Nominal Exchange Rate Variability, Nominal Wage Rigidity, and the Pattern of Trade

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Benefit of fixed nominal exchange rate (NXRT): Stabilize NXRT $\rightarrow$ trade $\uparrow$?
Exchange rate stabilization → Trade ↑?

• Benefit of fixed nominal exchange rate (NXRT): Stabilize NXRT → trade↑?
  • Myth: yes
  • Theory: classically yes, but some say no
  • Empirics: mixed
Exchange rate stabilization → Trade ↑?

- Benefit of fixed nominal exchange rate (NXRT): Stabilize NXRT → trade↑?
  - Myth: yes
  - Theory: classically yes, but some say no
  - Empirics: mixed
- Studied aggregate (bilateral) trade
- Impacts may differ across sectors
- This paper: sector-level focusing on interactive impacts with nominal wage rigidity
  - Key nominal friction in biz cycles
Exchange rate variability $\times$ Wage rigidity

- Question: Does variability of nominal exchange rate hurt exports?
- Answer: Yes, if the sector faces sticky wage workers
Exchange rate variability \(\times\) Wage rigidity

- **Question:** Does variability of nominal exchange rate hurt exports?
  - **Answer:** Yes, if the sector faces sticky wage workers
- A toy model to see the mechanisms
- Empirics by “interaction-term” identification
Exchange rate variability × Wage rigidity

• Question: Does variability of nominal exchange rate hurt exports?
  • Answer: Yes, if the sector faces sticky wage workers
• A toy model to see the mechanisms
• Empirics by “interaction-term” identification
• A country whose nominal exchange rate varies little has comparative advantage in industries which intensively use sticky-wage workers
The idea goes back to ...

Freely fluctuating exchanges involve three serious disadvantages. In the first place, they create an element of risk which tends to discourage international trade. The risk may be covered by “hedging” operations where a forward exchange market exists; but such insurance, if obtainable at all, is obtainable only at a price and therefore generally adds to the costs of trading. (p. 210)

A fixed exchange rate is typically used to stabilize the value of a currency... This makes trade and investments between the two currency areas easier...

A small open economy model

- \( t = 0, 1, \ldots \)
- Two-good \((i = 1, 2)\) small-open
- HHs \(\rightarrow\) (labor) \(\rightarrow\) firms
- World goods price \(P_i^*\), exogenously fixed
- No uncertainty except for NXRT \((\mathcal{E})\)
- \(\mathcal{E}\): exogenous, stochastic

\[
\ln \mathcal{E} \sim \text{iid} \ N(\mu, \sigma^2)
\]

- Goods price in home \(P_i = \mathcal{E} P_i^*\)
One-period ahead wage rigidity

- Production factor: labor $l_{ji}(\nu)$
  - Differentiated ($\nu$) workers $\Rightarrow$ HHs set wages
  - $j = f, s$: “flexible” & “sticky”-wage labor
- “Sticky” wage: nominal wage determined at the end of the previous period (as Obstfeld & Rogoff 00)
  - OR00: sticky-wage labor only
  - Why not Calvo, downward rigid inequality, etc?—Easy to handle variance
Firms use distinguished workers

Firms $i = 1, 2$, labor type $j = f, s$.

$$\max P_i y_i - \sum_j \int_0^1 W_{ji}(\nu) l_{ji}(\nu) d\nu,$$

where $y_i = a_i f_i^\omega s_i^{1-\omega}$, 

$$l_{ji} = \left( \int_0^1 l_{ji}(\nu)^{\phi-1} \frac{1}{\phi} d\nu \right)^{\frac{\phi}{\phi-1}}.$$

$$\Rightarrow l_{ji}(\nu) = \left( \frac{W_{ji}(\nu)}{W_{ji}} \right)^{-\phi} l_{ji} \quad (\diamondsuit)$$
Households as wage setter

\[
E \sum_t \beta^t \left[ \ln c_t(\nu) - \sum_j \sum_i \frac{l_{jit}(\nu)}{\eta} \right]
\]

\[
c(\nu) = \prod_i c_i(\nu)^{\alpha_i},
\]

\[
c(\nu) + \int_{h'} q(h') b(\nu, h') \, dh'
\]

\[
= \sum_j \sum_i \frac{W_{ji}(\nu)}{P} l_{ji}(\nu) + b(\nu, h),
\]

\[
c(\nu) = \sum_i P_i c_i(\nu) / P,
\]

