Misallocation Under Trade Liberalization

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Motivation

- How do developing countries benefit from opening up to trade?
- Developing countries have large domestic distortions
  - taxes and subsidies, implicit guarantees and bailouts, preferential access to land and capital, industrial policy and export promotion, imperfect financial and labor markets
- What is the impact of trade liberalization under firm distortions?

What We Do

- Construct a general equilibrium model of trade with distortions
  - Model: Melitz meets Hsieh and Klenow
  - Firms differ in productivity and distortion (like a revenue tax)
  - Misallocation among incumbents, and entry and exit
- Derive a welfare expression under distortion
  - Welfare loss after trade liberalization comes from worsening of misallocation
- Quantify the effect of trade liberalization by estimating the model with Chinese manufacturing data

Key Mechanism

- No distortions, trade induces resources to flow from low to high productivity firms through **selection** (Melitz)
- Distortions act as a **veil** to a firm's true productivity
  - Low productive but highly subsidized firms produce
  - Trade enables low productive, highly subsidized firms to expand
  - Trade drives out productive but highly taxed firms

Trade Can Exacerbate Misallocation!

General Welfare Expression

Encompasses two special cases

- Pareto distributed *productivity*, homogenous distortions
  - Arkolakis, Costinot, and Rodrguez-Clare (2012), (ACR)
  - Always gain from trade
- Pareto distributed *distortions*, homogenous productivity
  - Loss from trade when input share grows faster than output share used in export (worsening of misallocation)

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General case

- Two forces, productivity and distortion, compete for firm selection
- Need micro data to uncover the joint distribution of productivity and distortions

Quantitative Analysis

- Presence of large distortions according to Chinese firm-level data
  - Measure distortions with average product of inputs
  - Large dispersion in measured distortions
  - Positive correlation between measured distortion and productivity
- Estimate the model to match the observed joint distribution of measured distortion and productivity
- Welfare gains from trade are only one-third of standard predictions with only aggregate import shares
- Domestic reform to reduce distortions account for 66% of China's GDP growth from 1998-2005

Model

- Two open economies
  - may differ in labor, productivity, distortions
- Each country has a representative consumer, a final goods producer, and a continuum of intermediate goods producers
- Intermediate firms differ in productivities φ (*Melitz*) and output distortions τ (Hsieh and Klenow, *HK*)
- Fixed cost of entry f_e, production f, export f_x
  Iceberg export cost τ_x

Consumer and Final Goods Producer

- The representative consumer consumes final goods

$$\max u(C)$$

subject to

$$PC = wL + \underbrace{\Pi}_{dividend} + \underbrace{T}_{transfer}$$

- Final goods produced with CES aggregator:

$$Q = \left[\int_{\omega \in \Omega} q(\omega)^{\frac{\sigma-1}{\sigma}} d\omega \right]^{\frac{\sigma}{\sigma-1}}$$

$\Rightarrow$ demand function for firm ω:

$$q\left(\omega; P, Q\right) = \left(\frac{P}{p(\omega)} \right)^{\sigma} Q$$

Intermediate Goods Producer

- Pay entry cost f_e to start a firm
- Draw productivity φ and output wedge τ from $g(\varphi, \tau)$
  - Output wedge τ: larger $\tau \Rightarrow$ higher tax on revenue
- Produce a variety with linear technology and fixed cost f labor requirements for q units:

$$\ell = f + q/\varphi$$

- If export, pay fixed cost $f_x \geq f$ and iceberg cost $\tau_x \geq 1$

Intermediate Goods Producer: Domestic

$$\max_{p} \quad \frac{1}{\tau} p q\left(p; P, Q\right) - \frac{w}{\varphi} q\left(p; P, Q\right) - wf$$

- Optimal price

$$p = \frac{\sigma}{\sigma - 1} \frac{w\tau}{\varphi}$$

- Production cutoff: produce when $\varphi \geq \varphi^*(\tau)$

$$\varphi^*(\tau) = \frac{\sigma^{\frac{\sigma}{\sigma-1}}}{\sigma - 1} \left[\frac{wf}{P^\sigma Q}\right]^{\frac{1}{\sigma-1}} w\tau^{\frac{\sigma}{\sigma-1}}$$

- Productivity and distortion jointly determine selection
  - Produce if productive or less "taxed"

Intermediate Goods Producer: Export

$$\max_{p} \quad \frac{1}{\tau} pq\left(p; P_f, Q_f\right) - \frac{w\tau_x}{\varphi} q\left(p; P_f, Q_f\right) - wf_x$$

- Price

$$p = \frac{\sigma}{\sigma - 1} \frac{w\tau_x \tau}{\varphi}$$

- Export cutoff: export when $\varphi \geq \varphi_x^*(\tau)$

$$\varphi_x^*(\tau) = \frac{\sigma^{\frac{\sigma}{\sigma-1}}}{\sigma - 1} \left[\frac{wf_x}{P_f^{\sigma} Q_f}\right]^{\frac{1}{\sigma-1}} (w\tau_x)\tau^{\frac{\sigma}{\sigma-1}}$$

