Export Prices across Firms and Destinations

The Quarterly Journal of Economics 127 (2012) 127, p.379–436.

Kalina Manova
University of Oxford, NBER and CEPR

Zhiwei Zhang
Nomura Asset Management

Links: Kalina Manova's webpage and research portfolio, this paper, and these slides

Motivation

- Firm heterogeneity is an important feature of international trade patterns
  - More productive firms are more likely to export, have higher export revenues, and enter more markets

    (Clerides, Lach & Tybout 1998; Aw, Chung & Roberts 2000; Bernard, Jensen, Redding & Schott 2007; Bernard, Jensen & Schott 2009)
  - Trade is highly concentrated in a few multi-product firms which transact with many countries

    (Eaton, Kortum & Kramarz 2004, 2008; Bernard, Redding & Schott 2009a,b,c; Bernard, Jensen & Schott 2009; Arkolakis & Mündler 2009; Manova & Zhang 2008)

- These patterns are consistent with efficiency sorting models
  - More productive firms perform better because they have lower marginal costs and charge lower prices
  - Melitz (2003), BEJK (2003), Melitz & Ottaviano (2008)

Motivation

- Growing body of evidence that quality differentiation also matters
  - Larger exporters pay higher wages and are more skill and capital intensive (Bernard & Jensen 1995; BJRS 2007; Verhoogen 2008)
  - Exporters charge higher prices than non-exporters, and plant size is positively correlated with input and output prices (Verhoogen 2008; Kugler & Verhoogen 2008; Hallak & Sivadasan 2008; Iacovone & Javorcik 2008)
  - Positive correlation between export prices and the exporter's and importer's GDP per capita (Schott 2004; Hummels & Klenow 2005; Hallak 2006; Mandel 2008)
- These patterns are consistent with quality sorting
  - More successful firms sell higher quality goods at higher prices
  - Baldwin and Harrigan (2007), Johnson (2007), Verhoogen (2008), Kugler and Verhoogen (2008), Hallak and Sivadasan (2008), Kneller and Yu (2008)

Why Do We Care?

- Firm heterogeneity—in either productivity or quality—has implications for aggregate trade outcomes, productivity and welfare
  - Intra-industry reallocations across firms are an important margin of adjustment to trade liberalization (Pavcnik 2002; Bernard, Jensen & Schott 2006)
- Which firms and workers benefit or suffer from globalization depends on the nature of firm heterogeneity
  - Relevant in view of the rise of low-cost giants such as China and India
  - US output and employment in long-quality-ladder industries are less vulnerable to import competition from low-wage countries (Khandelwal 2008)
- Implications for investment and trade policy in developing countries
  - Stimulating investment and innovation in production efficiency vs. product quality
  - Imports liberalization to facilitate access to foreign inputs

This Paper

- Use new proprietary data on the universe of Chinese exporting firms to establish new stylized facts about the variation in free on board export prices across firms and destinations

- Find evidence consistent with quality differentiation across firms and across destinations within firms
  - Better exporters use higher-quality inputs to produce higher-quality goods
  - Firms vary the quality of their products across destinations by using inputs of different quality levels

- Previously unexplored dimension of firm heterogeneity with potential implications for both aggregate welfare and inequality
  - In response to trade liberalization, firms may adjust not only product scope, trade partners and trade volumes, but also product quality across and within destinations

Six Stylized Facts

1. Across firms within a product, firms that charge higher export prices have higher revenues in each destination, bigger worldwide sales and more export destinations
2. Across firms within a product, firms with more destinations offer a wider range of export prices
3. Across destinations within a firm-product, firms earn bigger revenues in countries where they set higher prices
4. Across destinations within a firm-product, firms charge higher f.o.b. prices in richer, larger, bilaterally more distant and overall less remote economies
5. Across firms within an import product, firms paying higher imported-input prices have higher export prices, bigger worldwide sales and more export destinations
6. Across firms within an import product, firms that export more, enter more markets and offer a wider range of export prices pay a wider range of imported-input prices and source inputs from more origin countries

Note: These patterns are stronger for goods with greater scope for quality differentiation