Labor demand (◊).
Wage: markup over marginal cost

- \( P = \prod_i P_i^{\alpha_i} = \prod_i (\mathcal{E} P_i^*)^{\alpha_i} = \mathcal{E} P^* \)
- Full consumption insurance \( \Rightarrow c = c^* \), constant
- Symmetry \( \Rightarrow \) drop \( \nu \)

\[
W_{fi} = \frac{\phi}{\phi - 1} \Gamma/_{fi}^{\eta-1} Pc^*
\]

\[
W_{si} = \frac{\phi}{\phi - 1} \Gamma \frac{\text{E} \left[ I_{si}^\eta \right]}{\text{E} \left[ \frac{I_{si}}{Pc^*} \right]}
\]
Long-run trade balance

\[ \sum_{t} \beta^{t} c^{*} = \sum_{t} \beta^{t} \mathbb{E} \sum_{i} P_{i} y_{i} / P \]

- \( c^{*} \) determined after calculating \( y_{i} \)
Remarks

• Pass-through
  • 100% path-through as an importer
  • 0% path-through as an exporter
  • Empirics: somewhere b/w, depending on countries, industries...

• Forward market
  • No access to forward market
  • (Possible extension) even available, needs to pay additional costs
Benchmark: no wage rigidity

- No rigidity eqm: denoted by

\[
\bar{W}_{si} = P_i^* a_i \omega_i \eta \left(1 - \omega_i \right) \frac{\eta - \omega_i}{\eta} E
\]

\[
\bar{y}_i = a_i \left( \frac{P_i^* \phi - 1}{P^* \phi \Gamma} \right) \frac{1}{\eta - 1}
\]

\[
\times \omega_i^{\eta - 1} \left(1 - \omega_i \right) \frac{1 - \omega_i}{\eta - 1} \left( \frac{1}{c^*} \right)^{\eta - 1}
\]

- Nominal prices: proportional to \( E \)
- Real variables: do not depend on \( E \)
Benchmark: no wage rigidity

$P_1/P_2$

$\bar{c}_2$

PPF

Indifference curve

World relative price

$\bar{y}_2$

$\bar{c}_1$

$\bar{y}_1$
Wage setting under wage rigidity

From FOCs

\[ W_{si} = P_i^* a_i \omega_i^{\eta} (1 - \omega_i) \eta \tilde{E}_i \]

where

\[ \tilde{E}_i \equiv \left( \frac{\eta}{E} \frac{\eta - \omega_i}{\omega_i (\eta - 1)} \right) \left( \frac{\eta - \omega_i}{\eta} \right) \]

- Difference: \( E \) vs \( \tilde{E}_i \)
- Wage determined thru “expectation”
Output under rigidity depends on NXRT

- Output “gap” from no rigidity eqm

\[ \frac{y_i}{\bar{y}_i} = \left( \frac{\bar{c}^*}{c^*} \right)^{\frac{1}{\eta-1}} \left( \frac{\bar{E}}{\bar{E}_i} \right) \frac{\eta(1-\omega_i)}{\omega_i(\eta-1)} \]

\( y_i \) depends on
- fundamentals (e.g., \( a_i \) thru \( \bar{y}_i \))
- the gap of consumption levels
- the gap b/w “expected” & realized NXRT
- \( \bar{E} \uparrow \rightarrow y_i \uparrow \)
Exchange rate stabilization $\rightarrow$ Trade $\uparrow$?

