The International Price System

Gita Gopinath
Harvard

Paper prepared for Jackson Hole Symposium 2015
International Linkages: Consensus Policy View

1. Nominal Exchange Rates and Inflation

2. Nominal Exchange Rates and Trade Balance
International Linkages: Consensus Policy View

1 Nominal Exchange Rates and Inflation
   • Depreciations (appreciations) are inflationary (deflationary)
   
   \[ P^M = \varepsilon_{h/f} \bar{P}_f \quad \varepsilon_{h/f} \uparrow, \; P^M \uparrow \]

2 Nominal Exchange Rates and Trade Balance
International Linkages: Consensus Policy View

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   - Depreciations (appreciations) are inflationary (deflationary)
     \[
     P^M = \frac{\varepsilon_{h/f}}{f} \bar{P}_f \\
     \varepsilon_{h/f} \uparrow, P^M \uparrow
     \]

2. Nominal Exchange Rates and Trade Balance
   - Depreciations (appreciations) improve (deteriorate) trade balance, if demand sufficiently elastic.
     \[
     TOT \equiv \frac{P_X}{P_M} = \frac{\bar{P}^h}{\varepsilon_{h/f} \bar{P}_f} \\
     \varepsilon_{h/f} \uparrow, TOT \downarrow
     \]

International Linkages: Consensus Policy View

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Is China sparking a global currency war?

by Patrick Gillespie  @CNNMoney

January 7, 2016: 2:12 PM ET
Publications using BLS IPP data


International Linkages

• The International Price System

1. Dominance of dollar invoicing* in world trade.

2. International prices, in their currency of invoicing, are not very sensitive to exchange rates at horizons of up to two years.
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• Inflation

\[ P_{US}^M = \bar{P}^\$ \]

insulated

\[ P_{ROW}^M = \mathcal{E}_{ROW}/\bar{P}^\$ \]

sensitive

*currency in which an invoice for exported or imported goods is denominated. (Non-commodities)
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• Inflation

\[ P^M_{US} = \bar{P}^S \quad \text{insulated} \]

\[ P^M_{ROW} = \mathcal{E}_{ROW}/\bar{P}^S \quad \text{sensitive} \]

• Terms of Trade

\[ TOT = \frac{\bar{P}_h^S}{\bar{P}_f^S} \]
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• Terms of Trade

\[ \underbrace{TOT} = \frac{\bar{P}^h}{\bar{P}^f} \quad \text{stable} \]

• Devereux, Engel & Tille (2003), Corsetti & Pesenti (2005)

*currency in which an invoice for exported or imported goods is denominated. (Non-commodities)
Road Map

• Illustration using three countries

• Empirical evidence for IPS (35 countries)
  • Dollar dominance
  • Low sensitivity to ER’s

• Empirical evidence for IPS using BLS IPP data

• Policy Implications
A Tale of Three Countries

ER Pass-through into Import Prices

\[ \Delta ipi_{n,t} = \alpha_n + \sum_{k=0}^{T} \beta_{n,k} \Delta e_{n,t-k} + \sum_{k=0}^{T} \gamma_{n,k} \Delta ppi_{n,t-k} + \varepsilon_{n,t}, \quad T = 8 \]

<table>
<thead>
<tr>
<th>ERPT</th>
<th>Turkey</th>
<th>Japan</th>
<th>US</th>
</tr>
</thead>
<tbody>
<tr>
<td>One quarter</td>
<td>93%</td>
<td>83%</td>
<td>34%</td>
</tr>
<tr>
<td>Eight quarter</td>
<td>100%</td>
<td>90%</td>
<td>44%</td>
</tr>
<tr>
<td>Foreign Invoicing</td>
<td>97%</td>
<td>76%</td>
<td>7%</td>
</tr>
</tbody>
</table>
Road Map

• Illustration using three countries

• Empirical evidence for IPS (35 countries)
  • Dollar dominance
  • Low sensitivity to ER’s

• Macro and micro implications of IPS: Casas, Diez, Gopinath, Gourinchas (2015)
Data

• Import Price Index and Producer Price Index data

• Construct trade weighted exchange rates and trade weighted PPI
  • Bilateral trade flows: IMF’s Direction of Trade Statistics database

• Currency invoicing
  • Customs agencies, central banks, other statistical agencies
  • Kamps (2006), Chinn & Ito (2014)

• BLS confidential import and export price data

• I-O tables to measure import content in consumption
IPS Definition 1: Dominance of dollar invoicing in world trade

