Exchange Rate Flexibility and Employment

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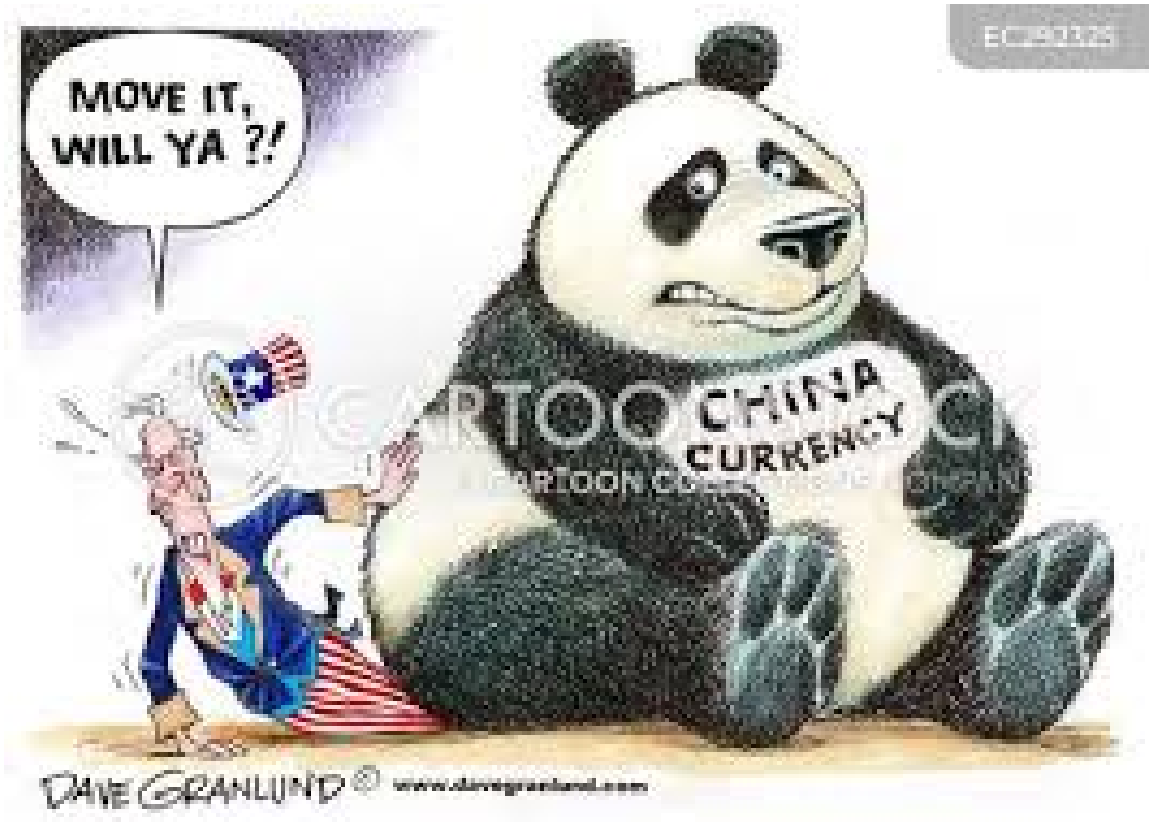
Motivation

- The Chinese exchange rate regime in early 2000s faced substantial criticism



Motivation

- Exchange rates vs labor market
- Effects of exchange rates on employment at the country or industry level
  - Campa and Goldberg (2001), Klein, Schuh and Triest (2003)
- On the micro side
  - Dai and Xu (2017): The effect of RER shocks on resource re-allocation
  - Not many studies on the effect of exchange rate regime choices

This paper

- Can exchange rate flexibility affect firms' re-allocation?
- Theory and empirical evidence
- The take-away message
  - In theory: exchange rate flexibility affects firms' decisions in a nonlinear way
    - With high labor intensity in production, fixed $\rightarrow$ higher employment
    - With high capital intensity in production, flexible $\rightarrow$ higher employment
  - Empirical evidence: Chinese firm-level data