- Upward w-rigidity + depreciation ($E \uparrow$)
- High goods price, low labor cost
- Rigid sector gets “competitiveness”
- Output surge
Exchange rate stabilization $\rightarrow$ Trade $\uparrow$?

- Upward w-rigidity $+$ depreciation ($E^\uparrow$)
  - High goods price, low labor cost
  - Rigid sector gets “competitiveness”
  - Output surge

- Downward w-rigidity $+$ appreciation ($E^\downarrow$)
  - Low goods price, high labor cost
  - Rigid sector loses “competitiveness”
  - Output reduction

- Magnitude larger if $\omega_i$ smaller ($=\text{relying more sticky-wage workers}$)
Exchange rate stabilization → Trade ↑?

- Upward w-rigidity + depreciation ($E^\uparrow$)
  - High goods price, low labor cost
  - Rigid sector gets “competitiveness”
  - Output surge
- Downward w-rigidity + appreciation ($E^\downarrow$)
  - Low goods price, high labor cost
  - Rigid sector loses “competitiveness”
  - Output reduction
- Magnitude larger if $\omega_i$ smaller (= relying more sticky-wage workers)
- On average...? Using log-normal assumption
Long-run (average/expected) effects

\[
E \left[ \frac{y_i}{\bar{y}_i} \right] = \left( \frac{\bar{c}^*/c^*}{\eta-1} \right) \frac{1}{\eta-1} \\
\times \exp \left( -\frac{\sigma^2}{2} \left( \frac{\eta}{\omega_i(\eta - 1)} \right)^2 \left( 1 - \omega_i \right)(\eta - \omega_i) \right)
\]

- Ignore \( \bar{c}^*/c^* \) term
- Comparing two industries \( (i \text{ and } i') \), common terms disappear
- \( \omega_i \uparrow \rightarrow E \left[ \frac{y_i}{\bar{y}_i} \right] \uparrow \)
- \( \sigma \uparrow \rightarrow E \left[ \frac{y_i}{\bar{y}_i} \right] \downarrow \)
- \( \sigma \uparrow \rightarrow E \left[ \frac{y_i}{\bar{y}_i} \right] \downarrow \downarrow \) when \( \omega_i \) low
Exchange rate variability $\times$ Wage rigidity

- Large fluctuation in rigid sector
- HHs dislike fluctuations in leisure
- On avg, low labor & output
- Sectors facing more sticky wage workers incur more “costs”
- A country whose nominal exchange rate varies little has comparative advantage in industries which intensively use sticky-wage workers
Empirical test: interaction-term identification

- Interaction-term identification (c.f., Romalis 04, Nunn 08, Cuñat & Melitz 12)
- Country-industry-(year) exports on country(-year) FEs, industry(-year) FEs, and the interaction-term:
  - Education\(^C\) \times \text{skill intensity}_i \Rightarrow +
  - Rule of law\(^C\) \times \text{contract intensity}_i \Rightarrow +
  - Labor market flex.\(^C\) \times \text{sector shock size}_i \Rightarrow +
  - Exchange rate var\(^C\) \times \text{wage rigidity}_i \Rightarrow −
Empirical test: interaction-term identification

• A country who faces variable NXRT has c.a. in industries whose wages are flexible

\[ \ln x_{it}^c = (z^c \circ q_i)' \beta + \gamma_t^c + \delta_{it} + \ldots + u_{it}^c \]

• country \( c \), industry \( i \), year \( t \)
• \( x_{it}^c \): \( c \)'s exports of \( i \) to the world in \( t \)
• \( z^c \): country variables (e.g., \( \sigma(NXRT) \))
• \( q_i \): industry variables (e.g., Wage rigidity)
• \( \circ \): element-by-element multiplication
• \( \gamma_t^c \): country-year FE
• \( \delta_{it} \): industry-year FE
• Check \( \beta \)
Trade data + Current Population Survey

