Firm-specific Exchange Rate Shocks and Employment Adjustment: Theory and Evidence

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Introduction

- In open economies, exchange rates are often considered to be an important shock that affects the labor market.
- Most previous studies have used industry or country level data to study the impact exchange rates on employment.
  - Revenga (1992), Campa and Goldberg (2001); Klein et al. (2003)
- Limited evidence on how exchange rate changes induce labor reallocation across firms within an industry.
  - The majority of job reallocation occured within narrowly defined industries.

Introduction

- We examine how exchange rate shocks induce labor reallocation across firms within an industry.
- Methodological contribution: effective exchange rates at the firm-level
  - Trade-weighted average of exchange rate changes of firm's all trading partners.
- Two major benefits:
  - Examine the job reallocations across heterogenous firms along two dimensions: external orientation and trade partner choice.
  - Facilitates the identification of the alternative transmission channels.

Our approach

- Develop a theoretical model that link firm employment changes to firm-specific effective exchange rate changes and firm's external orientation.
- Empirically construct firm-specific exchange rate measures exploiting the richness of our data that reports exports by destination and imports by source country for each firm.
- Disentangle the contribution of external orientation and trade partner choice in intra-industry labor reallocation.
- Compare the estimated employment impacts of exchange rates using firm-specific, industry-specific and aggregate effective exchange rates.

