Global Trade and the Dollar
Boz, Gopinath Plagborg-Mller

discussion by M. Devereux

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Summary of paper

- Major contribution to the empirics of international pricing
- Provides clear support to DCP versus LCP/PCP
  - Shows US dollar plays an outsized role in trade prices and quantities
  - Appreciating dollar is a global negative shock
  - Sensitivity is increasing in dollar invoicing
  - US dollar more important than euro for trade prices
- Implications for:
  - NK international business cycle models,
  - Global trade dynamics,
  - International policy evaluation
  - The role of US monetary policy in global spillovers

Discussion

- Paper in context of the literature
- Simple illustrative model
- Specific comments on empirics
- Suggestions for alternative testing
- Sustainability of DCP, Welfare implications

Context

- Obstfeld Rogoff 2005 - PCP (Mundell-Fleming model)
- PCP model inconsistent with evidence - deviations from LOOP
  - Engel and Rogers, 1996, Engel 1999
- LCP can explain deviations from LOOP
- But evidence from trade invoicing doesn't support LCP
- VCP - DCP - Goldberg Tille 2008, 2009, Gopinath 2015
- Key feature - trade between non-US countries invoiced in US dollar

Canada Imports 2002-2008

	Percentage of shipments							Percentage of value						
	U.S.	China	HK	E.U.	India	BD	Other	U.S.	China	HK	E.U.	India	BD	Other
2002	25	15	5	16	5	1	32	10	30	7	6	6	2	38
2003	23	15	4	15	5	2	34	10	30	6	5	7	6	36
2004	22	18	4	14	5	3	35	9	33	5	5	7	8	33
2005	17	26	2	12	6	3	34	7	45	2	4	7	7	28
2006	13	29	2	10	7	3	37	6	50	1	4	6	7	26
2007	12	33	2	9	5	3	36	5	53	1	4	5	7	25
2008	12	33	2	8	6	3	37	6	50	1	4	6	8	25

Canada Imports Invoicing 2002-2008

	Percentage of shipments						Percentage of value					
	USD	CAD	EUR	HKD	GBP	Other	USD	CAD	EUR	HKD	GBP	Other
2002	62	22	11	2	2	1	85	10	4	1	0	0
2003	63	22	11	2	2	1	84	11	3	1	0	0
2004	68	17	11	2	2	1	84	11	4	1	0	0
2005	67	17	11	2	2	1	85	11	3	1	0	0
2006	66	18	11	1	3	1	85	10	3	1	0	0
2007	67	19	11	1	2	1	85	10	4	1	0	0
2008	70	18	9	1	1	1	85	10	4	1	0	0

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- Casas et al. - implications for NK open economy models

Understanding the implications of different pricing models

- Say there is a three country model Country Home (G), Foreign (R), and Centre (U)
  - Producer Currency Pricing (PCP) - currency of seller
  - Local Currency Pricing (LCP) currency of the buyer
  - Dominant Currency Pricing (DCP) - currency U

Model

- Home utility

$$U = \log C_G + \log \frac{M_G}{P_G} - \frac{Y_G}{\theta_G}$$

$$C_G = \frac{1}{3} C_{GG}^{\frac{1}{3}} C_{GR}^{\frac{1}{3}} C_{GU}^{\frac{1}{3}}$$

- The price index

$$P = P_{GG}^{\frac{1}{3}} P_{GR}^{\frac{1}{3}} P_{GU}^{\frac{1}{3}}$$

- Complete Markets for risk-sharing
- Normalize sticky prices to unity

Equilibrium exchange rate

- Under all pricing assumptions, the exchange rates are

$$S_{GR} = \frac{M_G}{M_R}, \quad S_{GU} = \frac{M_G}{M_U}$$

- Reflect relative money supplies in the two countries

Equilibrium for PCP

- Full PPP, no deviations from LOOP

$$C_G = C_R = C_U$$

$$Y_G = \frac{1}{3}\frac{M_G}{P_{GG}} + \frac{1}{3}\frac{M_R}{P_{RR}} + \frac{1}{3}\frac{M_U}{P_{UU}} = \frac{M_G}{P_{GG}}$$

- Home output 'insulated' from demand shocks in both R and U
- Terms of trade increasing in S_{GR}, S_{GU}

Equilibrium for LCP

- No PPP, Deviations from LOOP

$$C_G = S_{GR} C_R, \quad C_G = S_{GU} C_U$$

Home output

$$Y_G = \frac{1}{3} \frac{M_G}{P_{GG}} + \frac{1}{3} \frac{M_R}{P_{RG}} + \frac{1}{3} \frac{M_U}{P_{UG}}$$