- Trade data ($t = 2011, \ldots, 2015$)
  - UN comtrade, manufacturing only
  - HS-6 $\rightarrow$ US-IO industries ($i = 1, \ldots, 53$)
- Country-year variables
  - Lagged 8-year averages
- NXRT: Own currency to USD, monthly
  - Coeff of variation (SD/AVG)
  - Prob of wage unchange in one-year
  - Avg a/s workers in industry $i$
Wage rigidity from US CPS

• Apply US data to all countries
  • Common practice in the literature
  • Data availability

• Available US data
  • CPS (Many cross-section)
  • PSID (longer)
  • Survey of Income and Program Participation (high frequency: c.f., Barattieri et al. 14, Bils et al. 2019)
Wage rigidity from US CPS

- Sector-level wage rigidity: US CPS
  - 4 months surveys, 8 months no surveys, 4 months surveys
  - All months: age, working status, industry, occupation, hours, but no wage/earnings
  - Last month of the each of the 4 months (“Outgoing Rotation Group” questions): hourly wage, weekly earnings, usual hours worked, weeks per year
- Panel connection possible from 1989
- Pooled obs 1989–2007 (or –2017)
Wage rigidity from US CPS

• Focus on hourly wage
  • Robustness: if hourly wage missing, supplement by weekly earnings / usual hours worked
  • Still ignoring many workers
• Industry: 1990 US census industry code (85 relevant for mfg)
  • (Census90 $\rightarrow$ SIC87) $\rightarrow$ (NAICS92 $\rightarrow$ IO02 (53 4-digit))
  • Agg emp weight in 97 Economic census
• Robustness: map to 274 IO2 6-digit
<table>
<thead>
<tr>
<th>Code</th>
<th>Name</th>
<th>Rigidity</th>
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<tbody>
<tr>
<td>3110</td>
<td>Food manufacturing</td>
<td>9.35%</td>
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<tr>
<td>3121</td>
<td>Beverage manufacturing</td>
<td>10.74%</td>
</tr>
<tr>
<td>3122</td>
<td>Tobacco manufacturing</td>
<td>9.31%</td>
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<tr>
<td>3130</td>
<td>Textile mills</td>
<td>10.29%</td>
</tr>
<tr>
<td>3140</td>
<td>Textile product mills</td>
<td>15.39%</td>
</tr>
<tr>
<td>3150</td>
<td>Apparel manufacturing</td>
<td>15.58%</td>
</tr>
<tr>
<td>3160</td>
<td>Leather and allied product manufacturing</td>
<td>20.23%</td>
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<tr>
<td>3170</td>
<td>Apparel manufacturing</td>
<td>15.58%</td>
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<td>3210</td>
<td>Wood product manufacturing</td>
<td>13.68%</td>
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<td>3221</td>
<td>Pulp, paper, and paperboard mills</td>
<td>9.79%</td>
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<td>3222</td>
<td>Converted paper product manufacturing</td>
<td>10.85%</td>
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<tr>
<td>3230</td>
<td>Printing and related support activities</td>
<td>14.63%</td>
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<tr>
<td>3240</td>
<td>Petroleum and coal products manufacturing</td>
<td>13.68%</td>
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<tr>
<td>3251</td>
<td>Basic chemical manufacturing</td>
<td>8.99%</td>
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<tr>
<td>3252</td>
<td>Resin, rubber, and artificial fibers manufacturing</td>
<td>10.15%</td>
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<tr>
<td>3253</td>
<td>Agricultural chemical manufacturing</td>
<td>7.75%</td>
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<tr>
<td>3254</td>
<td>Pharmaceutical and medicine manufacturing</td>
<td>9.98%</td>
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<tr>
<td>3255</td>
<td>Paint, coating, and adhesive manufacturing</td>
<td>9.57%</td>
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<tr>
<td>3256</td>
<td>Soap, cleaning compound, and toiletry manufacturing</td>
<td>7.56%</td>
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<tr>
<td>3259</td>
<td>Other chemical product and preparation manufacturing</td>
<td>9.54%</td>
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<tr>
<td>3260</td>
<td>Plastics and rubber products manufacturing</td>
<td>12.78%</td>
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<tr>
<td>3270</td>
<td>Nonmetallic mineral product manufacturing</td>
<td>11.10%</td>
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<tr>
<td>3315</td>
<td>Foundries</td>
<td>8.48%</td>
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<tr>
<td>331A</td>
<td>Iron and steel mills and manufacturing from purchased steel</td>
<td>9.06%</td>
</tr>
<tr>
<td>331B</td>
<td>Nonferrous metal production and processing</td>
<td>8.61%</td>
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<tr>
<td>3321</td>
<td>Forging and stamping</td>
<td>12.26%</td>
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<tr>
<td>3322</td>
<td>Cutlery and handtool manufacturing</td>
<td>7.99%</td>
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<tr>
<td>3323</td>
<td>Architectural and structural metals manufacturing</td>
<td>10.86%</td>
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<tr>
<td>3324</td>
<td>Boiler, tank, and shipping container manufacturing</td>
<td>12.44%</td>
</tr>
<tr>
<td>3331</td>
<td>Other metal product manufacturing</td>
<td>3.42%</td>
</tr>
</tbody>
</table>

