Managing Trade: Evidence from China and the US

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Two Literatures with Open Questions

- Trade and productivity
  - Long literature linking export performance to productivity: e.g. Melitz 2003, BEJK 2003, Melitz-Ottaviano 2008, Bernard et al 2007, …
  - Recent focus on product quality: e.g. Verhoogen 2008, Kugler-Verhoogen 2012, Khandelwal 2010, Manova 2012, Johnson 2007, …
- Management and productivity
  - Even older literature on management, productivity and firm performance: e.g. Walker 1887, Taylor 1912, Syversson 2011, …
  - Again, newer literature focusing on quality control: e.g. Deming 1950, Roos et al 1990, Bloom et al 2013, Sutton 2007, …

This Paper

- Examine the role of management practices for export performance to shed light on both open questions
- Exploit unique data on plant-level production, plant-level management practices, and transaction-level trade activity
  - Study world's two largest export economies: China and the US
  - Establish consistent patterns in both countries despite different income levels, institutional quality and market frictions

Key Results

- Better managed firms are more successful exporters
  - Export probability and revenues
  - Export product range and destinations
- Better managed firms produce higher quality
  - Export product price, quality and quality-adjusted price
  - Imported input price, quality and range
- Management more important for trade than domestic activity

➔ Production complementarity between quality and management

➔ Management an important, directly measured component of productivity

Related Literature

- Firm heterogeneity matters for aggregate productivity, welfare and gains from trade (Hsieh-Klenow 2009, Arkolakis et al 2012, Melitz-Redding 2013)
  - Reallocation across firms and productivity upgrading within firms important in adjustment to trade reforms (Pavcnik 2002, Bernard et al 2006, Bustos 2011)

- Poor managerial practices and poor product quality hinder growth and entrepreneurship in developing countries
  - Role of trade with developed countries that maintain high quality standards
  - Role of imported inputs (e.g. Goldberg et al 2013, Fieler et al 2015…)

