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)

$$P^M = \mathcal{E}_{h/f} \bar{P}_f^f \qquad \mathcal{E}_{h/f} \uparrow, P^M \uparrow$$

2. Nominal Exchange Rates and Trade Balance

International Linkages: Consensus Policy View

1. Nominal Exchange Rates and Inflation
   - Depreciations (appreciations) are inflationary (deflationary)

$$P^M = \mathcal{E}_{h/f} \bar{P}^f_f \qquad \mathcal{E}_{h/f} \uparrow, P^M \uparrow$$

2. Nominal Exchange Rates and Trade Balance
   - Depreciations (appreciations) improve (deteriorate) trade balance, if demand sufficiently elastic.

$$TOT \equiv \frac{P_X}{P_M} = \frac{\bar{P}^h_h}{\mathcal{E}_{h/f} \bar{P}^f_f} \qquad \mathcal{E}_{h/f} \uparrow, TOT \downarrow$$

International Linkages: Consensus Policy View

1. Nominal Exchange Rates and Inflation
   - Depreciations (appreciations) are inflationary (deflationary)

$$P^M = \mathcal{E}_{h/f} \bar{P}^f_f \qquad \mathcal{E}_{h/f} \uparrow, P^M \uparrow$$

2. Nominal Exchange Rates and Trade Balance
   - Depreciations (appreciations) improve (deteriorate) trade balance, if demand sufficiently elastic.

$$TOT \equiv \frac{P_X}{P_M} = \frac{\bar{P}^h_h}{\mathcal{E}_{h/f} \bar{P}^f_f} \qquad \mathcal{E}_{h/f} \uparrow, TOT \downarrow$$

- Fleming (1962), Mundell (1963), Dornbusch (1976), Svenson & van Wijnbergen (1989), Obstfeld & Rogoff (1995)

Is China sparking a global currency war?

by Patrick Gillespie @CNNMoney

January 7, 2016: 2:12 PM ET

Publications using BLS IPP data

1. "The International Price System," Forthcoming *Jackson Hole Symposium Proceedings*, 2015.
2. Ariel Burstein and Gita Gopinath. "International Prices and Exchange Rates," in Gopinath, G., Helpman, E., and Rogoff, K. (Eds.): *Handbook of International Economics*, Volume 4, 2014. Amsterdam: Elsevier
3. Gita Gopinath, Oleg Itskhoki and Brent Neiman. Trade Prices and the Global Trade Collapse of 2008-09," *IMF Economic Review*, September 2012, Volume 60(12)
4. Gita Gopinath and Oleg Itskhoki. "In Search of Real Rigidities," *NBER Macroeconomics Annual*, 2010, Volume 25.
5. Gita Gopinath and Oleg Itskhoki. "Frequency of Price Adjustment and Pass- through,?" *Quarterly Journal of Economics*, May 2010, Volume 125(2).
6. Gita Gopinath, Oleg Itskhoki and Roberto Rigobon. "Currency Choice and Exchange Rate Pass-through,?" *American Economic Review*, March 2010, Vol- ume 100(1).
7. Gita Gopinath and Roberto Rigobon. "Sticky Borders," *Quarterly Journal of Economics*, May 2008, Volume 123(2)

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.

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.

- Inflation

$$\underbrace{P^M_{US}}_{\text{insulated}} = \bar{P}^{\$} \qquad \underbrace{P^M_{ROW}}_{\text{sensitive}} = \mathcal{E}_{ROW/\$}\bar{P}^{\$}$$

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.

- Inflation

$$\underbrace{P^M_{US}}_{\text{insulated}} = \bar{P}^{\$} \qquad \underbrace{P^M_{ROW}}_{\text{sensitive}} = \mathcal{E}_{ROW/\$}\bar{P}^{\$}$$

- Terms of Trade

$$\underbrace{TOT}_{\textit{stable}} = \frac{\bar{P}^{\$}_h}{\bar{P}^{\$}_f}$$

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.

- Inflation

$$\underbrace{P^M_{US}}_{\text{insulated}} = \bar{P}^{\$} \qquad \underbrace{P^M_{ROW}}_{\text{sensitive}} = \mathcal{E}_{ROW/\$}\bar{P}^{\$}$$

- Terms of Trade

$$\underbrace{TOT}_{stable} = \frac{\bar{P}^{\$}_h}{\bar{P}^{\$}_f}$$

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

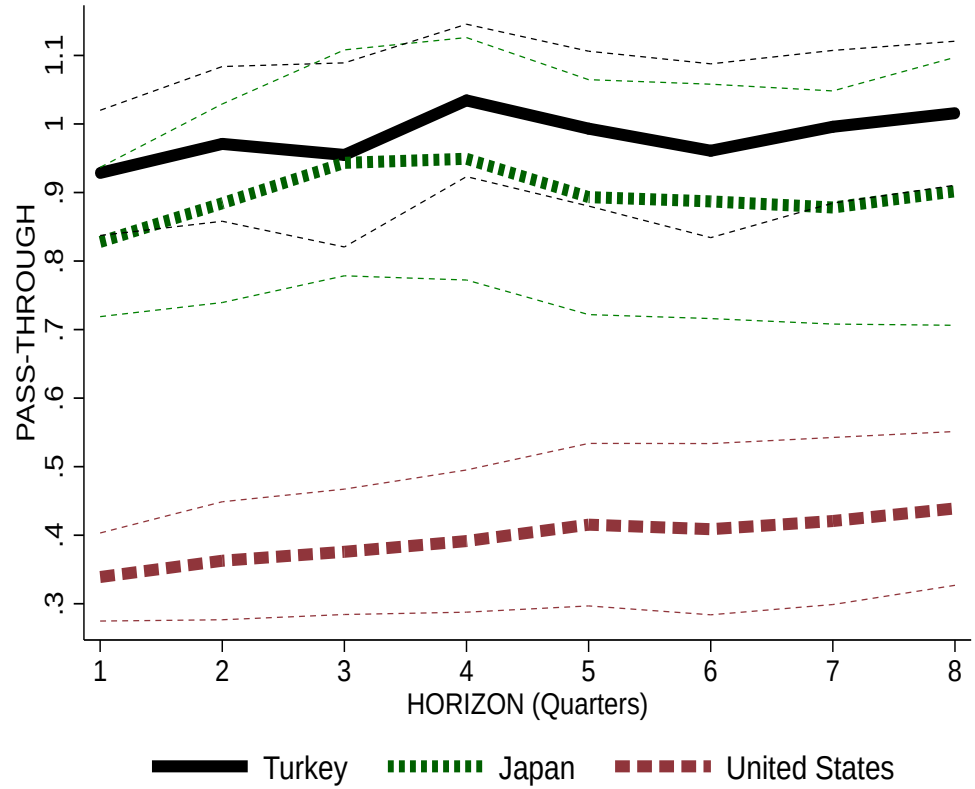
*currency in which an invoice for exported or imported goods is denominated. (Non-commodities)