“Exchange rate & trade pattern” Hiro Ishise (ishise@osipp.osaka-u.ac.jp) 27 / 35
<table>
<thead>
<tr>
<th>NAICS Code</th>
<th>Description</th>
<th>Wage Rigidity</th>
</tr>
</thead>
<tbody>
<tr>
<td>3331</td>
<td>Agriculture, construction, and mining machinery manufacturing</td>
<td>11.57%</td>
</tr>
<tr>
<td>3332</td>
<td>Industrial machinery manufacturing</td>
<td>8.13%</td>
</tr>
<tr>
<td>3333</td>
<td>Commercial and service industry machinery manufacturing</td>
<td>7.89%</td>
</tr>
<tr>
<td>3334</td>
<td>HVAC and commercial refrigeration equipment manufacturing</td>
<td>9.11%</td>
</tr>
<tr>
<td>3335</td>
<td>Metalworking machinery manufacturing</td>
<td>11.99%</td>
</tr>
<tr>
<td>3336</td>
<td>Engine, turbine, and power transmission equipment manufacturing</td>
<td>10.27%</td>
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<tr>
<td>3339</td>
<td>Other general purpose machinery manufacturing</td>
<td>10.09%</td>
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<tr>
<td>3341</td>
<td>Computer and peripheral equipment manufacturing</td>
<td>10.38%</td>
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<td>3344</td>
<td>Semiconductor and other electronic component manufacturing</td>
<td>11.42%</td>
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<tr>
<td>3345</td>
<td>Electronic instrument manufacturing</td>
<td>11.15%</td>
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<tr>
<td>3346</td>
<td>Manufacturing and reproducing magnetic and optical media</td>
<td>11.71%</td>
</tr>
<tr>
<td>334A</td>
<td>Audio, video, and communications equipment manufacturing</td>
<td>11.60%</td>
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<tr>
<td>3351</td>
<td>Electric lighting equipment manufacturing</td>
<td>11.44%</td>
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<tr>
<td>3352</td>
<td>Household appliance manufacturing</td>
<td>7.41%</td>
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<td>3353</td>
<td>Electrical equipment manufacturing</td>
<td>11.53%</td>
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<td>3359</td>
<td>Other electrical equipment and component manufacturing</td>
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<td>3361</td>
<td>Motor vehicle manufacturing</td>
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<td>3364</td>
<td>Aerospace product and parts manufacturing</td>
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<td>336A</td>
<td>Motor vehicle body, trailer, and parts manufacturing</td>
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<td>336B</td>
<td>Other transportation equipment manufacturing</td>
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<tr>
<td>3370</td>
<td>Furniture and related product manufacturing</td>
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<td>3391</td>
<td>Medical equipment and supplies manufacturing</td>
<td>9.57%</td>
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<tr>
<td>3399</td>
<td>Other miscellaneous manufacturing</td>
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### Probability of no wage change (after 1 yr)