- …

Outline

1. Six datasets
2. Empirical results
3. Model

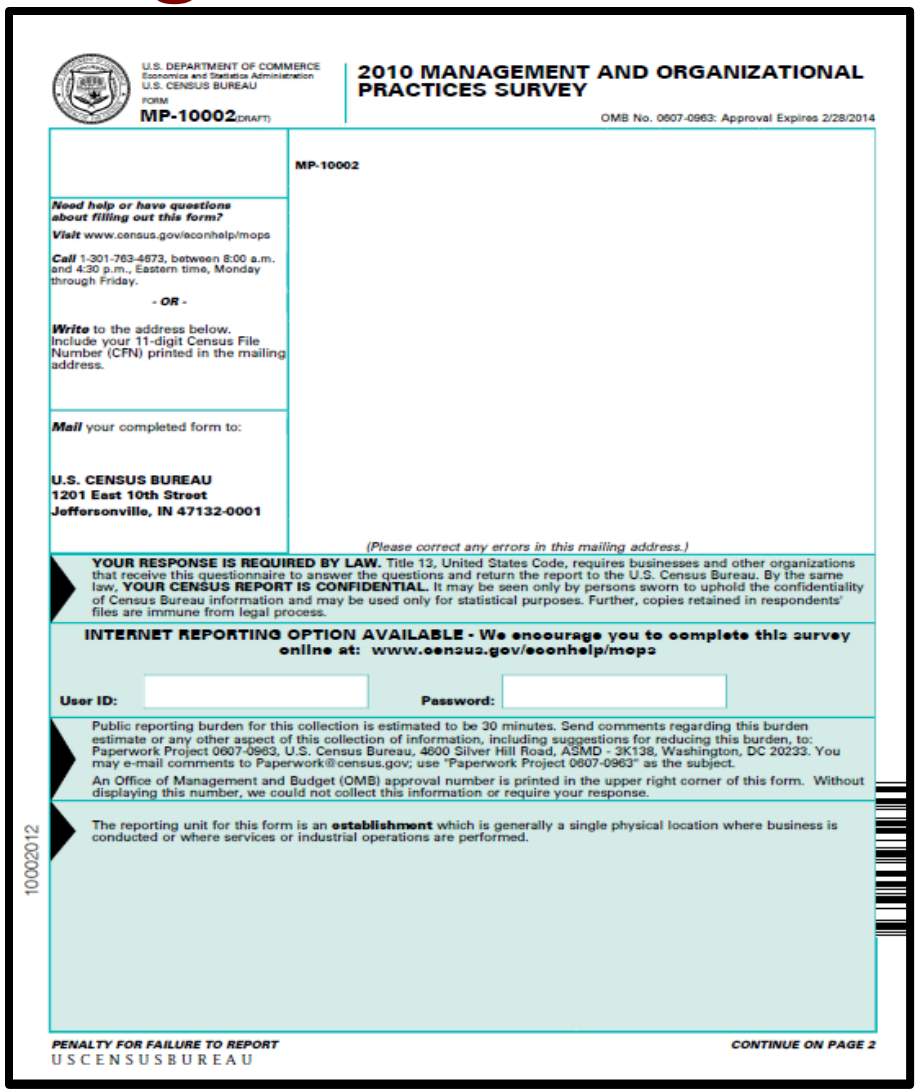
US Data: Production and Trade

- Production: establishment-level data from Annual Survey of Manufacturers
  - ~45,000 plants and >10,000 firms in 2010
  - Shipments, exports, labor, capital, materials, …
- Trade: transaction-level data from Longitudinal Federal Trade Transaction Database
  - ~100 million transactions a year
  - Product, month, source/destination country
  - Revenue, units, quantity

US Data: Management

- Management and Organizational Practices Survey
  - 47,534 manufacturing plants
  - Mandatory, 78% response rate
  - 5.6m employees or >50% of US manufacturing