  - Export if productive or less "taxed"
  - Due to export cost, export cutoff is higher, $\varphi_x^*(\tau) \geq \varphi^*(\tau)$

Equilibrium

Equilibrium consist of quantities and prices of intermediate firms and aggregate variables:

Home $P, Q, \varphi^*(\tau), \varphi_x^*(\tau), M, w = 1$

Foreign $P_f, Q_f, \varphi_f^*(\tau), \varphi_{xf}^*(\tau), M_f, w_f$

- Home and foreign firms: produce, export, prices and quantities
- Zero cutoff profit and free entry conditions
- Goods markets clearing: balanced trade
- Labor markets clearing

M, M_f are the measures of operating firms of Home and Foreign, respectively

General Welfare Expression

Proposition

Under symmetric countries, the change of welfare under an iceberg cost shock is

$$
\begin{aligned}
d\ln W = \frac{1}{\gamma_{sd}+\sigma-1}\Big[& -d\ln\lambda \\
& + d\ln M_e \\
& + \frac{\sigma}{\sigma-1}(\gamma_{sd}-\gamma_d)d\ln M_e \\
& + \left(\sigma-1+\frac{\sigma\gamma_{sd}}{\sigma-1}\right)(-d\ln\lambda) - \left(\sigma-1+\frac{\sigma\gamma_d}{\sigma-1}\right)(-d\ln S_d)\Big]
\end{aligned}
$$

- *λ: output share for domestic goods; S_d: input share for domestic goods*
- *M_e: measure of entrants*
- *γ_d elasticity of domestic output share to cutoff, varies with trade cost*
- *γ_{sd} elasticity of domestic input share to cutoff, varies with trade cost*

Special Case: Gain From Trade

Proposition

- *[1.]* ***Pareto distributed productivity, homogeneous distortion***

$$d\ln W = \frac{1}{\gamma+\sigma-1}\Big[-d\ln\lambda\Big]$$

  - *input share = output share,* $-d\ln\lambda = -d\ln S_d$
  - *Always gain from trade (ACR)*

$$-d\ln\lambda \geq 0 \quad \Rightarrow \quad d\ln W \geq 0$$

λ: output share for domestic goods (import share)

Special Case: Loss from Trade

Proposition

- [2.] ***Pareto distributed distortions, homogenous productivity***

$$d \ln W = \frac{\sigma}{\sigma - 1}\left[(-d \ln \lambda) - (-d \ln S_d)\right]$$

  - *Loss from trade when input share grows faster than output share for trade after trade liberalization,*

$$-d \ln S_d \geq -d \ln \lambda \quad \Rightarrow \quad d \ln W \leq 0$$

  - *Open always has lower welfare than autarky*

λ: output share for domestic goods; S_d: input share for domestic goods

General Welfare Expression

Proposition

The change of welfare associated with an iceberg cost shock is

$$d \ln W = \frac{1}{\gamma_{sd} + \sigma - 1} \Big[-d \ln \lambda \qquad (ACR)$$

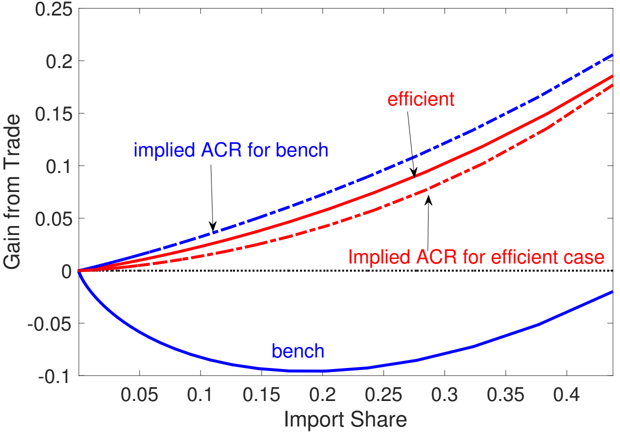
$$+ d \ln M_e \qquad (Melitz - Redding) \Big\} \text{ pure technology}$$

$$\text{resource allocation} \Big\{ + \frac{\sigma}{\sigma - 1} (\gamma_{sd} - \gamma_d) d \ln M_e$$

$$+ \left(\sigma - 1 + \frac{\sigma \gamma_{sd}}{\sigma - 1} \right) (-d \ln \lambda) - \left(\sigma - 1 + \frac{\sigma \gamma_d}{\sigma - 1} \right) (-d \ln S_d) \Big]$$