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



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

ERPT	Turkey	Japan	US
One quarter	93%	83%	34%
Eight quarter	100%	90%	44%
Foreign Invoicing	97%	76%	7%

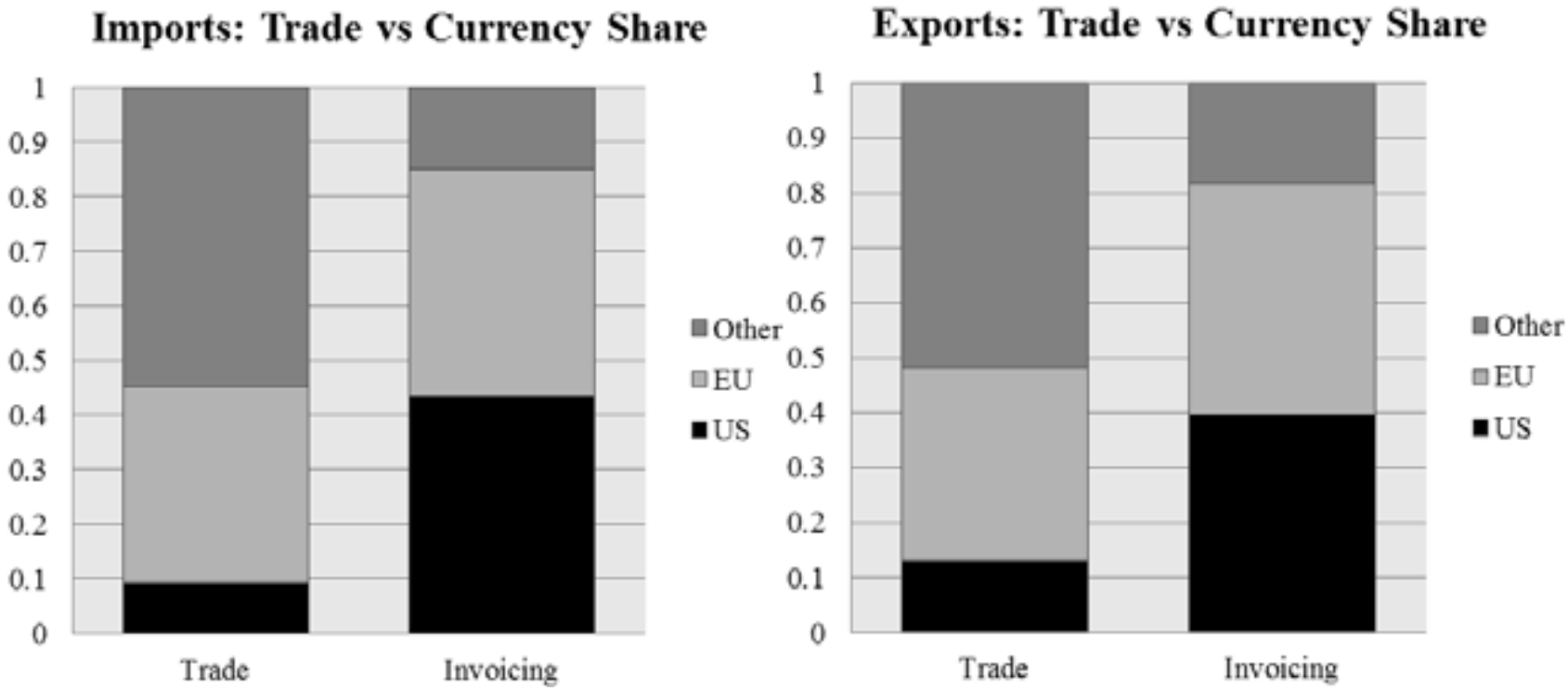
Road Map

- 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 data base
- 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