- 3 types of management practices
  - targets
  - monitoring
  - incentives



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2010 MANAGEMENT AND ORGANIZATIONAL PRACTICES SURVEY

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Targets

- Design, integration and realism of production targets

Example:

8 In 2005 and 2010, who was aware of the production targets at this establishment? *Check one box for each year*

	2005	2010
Only senior managers	☐	☐
Most managers and some production workers	☐	☐
Most managers and most production workers	☐	☐
All managers and most production workers	☐	☐

Monitoring

- Data collection and analysis

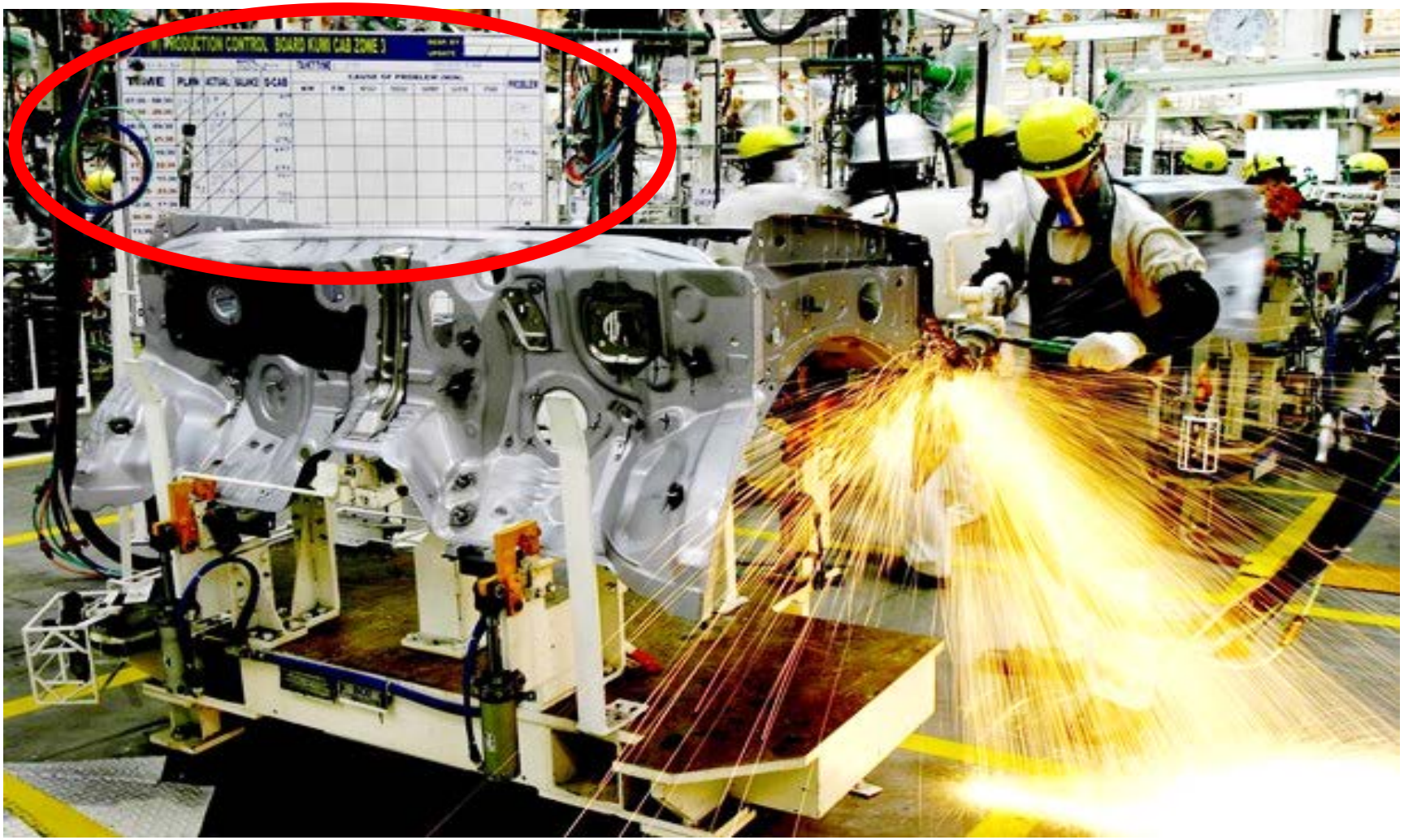
Example:

2 In 2005 and 2010, how many key performance indicators were monitored at this establishment?

Examples: Metrics on production, cost, waste, quality, inventory, energy, absenteeism and deliveries on time.

Check one box for each year	2005	2010
1-2 key performance indicators	☐	☐
3-9 key performance indicators	☐	☐
10 or more key performance indicators	☐	☐
No key performance indicators (If no key performance indicators in both years, SKIP to **6**)	☐	☐

Example of Performance Metrics: Car Plant



Example of No Performance Metrics: Textile Plant

Incentives

- Rewarding high performers and improving low performers

Example:

10 In 2005 and 2010, when production targets were met, what percent of **non-managers** at this establishment received performance bonuses? *Check one box for each year*

	2005	2010
0%	☐	☐
1-33%	☐	☐
34-66%	☐	☐
67-99%	☐	☐
100%	☐	☐
Production targets not met	☐	☐

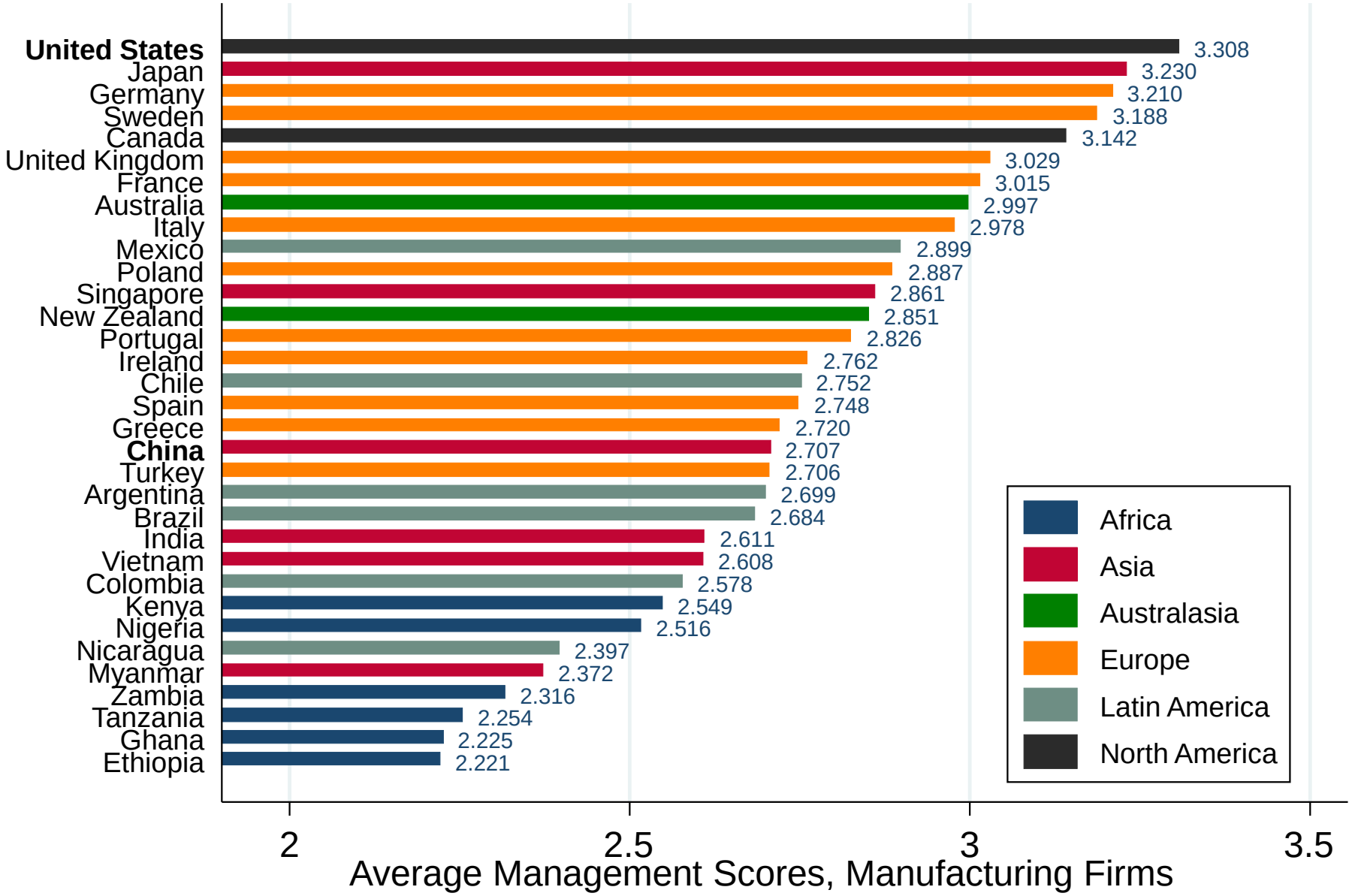
China Data: Production and Trade

- Production: firm-level data from Annual Survey of Industrial Enterprises
  - >200,000 firms, 1999-2007
  - Output, total exports, employment, inputs, ownership, …
- Trade: transaction-level data from Chinese Customs Trade Statistics
  - ~100 million transactions a year
  - Product, month, source/destination country, trade regime
  - Revenue, units, quantity

China Data: Management

- World Management Survey
  - 20,000+ firms, 34 countries since 2004
  - 507 companies in China in 2007

- Survey procedure (Bloom and Van Reenen 2007)
  - 45min double-blind phone interview of plant managers
  - 18 questions on monitoring, targets and incentives


United States 3.308
Japan 3.230
Germany 3.210
Sweden 3.188
Canada 3.142
United Kingdom 3.029
France 3.015
Australia 2.997
Italy 2.978
Mexico 2.899
Poland 2.887
Singapore 2.861
New Zealand 2.851
Portugal 2.826
Ireland 2.762
Chile 2.752
Spain 2.748
Greece 2.720
China 2.707
Turkey 2.706
Argentina 2.699
Brazil 2.684
India 2.611
Vietnam 2.608
Colombia 2.578
Kenya 2.549
Nigeria 2.516
Nicaragua 2.397
Myanmar 2.372
Zambia 2.316
Tanzania 2.254
Ghana 2.225
Ethiopia 2.221
Africa
Asia
Australasia
Europe
Latin America
North America
2
2.5
3
3.5
Average Management Scores, Manufacturing Firms

Summary Statistics

- Unconditional exporter management premium
  - China: 21%
  - US: 146%

	China		US	
	Exporters	Non-exporters	Exporters	Non-exporters
# Observations	1,875	1,358		
Management score	-0.27	-0.34	0.12	-0.26
Log Gross output	11.72	11.55	10.60	9.55
Log Employment	6.46	6.15	4.76	3.96