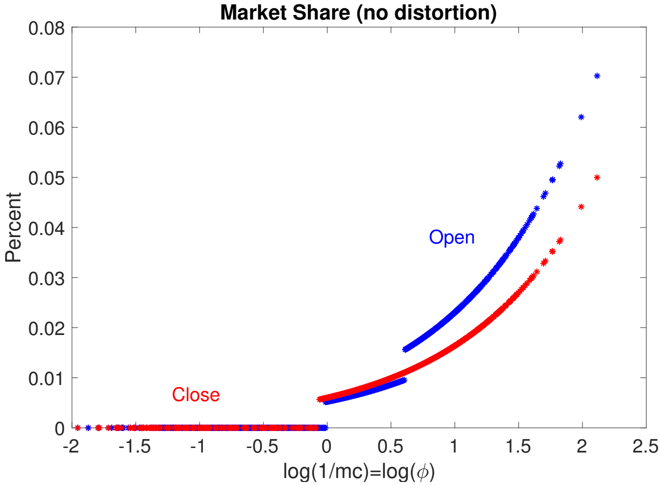
- *Entry M_e also matters for welfare as in Melitz and Redding (2015)*
- *'Pure technology effect' vs 'resource allocation effect' as in Baqaee and Farhi (2018)*
- *Joint distribution of distortion and productivity matters for welfare gain or loss from trade with varying elasticities γ_d and γ_{sd}*

An Numerical Example



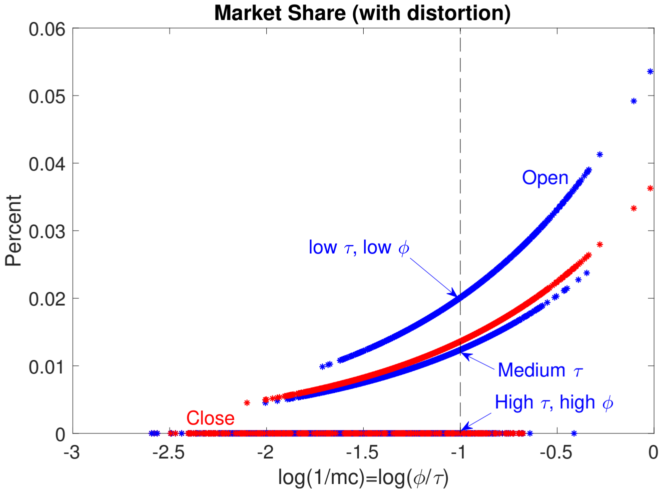
- Welfare loss from trade
- Ignoring firm-level distortions implies very different trade gains
  (φ, τ) joint log-normally distributed, correlation τ and φ of $\rho = 0.8$, $\sigma_\varphi = \sigma_\tau = 0.5$

Why Loss From Trade?



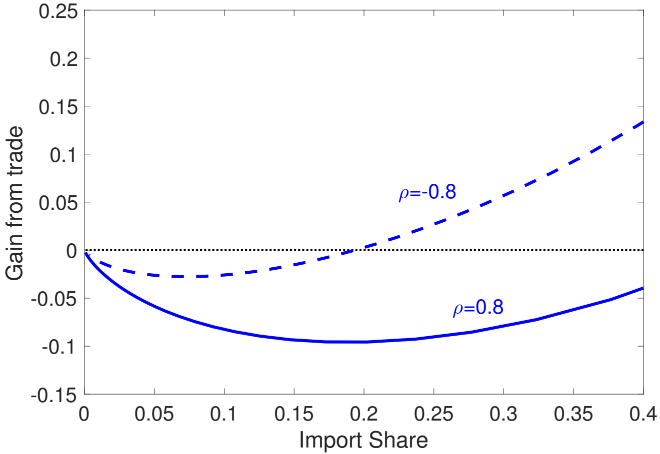
- No distortion, trade leads to reallocation toward productive firms: high φ firms exporting and low φ firms exit

Why Loss From Trade?



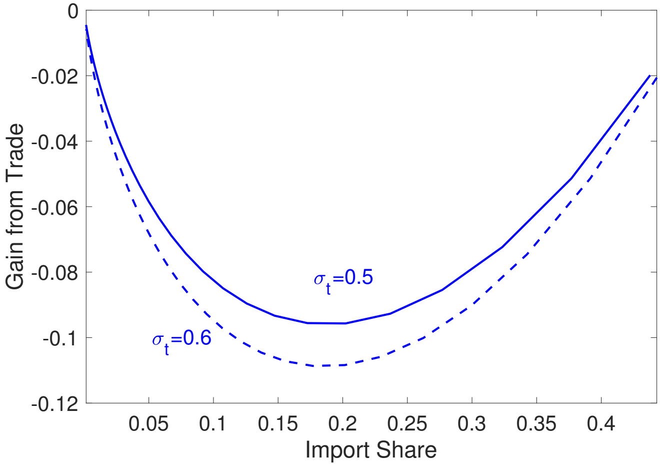
- With distortion, trade allows subsidized firms to grow and high tax firms exit

It matters who is "taxed"



- High correlation of (φ, τ) generates larger loss from trade
- Even $\rho = -0.8$, still have loss from trade

