
Exchange Rates and Wages in an Integrated World

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Question

- How do exchange rates affect the real economy?
 - exchange rate fluctuations have become a common aspect of globalization
 - Labor market effects
 - Channels through which exchange rates affect the labor market
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Existing models

- Depreciation



- Increase in competitiveness of export (and import competing) sector



- Increased demand for workers



- Increase in real wages

International labor mobility becoming increasingly important

- Assumption underlying models on exchange rate and wages - labor supply is fixed.
 - World economy - increasingly integrated
 - International labor mobility – prominent feature of globalization
 - 175 million people—lived and worked outside their country of birth in 2000,
 - as opposed to 75 million—in 1965
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Main contribution of the paper

- Implications of increased labor mobility for the real effects of exchange rates
 - Paper explores a new channel through which exchange rates can affect wages
 - via labor supply.
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Overview of the talk

- Idea and anecdotal evidence
 - Identification strategy
 - Related literature
 - Pass-through in general
 - Evidence on exchange rates and labor mobility
 - Theoretical framework
 - Empirical specification
 - Results
 - Conclusions
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Idea

Depreciation (e.g. more pesos per dollar)



Emigration or threat of emigration (from Mexico to US)



Higher wages in pesos (e.g. in Mexico)

Anecdotal evidence (contd.): exchange rates and labor mobility

- **“Exchange rate keeps Filipinos from working abroad” (FT, 16th November, 2007)**

“The monthly pay of most of the Middle East jobs is measly – US dollars 250 for hotel workers or dollars 300 for laborers. But, because of the weak US dollar, the peso value of their salaries has been eroded by 20-25 per cent since 2000 and that has had a big impact on one of the world's biggest exporters of labor”

Anecdotal evidence: exchange rates and labor mobility

- **“Weak pound has Poles eyeing homeland”**

(FT, May 25, 2008)

“A survey by Britain's largest Polish-speaking radio station at the end of last year reported that almost 40 per cent of migrant Polish workers would seriously consider returning home if the exchange rate fell to four zlotys to the pound.”

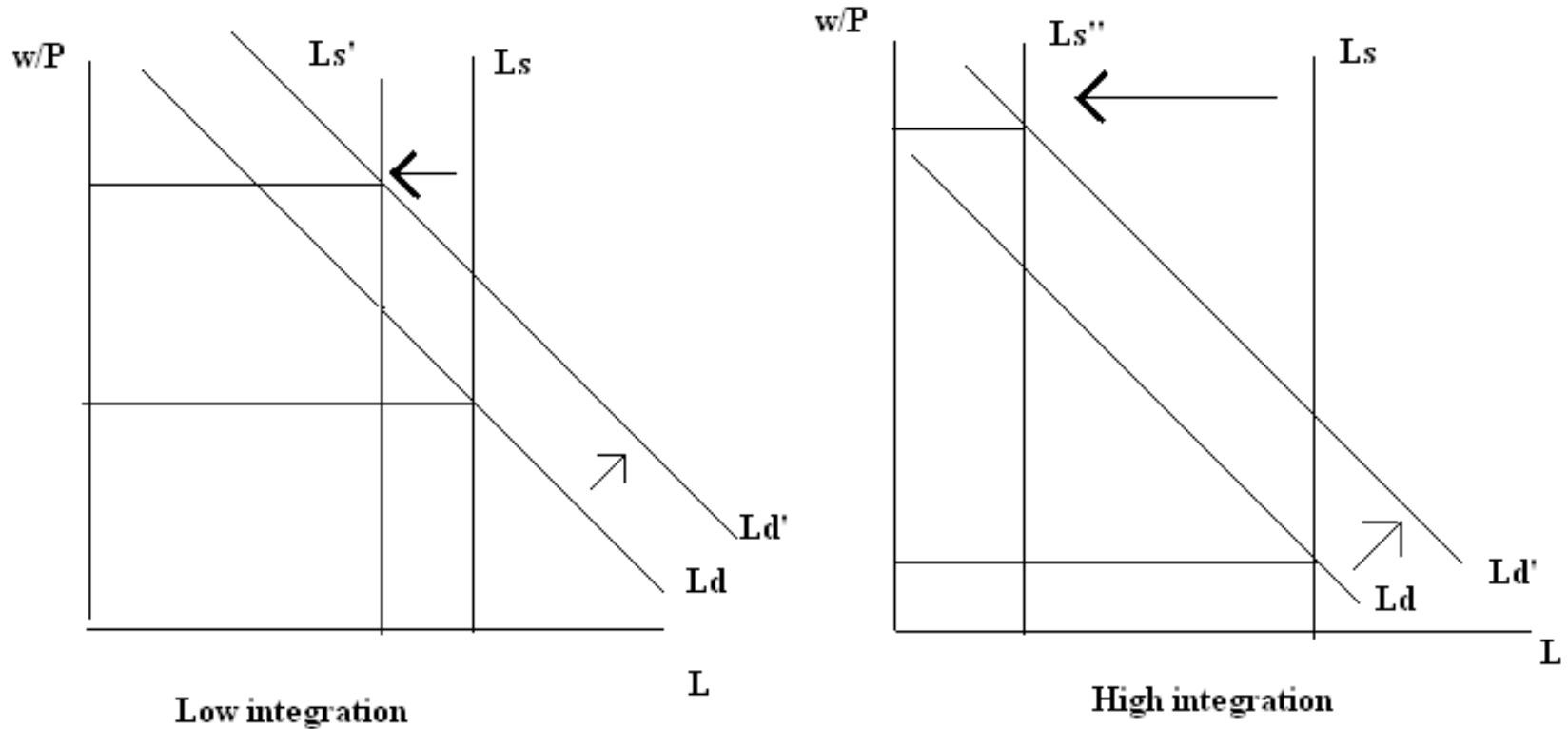
- **“Poles go home to greener pastures” (FT, April 1, 2008)**