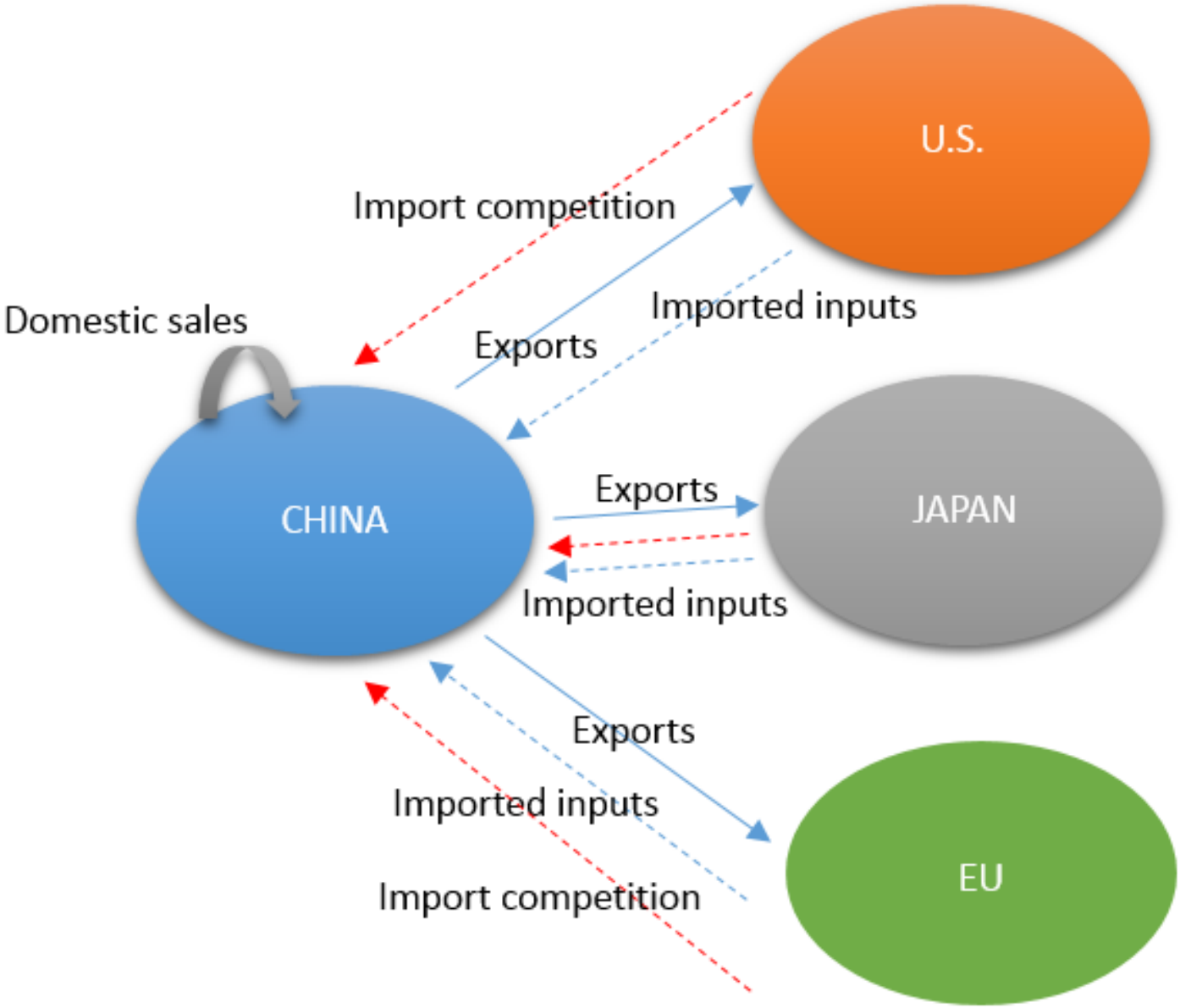
Major Findings

- Exchange rate movements induce significant labor reallocation across firms with different degrees of external orientation, and across firms with different trading partners, as predicted by theory.
- Trading partner distribution is as important as external orientation in explaining firm's heterogeneous employment response to exchange rate movements.
- Compared with effective exchange rate measures constructed at more aggregate levels, using firm-specific effective exchange rates increases the predicted cross-firm variation of exchange-rate-induced employment changes by around 40%.

Literature

- Abundant literature on the impact of exchange rate fluctuations on employment.
- Earlier works: country or industry level.
  - exchange rate variations and net employment: Branson and Love (1986, 1987); Revenga (1992); Burgess and Knetter, (1998); Goldberg and Tracy (2000); Campa and Goldberg (2001)
  - exchange rate variations and gross job flows: Gourinchas (1999); Klein et al. (2003)
- Investigations at the firm level:
  - Nucci and Pozzolo (2010) (for Italy).
  - Ekholm et al. (2012) (for Norway).

- Introduction
- **Theory**
- Empirical Strategy
- Data
- Results
- Further Discussions


U.S.
Import competition
Domestic sales
Exports
Imported inputs
CHINA
Exports
JAPAN
Imported inputs
Exports
Imported inputs
Import competition
EU

Elasticity of employment to bilateral exchange rate

Theorem

The elasticity of employment L_{in} to bilateral exchange rate e_{nk} is a function of firm's import intensity from country k (φ_{ink}), the share of exports to country k over its total sales (χ_{ink}), and the interaction between firm's share of domestic sales over its total sales (χ_{inn}) and the import penetration ratio of country k (M_{kn}).

$$\frac{\partial \ln L_{in}}{\partial \ln e_{nk}} = (\alpha_{ink} - \eta^{IM}_{ink})\varphi_{ink} - \beta_{ink}\chi_{ink} - \gamma_{nk}\chi_{inn}M_{kn} + \lambda_{nk} \qquad (1)$$