Literature

- Exchange rate vs trade:
  - Rose (2000), Frankel and Rose (2002), Klein and Shambaugh (2006), Bergin and Lin (2012)
- Exchange rate vs employment:
  - Campa and Goldberg (2001), Klein, Schuh and Triest (2003), Dai and Xu (2017)
- Exchange rate regime vs growth, the finance channel:
  - Aghion et al. (2009)

Roadmap

1. Introduction
2. Theory
3. Empirical evidence
4. Summary and future research

Households

- A simple one-period model
- Utility

$$\mathbb{E}\left[\log C + v\left(D\right)\right]$$

where D denotes the real value of investment portfolio at the end of the period.

- Budget constraint

$$C + qD + \frac{M}{P} \leq \frac{WL + R\bar{K} + \Pi + T}{P}.$$

- CIA constraint

$$PC \leq M.$$

International Risk Sharing

- Investment portfolio

$$1 = \mathbb{E}\left[\frac{v'(D)}{C^{-1}} q^{-1}\right]$$

- For a representative household in Foreign to invest in the same investment portfolio

$$1 = \mathbb{E}\left[\frac{v'(D^*)}{C^{*-1}} \left(\frac{\mathcal{E}P^*}{P} q^{-1}\right)\right]$$

- International risk sharing

$$\frac{v'(D^*)}{C^{*-1}} \left(\frac{\mathcal{E}P^*}{P}\right) = \frac{v'(D)}{C^{-1}}$$

- With linear $v(\cdot)$, the standard Backus-Smith condition

$$\mathcal{E} = \frac{PC}{P^*C^*}$$

Firms

- Production

$$Y(j) = \frac{AK(j)^{1-\alpha_j} L(j)^{\alpha_j}}{\alpha_j^{\alpha_j} (1-\alpha_j)^{1-\alpha_j}}$$

- Marginal cost:

$$MC(j) = \frac{R^{1-\alpha_j} W^{\alpha_j}}{A}$$

- Dixit-Stiglitz demand structure

$$Y_H = \left(\int_0^1 Y_H(j)^{\frac{\eta-1}{\eta}} dj \right)^{\frac{\eta}{\eta-1}}, \; Y_H^* = \left(\int_0^1 Y_H^*(j)^{\frac{\eta-1}{\eta}} dj \right)^{\frac{\eta}{\eta-1}}$$

- Price rigidity: firms set prices before sales and shocks.

Sticky Price

- Local currency pricing (LCP)
- Optimal prices:

$$P_H(j) = \frac{\eta}{\eta - 1}\mathbb{E}\left[MC(j)\right]$$

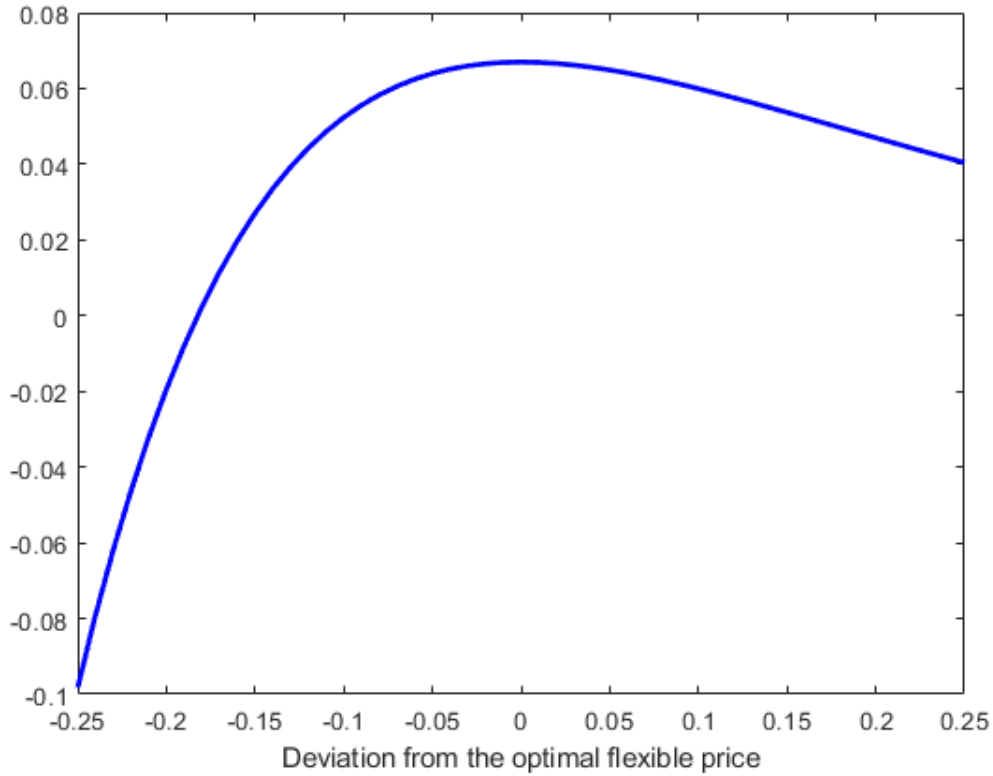
$$P_H^*(j) = \frac{\eta}{\eta - 1}\mathbb{E}\left[\frac{MC(j)}{\mathcal{E}}\right]$$