“The **zloty has also risen** sharply against both the pound and the euro”

Identification strategy

- New empirical strategy to identify the effect of exchange rates on wages by exploiting variation across countries in the degree of integration between domestic and international labor markets.
 - Does the response of wages to exchange rates vary between countries with low and high labor market integration?
 - Labor market integration defined in terms of costs of moving abroad in response to a shock.
 - More integrated the labor market is and easier it is for workers to move; a given exchange rate depreciation is associated with a larger increase in wages.

Identification strategy (contd.)



Literature – exchange rate pass-through

- **Pass through of exchange rates to wages** (Campa and Goldberg, 2001; Goldberg and Tracy, 2003 etc.)
 - Try to identify the **labor demand channel**
 - Individual level or industry level data
 - Identification based on differential effects on industries based on exports/imports; skill, occupation, etc.
 - Focus on the United States or G7 countries
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Literature – direct evidence on exchange rates, labor mobility and wages

- Evidence from Mexico/US border:
 - Exchange rate shocks and border apprehensions at the US-Mexico border (Hanson and Spilimbergo, 1999). A devaluation of the peso by 10 percent increases, *ceteris paribus*, border apprehensions by 6 to 8 percent.
 - Exchange rate shocks, return migration and remittances of households in Philippines (Yang, 2006; Yang, forthcoming)
 - Effect of emigration on wages in source countries. A 10 percent migration increases wages by 4 percent (Aydemir and Borjas, 2007; Bouton, Paul, and Tiongson, 2009; Mishra, 2007)
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Simple framework

Domestic labor demand in an integrated world

$$L^d = \left[\frac{w}{P} \right]^{-\alpha} E \left(\frac{eP^*}{P} \right) M \left(\frac{eP^*}{P} \right) D \quad (1)$$

W = nominal wage, P = domestic price index.

P^* = foreign price index

E, M Exports and imports respectively

e = nominal exchange rate in home currency units per unit of the foreign currency,

D Other factors affecting demand

Framework (contd)

Domestic labor supply in an integrated world

$$L^s = \left[\frac{w}{P} \right]^\gamma \left[\frac{e^\beta w^*}{P^\beta P^{*1-\beta}} \right]^{-\phi I} S$$

w^* foreign wage.

I degree of labor market integration.

