The Exchange Rate, Employment and Hours: What Firm-Level Data Say

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Motivation

- How do exchange rate fluctuations affect the real economy?
- The answer is not obvious: according to Sargent's law, "when you mix prices and quantities the result stinks" (Backus, 1999)
- Exchange rate swings, however, are an empirically important source of fluctuations (Gourinchas; 1998)
- We focus on the effects of exchange rate variations on employment, hours and wages

Motivation

- How do exchange rate fluctuations affect labor market variables?
- The literature has broadly addressed two issues and found:
  - strong evidence of effects on gross job flows and inter- and intra-industry employment reallocation (Gourinchas, 1998 and 1999; Klein et al., 2003)
  - mixed evidence of effects on net employment or hours worked (Grossman, 1986; Branson and Love, 1988; Revenga, 1992; Burgess and Knetter, 1998; Goldberg and Tracy, 2000; Campa and Goldberg,2001)
- Burgess and Knetter (1998), Klein et al. (2003) and especially Campa and Goldberg (2001) find a low responsiveness of employment to exchange rate fluctuations

Motivation

- We argue that Campa and Goldberg (2001) results is a figment of their use of industry level data. Indeed, gross job flows are relevant even within narrowly defined industries and industry data can therefore hide the effects of exchange rate on net employment
- We analyze the responsiveness of employment to exchange rate fluctuations using microeconomic panel data drawn from two high-quality sources
- We identify a variety of transmission channels and allow the relevance of each of them to vary across firms
- This shapes a firm-specific response to currency shocks that we uncover and that depends on a number of firm-specific features

Channels of transmission

- An exchange rate depreciation can affect employment through three channels:
  - an increase in foreign sales: the foreign revenue channel
  - an increase in costs of imported inputs: the cost channel
  - an increase in domestic sales: the domestic revenue channel
- The foreign revenue channel is stronger the larger is the share of revenues from exports in total revenues
- The cost channel is stronger the more a firm relies on imported inputs
- The domestic revenue channel is stronger the larger is the degree of import penetration in the domestic market
- Employment sensitivity to exchange rate fluctuations is stronger for firms with lower market power

Summary of findings

- We find evidence of an economically and statistically significant effect of a depreciation on employment, that is:
  - positive through the revenue channel
  - negative through the cost channel
  - stronger for firms with low market power
- In addition, we also consider how these effects change with:
  - the degree of import penetration in the domestic market where the firm operates
  - the firm's export status (exporting, non-exporting and switching trading status)
  - the degree of input substitutability in the production function
  - worker types within each firm (i.e., blue- vs. white-collars)
- Finally, we consider the effects at the firm level:
  - on wages
  - on gross job flows

Labor demand and supply

- The firm maximizes its profits:

$$\pi(q, q^*, e) = \max_{q,q^*,z,z^*,L} p(q, e)q + \frac{p^*(q^*, e)q^*}{e} - zs - \frac{z^* s^*(e)}{e} - wL$$

subject to the technology constraint:

$$q + q^* = Q = F(L, z, z^*)$$

An increase in e is an appreciation. z and z^* are intermediate inputs; s and s^* are their respective prices.

- As in Campa and Goldberg (2001), labor supply is a simple linear function of the wage, w, and of aggregate demand conditions, y:

$$L = a_0 + a_1 w + a_2 y$$

Elasticity of employment to the exchange rate

- Solving the optimization problem and equating labor demand and supply we obtain the elasticity of equilibrium employment with respect to exchange rate, e:

$$\frac{\Delta L}{\Delta e}\frac{e}{L} = \frac{1}{\overline{\mu}}[-\chi(1-\eta_{p^*,e}) + \alpha(1-\eta_{s^*,e}) + (1-\chi)\eta_{p,e}]B$$

  where:

  - χ is the degree of foreign exposure on revenue side
  - α is the degree of foreign exposure on cost side
  - $\overline{\mu}$ is the average mark-up in home and foreign markets
  - $\eta_{p^*,e} \in [0,1]; \eta_{p,e} \in [-1,0], \eta_{s^*,e} \in [0,1]$ are pass-through elasticities
  - B is a combination of parameters

- This equation summarizes the theoretical background and provides a number of testable implications

Revenue and cost transmission channels

$$\frac{\Delta L}{\Delta e}\frac{e}{L} = \frac{1}{\mu}[-\chi(1-\eta_{p^*,e}) + \alpha(1-\eta_{s^*,e}) + (1-\chi)\eta_{p,e}]B$$

- The effect of a depreciation on employment is:
  - positive through the foreign revenue channel, $-\chi(1-\eta_{p^*,e})$
  - negative through the cost channel, $\alpha(1-\eta_{s^*,e})$
  - positive through the domestic revenue channel, $(1-\chi)\eta_{p,e}$
- the effect through foreign revenues is increasing in χ
- the effect through the cost channel is increasing in α
- the effect through domestic revenues is increasing in $(1-\chi)$