- Home output is affected equally by demand shocks in all countries
- Terms of trade decreasing in S_{GR}, S_{GU}

Equilibrium for DCP

- Equilibrium consumption for home is

$$C_G = C_R S_{GR}^{-\frac{1}{3}}, \quad C_G = C_U S_{GU}^{-\frac{1}{3}}$$

  - Partial risk-sharing
- Equilibrium Home output

$$Y_G = \frac{1}{3} \frac{M_G}{P_{GG}} + \frac{1}{3} \frac{M_U}{P_{RG}} + \frac{1}{3} \frac{M_U}{P_{UG}}$$

- Home output excess sensitivity to M_U, independent of M_R

$$Y_U = \frac{M_U}{P_{UU}}$$

- Country U output same as under PCP
- Terms of trade independent of $S_{GR}, \ S_{GU}$

Equilibrium for DCP

- Appreciation of U currency reduces trade between R and G
- Exports from G to R (Imports to G from R)

$$\frac{M_R}{3S_{RU}P_{RG}}, \quad \left(\frac{M_G}{3S_{GU}P_{GR}}\right)$$

- Global trade falls under a strengthened U currency

Optimal Policy

- PCP
$$M_G = \theta_G, \quad C = (\theta_G \theta_R \theta_U)^{\frac{1}{3}}, \quad Y_G = \theta_G$$
$$S_{GU} = \frac{\theta_G}{\theta_U}$$

  - Full risk sharing, efficient output, flexible exchange rates
- LCP
$$M_G = C_G = (\theta_G \theta_R \theta_U)^{\frac{1}{3}}, \quad Y_G = (\theta_G \theta_R \theta_U)^{\frac{1}{3}}$$

  - Full risk-sharing, inefficient output, fixed exchange rates

Optimal Policy

- DCP (Devereux Shi Xu, 2008)

$$M_G = \theta_G, \quad M_U = (\theta_G \theta_R \theta_U)^{\frac{1}{3}}$$

$$Y_G = \frac{1}{3}\theta_G + \frac{2}{3}(\theta_G \theta_R \theta_U)^{\frac{1}{3}}, \quad Y_U = (\theta_G \theta_R \theta_U)^{\frac{1}{3}}$$

$$S_{GR} = \frac{\theta_G}{\theta_R}, \quad S_{GU} = (\theta_G \theta_R \theta_U)^{\frac{1}{3}}$$

  - Limited risk sharing, inefficient output, dampened exchange rates vis a vis U

Connection to this paper

- Empirical investigation
  - Price responses (pass-through)
  - Terms of trade responses
  - Trade flows
- All tend to support DCP vis a vis PCP, LCP

Comments on results

- ► Use of unit value prices, at annual level
    - ► Can we treat these as sticky?
    - ► Data quite different from Gopinath Itskhoki Rigobon 2012
    - ► Individual prices change every period
    - ► Pass-through should be interpreted as 'medium run pass-through'?
- ► Devereux Dong Tomlin 2017, using UVP - HS10 level
    - ► Pass-through related to market share (see also Auer an Schoenle 2016 JIE)
    - ► Suggests endogenous movements in markups related to MS

Pass-through and market share

Table 5: Market Share and Pass-Through

	(I)	(II)	(III)	(IV)	(V)
Exchange rate ($\triangle_\tau e_{st}$)	0.486***	0.487***	0.488***	0.486***	0.486***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Exporter market share (MS_{vt})	-0.007***	-0.007***			-0.005**
	(0.002)	(0.002)			(0.002)
$\triangle_\tau e_{st} \cdot MS_{vt}$	-0.099	-0.290**			-0.341**
	(0.065)	(0.145)			(0.159)
$\triangle_\tau e_{st} \cdot MS_{vt}^2$		0.402*			0.648***
		(0.216)			(0.223)
Importer market share (MS_{ft})			-0.005***	-0.005***	-0.003*
			(0.002)	(0.002)	(0.002)
$\triangle_\tau e_{st} \cdot MS_{ft}$			-0.122	0.078	0.164
			(0.082)	(0.142)	(0.151)
$\triangle_\tau e_{st} \cdot MS_{ft}^2$				-0.397**	-0.546***
				(0.197)	(0.210)
Constant	0.003*	0.003*	0.003*	0.003**	0.003*
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Obs.	7,993,402	7,993,402	7,993,402	7,993,402	7,993,402
R^2	0.003	0.003	0.003	0.003	0.003

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    - Individual prices change every period
    - Pass-through should be interpreted as 'medium run pass-through'?
- Results of DDT, using UVP - HS10 level
    - Pass-through related to market share (see also Auer an Schoenle)
    - Suggests endogenous movements in markups related to MS
- Trade-off between quality of price data and comprehensive coverage
    - Would be nice to have more precise price data across countries (Billion Price index?)