S Institutional/demographic characteristics that affect labor supply

Framework (contd)

In equilibrium, $L^s = L^d$ Taking logs:

$$\ln \frac{w}{P} = a_1 I \ln \frac{e}{P} + a_2 \ln E + a_2 \ln M \\ + a_2 \ln X + a_3 I \ln w^* + a_4 I \ln P^*$$

$$a_1 = \frac{\beta\phi}{\alpha + \gamma}; a_2 = \frac{1}{\alpha + \gamma}; a_3 = \frac{\phi}{\alpha + \gamma};$$

$$a_4 = -\frac{\phi(1 - \beta)}{\alpha + \gamma}; X = D - S$$

Empirical specification

$$\ln \frac{w_{it}}{P_{it}} = \alpha \ln I_{it-1} + \beta \ln \frac{e_{it-1}}{P_{it-1}} + \gamma (\ln I_{it-1} * \ln \frac{e_{it-1}}{P_{it-1}})_i + \theta X_{it-1} + s_i + v_t + \varepsilon_{it}$$

Country: i Year: t

$\frac{w_{it}}{P_{it}}$ Real wage

$\frac{e_{it-1}}{P_{it-1}}$ Lagged real exchange rate

I_{it-1} Lagged measure of emigration

X_{it-1} Lagged controls

s_i Country fixed-effects

v_t Time fixed-effects

How to measure integration?

- Costs of moving abroad
 - Larger networks imply lower costs of moving and finding jobs (Borjas, 1992; Munshi, 2003; Montgomery, 1991)
 - Lagged emigration rates as proxy for networks
 - Alternative measures of integration
 - Lagged remittances (as a share of GDP)
 - Lagged stock of emigrants
 - Common official language, common border and colonial linkage with the top 5 destination countries
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Data – wages and migration

■ Wages

- Hourly manufacturing wages (local currency) – ILO Key Indicators of Labor Market
 - Wages and salaries / earnings
 - Wage earners (production workers), salaries employees (non-production) or both
 - Social security contributions (e.g. Chile, Colombia, Turkey etc.)
- IFS (Wage indices – wage rates or earnings per worker per specified time period)
- Freeman-Oostendorp – October ILO Inquiry
- Hourly wages of immigrants in the US – Census Population Survey (CPS) (migrants defined by country of birth)

■ Migration

- International Migration Statistics, OECD, 2006
 - Migrants to the OECD defined by nationality/birth
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Data – exchange rates

- Migration-weighted exchange rates

$$e_{ct} = \sum_{c'} e_{cc'} \frac{M_{cc'}}{M_{ct}}$$

- Deflated by CPI from IFS
- Initial sample period weights
- Bilateral exchange rates calculated from the IFS

- Alternative measures of exchange rates

- Time-varying weights
- Sample average weights
- 1995 weights
- US\$ exchange rates
- Trade-weighted exchange rates (IMF)

Time series properties of real wages and exchange rates

Table A5. Panel Unit Root and Cointegration Tests

	Ln (real wage)	Ln (real exchange rate)	1 % critical values	5% critical values
Unit Root Tests (Null=Unit Root, Large negative values imply rejection)				
Bootstrapped Im, Pesaran & Shin ADF statistic	-0.01	0.20	-1.28	-1.64
Bai-Ng (2004) with orthogonalized data Im, Pesaran & Shin ADF statistic	0.48	1.35	-1.28	-1.64
Pesaran (2007) cross-sectionally augmented ADF statistic	-2.34	-2.00	-5.01	-4.01
Cointegration Tests (Null=No Cointegration, Large negative values imply rejection)				
Pooled Phillips-Perron statistic		-1.63	-1.28	-1.64
Pooled ADF statistic		-3.26	-1.28	-1.64
Group mean Phillips-Perron statistic		-0.41	-1.28	-1.64
Group mean ADF statistic		-3.40	-1.28	-1.64
Number of countries	53	53		
Number of periods	25	25		

Table 2. Effect of Exchange Rates on Wages-Interaction With Labor Market Integration

Dependent variable: ln(real wage)