Market power

$$\frac{\Delta L}{\Delta e}\frac{e}{L} = \frac{1}{\overline{\mu}}[-\chi(1-\eta_{p^*,e}) + \alpha(1-\eta_{s^*,e}) + (1-\chi)\eta_{p,e}]B$$

Moreover, the transmission of exchange rate shocks to employment is stronger for firms with lower market power through:

- the price elasticity of demand, $\overline{\mu}$. Recall that revenues in foreign markets are: $\frac{p^*q^*}{e}$; $e \downarrow$; $p^* \downarrow$; $q^* \uparrow$
- the exchange rate pass-through to the export prices, $\eta_{p^*,e} \in [0,1]$ depends on pricing power (Dornbusch, 1987)
- the exchange rate pass-through to prices of imported goods, $\eta_{p,e} \in [-1,0]$ depends on the competitive pressure
- the exchange rate elasticity of foreign input prices, $\eta_{s^*,e} \in [0,1]$ depends on the degree of competition

Econometric model

- We specify the following dynamic equations for labor input:

$$\Delta n_{it} = \beta_0 + \beta_1 \alpha_{it-1} \Delta e_t + \beta_2 \chi_{it-1} \Delta e_t +$$

$$+\beta_3 \alpha_{it-1} + \beta_4 \chi_{it-1} + \beta_5 \Delta s_{it-1} + \beta_6 mkup_{it-1} + \beta_7 \Delta n_{it-1} + b' Z_{it} + \lambda_i + u_{it}$$

  - n_{it} is labor input of firm i at time t (employees or hours worked)
  - α_{it-1} is the share of imported inputs (lagged one year to mitigate the possible simultaneity bias)
  - χ_{it-1} is the (lagged) share of export sales
  - e_t is the real effective exchange rate
  - s_{it} is the value of real sales
  - $mkup_{it}$ is the value of profit margins
  - Z_{it} include year, industry, size and geographic dummies
- We use the system GMM panel estimator

Data

- The empirical analysis is conducted on an unbalanced panel of about 2,400 Italian manufacturing firms with more than 50 employees over the period 1984-1999
- Data are drawn from the Bank of Italy's Surveys of Investment in Italian Manufacturing merged with information from the Company Accounts Data Service reports
- Data on the shares of imported inputs combine firm-level information with industry-level information from the 44-sectors input-output table of 1992, updated with information on import demand and production
- Each firm's time varying market power is computed as

$$\overline{mkup}_{it} = \left(\frac{\text{sales} + \Delta\text{inventories} - \text{payroll} - \text{non-labor costs}}{\text{sales} + \text{change in inventories}} \right)_{it}$$

- For measuring currency oscillations, we use the permanent component of the export and the import real effective exchange rate changes of the Italian currency taking into account 24 bilateral exchange rates

Basic results

	(1)	(2)	(3)	(4)
Variable	Employment: Δl_{it}		Hours: Δh_{it}	
$\alpha_{it-1} \cdot \Delta pmer_t$	2.929**	2.681**	3.821**	4.775**
	(1.358)	(1.011)	(1.434)	(1.158)
$\chi_{it-1} \cdot \Delta peer_t$	−1.766**	−1.217**	−0.988**	−0.677**
	(0.329)	(0.213)	(0.275)	(0.237)
α_{it-1}	0.403**	0.410**	0.419**	0.502**
	(.053)	(0.047)	(0.065)	(0.059)
χ_{it-1}	0.003	0.006	−0.001	0.001
	(0.005)	(0.004)	(0.006)	(0.006)
Δs_{it-1}	0.033**	0.025**	0.038**	0.299**
	(0.005)	(0.004)	(0.007)	(0.006)
$MKUP_{it-1}$	−−	0.198**	−−	0.163**
		(0.030)		(0.023)
Lagged dependent variable	0.167**	0.156**	0.031**	0.020**
	(0.016)	(0.012)	(0.013)	(0.011)
Observations	6,766	6,766	6,390	6,390

Industry level results

	(1)	(2)
Variable	Employment: Δl_{jt}	Hours: Δh_{jt}
$\alpha_{jt-1} \cdot \Delta pmer_t$	-12.58	-0.959
	(13.75)	(19.18)
$\chi_{jt-1} \cdot \Delta peer_t$	5.686	2.107
	(7.867)	(10.21)
α_{jt-1}	-0.122	-0.180
	(0.208)	(0.381)
χ_{jt-1}	0.244^{*}	0.225
	(0.138)	(0.169)
Δs_{jt-1}	1.057^{**}	-0.813
	(0.499)	(0.885)
$MKUP_{jt-1}$	2.330^{**}	2.020^{**}
	(0.962)	(0.594)
Lagged dependent variable	-1.368^{**}	0.602
	(0.519)	(0.858)
Constant	-0.346^{**}	-0.232^{**}
	(0.122)	(0.093)
Observations	182	182