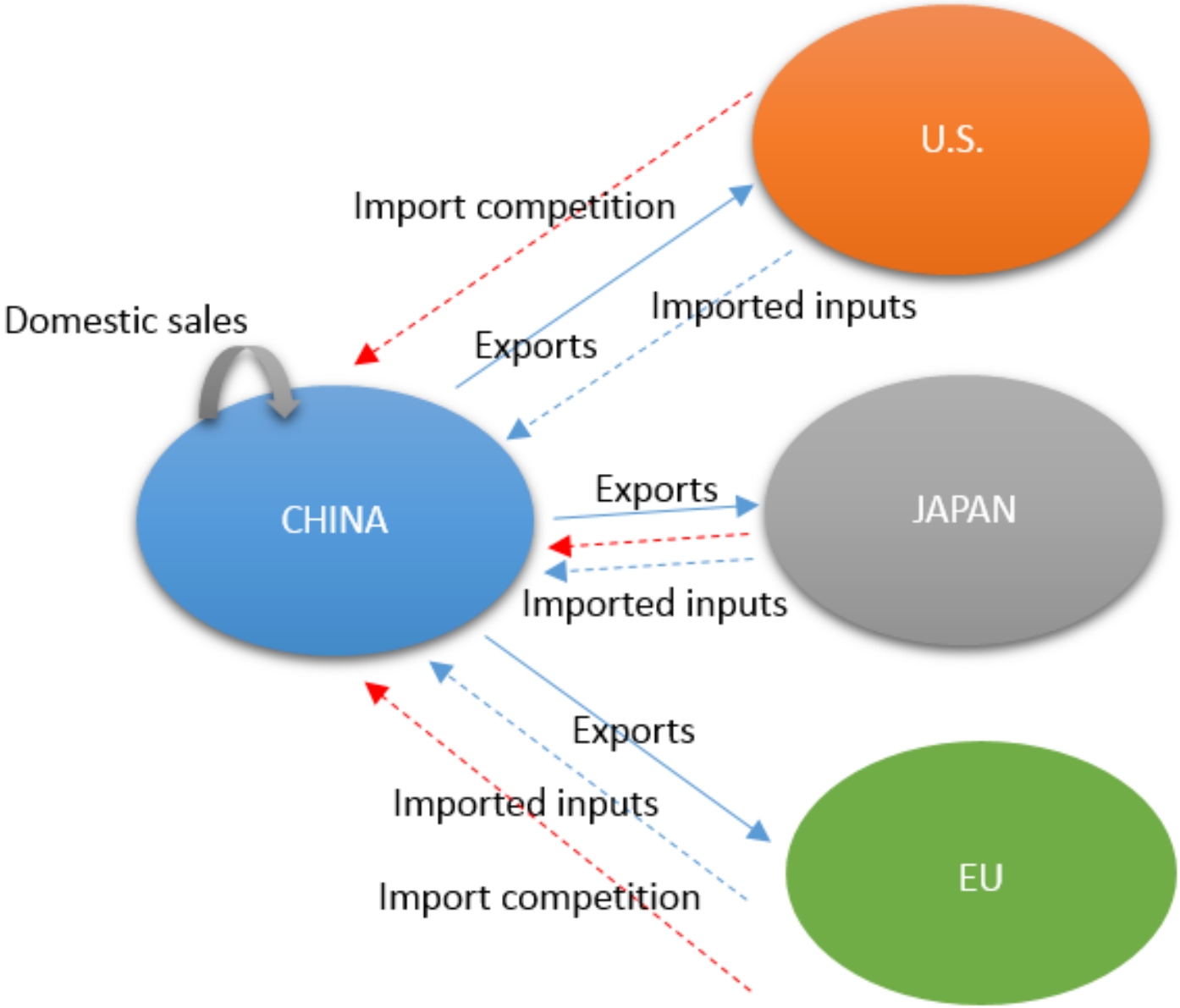
where $\alpha_{ink}, \beta_{ink}, \gamma_{nk} > 0$.

Elasticity of employment to exchange rates

$$\frac{\partial \ln L_{in}}{\partial \ln e_{nk}} = (\alpha_{ink} - \eta^{IM}_{ink})\varphi_{ink} - \beta_{ink}\chi_{ink} - \gamma_{nk}\chi_{inn}M_{kn} + \lambda_{nk} \qquad (2)$$

- The three terms in Equation (13) reflect different channels transmitting exchange rate shocks to employment.