	[1]	[2]	[3]	[4]	[5]	[6]
Ln migration-weighted real exchange rate _{t-1}	0.353***	0.250**	0.295**	0.294	0.338*	0.343
Ln migration-weighted real exchange rate_{t-1} * Ln emigration rate_{t-1}	0.013**	0.014**	0.015*	0.041***	0.049**	0.050**
Ln emigration rate _{t-1}	0.042**	0.061***	0.058**	0.124***	0.140***	0.137***
Ln (exports/GDP) _{t-1}	0.034	-0.078	0.049	0.003	0.077	0.214
Ln (imports/GDP) _{t-1}	-0.432***	-0.273***	-0.343*	-0.268	-0.28	-0.373
Dummy for crisis _{t-1}		-0.156	-0.152	0.003	0.033	0.07
Ln unemployment rate _{t-1}			-0.088*	-0.071	-0.084	-0.143*
Ln tax wedge _{t-1}				-0.318***	-0.310**	-0.264**
Ln (FDI/GDP) _{t-1}					0.046*	0.026
Ln average OECD wage _{t-1}						0.065
Ln average OECD price _{t-1}						-0.089
Country fixed effects	Y	Y	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y	Y	Y
Observations	740	710	574	419	393	378
Number of countries	66	66	58	47	44	44

Table A7. Effect of Exchange Rates on Wages-Interaction With Labor Market Integration: Consistent Sample

Dependent variable: ln(real wage)						
	[1]	[2]	[3]	[4]	[5]	[6]
Ln migration-weighted real exchange rate _{t-1}	0.360*	0.354	0.337	0.339	0.342	0.343
Ln migration-weighted real exchange rate_{t-1} * Ln emigration rate_{t-1}	0.046**	0.046**	0.047**	0.050**	0.050**	0.050**
Ln emigration rate _{t-1}	0.124***	0.123***	0.125***	0.138***	0.137***	0.137***
Ln (exports/GDP) _{t-1}	0.094	0.093	0.205	0.191	0.193	0.214
Ln (imports/GDP) _{t-1}	-0.402*	-0.391*	-0.477*	-0.387	-0.390	-0.373
Dummy for crisis _{t-1}		0.042	0.055	0.066	0.067	0.070
Ln unemployment rate _{t-1}			-0.149*	-0.136*	-0.139*	-0.143*
Ln tax wedge _{t-1}				-0.274**	-0.267**	-0.264**
Ln (FDI/GDP) _{t-1}					0.029	0.026
Ln average OECD wage _{t-1}						0.065
Ln average OECD price _{t-1}						-0.089
Country fixed effects	Y	Y	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y	Y	Y
Observations	378	378	378	378	378	378
Number of countries	44	44	44	44	44	44

Table 3b. Effect of Exchange Rates on Wages-Interaction With Labor Market Integration: Alternative Measures of Exchange Rates

Dependent variable: ln(real wage)

	US\$ real exchange rate	Time-varying weights	Constant weights (average over sample)	Constant weights (1995)	Trade-weighted real exchange rate
	[1]	[2]	[3]	[4]	[5]
Ln real US\$ exchange rate _{t-1}	0.129				
Ln real US\$ exchange rate _{t-1} * ln emigration rate _{t-1}	0.082***				
Ln real migration-wt (II) exchange rate _{t-1}		0.366**			
Ln real migration-wt (II) exchange rate_{t-1} * ln emigration rate_{t-1}		0.081***			
Ln real migration-wt (III) exchange rate _{t-1}			0.216***		
Ln real migration-wt (III) exchange rate_{t-1} * ln emigration rate_{t-1}			0.078**		
Ln real migration-wt (IV) exchange rate _{t-1}				0.178	
Ln real migration-wt (IV) exchange rate_{t-1} * ln emigration rate_{t-1}				0.084***	
Ln real trade-wt exchange rate _{t-1}					-0.083
Ln real trade-wt exchange rate_{t-1} * ln emigration rate_{t-1}					0.072**
Ln emigration rate _{t-1}	0.206***	0.093***	0.200***	0.213***	-0.047
Country fixed effects	Y	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y	Y
Observations	378	378	378	378	378
Number of countries	44	44	44	44	44