Outline

1. Motivation and introduction
2. Data
3. Stylized facts
4. Theory and alternative explanations
5. Conclusion

The Value of Firm-Level Data

- Prior evidence on the correlation between product-level export prices and destination market size and distance is indicative of quality sorting
  (Baldwin & Harrigan 2007; Johnson 2007)
  - But the behavior of aggregate prices may be inconclusive since certain patterns are consistent with both efficiency and quality sorting
  - Even if aggregate prices behave in a manner consistent with a given model, firm prices might not

- Earlier firm-level evidence is consistent with quality sorting but largely based on average input and output prices
  (Verhoogen 2008; Kugler & Verhoogen 2008; Hallak & Sivadasan 2008)
  - Exception: Crozet, Head and Mayer (2009)
  - No evidence on firm export prices across products and destinations

Chinese Trade Data

- A unique new database on the universe of Chinese trading firms (Manova and Zhang 2008)
  - Firm-level data on exports and imports by product and trade partner
  - 96,522 exporters, 6,908 HS-8 products, 231 destinations
  - Revenues & quantities → unit prices
  - Annual data for 2005
  - Other variables: firm ownership type, firm location, mode of transport
- Note: We exclude 23,073 wholesalers that serve as intermediaries between foreign and domestic firms but do not manufacture

Price Variation in the Data

- Substantial variation in f.o.b. export prices
  - across firms and destinations within a product (average st. dev. 1.11)
  - across exporters in a given destination-product market (average st. dev. 0.90)
  - across destinations within a firm-product pair (average st. dev. 0.46)

	# Obs.	Average	St. Dev.	Min	5th Percentile	95th Percentile	Max
Variation in (log) prices across firms and destinations within HS-8 products							
1. firm-product-destination prices (product F.E.)	2,179,923	0.00	1.24	−12.12	−1.93	2.02	13.65
2. St. dev. of prices across firms and destinations within products (product F.E.)	6,591	1.11	0.65	0.00	0.26	2.33	5.92
Variation in (log) prices across destinations within firm-HS-8 product pairs							
3. St. dev. of prices across destinations within firm-product pairs (firm-product pair F.E.)	303,935	0.46	0.49	0.00	0.01	1.39	9.14
Variation in (log) prices across firms within destination-HS-8 product pairs							
4. St. dev. of prices across firms within destination-product pairs (destination-product pair F.E.)	159,778	0.90	0.74	0.00	0.08	2.30	8.36

Country and Product Data

- Destination country characteristics
  - Market size: GDP (World Bank)
  - Income: GDP per capita (World Bank)
  - Bilateral distance from China (CEPII)
  - Overall remoteness: GDP-weighted average of a country's bilateral distance
  - 6,879 HS-8 products, 179 destinations
- Products' scope for quality differentiation
  - Rauch (1999) dummy for differentiated good
  - R&D intensity (Klingebiel, Kroszner, & Laeven 2007)
  - Advertisement and R&D intensity (Kugler & Venhoogen 2011)

Export Prices and Revenues: Variation Across Firms Within a Product

$$\log(price_{fp}) = \alpha + \beta \cdot \log(revenue_{fp}) + \delta_p + \varepsilon_{fp}, \text{ firm } f, \text{ product } p$$

	Variation across firms within products						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(log) Revenue	0.094***		0.040***	0.097***	0.091***	0.085***	0.067***
	(49.25)		(14.15)	(48.26)	(47.14)	(41.31)	(24.07)
(log) Quantity		−0.165***					
		(− 103.75)					
(log) Revenue x different. good			0.065***				
			(22.83)				
(log) Revenue x R&D intensity				−0.079*			
				(− 1.73)			
(log) Revenue x high R&D intensity					0.008***		
					(4.67)		
(log) Revenue x adv. + R&D intensity						0.362***	
						(8.23)	
(log) Revenue x rich destinations							0.031***
							(11.37)
Product FE	Y	Y	Y	Y	Y	Y	Y
R-squared	0.644	0.671	0.642	0.637	0.637	0.637	0.649
# observations	898,247	898,247	619,357	871,596	871,596	875,097	974,033
# products	6,908	6,908	4,276	6,182	6,182	6,252	6,879
# firm clusters	96,522	96,522	84,464	93,514	93,514	94,005	94,664