- Nominal exchange rate flexibility will play a significant role in influencing firms' pricing decisions.

Price vs Profit

- Prices vs Profits:

  a negative deviation in price P_H (or P_H^*) from the optimal flexible price yields a greater profit decline than a positive deviation



Click here to Lemma.

Price vs Profit

- Why?
  - If all shocks are log-normally distributed, marginal costs are log-normally distributed.
  - Firms' prices may deviate from the optimal flexible prices.
  - Two factors affecting profits: profit per unit ($P_H(j) - MC_H(j)$) and quantity sold ($(P_H(j)/P_H)^{-\eta} Y_H$).
  - The second term (quantity) is log-linear.
  - The first term (profit per unit): a one percent decrease from the optimal flexible price will cause a greater decline in unit profit than a one percent increase.
  - Hence, firms set higher prices to avoid loss when facing uncertainties!

Equilibrium

- Capital market clears:
  - R is determined by

$$\bar{K} = \int_0^1 \frac{(1-\alpha_j)\, MC\,(j)}{R} \left(Y_H\,(j) + Y_H^*\,(j)\right) dj$$

- Labor market:
  - Wage rigidity: W at some reservation value at the beginning of the period
  - Labor input: determined by labor demand

Exchange Rate Policy

- Shocks: a real shock (productivity shock A) and a nominal shock (Foreign nominal demand shock M^*).
- Exchange rate regimes:
  - Fixed exchange rate regime:

$$M = M^*$$

  - Flexible exchange rates: $\log M$ indepdently drawn from a random distribution.

Results on Comparative Advantages

Lemma

Under the assumptions that $v(\cdot)$ is linear and $\gamma = \frac{1}{2}$, we can show that

$$\frac{\partial(p_H^{flexible}(j) - p_H^{fixed}(j))}{\partial \alpha_j} > 0 \text{ and } \frac{\partial(p_H^{*flexible}(j) - p_H^{*fixed}(j))}{\partial \alpha_j} > 0. \quad (1)$$

- Comparative advantage of fixed exchange rates (flexible exchange rates) for labor-intensive (capital-intensive) firms

Remarks

- Prices set based on expectations: greater uncertainties → higher preset prices (click here)
- With capital-intensity technology:
  - Capital rental rate determined by domestic and foreign shocks
  - If foreign demand goes up,
    - Fixed exchange rate regime: domestic demand also rises
    - Flexible exchange rate regime: domestic demand is independent of foreign demand
  - Exchange rate adjustments effectively buffer foreign shocks
  - Flexible exchange rates → comparative advantage (lower exporting prices)

Remarks

- With labor-intensive technology:
  - Marginal cost less volatile due to wage rigidity
  - Marginal cost not much dependent on shocks
  - Uncertainty largely comes from nominal exchange rate fluctuations
  - Fixed exchange rates $\rightarrow$ comparative advantage (lower exporting prices)

Results on Employment

Proposition

Under the assumptions in Lemma 1, given any realized A, M, and M^*, we can show that

$$\frac{\partial(L^{flexible}(j) - L^{fixed}(j))}{\partial \alpha_j} < 0.$$

- Exchange rate flexibilities affect firms' employment but in a non-linear way
- Labor-intensity in production matters for the effect of exchange rate flexibilities.

