

# Exchange Rate, Quality, and Export Prices

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December 2014

- **Introduction**
- Data description
- Estimating response of export price to exchange rates
- Quality and response of export price to exchange rates
- Further discussions

- How prices respond to exchange rate movements is a classic topic in international economics.
- important to understand the price differences across countries.
- central to assess the impact of exchange rates on real economic variables e.g. trade balance, unemployment
- A vast literature on exchange rate pass-through.

- Two reasons why exchange rate passthrough merits further investigation
1. There is still limited evidence on how the price of individual firms respond heterogeneously to exchange rates.
    - ① Recent trade and macro models with heterogeneous firms show that the price response to shocks could be different across firms.
    - ② This heterogeneous response at firm level could have substantial impact on passthrough at an aggregate level.
  2. which sources of firm heterogeneity matter for the response is still underexplored.
    - ① In particular, there is only limited evidence on how price responses to exchange rates depend on product quality.

# Introduction

- We Investigate how export prices of firms respond to exchange rate shocks using micro-level data covering the universe of Chinese exporters during 2000-2006.
  - The highly disaggregate nature of the data allows us to estimate the impacts of exchange rate changes at firm-product-country level.
  - We find several facts:
1. responses of export prices(denominated in RMB) to exchange rate shocks are low
    - ① A 10% depreciation of the RMB is associated with a 0.6% increase in export price.
  2. the elasticity increases with the income level of the destination country.
    - ① A 10% depreciation leads to 1% increase in export price for exports to high income countries.
    - ② no significant impacts on export prices to low income countries.

- What explains these facts?
- A possible explanation is quality
- If the prices of low quality goods respond less to exchange rates:
- the average response of export prices to exchange rates is low in China because China mainly exports low quality products
- price response to exchange rates are larger for exports to high-income countries because products exported to high-income countries are associated with higher quality.

- We empirically investigate the impact of quality on exchange rate pass-through.
- We infer product quality at the firm-product level using information on prices and quantity (Khandewal et al., 2013).
- An increase of product quality by one standard deviation increases the elasticity of export prices to exchange rates by 2.51%.
- This conclusion is robust to alternative specifications, samples, and measurements of quality
- Quantitatively, the impact of quality is comparable to other firm-level characteristics, such as productivity and import intensity.

- Literature on exchange rate pass-through.
  - earlier work at country level or sectoral level. (Campa and Goldberg, 2005; Gaulier et al. 2008)
  - Recent studies at firm-level: Berman et al. (2012); Chatterjee et al. (2013); Amiti et al. (2013)
  - Quality and exchange rate passthrough: Auer and Chaney(2012); Chen and Juvenal(2013)
- Literature on quality and trade
  - quality as an important determinant of international trade flows: Schott(2004), Hallak (2006), Fielser (2011)
  - quality as an important dimension of firm heterogeneity: Manova and Zhang(2012); Crozet et al.(2012); Kugler and Verhoogen(2012)



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- Main data set: Transaction trade data from General Administration of China Customs.
  - Covers the universe of exporters and importers in China during 2000-2006.
  - Detailed information on export\import value and quantity, by product(HS8), country of destination/origin, trade mode, unit, etc.
  - We work at HS6 level in order to have a consistent product classification over time.
- Supplement data: Annual Survey of Industrial Firms, 2000-2006.
  - Covers all State Owned Enterprises and non-SOE that are 'above scale'.
  - Balance sheet information: output, wages, material costs etc.
  - Only used for robustness checks to control for marginal cost shocks.

# Data Description

	Obs	Mean	Std Dev	Min	Max
<b>A. Based on Cumstom Data</b>					
# products (HS6)	6,620,810	80	121.57	1	678
# Destination Countries	6,620,810	13	13.86	1	68
$\Delta \ln NER_{ct}$	6,620,810	0.01	0.06	-0.17	0.18
$\Delta \ln p_{fpct}$	6,620,810	0.02	0.59	-2.04	2.12
<b>B. Based on Annual Industrial Survey of Manufacturing Firms</b>					
TFP	2,331,611	4.95	1.04	2.34	7.67
Intermediate Import Ratio	2,716,886	0.03	0.09	0	0.57
$\Delta \ln(\text{Wage})$	2,711,261	2.71	0.6	1.14	4.57
(log change of) import price	1,956,778	0.01	0.05	-0.16	0.23

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$$\Delta \ln p_{fpct} = \alpha + \beta \Delta \ln NER_{ct} + \mu_{pc} + \varphi_t + \varepsilon_{fpct} \quad (1)$$