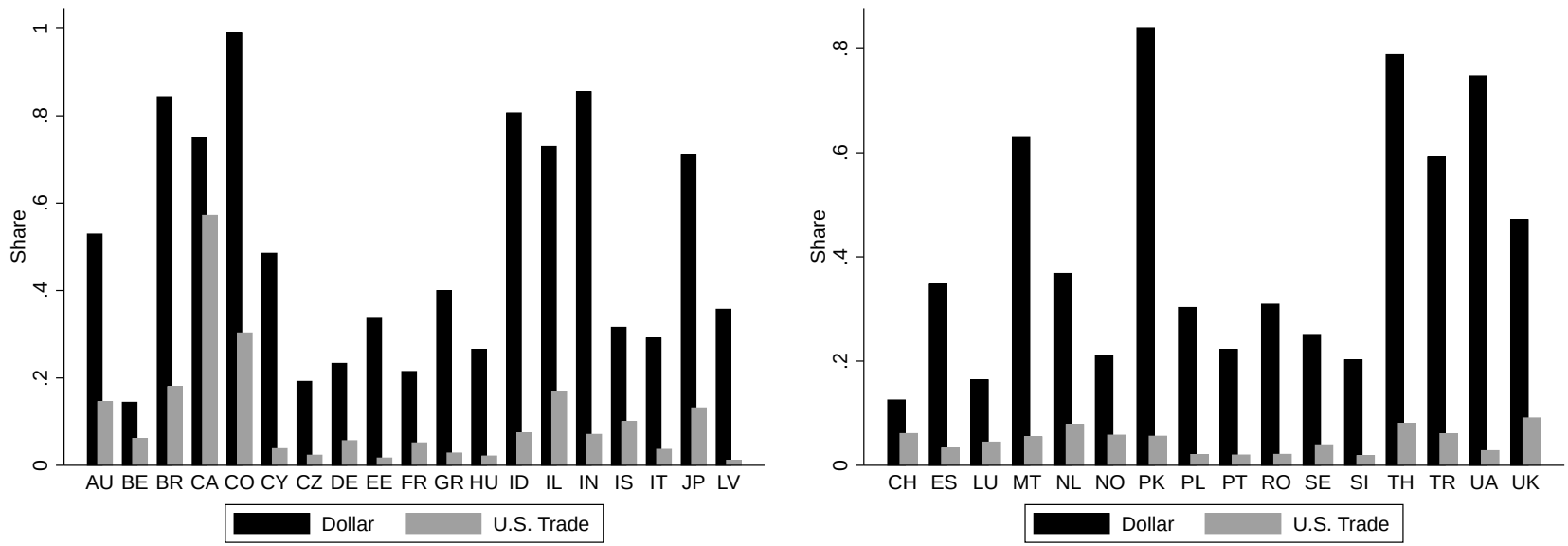


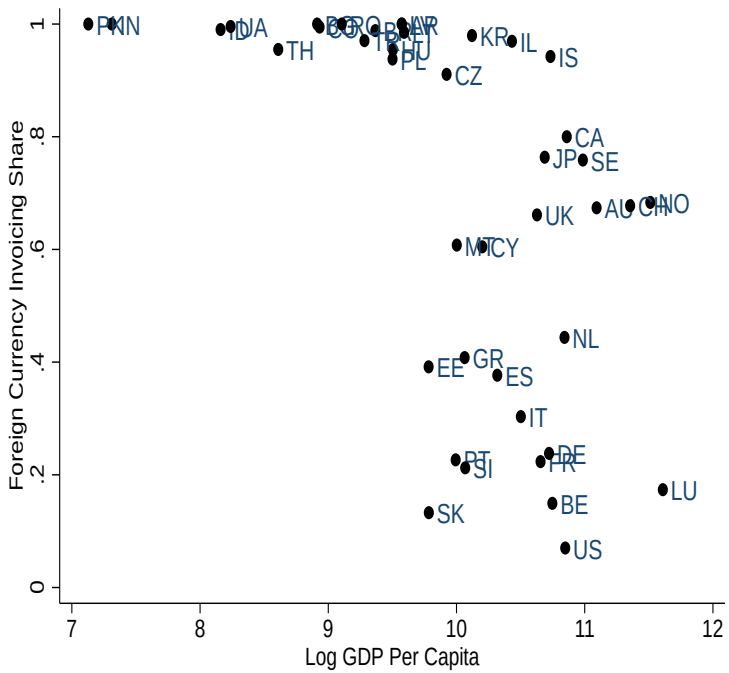
Figure : Dollar Dominance in World Trade: By Country

IPS Definition 1: Dominance of dollar invoicing in world trade

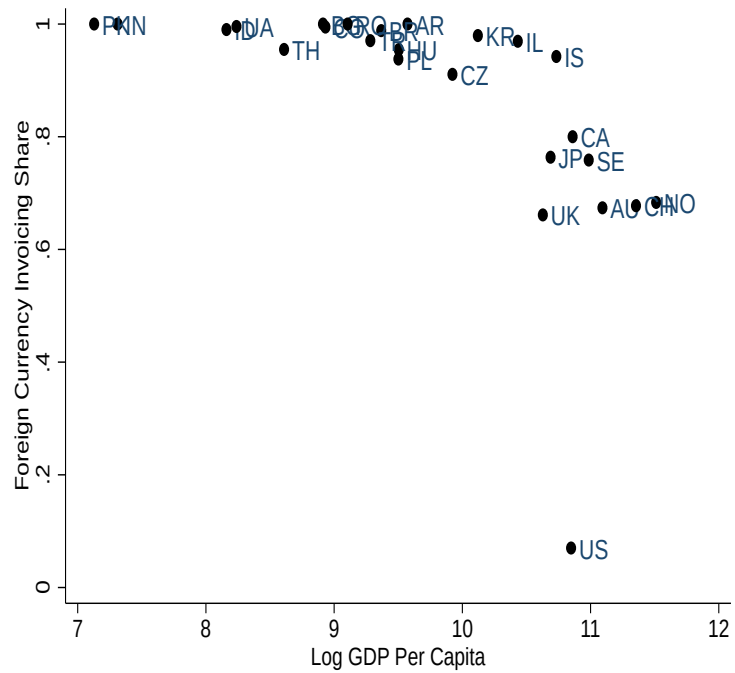
Country	Imports	Exports
United States	0.93	0.97
Italy*	0.58	0.61
Germany*	0.55	0.62
Spain*	0.54	0.58
France*	0.45	0.50
United Kingdom	0.32	0.51
Australia	0.31	0.20
Switzerland	0.31	0.35
Norway	0.30	0.03
Sweden	0.24	0.39
Japan	0.23	0.39
Canada	0.20	0.23
Poland	0.06	0.04
Iceland	0.06	0.05
Thailand	0.04	0.07
Israel	0.03	0.00
Turkey	0.03	0.02
South Korea	0.02	0.01
Brazil	0.01	0.01
Indonesia	0.01	0.00
India	0.00	0.00