Estimation Strategy

- Employment regression:

$$\log(emp_{kt}) = \beta_0 + \beta_1 \cdot fixed_{k,t} + \beta_2 \cdot (labor_k \times fixed_{k,t}) + \boldsymbol{Z'_{k,t}}\lambda + \gamma_{h,t} + \gamma_k + \epsilon_{k,t}$$

  - Prediction: $\beta_1 < 0$ and $\beta_2 > 0$

- Price regression:

$$\log(P_{k,j,t}) = \beta_0 + \theta_1 \cdot fixed_{j,t} + \theta_2 \cdot (labor_k \times fixed_{j,t}) + \boldsymbol{Z'_{k,t}}\lambda + \gamma_{h,t} + \gamma_k + \epsilon_{k,t}$$

  - Prediction: $\theta_1 > 0$ and $\theta_2 < 0$

Data

- Datasets: Chinese firm-level data, Customs data, Klein and Shambaugh (2008)
- Exchange rate flexibility:
  - Bilateral exchange rate regime: Klein and Shambaugh (2008)
  - Firm level exchange rate flexibility: firm-level export (average across all years) as weight, weighted aggregation between China and all exporting destinations.
- Labor intensity: wage payment to value-added ratio (average across all years in the sample)
- Other variables:
  - Firm characteristics: age, profit margin, leverage ratio, export status, firm level RER and etc.

Baseline Results

	(1)	(2)	(3)	(4)
labor × *fixed*	0.209***		0.337***	
	(0.021)		(0.023)	
labor × *peg*		0.196***		0.315***
		(0.024)		(0.027)
labor × *inpeg*		0.336***		0.457***
		(0.048)		(0.048)
fixed	-0.037***		-0.091***	
	(0.009)		(0.010)	
peg		-0.045***		-0.088***
		(0.011)		(0.013)
inpeg		-0.040**		-0.112***
		(0.019)		(0.019)
log rer	0.047***	0.048***	0.039***	0.039***
	(0.003)	(0.003)	(0.003)	(0.003)
Control variables	NO	NO	YES	YES
Industry × *Time* FE	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES
R-squared	0.883	0.883	0.938	0.938
Observations	432,972	432,972	305,765	305,765

Price Regression Results

	Full Sample		Excluding P. T.		Excluding P. T. and T. I.	
	(1)	(2)	(3)	(4)	(5)	(6)
labor × *fixed*	-0.133***		-0.093***		-0.094***	
	(0.014)		(0.017)		(0.017)	
labor × *peg*		-0.174***		-0.119***		-0.119***
		(0.020)		(0.025)		(0.025)
labor × *inpeg*		-0.076***		-0.060***		-0.061***
		(0.017)		(0.020)		(0.020)
fixed	0.040***		0.026***		0.026***	
	(0.005)		(0.006)		(0.006)	
peg		0.026**		0.008		0.009
		(0.010)		(0.011)		(0.011)
inpeg		0.029***		0.022***		0.022***
		(0.006)		(0.007)		(0.007)
log rer	0.023	0.009	0.023	0.011	0.024	0.012
	(0.014)	(0.014)	(0.017)	(0.017)	(0.017)	(0.017)
Control variables	YES	YES	YES	YES	YES	YES
Firm × *Product* × *Country* FE	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES
R-squared	0.960	0.960	0.961	0.961	0.961	0.961
Observations	837,934	837,934	620,738	620,738	618,144	618,144