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<tr>
<th>NAICS Code</th>
<th>Industry Description</th>
<th>Probability</th>
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<tr>
<td>332A</td>
<td>Ordnance and accessories manufacturing</td>
<td>0.031</td>
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<td>3352</td>
<td>Household appliance manufacturing</td>
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<td>Soap, cleaning compound, and toiletry manufacturing</td>
<td>0.076</td>
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<td>336B</td>
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<td>Computer and peripheral equipment manufacturing</td>
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## Correlated to other characteristics

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<tr>
<th></th>
<th>W</th>
<th>P</th>
<th>K</th>
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<td>Wage rigidity</td>
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<td>Price flexibility</td>
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<td>K-intensity</td>
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<td>External financial dep.</td>
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<td>Asset tangibility</td>
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<td>−0.32</td>
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<td>Relationship specificity</td>
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<td>0.67</td>
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<td>Concentration of input</td>
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<td>−0.43</td>
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<td>−0.71</td>
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<td>−0.42</td>
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<td>Downstreamness</td>
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<td>−0.31</td>
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<td>−0.73</td>
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<td>−0.45</td>
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Data supports theoretical prediction

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<tr>
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<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exch$^c \times w$-rigid$^i$</td>
<td>$-0.58^{**}$</td>
<td>$-0.52^*$</td>
<td>$-0.53^*$</td>
</tr>
<tr>
<td></td>
<td>(0.29)</td>
<td>(0.28)</td>
<td>(0.28)</td>
</tr>
<tr>
<td>Inf$^c \times w$-rigid$^i$</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Other comp. adv.</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>All other int.terms</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>GDPpc$^c \times i$-dummy</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>GDPpw$^c \times i$-dummy</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Country-year FE</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Industry-year FE</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td># Country</td>
<td>124</td>
<td>124</td>
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</tr>
<tr>
<td>Obs.</td>
<td>29,056</td>
<td>29,056</td>
<td>29,056</td>
</tr>
</tbody>
</table>
Which factor contributes more?

- Many (highly colinear) variables
- Focus on a few interaction terms
  - Full set of FEs & GDPpc
- Reporting standardized coefficients
  - One SD change in the interaction term associated with $\beta$ SD change in log exports

“Exchange rate & trade pattern” Hiro Ishise (ishise@osipp.osaka-u.ac.jp) 32 / 35
Comparison of factors: beta coefficients

<table>
<thead>
<tr>
<th>Factor</th>
<th>Std. β</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exchange rate variability × Wage rigidity</td>
<td>-0.56*</td>
<td>(0.29)</td>
</tr>
<tr>
<td>Schooling × H-intensity</td>
<td>-0.066</td>
<td>(0.072)</td>
</tr>
<tr>
<td>K/L ratio × K-intensity</td>
<td>0.13</td>
<td>(0.38)</td>
</tr>
<tr>
<td>Financial development × External fin. dep</td>
<td>0.093**</td>
<td>(0.039)</td>
</tr>
<tr>
<td>Financial development × Asset tangibility</td>
<td>-0.053</td>
<td>(0.11)</td>
</tr>
<tr>
<td>Rule of law × Rel. specificity</td>
<td>-0.11**</td>
<td>(0.044)</td>
</tr>
<tr>
<td>Labor flexibility × Sales volatility</td>
<td>-0.059</td>
<td>(0.052)</td>
</tr>
<tr>
<td>Natural resource × NR-intensity</td>
<td>0.17*</td>
<td>(0.089)</td>
</tr>
<tr>
<td>Inflation rate × Price flexibility</td>
<td>-0.0095</td>
<td>(0.017)</td>
</tr>
<tr>
<td>Inflation rate × Wage rigidity</td>
<td>0.55*</td>
<td>(0.30)</td>
</tr>
</tbody>
</table>
Robustness checks