Export Prices and Revenues:
Variation Across Firms Within a Destination-Product

$$\log(price_{fpd}) = \alpha + \beta \cdot \log(revenue_{fpd}) + \delta_{pd} + \varepsilon_{fpd}, \text{ destination } d$$

	Variation across firms Within destination-product pairs					
	(1)	(2)	(3)	(4)	(5)	(6)
(log) Revenue	0.081***		0.036***	0.077***	0.065***	0.061***
	(70.07)		(9.36)	(54.61)	(35.32)	(9.72)
(log) Quantity		−0.183***				
		(− 144.72)				
(log) Revenue x different. good			0.054***			
			(12.97)			
(log) Revenue x R&D intensity				0.200***		
				(3.17)		
(log) Revenue x adv. + R&D intensity					0.616***	
					(10.63)	
(log) Revenue x (log) GDP per capita						0.002***
						(3.17)
Destination-product FE	Y	Y	Y	Y	Y	Y
R-squared	0.744	0.773	0.729	0.741	0.741	0.743
# observations	2,179,923	2,179,923	1,494,839	2,130,413	2,139,735	2,098,634
# dest-product pairs	258,056	258,056	163,873	247,867	249,874	242,403

Export Prices & Revenues Across Firms

- Among exporters within a given product or destination-product market, firms selling at a higher price trade fewer quantities but have bigger revenues
  - Consistent with quality sorting models in which higher prices are associated with better quality and superior export performance

- The positive correlation between export price and revenues is stronger in sectors with greater scope for quality differentiation
  - Quality differentiation proxied by dummy for product differentiation (Rauch 1999), sector R&D intensity (Klingebiel, Kroszner and Laeven 2007), or sector combined advertising and R&D intensity (Kugler and Verhoogen 2008)
  - Interactions address concerns with positive or negative bias due to measurement error in export quantities

Export Prices and Number of Destinations: Variation Across Firms Within a Product

$$\log(price_{fp}) = \alpha + \beta \cdot \log(\#destinations_{fp}) + \delta_p + \varepsilon_{fp}$$

			Hom. goods	Diff. goods		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Dep. variable: (log) average f.o.b. export price, by firm and HS-8 product						
(log) # Destinations	0.014***	0.010	0.010	0.022***	0.004	−0.003
	(2.79)	(1.41)	(1.40)	(4.12)	(0.70)	(− 0.46)
(log) # Dest x different. good		0.012				
		(1.50)				
(log) # Dest x R&D intensity					0.428**	
					(2.43)	
(log) # Dest x adv. + R&D intensity						0.577***
						(3.77)
Product FE	Y	Y	Y	Y	Y	Y
R-squared	0.632	0.628	0.647	0.622	0.624	0.624
# observations	898,247	619,357	61,843	557,514	871,596	875,097
# products	6,908	4,276	1,321	2,955	6,182	6,252
# firm clusters	96,522	84,464	23,390	76,793	93,514	94,005

Export Prices and Number of Destinations: Variation Across Firms Within a Product

$$\mathrm{sd}_{fp}\left(\log\left(price_{fpd}\right)\right) = \alpha + \beta \cdot \log\left(\#destinations_{fp}\right) + \delta_p + \varepsilon_{fp}$$

			Hom. goods	Diff. goods		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel B. Dep. variable: st. dev. of (log) f.o.b. export prices across destinations within a firm-HS-8 product pair						
(log) # Destinations	0.004**	0.004	0.004	0.006***	−0.002	0.007**
	(2.12)	(0.90)	(0.88)	(2.65)	(− 0.77)	(2.33)
(log) # Dest x different. good		0.002				
		(0.53)				
(log) # Dest x R&D intensity					0.248***	
					(3.21)	
(log) # Dest x adv. + R&D intensity						−0.112
						(− 1.36)
Product FE	Y	Y	Y	Y	Y	Y
R-squared	0.139	0.137	0.200	0.126	0.135	0.136
# observations	303,935	210,419	18,741	191,678	296,777	298,032
# products	5,852	3,666	1,026	2,640	5,365	5,426
# firm clusters	66,360	54,545	10,560	48,845	64,223	64,616