Policy Shock in China

	(1)	(2)	(3)	(4)
labor × *post* 2006 *dummy*	-0.485***	-0.246***	-0.401***	-0.259***
	(0.020)	(0.017)	(0.021)	(0.018)
post 2006 *dummy*	0.330***	0.199***		
	(0.008)	(0.007)		
log rer	-0.074***	0.015***	0.014***	0.015***
	(0.004)	(0.004)	(0.004)	(0.004)
Control variables	NO	YES	NO	YES
Industry × *Time* FE	NO	NO	YES	YES
Firm FE	YES	YES	YES	YES
R-squared	0.852	0.936	0.891	0.941
Observations	216,533	152,297	216,162	152,008

Robustness Checks

- Alternative Measures on the key regressors (click here):
  - Firm level exchange rate flexibility: industry export share as the weight
  - Labor-intensity: wage payment to sales ratio
- Excluding processing trade firms. (click here)
- Excluding trade intermediaries and SOEs. (click here)
- Excluding the GFC period. (click here)
- Initial period export share as the weight to construct exchange rate flexibility. (click here)

DCP

- Dollar pricing: trade prices are in dollars

$$P_H = \frac{\eta}{\eta - 1}\mathbb{E}\left[MC\right]$$

$$P_H^* = \frac{\eta}{\eta - 1}\mathbb{E}\left[\frac{MC}{\mathcal{E}^{CHN,US}}\right]$$

- CHN-US nominal exchange rate matters: NOT the nominal exchange rate between CHN and exporting destination!
- Adding CHN-US exchange rate regime to regressions: the coefficients on bilateral exchange rate regime may become weaker under DCP

DCP: Employment Regression Results

	(1)	(2)	(3)	(4)
labor × *US fixed*	0.290***	0.309***	0.247***	0.275***
	(0.073)	(0.073)	(0.073)	(0.075)
labor × *fixed*	-0.027		0.009	
	(0.148)		(0.145)	
labor × *peg*		-0.083		-0.075
		(0.152)		(0.153)
labor × *inpeg*		0.378		0.632*
		(0.391)		(0.356)
US fixed	-0.206***	-0.211***		
	(0.033)	(0.033)		
fixed	0.040		-0.027	
	(0.068)		(0.067)	
peg		0.054		0.002
		(0.070)		(0.071)
inpeg		-0.055		-0.210
		(0.177)		(0.155)
log rer	0.061***	0.060***	0.131***	0.130***
	(0.020)	(0.020)	(0.020)	(0.020)
Control variables	YES	YES	YES	YES
Industry × *Time* FE	NO	NO	YES	YES
Firm FE	YES	YES	YES	YES
R-squared	0.949	0.949	0.959	0.959
Observations	27,358	27,358	26,526	26,526

DCP: Price Regression Results

	All Firms				Excluding P. T.		Excluding P. T. and T. I.	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
labor × *US fixed*	-0.176***	-0.195***	-0.174***	-0.198***	-0.135**	-0.170**	-0.133**	-0.167**
	(0.048)	(0.055)	(0.048)	(0.056)	(0.066)	(0.076)	(0.067)	(0.077)
labor × *fixed*	-0.008		-0.007		-0.060		-0.062	
	(0.042)		(0.044)		(0.061)		(0.062)	
labor × *peg*		0.048		0.054		0.015		0.009
		(0.060)		(0.061)		(0.081)		(0.082)
labor × *inpeg*		-0.026		-0.031		-0.092		-0.092
		(0.049)		(0.051)		(0.068)		(0.069)
US fixed	0.009	0.029						
	(0.022)	(0.023)						
fixed	-0.023		-0.012		0.009		0.010	
	(0.020)		(0.020)		(0.026)		(0.026)	
peg		-0.072***		-0.053**		-0.021		-0.018
		(0.027)		(0.027)		(0.032)		(0.032)
inpeg		-0.004		0.003		0.022		0.022
		(0.022)		(0.022)		(0.028)		(0.029)
log rer	-0.465***	-0.474***	-0.026	-0.034	-0.028	-0.030	-0.024	-0.025
	(0.044)	(0.044)	(0.035)	(0.035)	(0.040)	(0.040)	(0.040)	(0.040)
Control variables	YES	YES	YES	YES	YES	YES	YES	YES
Firm × *Product* × *Country* FE	YES	YES	YES	YES	YES	YES	YES	YES
Time FE	NO	NO	YES	YES	YES	YES	YES	YES
R-squared	0.952	0.952	0.952	0.952	0.952	0.952	0.952	0.952
Observations	158,832	158,832	158,832	158,832	101,906	101,906	101,068	101,068