Table 4. Estimated Elasticity of Real Wages to Real Exchange Rates

Weights →	Migration-weighted exchange rates				Real exchange rates (US\$)
	Initial sample [1]	Time-varying [2]	Sample average [3]	1995 [4]	None [5]
Mean emigration rate	0.29	0.29	0.14	0.10	0.05
Emigration rates (deciles) ↓					
10	0.15	0.05	-0.09	-0.15	-0.19
20	0.22	0.17	0.02	-0.03	-0.07
30	0.25	0.22	0.07	0.02	-0.02
40	0.28	0.26	0.11	0.07	0.02
50	0.32	0.33	0.18	0.14	0.09
60	0.34	0.36	0.21	0.17	0.12
70	0.35	0.38	0.23	0.20	0.15
80	0.37	0.40	0.25	0.22	0.17
90	0.39	0.45	0.30	0.26	0.21

Robustness checks

- Alternative measures of labor market integration
 - Emigration stocks
 - Remittances
 - Longer lags of emigration rates to measure integration
 - Composite measure of integration
 - Stronger effects for developing countries
 - Control for composition of trade
 - Interact labor-demand determinants (exports and imports) with measures of integration.
 - Alternative data sources on wages (IFS and FO)
 - Skilled and unskilled wages
 - Some evidence that the estimated interaction is higher for skilled wages
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Framework for receiving countries

- Mirror issue – effects of exchange rates on receiving countries
 - US – large receiving country
 - 36 % of all migrants to OECD end up in the United States
 - Idea – depreciation of peso vis-à-vis dollar → labor mobility from Mexico to US → reduction in wages of Mexican immigrants in the US
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Framework for receiving countries (contd.)

$$\ln \frac{w_i^{US}}{P^{US}} = -f(I_{i,US}) * \ln \frac{e_i}{P_i} + x^{US},$$

$$f'(I_{i,US}) > 0$$

i Refers to the migrant sending country

Table 11a. Effect of Exchange Rates on US Immigrant Wages-Interactions

Dependent variable: ln(real wage of immigrants in the US)

	[1]	[2]	[3]	[4]
Ln real exchange rate wrt US _{t-1}	0.376	0.361	0.914**	0.751*
Ln real exchange rate wrt US_{t-1} * Ln emigration rate to the US_{t-1}	-0.106**	-0.111**	-0.158*	-0.098
Ln emigration rate to the US _{t-1}	-0.226	-0.213	-0.603**	-0.582*
Ln (exports/GDP) _{t-1}	-0.152*	-0.144	-0.286	-0.206
Ln (imports/GDP) _{t-1}	0.082	0.077	0.007	0.004
Dummy for crisis _{t-1}		0.001	0.223	0.193
Ln unemployment rate _{t-1}			-0.127	-0.149
Ln tax wedge _{t-1}			-0.103	-0.031
Ln (FDI/GDP) _{t-1}			-0.029	-0.037
Ln average US wage _{t-1}				-1.561
Ln average US price _{t-1}				2.192
Country fixed effects	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	N
Observations	546	537	289	264
Number of countries	74	73	47	47

Table 12. Effect of Exchange Rates on Migration

Dependent variable: ln(emigration rate)				ln(remittances / GDP)		
Variable	[1]	[2]	[3]	[4]	[5]	[6]
Ln migration-weighted real exchange rate _{t-1}	0.471***	1.168***	1.157***	0.094	0.349**	0.644***
Ln real wage _{t-1}		0.226	0.391**		-0.145*	-0.224***
Dummy for crisis _{t-1}		0.101	0.195		-0.192*	-0.221*
Ln migration-weighted OECD wage _{t-1}			-0.028			-0.023
Ln migration-weighted OECD price _{t-1}			-0.172**			0.021
Country fixed effects	Y	Y	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y	Y	Y
Observations	2295	824	770	2213	805	702
Number of countries	161	66	65	143	63	60

Conclusions

- How do exchange rates affect wages?
 - Explore new channel via labor supply
 - Framework of exchange rate adjustment which explicitly takes into account labor supply effects
 - New identification strategy --- use variation across countries in the degree of labor market integration
 - Main result is that the elasticity of wages wrt exchange rates significantly higher for countries more integrated in the world labor market.
 - Findings call for including labor mobility in macro models of exchange rate adjustment
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