Export Prices & Number of Destinations Across Firms

- Exporters that supply more countries systematically charge a higher average price and exhibit greater price dispersion across importers
  - both largely driven by products with substantial potential for quality differentiation
- One standard deviation increase in trade-partner intensity (2.11 more destinations) associated with…
  - 1% rise in the average export price
  - 0.5% more dispersion in export prices across markets

Export Prices and Revenues:
Variation Across Destinations Within a Firm-Product

$$\log(price_{fpd}) = \alpha + \beta \cdot \log(revenue_{fpd}) + \delta_{fp} + \varepsilon_{fpd}$$

	Variation across destinations Within firm-product pairs						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(log) Revenue	0.021***		0.020***	0.015***	0.018***	0.017***	0.004***
	(36.34)		(35.77)	(6.52)	(23.79)	(13.92)	(4.29)
(log) Quantity		−0.080***					
		(− 117.98)					
Market share			0.015***				
			(4.53)				
(log) Revenue x different. good				0.008***			
				(3.27)			
(log) Revenue x R&D intensity					0.093***		
					(3.90)		
(log) Revenue x adv. + R&D intensity						0.145***	
						(3.81)	
(log) Revenue x (log) GDP per capita							0.002***
							(21.60)
Firm-product FE	Y	Y	Y	Y	Y	Y	Y
R-squared	0.954	0.957	0.954	0.950	0.953	0.953	0.954
# observations	2,179,923	2,179,923	2,179,923	1,494,839	2,130,413	2,139,735	2,098,634
# dest-product clusters	258,056	258,056	258,056	163,873	247,867	249,874	242,403
# firm-product pairs	898,247	898,247	898,247	619,357	871,596	875,097	869,203

Export Prices and Market Characteristics:
Variation Across Destinations Within a Firm-Product

$$\log(price_{fpd}) = \alpha + \beta \cdot \log(GDPpc_d) + \gamma \cdot \log(GDP_d) + \lambda \cdot \log(distance_d) + \mu \cdot \log(remote_d) + \delta_{fp} + \varepsilon_{fpd}$$

	Variation across destinations Within firm-product pairs					
	(1)	(2)	(3)	(4)	(5)	(6)
(log) GDP per capita	0.021***				0.015***	0.015***
	(27.24)				(14.84)	(15.42)
(log) GDP		0.012***			0.005***	0.008***
		(23.30)			(8.25)	(11.75)
(log) Distance			0.016***		0.012***	0.009***
			(8.40)		(6.01)	(4.52)
(log) Remoteness				−0.062***	−0.027***	−0.021***
				(− 18.75)	(− 8.26)	(−6.60)
Market share						0.067***
						(18.03)
Firm-product FE	Y	Y	Y	Y	Y	Y
R-squared	0.954	0.954	0.954	0.954	0.954	0.954
# observations	2,098,634	2,098,957	2,177,935	2,177,935	2,098,634	2,098,634
# dest-product clusters	242,403	242,649	256,772	256,772	242,403	242,403
# firm-product pairs	869,203	869,297	898,035	898,035	869,203	869,203
# destinations	179	180	210	210	179	179

Export Prices Across Destinations Within Firms

- Firms earn bigger revenues from a given product in markets where they set higher f.o.b. prices
  - Robust to controlling for firms' market share in each country and product
- Firms charge higher f.o.b. prices for the same product in bigger, richer, bilaterally more distant, and overall less remote markets
- Additional results and robustness
  - Results stronger for richer countries
  - Results hold only for products with scope for quality differentiation
  - Results stronger for firms that vary prices more across partners
  - Results robust to different error specifications

Multi-Quality Firms

- If firms vary product quality across destinations, they may do so by using inputs of different quality
  - Ex: a shoe manufacturer can produce two versions of a product: a cheap, low-quality shoe using cheap, low-quality inputs (rubber sole, man-made upper) and an expensive, high-quality shoe using expensive, high-quality inputs (waterproof sole, leather upper)
  - If quality upgrading requires a fixed adoption cost, offering multiple quality versions becomes a complex optimization problem

- In the absence of data on domestic inputs, we study firms' imported-input prices by product and source country
  - Quality sorting across firms: are imported-input prices positively correlated with export prices and export performance?
  - Quality differentiation across destinations within firms: is st. dev. of imported-input prices positively correlated with st. dev. of export prices and # destinations?