- Covers 55% of imports, 57% of exports. Averages post 1999.
- Dollar invoicing share: 4.7 times its share in world imports, 3.1 times its share in world exports.
- Euro invoicing share: 1.2 times for imports and exports.
- Goldberg (2013), Goldberg and Tille (2009), Ito and Chinn (2013)
**IPS Definition 1:** Dominance of dollar invoicing in world trade

Invoicing shares and GDP per capita

---

**Figure:** Dollar Dominance in World Trade: By Country
IPS Definition 1: Dominance of dollar invoicing in world trade

<table>
<thead>
<tr>
<th>Country</th>
<th>Imports</th>
<th>Exports</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>0.93</td>
<td>0.97</td>
</tr>
<tr>
<td>Italy*</td>
<td>0.58</td>
<td>0.61</td>
</tr>
<tr>
<td>Germany*</td>
<td>0.55</td>
<td>0.62</td>
</tr>
<tr>
<td>Spain*</td>
<td>0.54</td>
<td>0.58</td>
</tr>
<tr>
<td>France*</td>
<td>0.45</td>
<td>0.50</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>0.32</td>
<td>0.51</td>
</tr>
<tr>
<td>Australia</td>
<td>0.31</td>
<td>0.20</td>
</tr>
<tr>
<td>Switzerland</td>
<td>0.31</td>
<td>0.35</td>
</tr>
<tr>
<td>Norway</td>
<td>0.30</td>
<td>0.03</td>
</tr>
<tr>
<td>Sweden</td>
<td>0.24</td>
<td>0.39</td>
</tr>
<tr>
<td>Japan</td>
<td>0.23</td>
<td>0.39</td>
</tr>
<tr>
<td>Canada</td>
<td>0.20</td>
<td>0.23</td>
</tr>
<tr>
<td>Poland</td>
<td>0.06</td>
<td>0.04</td>
</tr>
<tr>
<td>Iceland</td>
<td>0.06</td>
<td>0.05</td>
</tr>
<tr>
<td>Thailand</td>
<td>0.04</td>
<td>0.07</td>
</tr>
<tr>
<td>Israel</td>
<td>0.03</td>
<td>0.00</td>
</tr>
<tr>
<td>Turkey</td>
<td>0.03</td>
<td>0.02</td>
</tr>
<tr>
<td>South Korea</td>
<td>0.02</td>
<td>0.01</td>
</tr>
<tr>
<td>Brazil</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>Indonesia</td>
<td>0.01</td>
<td>0.00</td>
</tr>
<tr>
<td>India</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>
**IPS Definition 1: Dominance of dollar invoicing in world trade**

Invoicing shares and GDP per capita

![Graph (a) Imports](image1)

![Graph (b) Imports, Ex-Euro](image2)
IPS Definition 1: Dominance of dollar invoicing in world trade
Invoicing shares and GDP per capita

(c) Exports
(d) Exports, Ex-Euro
IPS Definition 1a: Relative Stability of invoicing patterns over time

Figure: Fraction Priced in Foreign Currency
IPS Definition 2a: Countries with high SRPT have high LRPT

- Dynamic Lag Regression

\[
\Delta ipi_{n,t} = \alpha_n + \sum_{k=0}^{T} \beta_{n,k} \Delta e_{n,t-k} + \sum_{k=0}^{T} \gamma_{n,k} \Delta ppi_{n,t-k} + \varepsilon_{n,t}, \quad T = 8
\]

- Cumulative Pass-through, \( PT_{n,m} \equiv \sum_{k=0}^{m} \beta_{n,k} \)

\[
PT_{n,m} = \gamma + \eta PT_{n,1} + \varepsilon_{n,m}, \quad m = 4, 8
\]

- Start date 1990, 40 quarters at least, IP excluding petroleum for U.S.
- VECM, Generated regressor bias

- Burstein and Gopinath (2014)
IPS Definition 2a: Countries with high SRPT have high LRPT (4 quarter)

\[
\Delta ipi_{n,t} = \alpha_n + \sum_{k=0}^{T} \beta_{n,k} \Delta e_{n,t-k} + \sum_{k=0}^{T} \gamma_{n,k} \Delta ppi_{n,t-k} + \varepsilon_{n,t}, \quad T = 8
\]

\[
PT_{n,4} = \gamma + \eta PT_{n,1} + \varepsilon_{n,4}
\]

\[\begin{array}{|c|c|c|}
\hline
\text{Four Quarter} & \text{Slope} & \text{Intercept} \\
\hline
\text{OLS} & 0.921 & 0.053 \\
& (0.11) & (0.07) \\
\hline
\text{Bootstrap} & \\
\text{Mean} & 0.84 & 0.13 \\
5\text{th-pctile} & 0.57 & -0.08 \\
95\text{th-pctile} & 1.19 & 0.32 \\
S.D. & 0.23 & 0.15 \\
\hline
\end{array}\]