IPS Definition 1: Dominance of dollar invoicing in world trade

Invoicing shares and GDP per capita



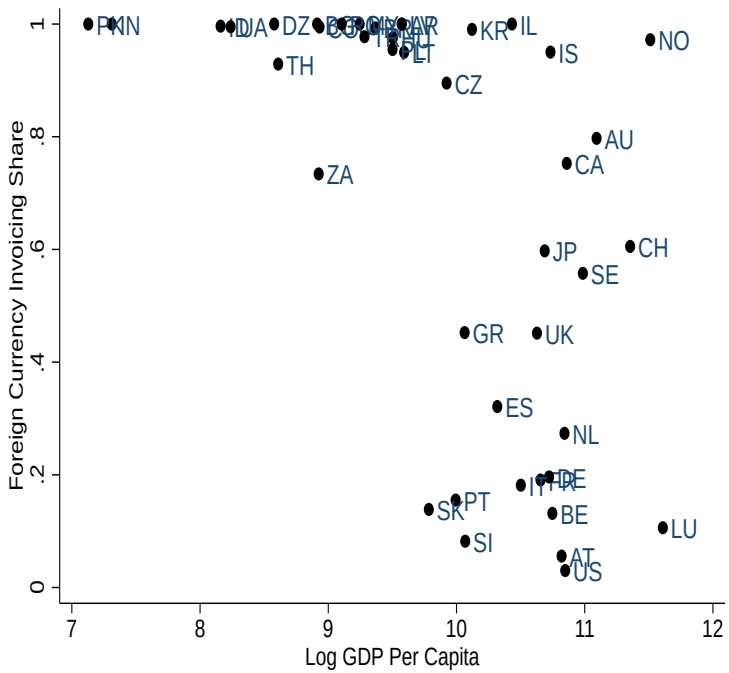
(a) Imports



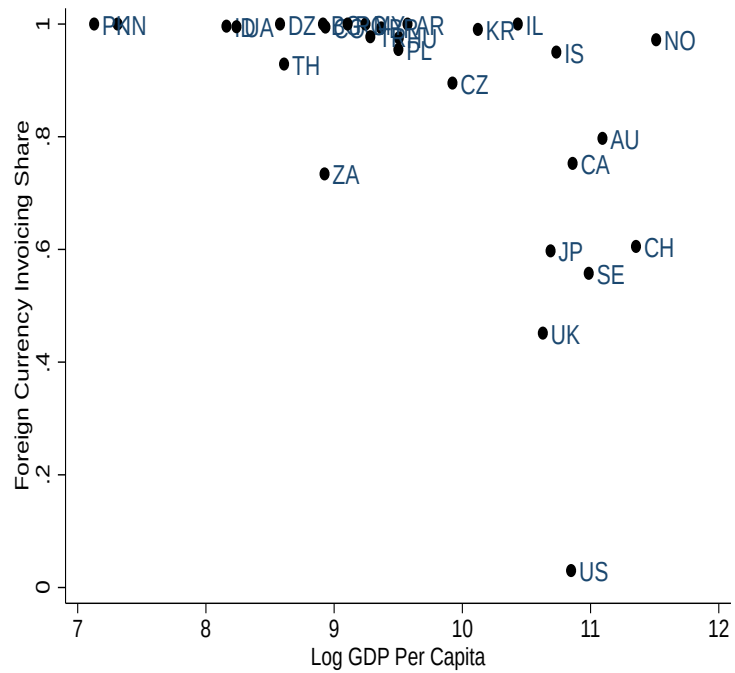
(b) Imports, Ex-Euro

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

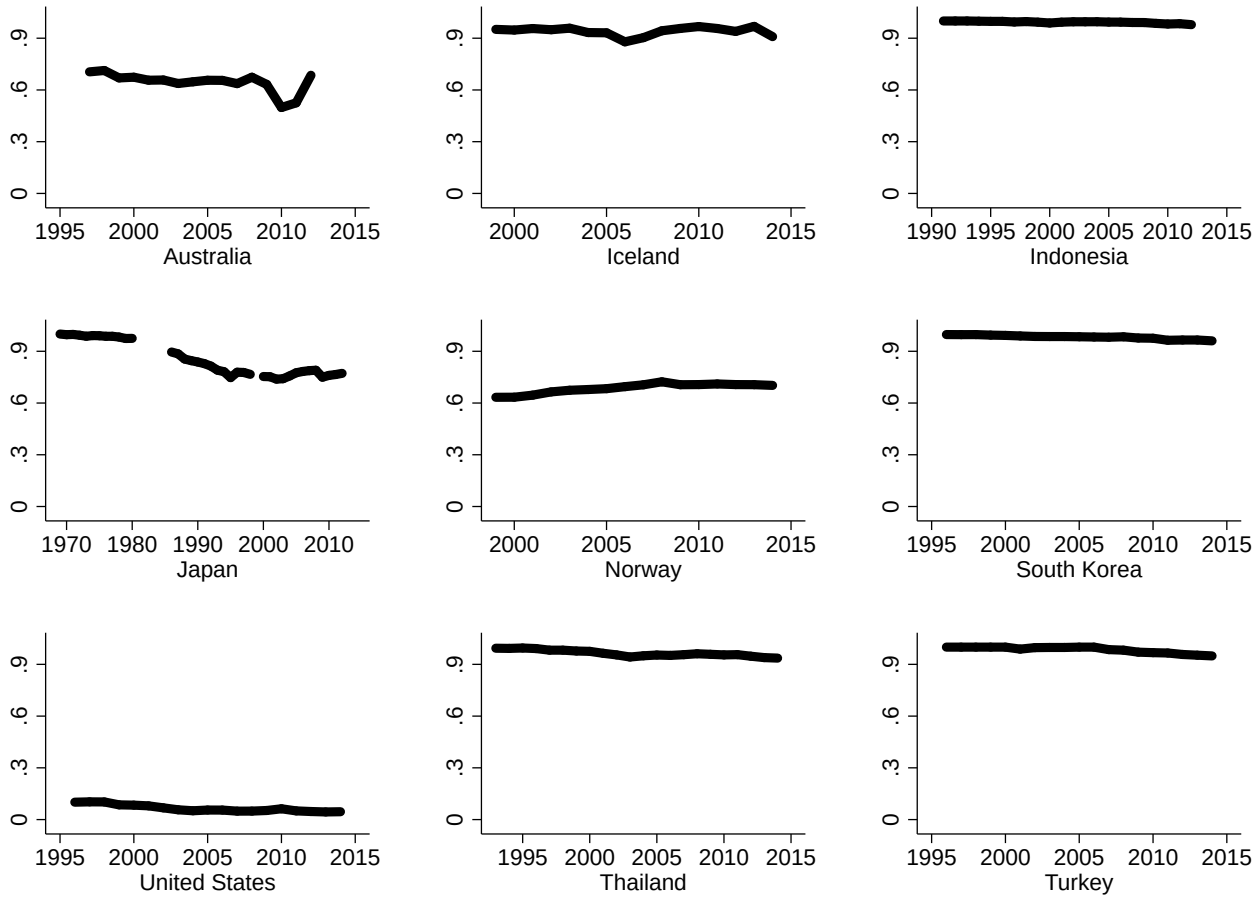


Figure : Fraction Priced in Foreign Currency

IPS Definition 2a: Countries with high SRPT have high LRPT

- Dynamic Lag Regression