Dispersion Matters

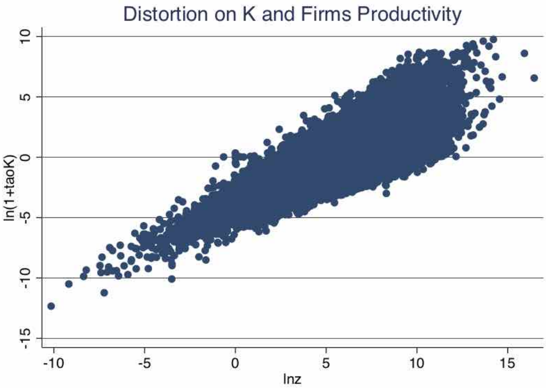


- High dispersion of τ generates larger loss from trade

Quantitative Analysis

- Chinese manufacturing survey data, 1998-2007
  - Balance-sheet data including all SOE and non-SOEs with sales over 5 million RMB
- Measure productivity and distortions following convention:
  - Distortions: average product of inputs: capital (APK), labor (APL), demean at industry level

Measured Distortions and Productivities



- Measured distortions and productivities are highly correlated
- Large dispersion in APL and APK within industry

APK Regression

VARIABLES	(1) ln(*APK*)	(2) ln(*APK*)	(3) ln(*APK*)	(4) ln(*APK*)	(5) ln(*APK*)	(6) ln(*APK*)
ln(*TFPQ*)	0.652***	0.697***	0.706***	0.705***	0.707***	0.711***
	(147.7)	(153.0)	(154.8)	(153.9)	(160.3)	(168.1)
age				-0.00178***	-0.00191***	-0.00174***
				(-8.772)	(-9.477)	(-9.386)
1.soe					-0.116***	-0.109***
					(-3.388)	(-3.313)
1.foreignown					-0.460***	-0.379***
					(-19.74)	(-20.60)
exporters						-0.233***
						(-13.82)
Constant	-3.617***	-3.280***	-3.204***	-3.173***	-3.049***	-3.042***
	(-134.6)	(-60.38)	(-54.16)	(-53.37)	(-44.45)	(-44.88)
Observations	1,616,507	1,616,507	1,506,572	1,505,657	1,505,657	1,505,657
R-squared	0.566	0.628	0.640	0.640	0.655	0.659
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	No	Yes	Yes	Yes	Yes	Yes
Location FE	No	No	Yes	Yes	Yes	Yes

Robust t-statistics clustered at the four-digit industry level in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

- Exporters face lower wedge

Measured Distortion

- The observed dispersion and correlation are different from the underlying ones
  - Selection generates positive correlation, even when ρ is negative: highly taxed firms need to be more productive to survive ▸ Selection
  - The measured dispersion are among operating firms
  - Dispersion in average product need not imply differences in marginal products ▸ Measurement
- Need micro data and structure model to
  - estimate the true relation between distortion and productivity
  - evaluate the distortion effects on TFP, welfare and the impact of trade

Parameter Value

Parameter	*Value*	*Identification*
Elasticity of substitution	$\sigma = 3$	
Mean wedge	$\mu_{\tau,f} = 0$	foreign has no distortion
Home labor	$L = 1$	normalization
Foreign Labor	$L^f = 0.2$	Relative labor size of US to China
	Internal Estimation	
Entry cost	$f_e = 0.2$	Fraction of firms producing
Fixed cost of producing	f =0.015	mean-lowest 5% $ln(K^\alpha L^{1-\alpha})$
Fixed cost of export	$f_x = 0.12$	fraction of firm exporting
Iceberg trade cost mean	$\tau_x = 1.5$	export intensity
Std. productivity	$\sigma_\varphi = 1.2$	std of existing firms lnVA
Std. wedge	$\sigma_\tau = 0.9$	std of existing firms $ln(K^\alpha L^{1-\alpha})$
Corr(wedge, productivity)	$\rho = 0.86$	Corr(lnVA, $ln(VA/K^\alpha L^{1-\alpha})$)
Mean foreign prod	$\mu_{f\varphi} = 5.5$	Relative GDP of US to China

- Fraction of firms producing: one-year survival rate in the data

▸ Identification

Targeted Moments

Target Moments	Data(2005)	Model
Fraction of firms producing ω_e	0.85	0.85
Mean $-$ lowest 5% for $ln(K^{\alpha}L^{1-\alpha})$	1.82	1.53
Fraction of firm exporting	0.30	0.28
Export intensity	0.41	0.42
std of existing firms ln(VA)	1.20	1.26
std of existing firms $ln(VA/K^{\alpha}L^{1-\alpha})$	0.93	0.84
Corr(lnVA, $ln(VA/K^{\alpha}L^{1-\alpha})$)	0.41	0.35
Relative real GDP of US to China	1.79	1.77

Welfare and TFP Implications

	Open relative to close			
	Welfare	TFP	Import Share	Implied ACR gain
Home (%)				
Benchmark	4.4	-2.9	30.8	12.7
No-distortion	9.8	13.3	20.8	10.1
Foreign (%)				
Benchmark	8.2	12.9	17.9	6.9
No-distortion	18.9	13.3	35	17.6
	TFP loss: Distortion relative to no-distortion			
	Overall loss	Misallocation	Entry-selection	
Benchmark	140.4	119.2	21.2	
Home close	124.2	118.7	5.4	