Market power

	(1)	(2)	(3)	(4)
Variable	Employment: Δl_{it}		Hours: Δh_{it}	
	Degree of market power		Degree of market power	
	Low	High	Low	High
$\alpha_{it-1} \cdot \Delta pmer_t$	2.943**	1.211**	6.444**	3.264**
	(0.524)	(0.566)	(0.888)	(1.635)
$\chi_{it-1} \cdot \Delta peer_t$	−1.069**	−0.306**	−0.641**	−0.386
	(0.099)	(0.088)	(0.162)	(0.386)
α_{it-1}	0.567**	0.349**	0.532**	0.445**
	(0.058)	(0.041)	(0.073)	(0.074)
χ_{it-1}	−0.005	0.004	0.001	0.007
	(0.005)	(0.004)	(0.006)	(0.007)
Δs_{it-1}	0.011**	0.028**	0.037**	0.035**
	(0.002)	(0.004)	(0.004)	(0.010)
$MKUP_{it-1}$	0.238**	0.273**	0.090**	0.244**
	(0.014)	(0.025)	(0.014)	(0.046)
Lagged dependent variable	0.116**	0.155**	−0.010	−0.003
	(0.009)	(0.009)	(0.010)	(0.015)
Observations	3,339	3,246	3,126	3,099

Additional results

- In addition to the results presented above, we show that:
  - the revenue side effect is stronger for firms in sectors with a higher degree of import penetration
  - firms with a larger share of blue collars have a lower exchange rate sensitivity
  - exchange rate swings have differential effects on employment for firms that are currently exporting, non-exporters, and that switch export status
  - exchange rate oscillations affect gross job flows at the firm level and job creation is significantly more reactive than job destruction
  - exchange rate movements have also significant effects on wages that depend on firms' external orientation and market power

Gross and excess job reallocation

- There is large empirical evidence that currency swings affect the volume of job creation and job destruction
- In order to verify this hypothesis also in our firm-specific data, we use two measures of gross job reallocation:
  - the gross job reallocation rate,

$$gjr_{it} = \frac{C_{it} + D_{it}}{\frac{1}{2}(L_{it} + L_{it-1})},$$

  - the excess job reallocation rate (the amount of job reallocation in excess to what is associated with changes in net employment)

$$ejr_{it} = \frac{C_{it} + D_{it} - |C_{it} - D_{it}|}{\frac{1}{2}(L_{it} + L_{it-1})}$$

- We also consider separately job creation and destruction

Gross job flows

Variable	(1) Gross Job Reallocation	(2) Excess Job Reallocation	(3) Job Creation	(4) Job Destruction
$\alpha_{it-1} \cdot \Delta pmer_t$	5.567*	5.137**	3.637**	1.645
	(2.986)	(2.453)	(1.691)	(1.536)
$\chi_{it-1} \cdot \Delta peer_t$	−0.443	−1.457**	−1.141**	0.165
	(0.541)	(0.472)	(0.301)	(0.235)
α_{it-1}	−0.076	0.121	0.102	−0.151**
	(0.252)	(0.202)	(0.090)	(0.078)
χ_{it-1}	−0.014	−0.016	−0.006	−0.006
	(0.029)	(0.024)	(0.011)	(0.011)
Δs_{it-1}	0.011**	0.021**	0.023**	−0.002
	(0.005)	(0.004)	(0.003)	(0.003)
$MKUP_{it-1}$	0.032	0.024	0.090**	−0.064**
	(0.056)	(0.056)	(0.031)	(0.021)
Observations	6,765	6,765	6,765	6,766

Wages

Variable	Real Wages: Δw_{it}		
	(1)	(2)	(3)
	Low Mark-up	High Mark-up	All Sample
$\alpha_{it-1} \cdot \Delta pmer_t$	2.848^{**}	2.743^{**}	$--$
	(0.819)	(0.891)	
$\chi_{it-1} \cdot \Delta peer_t$	-1.281^{**}	-0.375^{**}	$--$
	(0.163)	(0.170)	
$\alpha_{it-1} \cdot \Delta pmer_t \cdot (1 - MKUP_{it-1})$	$--$	$--$	2.461^{**}
			(0.848)
$\chi_{it-1} \cdot \Delta peer_t \cdot (1 - MKUP_{it-1})$	$--$	$--$	-1.100^{**}
			(0.184)
α_{it-1}	0.368^{**}	0.215^{**}	0.248^{**}
	(0.055)	(0.049)	(0.040)
χ_{it-1}	-0.007	-0.001	-0.005
	(0.005)	(0.004)	(0.004)
Δs_{it-1}	0.016^{**}	-0.016^{**}	-0.001
	(0.003)	(0.004)	(0.004)
$MKUP_{it-1}$	0.127^{**}	0.168^{**}	0.141^{**}
	(0.012)	(0.034)	(0.016)
Δn_{it-1}	0.083^{**}	-0.015	0.048^{**}
	(0.010)	(0.014)	(0.011)
Observations	3,335	3,245	6,579