Imported-Input Prices and Export Performance: Variation Across Firms Within an Import Product

$$\log(price_{fpo}) = \alpha + \beta \cdot \log(export\ performance_f) + \delta_p + \varepsilon_{fpo}$$

- $price_{fpo}$: price firm f pays for imported input p from origin country o
- $export\ performance_f$: total exports, number of destinations, average export price or standard deviation of export prices across products and destinations

Panel A. Dep. variable: (log) import price, by firm, source country, and HS-8 product				
(log) Total firm exports	0.139***			
	(25.45)			
(log) # Export destinations		0.047***		
		(4.58)		
Average (log) export price			0.459***	
			(44.30)	
St. dev. of (log) export price				0.669***
				(33.05)
Product FE	Y	Y	Y	Y
R-squared	0.603	0.589	0.630	0.599
# observations	724,790	724,790	724,790	587,110
# products	5,351	5,351	5,351	5,142
# firm clusters	37,647	37,647	37,647	27,291

Imported-Input Prices and Export Performance: Variation Across Firms Within an Import Product

$$\mathrm{sd}_{fp}\left(\log\left(price_{fpo}\right)\right) = \alpha + \beta \cdot \log\left(export\ performance_{f}\right) + \delta_{p} + \varepsilon_{fpo}$$

Panel B. Dep. variable: st. dev. of (log) import prices across source countries within a firm and HS-8 product				
(log) Total firm exports	0.042***			
	(24.07)			
(log) # Export destinations		0.051***		
		(17.04)		
Average (log) export price			0.076***	
			(21.39)	
St. dev. of (log) export price				0.147***
				(19.48)
Product FE	Y	Y	Y	Y
R-squared	0.193	0.182	0.191	0.185
# observations	129,059	129,059	129,059	125,828
# products	3,760	3,760	3,760	3,738
# firm clusters	21,248	21,248	21,248	20,027

Imported-Input Prices and Export Performance Across Firms

- Firms paying more for their imported inputs have higher export prices, larger worldwide export revenues, more export destinations, and greater export price variation across destinations

- Firms paying a wider range of imported-input prices have higher export prices, larger worldwide export revenues, more export destinations, and greater export price variation across destinations
  - Results obtained with product fixed effect, which capture the average amount of price dispersion and scope for quality differentiation in each imported input
  - Similar results across all products and source countries within a firm
  - Similar results with number of source countries

Robustness

- Measurement error: results are robust to…
  - excluding outliers
  - using monthly frequency (with month FE)
  - using rankings instead of levels of export price and revenue
  - focusing on textiles and apparel sector, which is likely to suffer less from ME due to quotas under MFA
- Wholesalers vs. retailers
  - Wholesalers' export prices should exhibit similar pattern as producers' as both compete in the same destination-product markets
  - Results hold with full sample that include both manufacturers and wholesalers
- Functional forms for distance
  - Allow the elasticity of export prices with respect to distance to vary nonlinearly

Heterogeneous Firm Models

- Firms can be ranked according to a single attribute, productivity, which uniquely determines their export status, pricing, revenues, and profits
  - Productivity draws fix firms' marginal production cost
  - Typically all firms with productivity above a certain threshold level become exporters and more productive firms perform better
  - Mark-ups depend on demand structure

Note: Theoretical predictions for export prices are for single-product firms in one sector, but carry over to a multi-sector world with multi-product firms

Efficiency Sorting with CES Demand

- Melitz (2003)
- More productive firms have lower marginal costs, offer lower prices, sell higher quantities, and earn bigger revenues
  - With CES, firms charge a constant mark-up over marginal cost and set the same free on board price in all markets
  - Corr(price, revenue) < 0 across firms in a destination
  - Corr(price, revenue) = 0 across destinations within a firm