- Implied ACR gain

$$\text{ACR gain} = -\frac{1}{\epsilon} log(\text{domestic share}).$$

- Home: welfare gains from trade (4.4) are only one-third of standard predictions with only aggregate import shares (12.7)

Changes from 1998-2005

Table: Data, Year 1998 and Year 2005

Target Moments	Data(1998)	Data(2005)
Fraction of firms producing ω_e	0.77	0.85
Mean $-$ lowest 5% for $ln(K^{\alpha}L^{1-\alpha})$	2.04	1.82
Fraction of firm exporting	0.25	0.30
Export intensity	0.30	0.41
std of existing firms ln(VA)	1.33	1.20
std of existing firms $ln(VA/K^{\alpha}L^{1-\alpha})$	1.12	0.93
Corr(lnVA, $ln(VA/K^{\alpha}L^{1-\alpha})$)	0.47	0.41
Relative real GDP of US to China	2.50	1.79
Change of China's real GDP		57%

- Over time, more firms export with higher export intensity, less dispersed distortions, less correlated distortions and productivities, GDP grows

Decompose China's Growth from 1998-2005

Table: Model, Decomposition of China's Growth between 1998-2005

	Change of Real GDP	Change of TFP
Benchmark	57%	56%
Counterfactual Change from 1998-2005:		
Technology and inputs(Increase of mean φ)	44%	46%
Trade alone (Decrease of τ_x)	8%	3%
Distortion alone (Decrease of σ_τ)	66%	69%

- Reduction of trade cost has small effect on China's growth

Discussion and Extension

- Endogenous wedges
  - Markup ▸ Markup
    - Exporters are on average have higher markup, hence higher instead of lower wedges
    - Measured log (MPL) and log (VA) will be almost perfectly correlated
    - Markup alone explains very little of the dispersion in TFPR
  - Financial frictions ▸ Financial
    - Bai, Lu and Tian (2017) disciplines financial frictions with firms financing data, sales distribution and change of capital
    - Financial frictions generate TFP loss, but cannot explain the relation between firms measured MPK and input
- Measurement errors ▸ Measurement error
  - Average annual observations within firms, first differences over years within firms, and covariance between first differences and average products
  - Taking out the standard measurement errors, there is still large distortion remaining

Conclusion

- Framework integrated Melitz and HK
  - Provide a general welfare expression under domestic distortions
  - Trade could generate TFP/welfare losses, from distortion on selection and entry
- Micro-level distortions matter for the impact of trade

Discussion: Before and After Exporting

VARIABLES	(1) log(TFPR)	(2) log(TFPR)	(3) log(TFPR)	(4) log(TFPR)
entry_effect			-0.104***	-0.0876***
			(-12.69)	(-11.93)
exit_effect			0.0315***	0.0286***
			(4.574)	(4.401)
starter			-0.101***	-0.0988***
			(-21.74)	(-22.30)
stopper			-0.0891***	-0.0728***
			(-20.98)	(-18.02)
alwaysexporters			-0.301***	-0.250***
			(-23.47)	(-21.94)
log(TFPQ)	0.636***	0.634***	0.638***	0.635***
	(250.5)	(256.2)	(254.9)	(260.0)
exporters	-0.264***	-0.218***		
	(-24.14)	(-22.61)		
1.soe		-0.135***		-0.134***
		(-6.230)		(-6.259)
1.foreignown		-0.148***		-0.136***
		(-20.63)		(-19.29)
Constant	-3.258***	-3.193***	-3.255***	-3.192***
	(-106.2)	(-94.57)	(-107.0)	(-95.42)
Observations	1,587,629	1,587,629	1,584,242	1,584,242
R-squared	0.823	0.827	0.826	0.829
Time FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

[illegible]

Discussion: Before and After Exporting

Table: Measured Marginal Products, data vs model

log(TFPR)	(1) Data	(2) Benchmark	(3) Export rebate	(4) Different τ
entry_effect	-0.104***	-0.050	-0.103	-0.09
starter	-0.101***	-0.429	-0.400	-0.08
alwaysexporters	-0.301***	-0.768	-0.791	-0.324
log(TFPQ)	0.638***	0.653	0.654	0.613

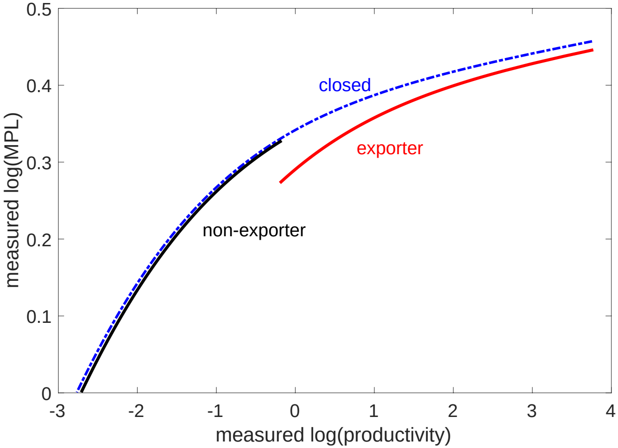
- An extension of our benchmark model that firms could face different distortions when exporting:
  - Explains the difference between exporters vs non-exporters, and the change after firms starting to export
  - The loss from trade is larger in this extension