Outline

1. Six datasets
2. Empirical results
3. Model

Empirical Strategy

- Document the conditional correlation between firms' managerial practices and trade performance

$$Trade_{ft} = \alpha + \beta \cdot Management_{f} + \delta' \cdot Z_{ft} + \varphi_{p} + \varphi_{i} + \varphi_{t} + \varepsilon_{ft}$$

  - $Trade_{ft}$: various export and import outcomes
  - $Management_{f}$: management z-score
  - φ_p, φ_i, φ_t : 31 province FE, 82 SIC-3 industry FE, year FE (China)
  - φ_p, φ_i : 50 state FE, NAICS-6 industry FE (US)
  - Z_{ft} : firm ownership, productivity, size, skill and capital intensity, age, "noise" in management score
  - ε_{ft} : errors clustered by firm (China) or robust (US)

Export Activity

	China				US			
Dep Variable:	Exporter Dummy		Log Exports		Exporter Dummy		Log Exports	
Management Score	0.096**	0.116***	0.638**	0.566*	0.042***	0.032***	0.481***	0.404***
	(2.30)	(2.75)	(2.14)	(1.81)	(13.96)	(10.71)	(21.38)	(18.11)
Capital Intensity		-0.01		0.145				
		(-0.76)		(1.43)				
Skill Intensity		-0.609***		-4.231***		0.032***		0.230***
		(-3.10)		(-2.64)		(9.34)		(8.07)
Log Wage		0.041*		0.401**		0.119***		1.071***
		(1.82)		(2.17)		(11.20)		(13.96)
Age		0.03		0.153		0.057***		0.562***
		(1.53)		(1.01)		(15.82)		(19.09)
	Own, Prov, Ind, Year FE; Noise Controls				State, Ind FE; Noise Controls			
R-squared	0.41	0.43	0.40	0.43	0.26	0.27	0.33	0.37
# observations	3,233	3,123	2,236	1,935	32,000	32,000	13,000	13,000
# firms	485	465	334	305				

Extensive Margin of Exports

	China			US		
Dep Variable:	Log # Dest	Log # Prod	Log # Dest-Prod	Log # Dest	Log # Prod	Log # Dest-Prod
Management Score	0.451***	0.404***	0.524***	0.143***	0.176***	0.209***
	(2.80)	(3.33)	(2.89)	(14.05)	(16.30)	(16.19)
	Own, Prov, Ind, Year FE; Noise + Firm Controls			State, Ind FE; Noise + Firm Controls		
R-squared	0.44	0.42	0.40	0.37	0.32	0.36
# observations	1,935	1,935	1,935	13,000	13,000	13,000
# firms	305	305	305			

Intensive Margin of Exports

	China		US	
Dep Variable:	Log Avg Exports per Dest-Prod	Log Exports Top Dest-Prod	Log Avg Exports per Dest-Prod	Log Exports Top Dest-Prod
Management Score	0.042	0.478*	0.194***	0.348***
	(0.20)	(1.74)	(13.94)	(17.38)
	Own, Prov, Ind, Year FE; Noise + Firm Controls		State, Ind FE; Noise + Firm Controls	
R-squared	0.45	0.43	0.30	0.43
# observations	1,935	1,936	13,000	13,000
# firms	305	305		

Economic Magnitudes

- Improving management by 1 standard deviation associated with
  - 5% higher probability of exporting
  - 27% higher exports
  - 19% more destinations
  - 17% more export products
  - 22% more destination-products

Is Management Same as Productivity ?