Efficiency Sorting with Linear Demand

- Melitz & Ottaviano (2008)

- Elasticity of residual demand depends on the toughness of competition
  - Firms charge lower mark-ups and lower f.o.b. prices in bigger, in bilaterally more distant, and in overall less remote destinations where competition is tougher
  - More productive firms have lower marginal costs, offer lower prices, sell higher quantities and earn bigger revenues, although they charge higher mark-ups
  - Corr(price, revenue) < 0 across firms in a destination
  - Corr(price, revenue) < 0 across destinations within a firm

Quality Sorting with CES Demand

- Baldwin & Harrigan (2007), Johnson (2007), Verhoogen (2008), Kugler & Verhoogen (2008), Hallak & Sivadasan (2008)

- Firms differ in both productivity and the quality of their product
  - Quality enters the utility function through a quantity-augmenting term and implications for quality-adjusted firm prices are as in Melitz (2003)

- Usually more productive firms sell higher quality products, but higher quality is associated with a higher marginal cost
  - E.g. Verhoogen (2008): firms actively choose input quality
  - E.g. Johnson (2007): upgrading to higher quality entails a bigger fixed cost
  - If quality increases in productivity sufficiently quickly, so will marginal costs and absolute prices
  - Otherwise, all predictions of the model would be as in Melitz (2003)

Quality Sorting with CES Demand

- More productive firms offer higher quality at higher prices, sell fewer quantities and earn bigger revenues
  - With CES, firms still set the same f.o.b. price in all markets
  - Corr(price, revenue) > 0 across firms in a destination
  - Corr(price, revenue) = 0 across destinations within a firm

Quality Sorting with Linear Demand

- Kneller and Yu (2008), Antoniades (2008)
- Firms differ in both productivity and the quality of their product
  - Implications for quality-adjusted firm prices as in Melitz & Ottaviano (2008)
  - Firms charge lower mark-ups and lower f.o.b. prices in bigger, in bilaterally more distant, and in overall less remote destinations where competition is tougher
  - Higher-quality firms charge higher prices because of both higher marginal costs and bigger mark-ups
- If quality increases sufficiently quickly in marginal cost,
  - Corr(price, revenue) > 0 across firms in a destination
  - Corr(price, revenue) < 0 across destinations within a firm
  - Otherwise, all predictions of the model as in Melitz & Ottaviano (2008)

Summary of Theoretical Predictions

		Firm price									
		Across firms in a destination	Across destinations within a firm					Avg. price across destinations			
Nature of firm heterogeneity	Relevant papers	Export revenue	Export revenue	Income	Market size	Distance	Remoteness	Income	Market size	Distance	Remoteness
Efficiency sorting, CES demand	Melitz (2003)	–	0	0	0	0	0	0	+	–	+
Efficiency sorting, linear demand	Melitz and Ottaviano (2008)	–	+/–	+/–	–	–	+	+/–	–	–	+
Quality sorting, CES demand	Baldwin and Harrigan (2011), Johnson (2007), Kugler and Verhoogen (2011), Verhoogen (2008)	+	0	0	0	0	0	0	–	+	–
Quality sorting, linear demand	Kneller and Yu (2008), Antoniades (2008)	+	+/–	+/–	–	–	+	+/–	+/–	+/–	+/–
Data		+	+	+	+	+	–	+	–	+/–	–

Reconciling Theory and Empirics: A Possible Quality Explanation

- Existing models cannot rationalize observed export price patterns in data
  - In extant models, firms sell the same quality product to all trade partners
  - CES: expect no price variation across destinations within a firm
  - Linear demand: expect firms to set lower prices & mark-ups in larger, in bilaterally more distant, and in overall less remote markets where competition is tougher

- Instead, empirical patterns are consistent with firms varying the quality of their products across markets in response to market toughness and consumer demand for quality
  - Firms may both reduce mark-ups and upgrade quality when they face tougher competition
  - Quality-upgrading would increase marginal cost and firms may charge a higher price even if they reduce their mark-up and offer lower quality-adjusted prices
  - Non-homothetic demand preferences can explain why firms might optimally sell higher-quality products at higher prices in richer markets