Discussion: Endogenous Markup

- Klenow and Willis (2016), Arkolakis et al (2017), Edmond et al (2018):
- Final goods produce with a Kimball aggregator, then the intermediate firms set price equal to

$$p = \frac{\sigma}{\sigma - (q/Q)^{\frac{\varepsilon}{\sigma}}} \frac{w\tau}{\varphi}.$$

Discussion: Endogenous Markup



Discussion: Endogenous Markup

- If the observed wedges are markups and they endogenously change with trade,
  - Exporters are on average have higher markup, hence higher instead of lower wedges
  - Measured log (MPL) and log (VA) will be almost perfectly correlated
  - Gains from trade without distortion is similar to ACR: pro-competitive effect of trade is elusive (Arkolakis et al 2017); and similar exogenous distortions are needed to match the observed dispersion and correlation

back

Discussion: Financial Friction

- Bai, Lu and Tian (2017)
  - Disciplines financial friction by firms balance sheet data
  - Financial friction generates TFP loss
  - But financial friction cannot explain the relation between observed firms MPK and inputs

back

Discussion: Measurement Errors

Average annual observation within firm				
std(ln(APK))	std(ln(APL))	$std(lnVA)$	$std(ln(VA/I))$	$corr(lnVA, ln(VA/I))$
1.19	0.96	1.19	0.94	0.4

	First level differences		
	2001	2004	2007
$std(ln(\triangle VA/\triangle K))$	1.82	1.78	1.76
$std(ln(\triangle VA/\triangle L))$	1.68	1.60	1.61

Discussion: Measurement Errors

Table: Measured Marginal Products using First Differences vs TFPR

VARIABLES	(1) $\log(\frac{\triangle VA}{\triangle I})$	(2) $\log(\frac{\triangle VA}{\triangle I})$	(3) $\log(\frac{\triangle VA}{\triangle I})$
$\log(TFPR)$	0.718***	0.715***	0.718***
	(135.3)	(158.6)	(135.3)
Constant	1.410***	0.331***	1.410***
	(78.31)	(17.49)	(78.31)
Observations	624,659	624,699	624,659
R-squared	0.173	0.269	0.173
Time FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes

Robust t-statistics in parentheses

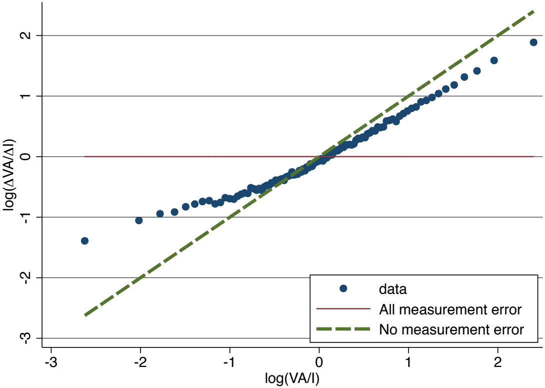
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Specification (2) weights all the observations with the absolute value of composite input growth.

Specification (3) weights all the observations with the share of aggregate value added.

Discussion: Measurement Errors

Figure: Measured Marginal Product using First Differences vs TFPR



Discussion: Measurement Errors

Follow Bils, Klenow, and Ruane (2017):

$$\triangle \widehat{VA}_i = \Phi \cdot \log(TFPR_i) + \Psi \cdot \triangle \hat{I}_i - \Psi(1-\lambda) \cdot \log(TFPR_i) \cdot \triangle \hat{I}_i + D_s + \xi_i$$

$$\lambda = 0.81$$

$$\lambda = \frac{\sigma^2_{\ln \tau}}{\sigma^2_{\ln(TFPR)}}.$$

Hence, 81% of variation in *TFPR* or average products is driven by distortion τ and only 19% is due to measurement errors. back