- Standard trade theory: firm productivity determines export performance (e.g. Melitz 2003)
  - Noise and endogeneity of measured TFPR (e.g. Hsieh-Klenow 2009, Bartelsman et al 2013, De Loecker 2011)
  - Multiple firm attributes may matter (e.g. Hallak-Sivadasan 2013)

- Management: productivity vs. input vs. second attribute
  - direct measure of TFPQ
  - more productive firms endogenously adopt better management
  - management $\perp$ other factor

- Less overlap in management distributions for exporters and non-exporters than TFPR distributions

Management vs. TFPR

Dep Variable:	TFPR	Exporter Dummy	Log Exports	Log # Dest	Log # Prod	Log # Dest-Prod	Log Avg Exports per Dest-Prod
China			Own, Prov, Ind, Year FE; Noise + Firm Controls				
Management Score	0.211*	0.138***	0.593*	0.484***	0.456***	0.586***	0.007
	(1.69)	(2.96)	(1.87)	(2.92)	(3.69)	(3.19)	(0.03)
TFPR (Lev-Pet)		-0.010	0.257***	0.146***	0.055	0.139***	0.118*
		(-0.82)	(3.35)	(3.73)	(1.61)	(3.29)	(1.94)
US			State, Ind FE; Noise + Firm Controls				
Management Score	0.046***	0.031***	0.392***	0.137***	0.171***	0.202***	0.190***
	(6.39)	(10.24)	(17.60)	(13.49)	(15.87)	(15.66)	(13.59)
TFPR (Lev-Pet)		0.023***	0.254***	0.134***	0.110***	0.166***	0.088***
		(6.19)	(8.24)	(9.75)	(7.37)	(9.39)	(4.43)

Management: Efficiency or Quality ?

- Good management may increase production efficiency
  - Assembling inputs more cheaply
- Producing high-quality goods may require effective management
  - Sourcing high-quality inputs
  - Ensuring quality control
  - Assembling complex products

Management: Efficiency or Quality ?

Management: Efficiency or Quality ?

Management: Efficiency or Quality ?

- Identifying efficiency and quality channels
  - output prices
  - variation across sectors with different scope for quality differentiation and intensity in relationship-specific investments
  - theory-based proxies for output quality and quality-adjusted prices
  - input characteristics

Export Product Quality

- Better managed firms produce higher-quality products, more efficiently
  - Model-consistent measure of export quality (Khandelwal 2010) : σ p + q

	China						US		
Dep Variable:	Log Export Unit Value			Estimated Export Quality			Log EX Unit Value	Estim EX Quality	EX Quality-Adj Price
Management Score	0.335**	0.180	-0.221	1.218*	0.402	-1.234	0.003	0.047**	-0.043***
	(2.16)	(0.98)	(-0.68)	(1.95)	(0.51)	(-0.90)	(0.77)	(2.55)	(-2.82)
Management Score x Adv & RD Intensity		0.433*			2.067*				
		(1.73)			(1.89)				
Management Score x Relation Specificity			0.944*			4.054*			
			(1.79)			(1.87)			
	Own, Prov, Ind, Year FE; Noise + Firm Controls						State, Ind FE; Noise + Firm Controls		
R-squared	0.92	0.92	0.92	0.92	0.92	0.92	0.97	0.96	0.95
# observations	58,102	57,814	57,817	58,102	57,814	57,817	290,000	290,000	290,000
# firms	303	302	302	303	302	302			

Imported Inputs: Quality

- Better managed exporters use more imported inputs, more expensive and higher-quality inputs, from richer countries of origin
  - China: foreign inputs from advanced countries are higher quality
  - US: fixed costs to offshoring inputs and assembly

	China				US		
Dep Variable:	Log (IM / Inputs)	Log Imports	Log Avg Origin Income	Log Import Unit Value	Log Imports	Log Avg Origin Income	Log Import Unit Value
Management Score	0.543*	1.341***	0.113**	0.245**	0.376***	0.041***	-0.001
	(1.86)	(4.32)	(2.14)	(2.53)	(12.83)	(4.27)	(-0.21)
	Own, Prov, Ind, Year FE; Noise + Firm Controls				State, Ind FE; Noise + Firm Controls		
				Orig-Prod FE			Orig-Prod FE
R-squared	0.50	0.56	0.38	0.81	0.29	0.21	0.97
# observations	1,778	1,778	1,780	76,626	10,000	10,000	140,000
# firms	290	290	290	290			

Imported Inputs: Complexity

- Better managed exporters use wider range of imported inputs, from more countries of origin
  - More complex products require more distinct inputs
  - Robust to controlling for number of export products