Some have been done, some to be added

• Cross-section
• Average trade over years as cross-section
• Exchange rate
  • Nominal effective exchange rate
  • Coeff of variation of growth rate
  • different lag years
• Wage rigidity
  • Supplemented w/ weekly earnings
  • 6-digit industry
  • SIPP data
• Poisson Pseudo ML

“Exchange rate & trade pattern” Hiro Ishise (ishise@osipp.osaka-u.ac.jp) 34 / 35
Exchange rate stabilization → Trade ↑?

- Question: Does exchange rate variability hurts exports?
  - Answer: Yes, if the sector faces sticky wage workers
- Theory: Two-sector small open, one-period advance wage setting
- Intuition: Sectors facing sticky wage workers incur adjustment costs
- Empirics: Interaction-term identification
- A country whose nominal exchange rate varies little has comparative advantage in industries which intensively use sticky-wage workers
Exchange rate variability × Wage rigidity

- **Question:** Does variability of nominal exchange rate hurt exports?
  - **Answer:** Yes, if the sector faces sticky wage workers

- **Theory**
  - Two-sector small open economy
  - Two-factors: flexible- & sticky-wage labor
  - Sticky-wage: one-period ahead determination
  - Variance of NXRT leads to more production in sector using more flex wage workers
Exchange rate variability × Wage rigidity

• Question: Does variability of nominal exchange rate hurt exports?
  • Answer: Yes, if the sector faces sticky wage workers

• Intuitive idea
  • NXRT fluctuation ⇒ uncertainty about nominal sales
  • w/o nominal rigidity, does not matter
  • w/ nominal rigidity, costly to adjust
  • Sectors facing more sticky wage workers incur more costs
Exchange rate variability $\times$ Wage rigidity

- Question: Does variability of nominal exchange rate hurt exports?
  - Answer: Yes, if the sector faces sticky wage workers

- Empirics
  - Data: country-sector level exports 2011–2015, matched with sector level wage rigidity constructed by panel dimension of US CPS
  - Reasonably robust to various checks
Exchange rate variability × Wage rigidity

• Question: Does variability of nominal exchange rate hurt exports?
  • Answer: Yes, if the sector faces sticky wage workers

• Result
  • A country whose nominal exchange rate varies less has comparative advantage in industries which intensively use sticky-wage workers
A property of log-normal variable $\ln x \sim N(\mu, \sigma^2)$

$$\text{Ex}^\rho = \rho \mu + 0.5 \rho^2 \sigma^2$$

The “expected” NXRT

$$\tilde{E}_i = \exp \left( \mu + \frac{\sigma^2}{2} \frac{\eta}{\omega_i} \left( \frac{\eta + 1 - 2\omega_i}{\eta - 1} \right) \right)$$

• Note: if $\sigma = 0$, $E = \tilde{E}_i = e^{\mu} \Rightarrow$ Back to benchmark
What’s new?: NXRT-based Comp adv

- $\sigma(NXRT) \uparrow \rightarrow \text{trade} \downarrow$?
  - Ethier 73, Clark 73, ...: risk aversion of firms
  - Bacchetta & van Wincoop 00: sticky output price
  - Hooper & Kohlhagen 78, ...: empirics
  - Focusing on the aggregate trade

This paper: Interactions w/ industry characteristics (i.e., comparative advantage)
What's new?: NXRT-based Comp adv

- Open-economy macro: aggregate short-run
  - Obstfeld & Rogoff 00: nominal wage rigidity, NXRT variability
  - Gali & Monacelli 16: wage & price rigidity, NXRT, optimal policy
  - Schmitt-Grohé & Uribe 16: downward rigidity, currency pegs, unemployment

This paper: sector-level long-run
What’s new?: NXRT-based Comp adv

- Recent papers on comparative advantage
  - Costinot 09: Theory highlighting interaction of country & industry characteristics
  - Romalis 04: educated country + skill intensive industry
  - Nunn 07, Levchenko 07: law enforcement + contract intensive industry
  - Cúñat & Melitz 12: labor market flexibility + industry shock size
  - Ishise 19: Trend inflation rate + input price rigidity

This paper: NXRT, wage rigidity
Most governments sought exchange-rate stability amid the sloshing tides of money.... Governments worry more about big swings in the dollar than in other currencies; trade is often conducted in dollar terms; ... It remains the world’s principal “anchor” currency, against which others seek to limit volatility...