Asymmetric Countries

$$TFP = \left[Q_d^{\frac{\sigma-1}{\sigma}} + Q_{ex}^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}$$

$$Welfare = Q = \left[Q_d^{\frac{\sigma-1}{\sigma}} + Q_{im}^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}} = \left[Q_d^{\frac{\sigma-1}{\sigma}} + \left(\frac{P_{ex}}{P_{im}} Q_{ex}\right)^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}$$

back

Proposition

$$d\ln W = \frac{1}{\gamma_{sd}+\sigma-1}\Big[-d\ln\lambda \qquad (ACR)$$
$$+ d\ln M_e \qquad (Melitz-Redding)$$
$$+ \frac{\sigma}{\sigma-1}(\gamma_{sd}-\gamma_d)d\ln M_e$$
$$+ \left(\sigma-1+\frac{\sigma\gamma_{sd}}{\sigma-1}\right)(-d\ln\lambda) - \left(\sigma-1+\frac{\sigma\gamma_d}{\sigma-1}\right)(-d$$

where

$$\gamma_d = \frac{\int \left(\frac{\varphi^*(\tau)}{\tau}\right)^{\sigma-1} g(\varphi^*,\tau)\varphi^* d\tau}{\int\int_{\varphi^*(\tau)} (\frac{\varphi}{\tau})^{\sigma-1} g(\varphi,\tau)d\varphi d\tau}$$

represents the hazard function for the distribution of log firm size within a market.

$$\gamma_{sd} = \frac{\int \left(\frac{\varphi^*(\tau)}{\tau}\right)^{\sigma-1} /\tau g(\varphi^*,\tau)\varphi^* d\tau}{\int\int_{\varphi^*(\tau)} (\frac{\varphi}{\tau})^{\sigma-1}/\tau g(\varphi,\tau)d\varphi d\tau}$$

represents the hazard function for the distribution of log after tax firm

Proposition

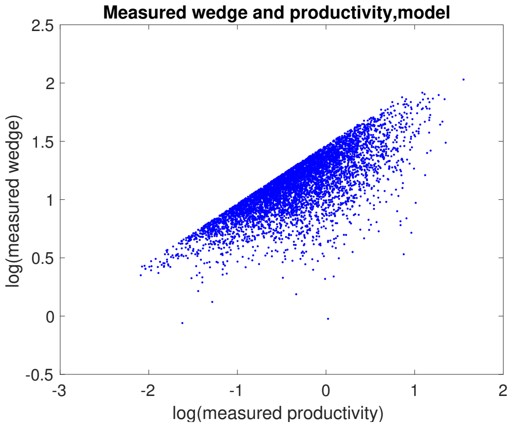
The proposition shows that for a local change in trade cost, if we know

- Change of domestic share and measure of entrants
- The joint distribution of firms sales and inputs
- Trade participation

We know the associated welfare change

back

Selection and Positive Correlation



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Measured MPL and φ

Measured marginal product of labor (APL) is affected by the fixed cost.

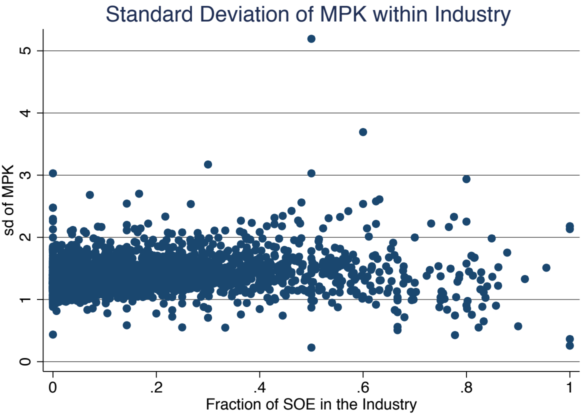
Measured MPL and φ in the data:

$$APL = \frac{pq}{\ell + f}$$

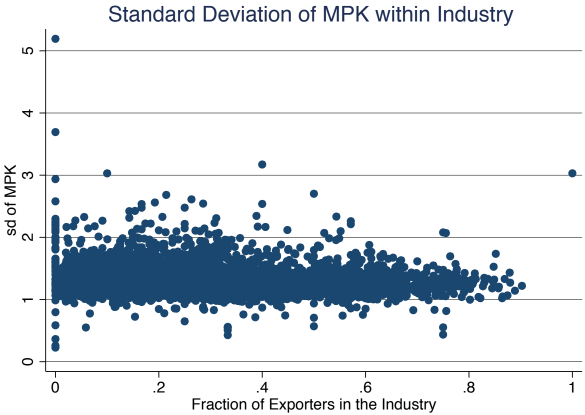
$$\varphi = \frac{q}{\ell + f}$$

back

No Evidence of Systematic Relation Across Industries



Hasn't Found Systematic Relation Across Industries



Identification

- Entry cost
  - $\omega_e E[\pi(\phi, \tau)] = wf_e$
- Fixed cost
  - The smallest firms: $\pi_{min} = wf$, hence $wl_{min} = (\sigma - 1)wf$ and
    The mean of firms labor:
    $wl_{mean} = (\sigma - 1)(E[\pi(\phi, \tau)] + wf) = (\sigma - 1)(\frac{wf_e}{\omega_e} + wf)$
  - Hence mean-lowest 5% $ln(K^{\alpha} L^{1-\alpha}) = \frac{\frac{f_e}{\omega_e} + f}{f}$