- $(\alpha_{ink} - \eta^{IM}_{ink})\varphi_{ink}$: *the import cost channel.*
- $-\beta_{ink}\chi_{ink}$: *the export price channel.*
- $-\gamma_{nk}\chi_{inn}M_{kn}$: *the import competition channel.*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Linking employment to firm-specific effective exchange rates

$$\begin{aligned}\Delta \ln L_{in} &= (\alpha_{in} - \overline{\eta}_{in}^{IM})\varphi_{in}\Delta IMFEER - \beta_{in}\chi_{in}\Delta EXFEER \\ &\quad -\gamma_n(1-\chi_{in})\Delta IMPEER + \lambda_n \qquad (3)\end{aligned}$$

- Links firm-level employment changes to three measures of effective exchange rate shocks using different trade shares as weights:
  - imported-weighted effective exchange rates ($\Delta IMFEER$).
  - export-weighted effective exchange rates ($\Delta EXFEER$).
  - import-penetration exchange rates ($\Delta IMPEER$).
- The impact of exchange rate changes on employment through the import cost channel, export price channel and the import competition channel.
- The magnitude of each channel will depend on the external orientation of the firm, φ_{in} and χ_{in}.

- Introduction
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Empirical Strategy

- An empirical counterpart of Equation (3):

$$\begin{aligned}\Delta \ln L_{it} &= \beta_0 + \beta_1 \varphi_{i,t-1} \Delta IMFEER_{it} + \beta_2 \chi_{i,t-1} \Delta EXFEER_{it} \\ &\quad + \beta_3 (1 - \chi_{i,t-1}) \Delta IMPEER_{jt} + \nu_j + \eta_t + \varepsilon_{it}\end{aligned} \tag{4}$$

- $\varphi_{i,t-1}$ and $\chi_{i,t-1}$: firm-level import and export intensity.
- $\Delta IMFEER_{it}$, $\Delta EXFEER_{it}$: import-weighted and export-weighted effective exchange rate changes (firm-specific).
- $\Delta IMPEER_{jt}$: import-penetration-weighted effective exchange rate changes (industry level).
- η_t : year fixed effects.
- ν_j : industry fixed effects

Data

- **Firm-level data.** Annual Survey of Industrial Firms, 2000-2006.
  - collected and maintained by the National Bureau of Statistics of China.
  - includes all State Owned Enterprises (SOE) and those Non-State Owned Enterprises with annual sales of RMB five million (or equivalently, about $850,000) or more.
- **Trade data.** transaction-level trade data from China's General Administration of Customs during 2000-2006.
  - Covers the universe of China's exporters and importers.
  - Report export and import values at the firm-level by product (HS 8-digit) and by destination or source country.
  - This data set allows us to calculate firm-level exports by destination and imports by source country.
- **Match the two data sets.**
  - using firm name, telephone number and zip code.
  - The merged data sets account for 54% of China's total exports and 50% of total imports over this period.

Variable Construction

- Export-weighted and import-weighted effective exchange rates at the firm level:

$$\Delta EXFEER_{it} = \sum_k (EX_{ik,t-1} / \sum_k EX_{ik,t-1}) \Delta \ln e_{kt} \tag{5}$$

$$\Delta IMFEER_{it} = \sum_k (IM_{ik,t-1} / \sum_k IM_{ik,t-1}) \Delta \ln e_{kt} \tag{6}$$

- change of import-penetration weighted effective exchange rate at the industry level.

$$\Delta IMPEER_{jt} = \sum_k \left(\frac{IM_{jk,t-1}}{DOMSALE_{jt-1} + \sum_k IM_{jk,t-1}} \right) \Delta \ln e_{kt} \tag{7}$$