“It’s been a privilege; Free exchange” The Economist; London. 422 (9027): 65. Feb 11, 2017.
Data

• Trade data \((t = 2011, \ldots, 2015)\)
  • UN comtrade, manufacturing only
  • HS-6 \(\rightarrow\) US-IO industries \((i = 1, \ldots, 53)\)
• Country-year variables
  • Lagged 8-year averages
  • For trade 2015, avg of 2009–2014
  • For trade 2014, avg of 2008–2013
Exchange rate variability

- NXRT of country’s currency to USD, monthly from IMF
- Measurement: Coefficient of variation
  - SD over 96 months / Avg over 96 months
  - Robustness: Coeff of variation of growth rate
- Why USD?: widely used as the vehicle currency
Other determinants of Comp. adv.

Including many other interaction terms

- Education\(^C\) × skill\(_i\)
- Kstock\(^C\) × k/l-ratio\(_i\)
- Rule of law\(^C\) × contract intensity\(_i\)
- Financial development\(^C\) × External finance dependency\(_i\)
- Labor market flexibility\(^C\) × sector shock size\(_i\)
- Inflation rate\(^C\) × Input price rigidity\(_i\)
- etc...
- NXRT\(^C\) and industry characteristics
- Country characteristics × wage rigidity\(_i\)
Robustness checks

Some have been done (but no presentation tables), some to be added

- Cross-section of other years
- Average trade over years as cross-section
- Exchange rate
  - Coeff of variation of growth rate
  - Years of lags
- Wage rigidity
  - Supplemented w/ weekly earnings
  - 6-digit industry
- Poisson Pseudo ML

“Exchange rate & trade pattern” Hiro Ishise (ishise@osipp.osaka-u.ac.jp) 11 / 13
### Regression results

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
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<th>(4)</th>
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<tbody>
<tr>
<td><strong>Exch(^c) \times w\text{-}rigid;</strong></td>
<td>0.030</td>
<td>-0.71***</td>
<td>-1.32***</td>
<td>-1.12***</td>
<td>-1.20***</td>
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<tr>
<td></td>
<td>(0.022)</td>
<td>(0.19)</td>
<td>(0.37)</td>
<td>(0.37)</td>
<td>(0.37)</td>
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<tr>
<td><strong>Inf(^c) \times w\text{-}rigid;</strong></td>
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<td>✓</td>
<td>✓</td>
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<tr>
<td><strong>Exch(^c) \times Price terms;</strong></td>
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<td>✓</td>
<td>✓</td>
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<tr>
<td><strong>Country terms(^c) \times w\text{-}rigid;</strong></td>
<td>✓</td>
<td>✓</td>
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<tr>
<td><strong>Exch(^c) \times Industry;</strong></td>
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<tr>
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<tr>
<td><strong>GDPpc(^c) \times i\text{-}dummy</strong></td>
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<tr>
<td><strong>GDPpw(^c) \times i\text{-}dummy</strong></td>
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<tr>
<td><strong># Country</strong></td>
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<tr>
<td><strong>Obs.</strong></td>
<td>7,691</td>
<td>7,237</td>
<td>5,978</td>
<td>5,978</td>
<td>5,978</td>
</tr>
</tbody>
</table>
• Generalize to $N$-sector model
  • Combined w/ CES aggregater (Armington trade model), the main result should hold
  • c.f., Levchenko 07, Ishise 19