- $f$ : firm;  $p$ : product (HS6);  $c$ : country;  $t$ : year
- $\Delta \ln p_{fpct}$  : log change of export unit value(in RMB)
- $\Delta \ln NER_{ct}$ : log change of nominal exchange rate (an increase in  $NER_{ct}$  implies an depreciation of the RMB).
- $\mu_{pc}$ : product-country fixed effects
- $\varphi_t$  : year effects
- $\varepsilon_{fpct}$  : error term

# Benchmark results

	(1)	(2)	(3)	(4)	(5)
$\Delta \ln p_{fpct}$	Whole	Whole	High Inc	Middle Inc	Low Inc
$\Delta \ln NER_{ct}$	0.064***	0.071***	0.102***	0.018**	0.013
	(12.31)	(7.94)	(14.24)	(1.97)	(0.51)
Fixed effects					
$\mu_{pc}$	Y	N	Y	Y	Y
$\mu_{fpc}$	N	Y	N	N	N
Year	Y	Y	Y	Y	Y
R2	0.028	0.534	0.016	0.06	0.096
#Obs	6,620,810	6,620,810	4,921,105	1,330,424	369,281

# Summary of the results

- Export price response to exchange rates is low.
  - Berman et al. (2012), 0.13 for French exporters.
  - Amiti et al.(2013), 0.2 for Belgium exporters.
- Response is larger for exports to high-income countries.
  - Consistent with Frankel et al.(2012).

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# Why do quality matter: theoretical background

- Recent theoretical development have proposed several mechanisms linking quality and exchange rate pass-through.
- models with heterogeneous markups: Berman et al. (2012); Auer and Chaney (2014)
- Distribution costs: Chen and Juvenal(2013)

$$\Delta \ln p_{fpct} = \alpha + \beta \Delta \ln NER_{ct} + \gamma \Delta \ln NER_{ct} \times Q_{fpc} + \delta Z_{ft} + \mu_{pc} + \varphi_t + \varepsilon_{fpct} \quad (1)$$

- $\Delta \ln p_{fpct}$  : log change of export price(in RMB)
- $\Delta \ln NER_{ct}$ : log change of nominal exchange rate.
- $Q_{fpc}$  :measures of quality
- $Z_{ft}$  : firm-level control variables(discussed later)
- $\mu_{pc}$ : product-country fixed effects
- $\varphi_t$  : year effects
- $\varepsilon_{fpct}$  : error term

# Estimation of quality

- Quality is generally unobservable and needs to be inferred from data.
- We infer quality at firm-product level following the methodology in Khandelwal et al.(2013).

$$\ln x_{fhct} = \sigma \ln p_{fhct} + \phi_h + \phi_{ct} + \varepsilon_{fhct} \quad (2)$$

- $\ln x_{fhct}$ : log export quantity
- $\ln p_{fhct}$ : log export price
- $\phi_h$ : HS6 product fixed effects
- $\phi_{ct}$  : country-year fixed effects
- $\varepsilon_{fhct}$  : error term

# Estimation of quality

- Impute some value of  $\sigma$  and estimate Equation (2) by OLS and take residuals:  $\hat{\varepsilon}_{fhct}$
- $\hat{\varepsilon}_{fhct}$  serves as a measure of quality.
- Intuition: conditional on price, varieties with higher sales have higher quality (within the same product category).
- In robustness checks we also use other quality measures.

# Benchmark results

	(1)	(2)	(3)	(4)	(5)
$\Delta \ln p_{fpct}$	$\sigma(\text{median})$	$\sigma(\text{mean})$	$\sigma=10$	50%	75%
$\Delta \ln NER_{ct}$	0.062*** (11.46)	0.062*** (11.65)	0.063*** (12)	0.057*** (7.93)	0.058*** (10.13)
$\Delta \ln NER_{ct} * Q_{fpc}$	0.003** (2.03)	0.003*** (3.65)	0.002*** (2.59)		
$\Delta \ln NER_{ct} * HQ_{fpc}$				0.015* (1.72)	0.026** (2.81)
Fixed effects					
$\mu_{pc}$	Y	Y	Y	Y	Y
Year	Y	Y	Y	Y	Y
R2	0.028	0.028	0.028	0.028	0.028
#Obs	6,573,958	6,573,958	6,573,958	6,573,958	6,573,958

# Benchmark results

- The exchange rate elasticity of export price would increase by 2.51% ( $=0.003*8.35$ ) if quality increases by a standard deviation.
- Firms with low quality increase their price 0.57% to 0.58% following a 10% depreciation. High quality firms have a stronger reaction of 0.7% to 0.9%.