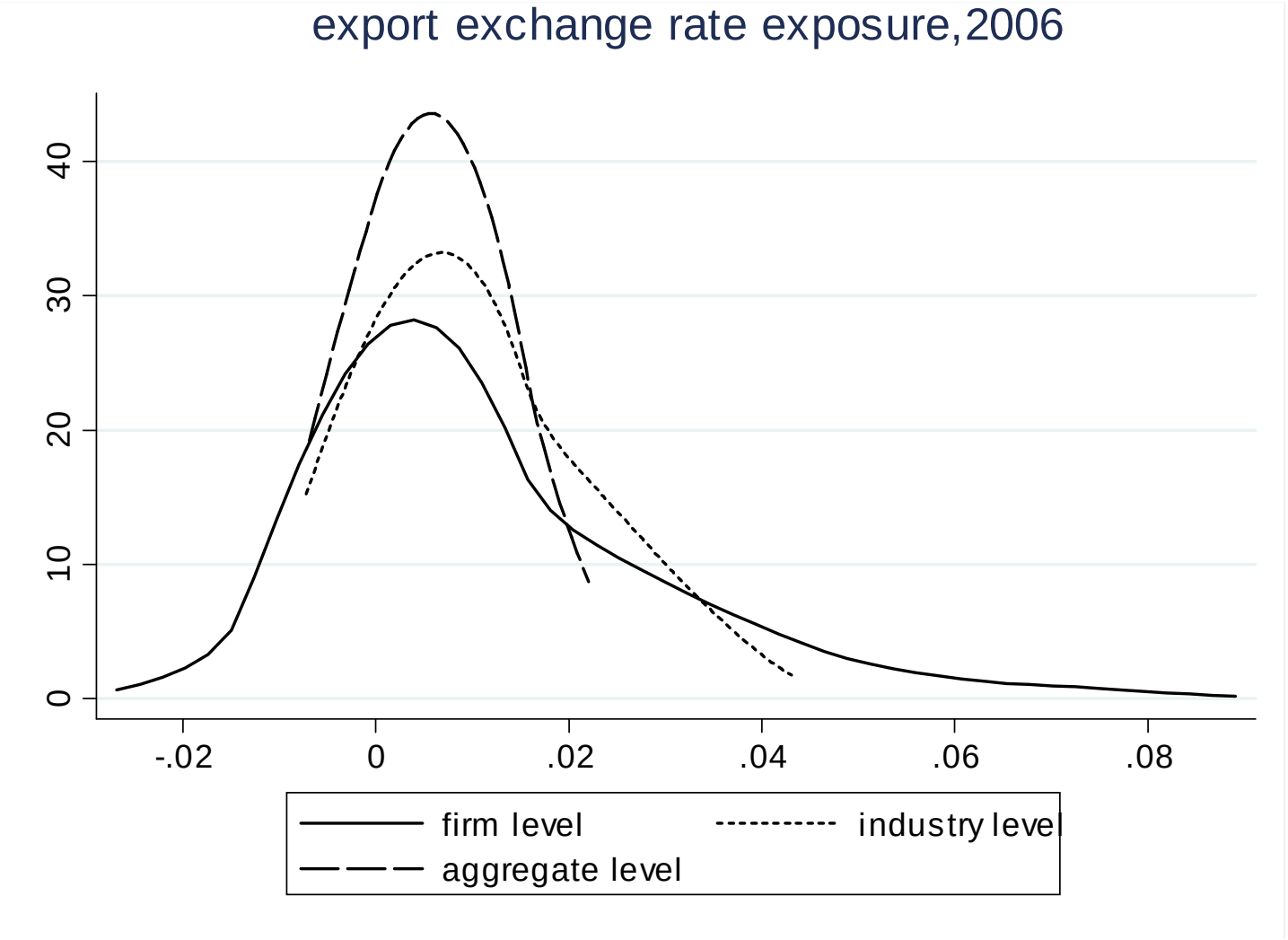
Variable Construction

- We also construct firm-level export and import intensity

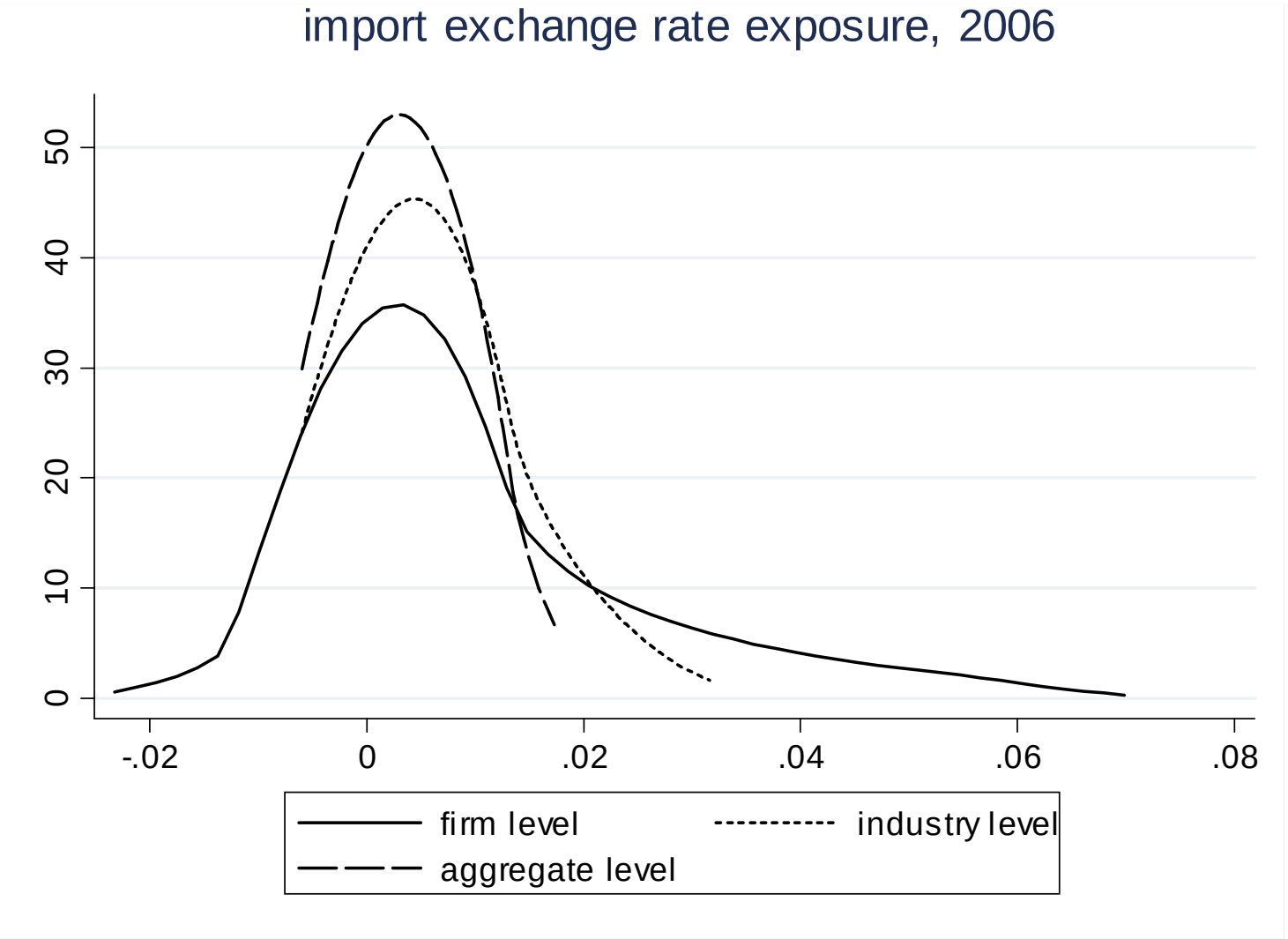
$$\chi_{i,t-1} = \frac{\sum_k EX_{ik,t-1}}{SALES_{i,t-1}} \tag{8}$$

$$\varphi_{i,t-1} = \frac{\sum_k IM_{ik,t-1}}{SALES_{i,t-1}} \tag{9}$$

Export exchange rate exposure



Import exchange rate exposure



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Baseline results

Dep variable: $\Delta \ln L_{it}$	(1)	(2)	(3)	(4)
$\varphi_{i,t-1} \times \Delta IMFEER_{it}$	0.213***	0.269***	0.212***	0.266***
	(0.045)	(0.047)	(0.045)	(0.047)
$\chi_{i,t-1} \times \Delta EXFEER_{it}$	-0.329***	-0.331***	-0.332***	-0.334***
	(0.034)	(0.035)	(0.035)	(0.035)
$(1-\chi_{i,t-1}) \times \Delta IMPEER_{jt}$			-0.074	-0.076
			(0.093)	(0.126)
Industry FE	Yes	No	Yes	No
Year FE	Yes	No	Yes	No
Industry-year FE	No	Yes	No	Yes
Observations	149,224	149,224	149,224	149,224
R-squared	0.010	0.025	0.010	0.025