	China			US		
Dep Variable:	Log # Origins	Log # Import Prod	Log # Origin-Prod	Log # Origins	Log # Import Prod	Log # Origin-Prod
Management Score	0.435***	0.415**	0.467***	0.141***	0.187***	0.209***
	(4.47)	(2.55)	(2.76)	(14.99)	(13.8)	(14.15)
	Own, Prov, Ind, Year FE; Noise + Firm Controls			State, Ind FE; Noise + Firm Controls		
R-squared	0.52	0.58	0.60	0.33	0.30	0.32
# observations	1,778	1,780	1,780	10,000	10,000	10,000
# firms	290	290	290			

Trade vs. Domestic Activity

- Management is disproportionately more important for exporting than domestic activity

Dep Variable:	Log Dom Sales	Exporter Dummy	Log Exports	Log # Dest	Log # Prod	Log # Dest-Prod	Log Avg Exports per Dest-Prod
China			Own, Prov, Ind, Year FE; Noise + Firm Controls				
Management Score	0.747***	0.140***	0.611*	0.446***	0.409***	0.533***	0.078
	(5.30)	(3.32)	(1.96)	(2.78)	(3.36)	(2.96)	(0.37)
Log Dom Sales		-0.025***	-0.035	0.005	-0.004	-0.007	-0.028
		(-7.33)	(-1.46)	(0.40)	(-0.41)	(-0.43)	(-1.50)
US			State, Ind FE; Noise + Firm Controls				
Management Score	0.374***	0.022***	0.171***	0.061***	0.053***	0.074***	0.097***
	(35.38)	(7.00)	(7.65)	(5.87)	(4.92)	(5.70)	(6.78)
Log Dom Sales		0.030***	0.632***	0.225***	0.334***	0.368***	0.264***
		(10.52)	(35.64)	(28.93)	(38.88)	(35.38)	(23.63)

(Export) Profits

- Better managed exporters have higher profits, even controlling for domestic sales
  - Consistent with higher export profits

China	Log Profits		
	Baseline	Controls	Domestic Sales
Management Score	1.309***	0.928***	0.865***
	(6.98)	(5.70)	(5.43)
Log Domestic Sales			0.097***
			(5.85)
Province FE, Industry FE, Year FE, Own FE, Noise Controls			
R-squared	0.45	0.55	0.57
# observations	2,520	2,438	2,438
# firms	467	448	448

Outline

1. Six datasets
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3. Model

Model Ingredients

- Heterogeneous-firm trade model with endogenous quality choice à la Kugler-Verhoogen (2012)

- Complementarity between management and product quality
  - Management ≈ productivity ≈ production technology
  - Output quality = input quality + production technology
  - Output complexity = input complexity + production technology
  - Output quantity = input quantity + production technology

- Two alternatives for management
  - Exogenous productivity draw
  - Fixed-cost technology chosen endogenously based on exogenous productivity draw

Conclusions

- Good management practices enhance export performance by enabling more efficient production of more sophisticated products
  - Consistent results for China and the US
  - Informs sources of firm heterogeneity and management mechanisms
  - Suggests management know-how and access to quality inputs shape impact of export reforms

- Future work: How does management affect …
  - response to shocks (2008-2009 crisis, SARS epidemic, XR shocks)
  - position in global value chains
  - multinational activity

Summary Statistics

	China			US		
	N	Mean	St Dev	N	Mean	St Dev
Log Exports	2,236	14.80	2.31	13,000	13.79	2.77
# Export Products	2,236	8.65	11.58	13,000	18.94	47.50
# Export Destinations	2,236	12.85	14.99	13,000	12.95	16.72
Log Imports	2,048	13.87	2.97	10,000	13.93	2.96
# Import Products	2,048	33.45	51.43	10,000	19.67	43.09
# Import Origin Countries	2,048	6.30	5.67	10,000	6.20	8.02

Example Monitoring: how is performance tracked?

Score	(1): Measures tracked do not indicate directly if overall business objectives are being met. Certain processes aren't tracked at all	(3): Most key performance indicators are tracked formally. Tracking is overseen by senior management	(5): Performance is continuously tracked and communicated, both formally and informally, to all staff using a range of visual management tools

Example Incentives: how does promotion work?

Score	(1) People are promoted primarily upon the basis of tenure, irrespective of performance (ability & effort)	(3) People are promoted primarily upon the basis of performance	(5) We actively identify, develop and promote our top performers