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

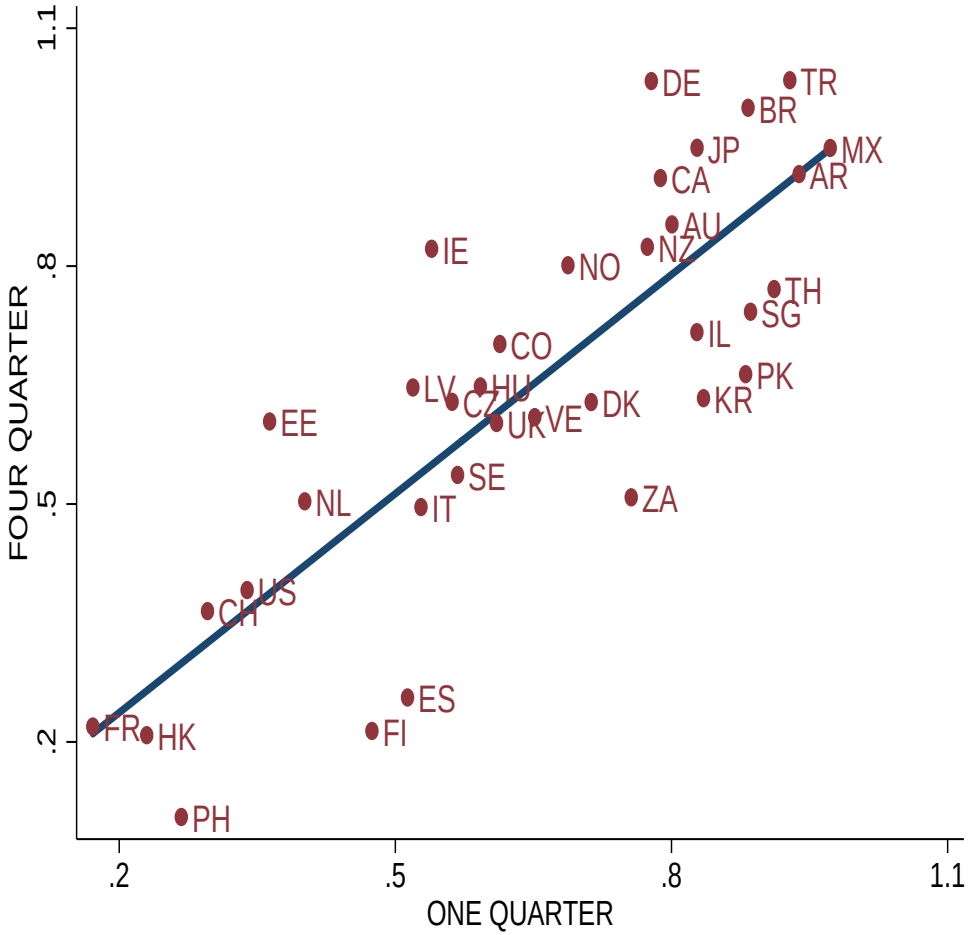
- Cumulative Pass-through, $PT_{n,m} \equiv \sum_{k=0}^{m} \beta_{n,k}$

$$PT_{n,m} = \gamma + \eta PT_{n,1} + \varepsilon_{n,m}, \qquad m = 4, 8$$

- 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)



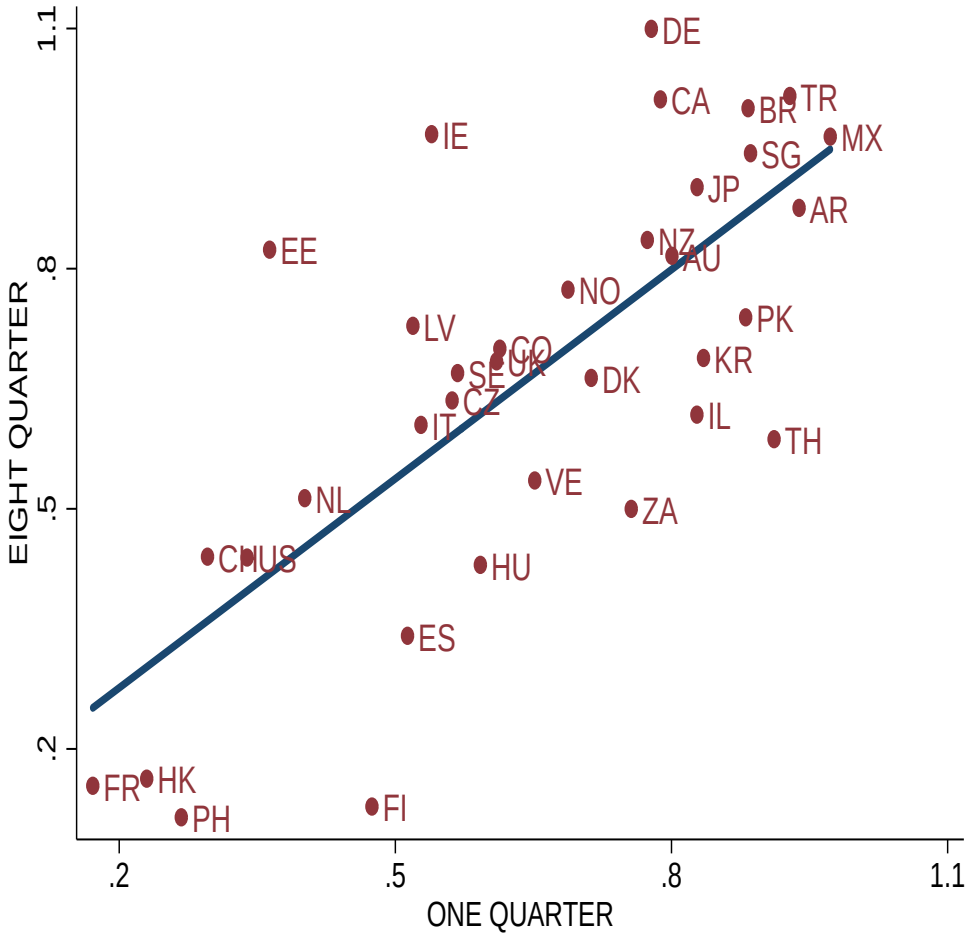
Four Quarter		
	Slope	Intercept
OLS	**0.921**	**0.053**
	(0.11)	(0.07)
Bootstrap		
Mean	0.84	0.13
5th-pctile	0.57	-0.08
95th-pctile	1.19	0.32
S.D.	0.23	0.15