Impact on labor reallocation

- What do these estimates imply about the impact of exchange rates on labor-reallocation?
- Calculate the fitted value of employment growth for each firm and year as follows:

$$\begin{aligned}\Delta \ln \widehat{L}_{it} &= \widehat{\beta}_1 \varphi_{i,t-1} \Delta IMFEER_{it} + \widehat{\beta}_2 \chi_{i,t-1} \Delta EXFEER_{it} \\ &\quad + \widehat{\beta}_3 (1 - \chi_{i,t-1}) \Delta IMPEER_{jt} \end{aligned} \tag{10}$$

- Examine how the predicted employment growth vary with
  - export and import intensity
  - major trading partner

Impact on labor reallocation

- $\Delta \ln \widehat{L}_{it}$ (%) by export & import intensity, 2006

exp./imp.	low	medium	high
low	-0.03	0.03	0.48
medium	-0.11	-0.18	0.30
high	-0.46	-1.06	-0.64

- $\Delta \ln \widehat{L}_{it}$ (%) by major export destination & import source, 2006

destination./source	Japan	United States	Euro zone	Korea
Japan	-0.74	-0.82	-0.88	-1.35
United States	-0.05	-0.27	-0.31	-0.51
Euro zone	0.06	-0.24	-0.22	-0.39
Korea	0.43	0.22	0.21	0.03

Contribution of external orientation v.s. trade partner choice

- Measure intra-industry labor reallocation by the standard deviation of $\Delta \ln \widehat{L}_{it}$.
- Shut down the cross-firm variation of external variation or FEER.
  - Fix export and import intensity at industry median
  - Fix FEER at industry median
- Trade partner choice explains around **48%** of the total variation of $\Delta \ln \widehat{L}_{it}$ within an industry.

Robustness Checks

- Alternative weighing
- Additional controls
- Lagged effects
- Subsample
- Add labor adjustment cost

Comparison with aggregate-level EER

Dep variable: $\Delta \ln L_{it}$	(1) industry REER	(2) industry REER	(3) agg. REER	(4) agg. REER
$\varphi_{i,t-1} \times \Delta Industry\_IMEER_{jt}$	-0.100*	-0.085		
	(0.058)	(0.062)		
$\chi_{i,t-1} \times \Delta Industry\_EXEER_{jt}$	-0.293***	-0.313***		
	(0.045)	(0.047)		
$\varphi_{i,t-1} \times \Delta Aggregate\_EER_{t}$			-0.356**	-0.237
			(0.140)	(0.147)
$\chi_{i,t-1} \times \Delta Aggregate\_EER_{t}$			-0.712***	-0.709***
			(0.107)	(0.111)
$(1-\chi_{i,t-1}) \times \Delta IMPEER_{jt}$	-0.094	-0.154	-0.109	-0.173
	(0.093)	(0.126)	(0.093)	(0.126)
Industry FE	Yes	No	Yes	No
Year FE	Yes	No	Yes	No
Industry-year FE	No	Yes	No	Yes
Observations	142,002	142,002	142,002	142,002

Comparison with aggregate-level EER

- Compare predicted labor-reallocation using different EER measures.

REER measures:	(1) firm REER	(2) industry REER	(3) aggregate REER
2001	1.15	0.99	0.72
2002	0.71	0.35	0.41
2003	1.16	0.94	1.30
2004	0.95	0.56	0.56
2005	0.75	0.14	0.13
2006	0.83	0.28	0.34
year average	0.93	0.54	0.58

- Using FEER increases the predicted labor-reallocation by 40%.
- Exchange rate shocks contribute to around 2.6% of the actual intra-industry labor reallocation.

Conclusion

- Investigate the impact of exchange rate shocks on intra-industry labor reallocation.
- Reallocation long two dimensions
  - External orientation
  - Trading partner distribution
- Trading partner distribution is as important as external orientation.
- Using FEER substantially increases the predicted variation of exchange-rate -incuded employment changes.