- Additional Controls
- Alternative measures of quality

- Additional Controls
- Control for changes in marginal costs
  - wages
  - price of imported intermediate inputs
- Controlling for these variables requires merging the customs data with the balance sheet data.
  - the merged sample accounts for 35% of total export value in the customs data.



# Robustness Checks

	(1)	(2)	(3)
Depdent Var.: $\Delta \ln p_{fpct}$	Add Wage	Add Import Price	Add Both
$\Delta \ln NER_{ct}$	0	-0.011	-0.009
	(0.03)	(-0.80)	(-0.61)
$\Delta \ln NER_{ct} * \text{Quality}$	0.032***	0.038***	0.031***
	(10.92)	(13.45)	(10.31)
$\Delta \ln(\text{Wage})$	0.004***		0.005***
	(3.16)		(4.27)
$\Delta \ln(\text{import price})$		0.475***	0.480***
		(42.63)	(38.09)
Fixed effects			
$\mu_{pc}$	Y	Y	Y
Year	Y	Y	Y
R2	0.0872	0.0864	0.0933
#Obs	1015885	1017491	899590

- Alternative measures of quality
- Intuition: within the same product, varieties with higher price have higher quality.
- Auer and Chaney (2009)

$$Q_{fpct} = \frac{p_{fpct} - \bar{p}_{pct}}{sd(p_{fpct})}$$

- Manova and Zhang (2012)

$$Q_{fpct} = \ln p_{fpct} - \ln \bar{p}_{pct}$$

# Robustness Checks

Dependent Var.: $\Delta \ln p_{fpct}$	(1) Quality:A&C	(2) Quality:Manova
$\Delta \ln NER_{ct}$	0.066*** (12.55)	0.075*** (12.93)
$\Delta \ln NER_{ct} * \text{Quality}$	0.066*** (12.55)	0.075*** (12.93)
Fixed effects		
$\mu_{pc}$	Y	Y
Year	Y	Y
R2	0.028	0.028
#Obs	6620786	6620810

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- The role of scope for quality differentiation
- Since quality is not directly observable, one may argue that our estimated quality might reflect something other than quality.
- To address this, we exploit the variation across products in terms of the scope for quality differentiation.
- We use the Rauch(1999) classification: differentiated v.s. homogeneous.
- If quality is at work, we expect the coefficient before the interaction term to be larger for products with higher scope for quality differentiation.

# Robustness Checks

Dependent Var.: $\Delta \ln p_{fpct}$	(1) Homogeneous	(2) Differentiated
$\Delta \ln NER_{ct}$	0.048*** (3.24)	0.040*** (6.45)
$\Delta \ln NER_{ct} * \text{Quality}$	-0.007 (-1.23)	0.040*** (6.45)
Fixed effects		
$\mu_{pc}$	Y	Y
Year	Y	Y
R2	0.0614	0.0256
#Obs	568616	5139309

- Quantative implications
- How import is quality compared with other determinants of passthrough?
- Berman et al.(2012) argues that higher productivity firms have lower passthrough.
- Amiti et al.(2014) argues that firms with higher import intensity have lower passthrough.
- Is quality still important after controlling for these channels?

# Further Discussion

Dependent Var.: $\Delta \ln p_{fpct}$	(1) Add TFP	(2) Add Import Ratio	(3) Add Both
$\Delta \ln NER_{ct}$	-0.014 (-1.11)	0.071 (1.58)	0.047 (1.04)
$\Delta \ln NER_{ct} * \text{Quality}$	0.038*** (14.26)	0.035*** (12.4)	0.034*** (12.01)
$\Delta \ln NER_{ct} * \text{TFP}$		-0.014 (-1.59)	-0.012 (-1.28)
$\Delta \ln NER_{ct} * \text{Import Ratio}$	0.395*** (4.49)		0.405*** (4.36)
Fixed effects			
Country-Product	Y	Y	Y
Year	Y	Y	Y
R2	0.0789	0.0873	0.0873
Observations	1227977	1055361	1055361



# Conclusion

- Estimate responses of export prices to exchange rates using firm-product level data for China during 2000-2006.
- A low response of export prices to exchange rates.
- Higher response for exports to high-income countries.
- Exchange rate elasticity of export prices increases with constructed measures of quality.
- The low response of export prices to exchange rates in China might be explained by the low quality of Chinese products.