$(R^2 = 0.68,\ N = 35)$

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

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

IPS Definition 2a: Countries with high SRPT have high LRPT (8 quarter)

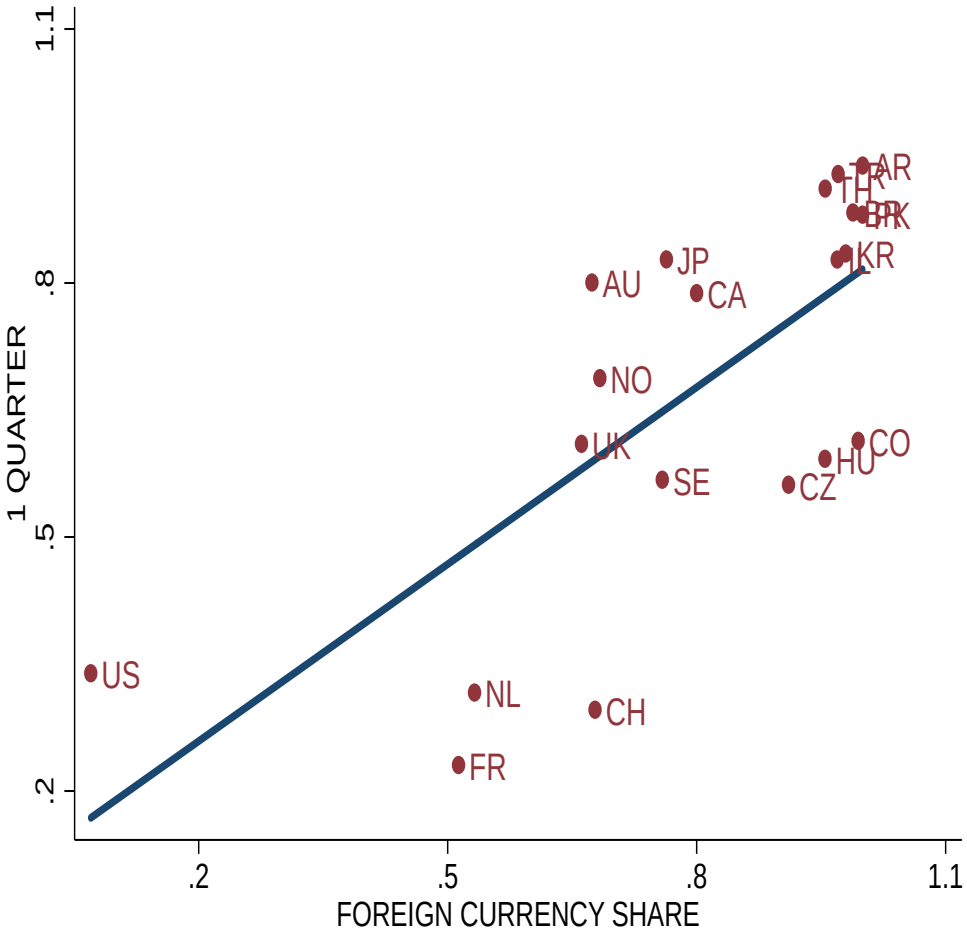


Eight Quarter		
	Slope	Intercept
OLS	**0.871**	**0.102**
	(0.14)	(0.10)
Bootstrap		
Mean	0.708	0.250
5th-pctile	0.33	0.00
95th-pctile	1.11	0.52
S.D.	0.27	0.18

$(R^2 = 0.53,\ N = 35)$

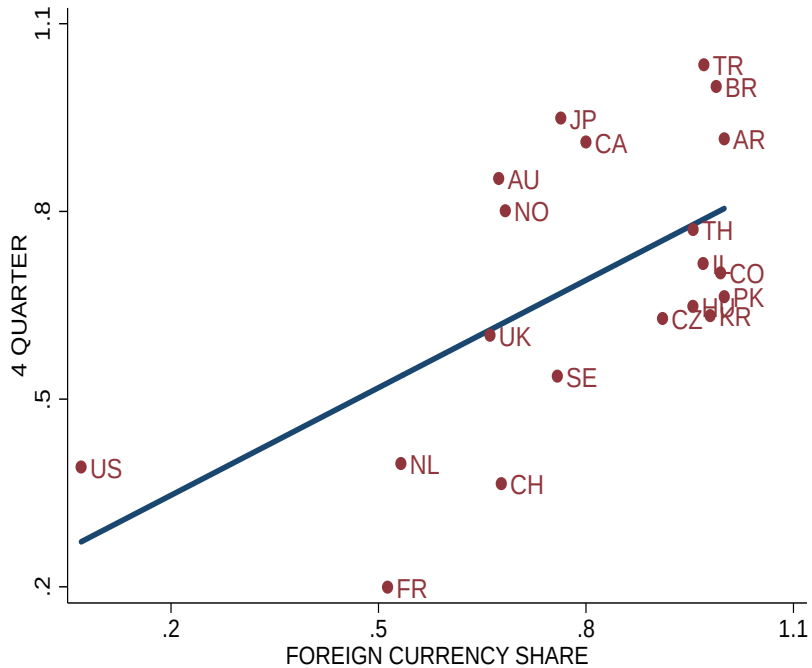
$$PT_{n,8} = \gamma + \eta PT_{n,1} + \varepsilon_{n,8}$$