\((R^2 = 0.68, \; N = 35)\)
IPS Definition 2a: Countries with high SRPT have high LRPT (8 quarter)

\[ PT_{n,8} = \gamma + \eta PT_{n,1} + \varepsilon_{n,8} \]

<table>
<thead>
<tr>
<th>Eight Quarter</th>
<th>Slope</th>
<th>Intercept</th>
</tr>
</thead>
<tbody>
<tr>
<td>OLS</td>
<td>0.871</td>
<td>0.102</td>
</tr>
<tr>
<td></td>
<td>(0.14)</td>
<td>(0.10)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bootstrap</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.708</td>
<td>0.250</td>
</tr>
<tr>
<td>5th-pctile</td>
<td>0.33</td>
<td>0.00</td>
</tr>
<tr>
<td>95th-pctile</td>
<td>1.11</td>
<td>0.52</td>
</tr>
<tr>
<td>S.D.</td>
<td>0.27</td>
<td>0.18</td>
</tr>
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\( R^2 = 0.53, \ N = 35 \)
IPS Definition 2b: Countries with higher shares of imports invoiced in a foreign currency have higher short-run and long-run pass-through.
IPS Definition 2b: Countries with higher shares of imports invoiced in a foreign currency have higher short-run and long-run pass-through
Detailed Evidence from the U.S.

   - Gopinath, Itskhoki, Rigobon (2010)

2. Prices, as opposed to unit values

3. Exclude intra-firm transactions

4. Can condition on a price change
Detailed Evidence from the U.S.


**Figure:** Aggregate ERPT by Currency
Figure: Aggregate ERPT by Currency by Country
**IPS Definition 2c:** Border prices, in whatever currency they are set in, respond partially to exchange rate shocks even conditional on a price change.

<table>
<thead>
<tr>
<th>PT Conditional on Price Change</th>
<th>D</th>
<th>ND</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>0.26</td>
<td>0.85</td>
</tr>
<tr>
<td>Germany</td>
<td>0.32</td>
<td>0.85</td>
</tr>
<tr>
<td>Switz.</td>
<td>0.21</td>
<td>0.67</td>
</tr>
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<td>0.76</td>
</tr>
<tr>
<td>UK</td>
<td>0.23</td>
<td>0.77</td>
</tr>
<tr>
<td>France</td>
<td>0.19</td>
<td>0.72</td>
</tr>
<tr>
<td>Spain</td>
<td>0.21</td>
<td>0.76</td>
</tr>
<tr>
<td>Diff.</td>
<td>0.21</td>
<td>0.93</td>
</tr>
<tr>
<td>10 HS</td>
<td>0.27</td>
<td>0.88</td>
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Sufficient statistic for currency choice.
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Sufficient statistic for currency choice

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<th>Life-long PT</th>
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<td>All</td>
<td>0.47</td>
<td>1.01</td>
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<tr>
<td>Diff.</td>
<td>0.39</td>
<td>0.98</td>
</tr>
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International Price System

Endogenous currency choice: Price in a currency in which ‘desired’ prices are most stable

- Strategic complementarity in pricing
  - GIR(2010): Homogenous (differentiated) goods prices in dollars (foreign currency)

- Imported input costs
  - Chung (2014)
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- **Can explain**
  - Why SR and LRPT are similar
  - Link between invoicing choices and PT
  - Why dollar dominance hard to break
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  - Link between invoicing choices and PT
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- Cannot be the full story: fixed costs important
Policy Implications

1. Inflation Stabilization

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\text{Inflation}_{\text{CPI}} = (\text{Import Content}) \cdot (\text{Import Pass-through})
\]
Policy Implications

1. Inflation Stabilization

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- Following a 10% depreciation

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  - More significant inflationary concerns for a country like Turkey.
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- Asymmetric monetary policy spillovers (parallel with asset markets)
Policy Implications

2 **Export Competitiveness:** *quantities versus mark-ups*
   - Do depreciations (appreciations) make exports cheaper (expensive)?
   - For the U.S., Yes
   - For most others, No: Mainly fluctuations in mark-ups (profits)
     - Japan: 33% of exports invoiced in yen.
     - PT into dollar prices even conditional on a price change for these goods is 23%

3 **Internationalization of Currencies:** *chinese yuan*
   - Added benefit of insulating domestic inflation from external shocks.

4 **Special Drawing Rights:** *more symmetry*
   - Bring greater symmetry in policy spillovers.
   - To be privately optimal, will need a large number of importers and exporters to price in *SDRs*. 