Summary

- Data supports the theoretical predictions
- The results hold in a number of robustness checks
- The role of DCP

Concluding Remarks

- Theory: labor-intensity plays an important role in determining the effect of exchange rate flexibility on firms' employment and prices
- Data: empirical evidence provides strong support to the theory
- Future work: discussion of optimal exchange rate policies

Alternative Measures

	Labor Intensity		EX Rate Regime Flexibility	
	(1)	(2)	(3)	(4)
labor × *fixed*	0.645***		0.147***	
	(0.067)		(0.015)	
labor × *peg*		0.606***		0.168***
		(0.074)		(0.022)
labor × *inpeg*		1.003***		0.103***
		(0.182)		(0.035)
fixed	-0.027***			
	(0.009)			
peg		-0.027***		
		(0.010)		
inpeg		-0.045***		
		(0.018)		
Control variables	YES	YES	YES	YES
Industry × *Time* FE	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES
R-squared	0.938	0.938	0.929	0.929
Observations	305,765	305,765	1,676,610	1,676,610

Back to robustness checks

Excluding GFC and Processing Trade

	Excluding GFC		Excluding Processing Trade	
	(1)	(2)	(3)	(4)
labor × *fixed*	0.171***		0.364***	
	(0.029)		(0.027)	
labor × *peg*		0.179***		0.326***
		(0.035)		(0.033)
labor × *inpeg*		0.189***		0.501***
		(0.056)	(0.051)	
fixed	-0.025*		-0.098***	
	(0.013)		(0.011)	
peg		-0.038**		-0.091***
		(0.017)		(0.014)
inpeg		-0.011		-0.125***
		(0.022)		(0.020)
Control variables	YES	YES	YES	YES
Industry × *Time* FE	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES
R-squared	0.939	0.939	0.941	0.941
Observations	207,869	207,869	229,703	229,703

Back to robustness checks

Excluding Trade Intermediaries and SOEs

	Excluding Intermediaries		Excluding SOEs	
	(1)	(2)	(3)	(4)
labor × *fixed*	0.336***		0.312***	
	(0.023)		(0.023)	
labor × *peg*		0.315***		0.296***
		(0.027)		(0.027)
labor × *inpeg*		0.458***		0.409***
		(0.048)		(0.048)
fixed	-0.091***		-0.080***	
	(0.010)		(0.010)	
peg		-0.088***		-0.079***
		(0.013)		(0.013)
inpeg		-0.113***		-0.096***
		(0.019)		(0.019)
Control variables	YES	YES	YES	YES
Industry × *Time* FE	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES
R-squared	0.938	0.938	0.936	0.936
Observations	305,244	305,244	292,714	292,714

Back to robustness checks

Base Year Export Constructed Measures

	(1)	(2)	(3)	(4)
labor × *fixed*	0.359***		0.336***	
	(0.052)		(0.054)	
labor × *peg*		0.306***		0.311***
		(0.058)		(0.061)
labor × *inpeg*		0.634***		0.504***
		(0.131)		(0.115)
fixed	-0.075***		-0.074***	
	(0.026)		(0.026)	
peg		-0.046		-0.067**
		(0.031)		(0.032)
inpeg		-0.188***		-0.119**
		(0.053)		(0.048)
Control variables	NO	NO	YES	YES
Industry × *Time* FE	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES
R-squared	0.906	0.906	0.939	0.939
Observations	65,736	65,736	54,830	54,830

Back to robustness checks.