Alternative Explanation 1

1. Spatial price discrimination (Martin 2009)
   - With CES and per unit transport costs, optimal mark-up increases with distance even without quality differentiation
   - Consistent with firms charging higher prices in distant countries

- This cannot explain:
  - Why firms set higher prices in bigger and richer markets
  - Positive correlation between export price and revenues within a firm across destinations or across firms within a market
  - Why correlation between export price and revenues increases with product scope for quality differentiation
  - Results for import prices

Alternative Explanation 2

2. Shipping the good apples out (Alchian and Allen 1964, Hummels and Skiba 2004)
   - Per unit transport costs raise relative demand for high-quality goods
   - Classical Alchian-Allen model: each firm produces a unique quality level
   - Extended Alchian-Allen: firms export multiple quality versions of an HS-8 product to each market but vary quality mix with destination distance and we observe higher firm prices in distant countries
   - Still quality sorting across firms and quality differentiation across countries within firms, but not in response to market toughness

- This cannot explain:
  - Why firms set higher prices in bigger and richer markets
  - Positive correlation between price and revenues within a firm across markets
  - Why correlation between export price and revenues increases with product scope for quality differentiation

Alternative Explanation 3

3. Firm-specific demand shocks (extended Foster, Haltiwanger and Syverson 2008)
   - Under certain demand conditions, firm-product-destination specific demand shocks can induce a positive correlation between firm export price and revenues within a firm across markets and across firms in a destination

- This cannot explain:
  - Why firms set higher prices in bigger, richer and more distant markets
  - Why correlation between export price and revenues increases with product scope for quality differentiation
  - Positive correlation between import and export prices, and between import prices and export performance
  - Why st. dev. of import price is correlated with export performance

Alternative Explanation 4

4. Firm-specific demand shocks and market power in input markets
   - If exporters have monopsony power, a positive demand shock will increase their demand for inputs and generate a positive correlation between input prices and export prices and between input prices and export revenues
   - If input suppliers have market power, a positive demand shock may reduce exporters' elasticity of output and input demand (Halpern and Koren 2007)

- This cannot explain:
  - Why firms set higher prices in bigger, richer and more distant markets
  - Why correlation between export price and revenues increases with product scope for quality differentiation
  - Why st. dev. of import price is correlated with export performance

Conclusion

- Nature of firm heterogeneity is important for understanding the welfare and inequality effects of trade liberalization or of the rise of China and India

- New stylized facts about firm prices are difficult to reconcile with existing heterogeneous firm models
  - Firms set higher export prices in larger, richer, more distant, less remote markets
  - Higher export prices are associated with greater export revenues across firms within a destination and across destinations within a firm, especially in goods with greater scope for quality differentiation
  - More successful exporters have higher average export and imported-input prices and bigger variation in export and imported-input prices across trade partners

- These patterns are consistent with quality sorting across firms and with firms adjusting both mark-ups and product quality across destinations

Average Export Price at Product Level:
Variation Across Destinations Within a Product

$$\log(price_{pd}) = \alpha + \beta \cdot \log(GDPpc_d) + \gamma \cdot \log(GDP_d) + \lambda \cdot \log(distance_d) + \mu \cdot \log(remote_d) + \delta_p + \varepsilon_{pd}$$

	All destinations	Rich destinations	Poor destinations
	(1)	(2)	(3)
(log) GDP per capita	0.019***	0.053***	−0.006
	(6.60)	(12.07)	(−0.76)
(log) GDP	−0.005**	−0.003	−0.025***
	(−2.02)	(−1.10)	(−6.40)
(log) Distance	−0.027***	0.021***	−0.108***
	(−5.62)	(3.91)	(−11.79)
(log) Remoteness	−0.148***	−0.134***	−0.106***
	(−15.48)	(−13.60)	(−4.39)
Product FE	Y	Y	Y
R-squared	0.854	0.855	0.876
# observations	242,403	161,835	80,568
# product clusters	6,879	6,773	5,860
# destinations	179	89	90

- The average f.o.b. export price is higher in smaller, richer, more proximate, and more central markets