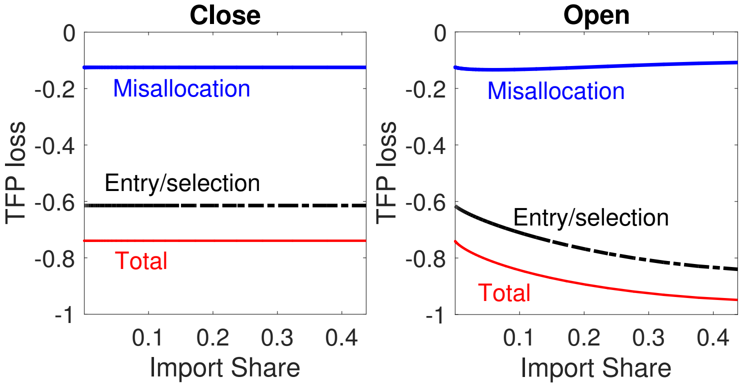
back

TFP Loss Decomposition

TFP loss decomposition

$$\log TFP - \log TFP_{ef} = \underbrace{\log TFP - \log TFP_{HK}}_{\text{misallocation loss}} + \underbrace{\log TFP_{HK} - \log TFP_{ef}}_{\text{entry and selection loss}}$$

TFP Loss Decomposition



- Loss due to misallocation and distortion on entry and selection
- Trade may allow more subsidized firms to get bigger, high tax firms exit, and generate larger loss from entry and selection

Data: Factor Distortions

- Dispersion in APL and APK:
  - Large dispersion in APL and APK within industry
  - Dispersion decreased slightly over time

	1998	2001	2004	2007
std(ln(APK))	1.348	1.306	1.241	1.185
std(ln(APL))	1.184	1.039	0.940	0.923

- We find factor distortion highly positively correlated with measured φ

APL Regression

VARIABLES	(1) ln(*APL*)	(2) ln(*APL*)	(3) ln(*APL*)	(4) ln(*APL*)	(5) ln(*APL*)	(6) ln(*APL*)
ln(*TFPQ*)	0.530***	0.570***	0.569***	0.568***	0.565***	0.567***
	(110.7)	(228.5)	(222.5)	(224.2)	(228.4)	(229.4)
age				-0.00161***	-0.00140***	-0.00128***
				(-9.072)	(-8.783)	(-8.440)
1.soe					-0.0840***	-0.0787***
					(-7.136)	(-7.057)
1.foreignown					0.0615***	0.123***
					(3.925)	(8.317)
exporters						-0.175***
						(-27.08)
Constant	-3.593***	-3.274***	-3.229***	-3.201***	-3.172***	-3.167***
	(-123.2)	(-109.1)	(-103.2)	(-100.5)	(-95.80)	(-97.30)
Observations	1,616,507	1,616,507	1,506,572	1,505,657	1,505,657	1,505,657
R-squared	0.619	0.691	0.699	0.700	0.701	0.705
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	No	Yes	Yes	Yes	Yes	Yes
Location FE	No	No	Yes	Yes	Yes	Yes

Robust t-statistics clustered at the four-digit industry level in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

- Exporters face lower wedge

Literature

- Gains from trade: Krugman(1979), Eaton and Kortum(2002), Melitz (2003), Arkolakis, Costinot, Rodriguez-Clare (2012), Melitz and Redding (2015), Arkolakis, Costinot, Donaldson and Rodriguez-Clare (2017)
- Misallocation: Restuccia and Rogerson (2008), Hsieh and Klenow (2009), Restuccia and Rogerson (2013), Midrigan and Xu (2014), Hopenhayn(2014),Song and Wu (2015), Bai, Lu and Tian (2017), David and Venkateswaran (2017), Baqaee and Farhi (2018)
- Interaction between domestic friction and trade: Bhagwati and Ramaswami (1963), Redding(2016), Zhu and Tombe (2017), Costa-Scottini (2018)

Measure Productivity and Distortions

- Model: firm i in country j

  labor distortion

$$MRPL_{ji} \equiv \frac{\sigma - 1}{\sigma}(1 - \alpha_j)\frac{p_{ji}y_{ji}}{\ell_{ji}} = \tau^{\ell}_{ji} w_j$$

  capital distortion

$$MRPK_{ji} \equiv \frac{\sigma - 1}{\sigma}\alpha_j \frac{p_{ji}y_{ji}}{k_{ji}} = \tau^{k}_{ji} r_j$$

  productivity

$$\varphi_{ji} = (P_j^{\sigma-1} X_j)^{\frac{1}{1-\sigma}} \frac{(p_{ji}y_{ji})^{\frac{\sigma}{\sigma-1}}}{k_{ji}^{\alpha_j} \ell_{ji}^{1-\alpha_j}}$$

- Data (average product, demean at industry level)

$$APL_{ji} \equiv \frac{p_{ji}y_{ji}}{\ell_{ji}}, \qquad APK_{ji} \equiv \frac{p_{ji}y_{ji}}{k_{ji}}, \qquad \varphi_{ji} = \frac{(p_{ji}y_{ji})^{\frac{\sigma}{\sigma-1}}}{k_{ji}^{\alpha_j} \ell_{ji}^{1-\alpha_j}}$$