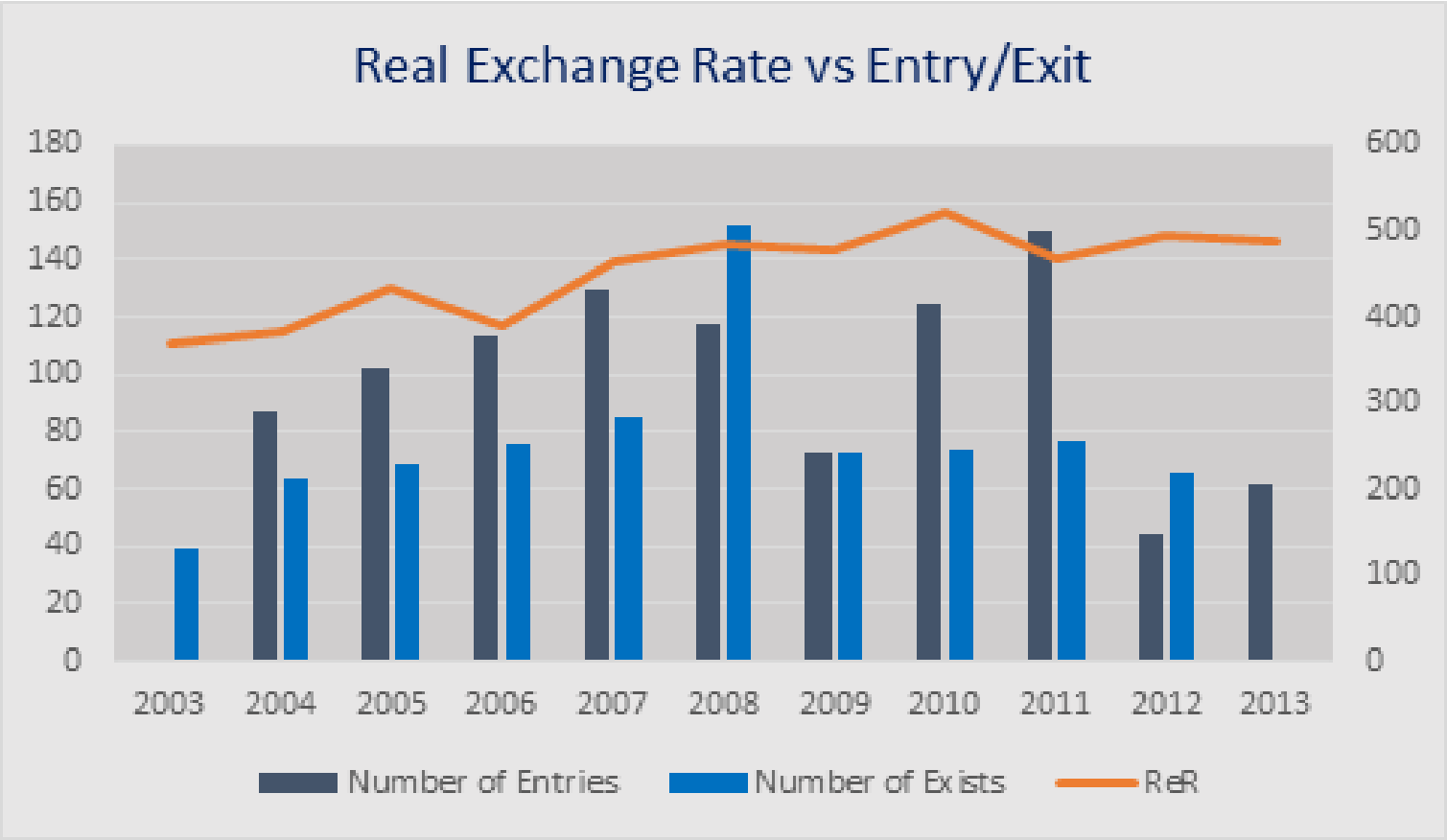


Export Market Participation: Transition Rates

Table 1: Firm Transition Rates in Export Market

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Exporter											
export	-	0.847	0.791	0.799	0.805	0.808	0.680	0.815	0.834	0.711	0.747
no export	-	0.153	0.209	0.201	0.195	0.192	0.320	0.285	0.166	0.289	0.253
Non-Exporter											
export	-	0.019	0.019	0.019	0.021	0.021	0.008	0.013	0.016	0.004	0.005
no export	-	0.981	0.981	0.981	0.979	0.979	0.992	0.987	0.984	0.996	0.995

Real Exchange Rate and Entry/Exit



Estimation

- Estimate a dynamic probit panel model for participation using Wooldridge(2002) or Heckman(1981) approaches to correct for the endogeneity of initial conditions
- Compute inverse Mills ratios for each time period
- Estimate export volume equation including inverse Mills ratios to correct for selection using pooled or panel regressions

Table 2: Export Volume Regressions

Variables	Pooled	Panel FE
Real Exchange Rate	0.8229***	0.6931***
	(0.1231)	(0.1435)
Productivity	0.5704***	0.4843***
	(0.0487)	(0.0409)
Destination and year fixed effects are included		
R-squared	0.19	0.22
Observations	12298	12298

Table 3: Estimates of Export Market Participation

Variables	Pooled Probit	Dynamic Probit
Lag of export status	3.5877***	2.7952***
	(0.0375)	(0.0443)
Initial export status	0.9877***	3.3604***
	(0.0526)	(0.1079)
Real Exchange Rate	-9.0642***	-11.1346***
	(0.4118)	(0.2502)
Lag of Real Exchange Rate	4.575***	2.6799***
Destination and year fixed effects are included		
R-Squared	0.12	0.09
Observations	172948	172948

Table 4: Marginal Effects

Variables	Pooled Probit	Dynamic Probit
Real Exchange Rate	-0.16	-0.09
Lag of Real Exchange Rate	0.17	0.03

Conclusions and Future Work

- The effect of real exchange rate movements on the export volume through entry/exit is relatively small (need robustness checks)
- Destination specific effects/the effect of diversification/exchange rate volatility
- The effect of imported inputs and relaxation of financial constraints/international borrowing