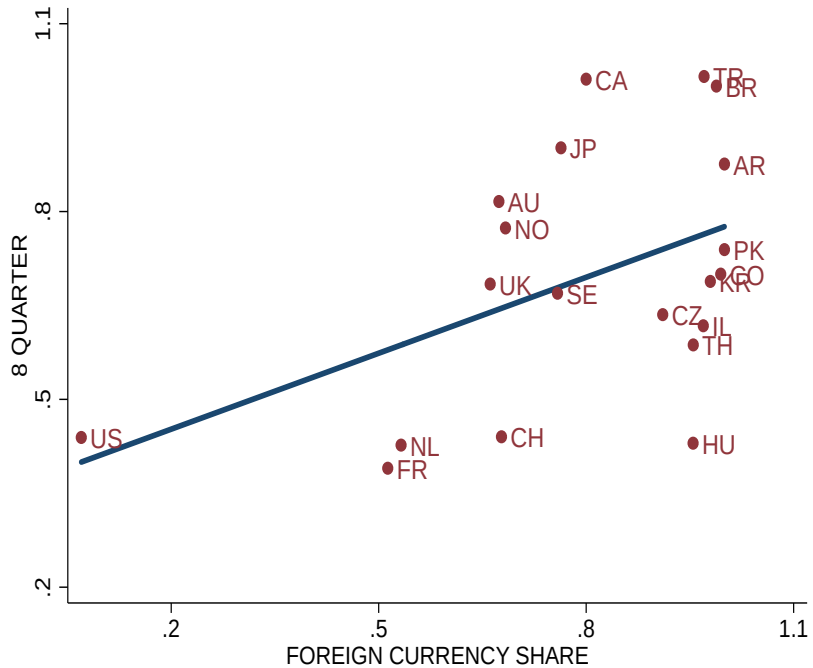
IPS Definition 2b: Countries with higher shares of imports invoiced in a foreign currency have higher short-run and long-run pass-through



	1 Quarter
$Frac_{foreign}$	**0.70**
	(0.16)
N	20
R^2	0.51

IPS Definition 2b: Countries with higher shares of imports invoiced in a foreign currency have higher short-run and long-run pass-through





	4 Quarter	8 Quarter
$Frac_{foreign}$	**0.57**	**0.40**
	(0.18)	(0.18)
N	20	20
R^2	0.34	0.17

Detailed Evidence from the U.S.

1. US BLS price surveys, 1994.M1-2014.M6.
   - 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.

US BLS price surveys, 1994.M1-2014.M6, Gopinath, Itskhoki, Rigobon (2010)

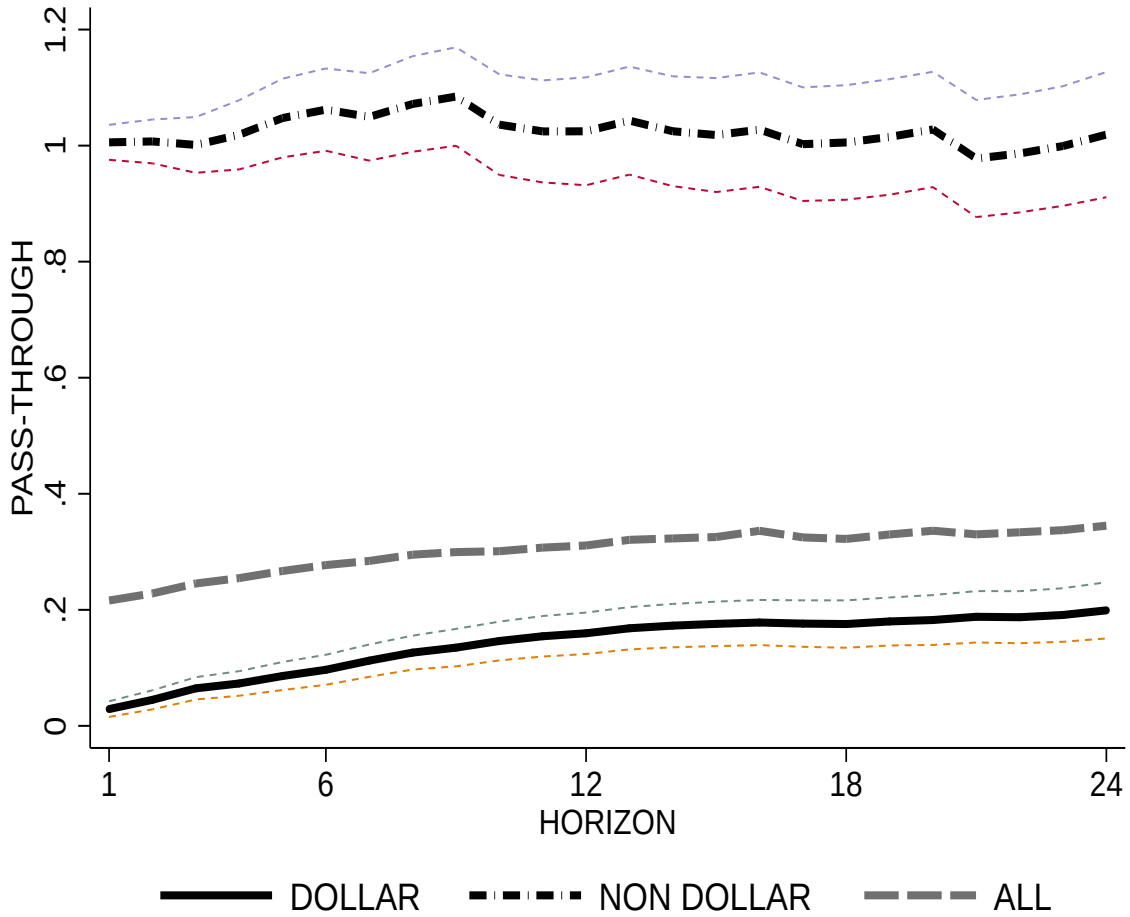


Figure : Aggregate ERPT by Currency

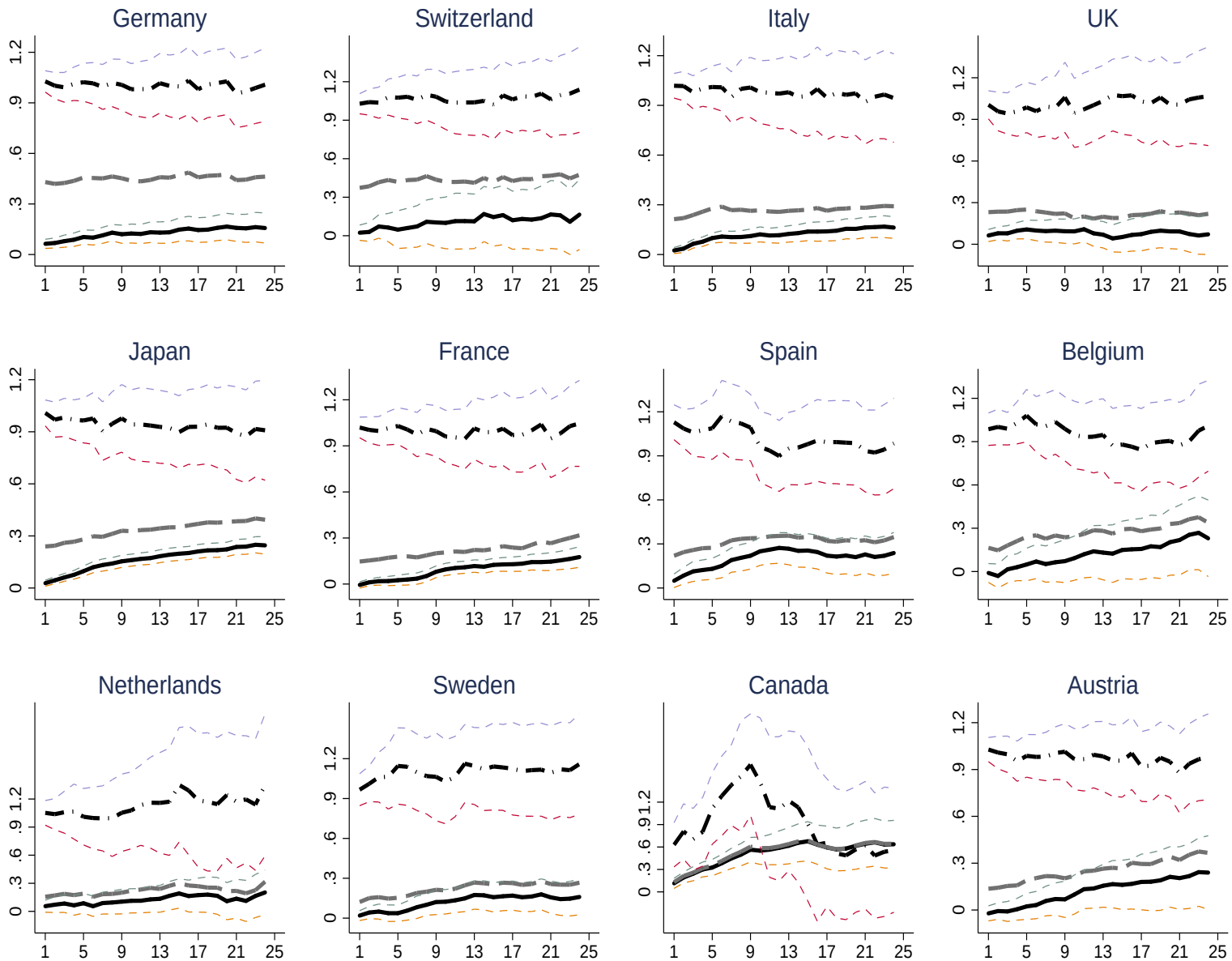


Figure : Aggregate ERPT by Currency by Country

IPS Definition 2c: Border prices, in whatever currency they are set in, respond partially to exchange rate shocks even conditional on a price change

go

PT Conditional on Price Change

	D	*ND*
All	0.26	0.85
Germany	0.32	0.85
Switz.	0.21	0.67
Italy	0.24	0.76
UK	0.23	0.77
France	0.19	0.72
Spain	0.21	0.76
Diff.	0.21	0.93
10 HS	0.27	0.88

Sufficient statistic for currency choice

IPS Definition 2c: Border prices, in whatever currency they are set in, respond partially to exchange rate shocks even conditional on a price change

go

PT Conditional on Price Change

	D	*ND*
All	0.26	0.85
Germany	0.32	0.85
Switz.	0.21	0.67
Italy	0.24	0.76
UK	0.23	0.77
France	0.19	0.72
Spain	0.21	0.76
Diff.	0.21	0.93
10 HS	0.27	0.88

Sufficient statistic for currency choice

Life-long PT

	D	*ND*
All	0.47	1.01
Diff.	0.39	0.98

International Price System

go

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

- Strategic complementarity in pricing
  - Demand systems: Kimball (1995), Melitz and Ottaviano (2008), Bergin and Feenstra (2001)
  - GIR(2010): Homogenous (differentiated) goods prices in dollars (foreign currency)
- Imported input costs
  - Chung (2014)

International Price System

go

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

- Strategic complementarity in pricing
  - Demand systems: Kimball (1995), Melitz and Ottaviano (2008), Bergin and Feenstra (2001)
  - GIR(2010): Homogenous (differentiated) goods prices in dollars (foreign currency)
- Imported input costs
  - Chung (2014)
- Can explain
  - Why SR and LRPT are similar
  - Link between invoicing choices and PT
  - Why dollar dominance hard to break

International Price System

go

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

- Strategic complementarity in pricing
  - Demand systems: Kimball (1995), Melitz and Ottaviano (2008), Bergin and Feenstra (2001)
  - GIR(2010): Homogenous (differentiated) goods prices in dollars (foreign currency)
- Imported input costs
  - Chung (2014)
- Can explain
  - Why SR and LRPT are similar
  - Link between invoicing choices and PT
  - Why dollar dominance hard to break
- Cannot be the full story: fixed costs important

Policy Implications

1. Inflation Stabilization

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

Policy Implications

1. Inflation Stabilization

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

- Following a 10% depreciation

	Import Content	*Inflation*$_{CPI}$
US	0.12	0.4 – 0.7
Japan	0.12	0.8 – 1.3
Mexico	0.15	1.38 – 1.59
Turkey	0.18	1.65 - 2.03

Policy Implications

1. Inflation Stabilization

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

- Following a 10% depreciation

	Import Content	*Inflation*$_{CPI}$
US	0.12	0.4 – 0.7
Japan	0.12	0.8 – 1.3
Mexico	0.15	1.38 – 1.59
Turkey	0.18	1.65 - 2.03

- Dollar appreciations:
  - Unlikely major disinflationary concern for US.
  - More significant inflationary concerns for a country like Turkey.

Policy Implications

1. Inflation Stabilization

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

- Following a 10% depreciation

	Import Content	*Inflation*$_{CPI}$
US	0.12	0.4 – 0.7
Japan	0.12	0.8 – 1.3
Mexico	0.15	1.38 – 1.59
Turkey	0.18	1.65 - 2.03

- Dollar appreciations:
  - Unlikely major disinflationary concern for US.
  - More significant inflationary concerns for a country like Turkey.
- Asymmetric monetary policy spillovers (parallel with asset markets)

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 *SDR*s.