Exchange Rates and Deviations from Law of one price

- DCP implies minimal deviations from LOOP among traded goods due to exchange rate changes

Back to model: LCP - all goods prices exhibit deviations from LOOP; $N^2 \times (N-1)/2$

G	R	U
P_{GG}	P_{RG}	P_{UG}
P_{RG}	P_{RR}	P_{UR}
P_{UG}	P_{RU}	P_{UU}

DCP - much fewer goods prices exhibit deviations from LOOP $(N-1)^2$

G	R	U
P_{GG}	P_{RG}	P_{UG}
P_{RG}	P_{RR}	P_{UR}
P_{UG}	P_{RU}	P_{UU}

Deviations from Law of one price

- DCP implies minimal deviations from LOOP among traded goods due to exchange rate changes
- Is this consistent with observations?
- Substantial literature (going back to Engel and Rogers) suggests exchange rate variation associated with widespread deviations from LOOP

Price regressions

- Not structural - same issues with controls as all PT regressions
- Note, without interactions, role of US dollar not identified - would be the same with euro
- Regressions without time fixed effects suggest euro PT minimal
- Devereux Dong Tomlin 2017 results for Canada interacts dollar and euro invoicing

$$\Delta P_{it} = \lambda_i + \delta_t + \Delta e_t + \Delta e_t D_{USD} + \Delta e_t D_{EUR} + Z_{it}\gamma + \epsilon_{it}$$

- Euro pass-through (for euro invoiced goods is as high as dollar pass-through)

Pass-through, Canadian dollar, US dollar, Euro

Table 4: Pass-Through and Currency Choice

Product	CA Dollar		US Dollar		Euro		Difference		
	β_C	(s.e.)	β_U	(s.e.)	β_E	(s.e.)	β_C - β_U	β_C - β_E	β_U - β_E
Overall	0.137***	(0.02)	0.502***	(0.01)	0.497***	(0.02)	-0.37***	-0.36***	0.01
Vegetable products	0.300***	(0.08)	0.325***	(0.05)	0.547***	(0.08)	-0.07	-0.25***	-0.22**
Food and beverage	0.020	(0.03)	0.481***	(0.03)	0.684***	(0.04)	-0.46***	-0.66***	-0.20***
Chemical products	0.128**	(0.06)	0.459***	(0.02)	0.521***	(0.07)	-0.32***	-0.39***	0.06
Textiles	0.096*	(0.06)	0.587***	(0.02)	0.484***	(0.04)	-0.49***	-0.39***	0.10**
Apparel	0.123***	(0.03)	0.623***	(0.01)	0.484***	(0.03)	-0.50***	-0.36***	0.14***
Footwear	0.078	(0.09)	0.702***	(0.03)	0.562***	(0.07)	-0.62***	-0.48***	0.14*
Metal products	0.193***	(0.04)	0.451***	(0.02)	0.255***	(0.07)	-0.26***	-0.06	0.20***
Industrial machinery	0.211***	(0.05)	0.597***	(0.02)	0.589***	(0.07)	-0.39***	-0.38***	0.01
Consumer electronics	0.169**	(0.08)	0.620***	(0.03)	0.740***	(0.11)	-0.45***	-0.57***	-0.12

Note: The pass-through coefficients for the different products are obtained using interaction terms, and therefore there is only one set of coefficients for the other explanatory variables. Each regression includes HS10 product and time fixed effects. We restrict the sample to price changes within the -100% to +100% range. The standard errors are clustered at the HS10 level.

Other suggestions

- Results on terms of trade - suggest DCP, not PCP or LCP
  - Other explanations for low correlation between exchange rates and terms of trade - Itskhoki and Mukhin 2017- strategic complementarities, Atkeson and Burstein 2008
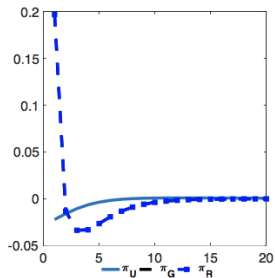
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- Business cycle implications - are shocks asymmetric?
    - Cook-Devereux, 2006 Asian crisis exacerbated by dollar currency pricing
- Effect of US dollar shock depends on trade patterns
    - Cook and Patel BIS 2017 - countries with more region based trade and less integrated into GVC are more sensitive to US dollar shock
    - Intuition - expenditure switching has bigger impact outside GVC

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- Evidence on CPI inflation response of US dollar - based on emerging market economies?
  - Evidence for inflation target countries is CPI not affected by US dollar exchange rate
  - Model suggests high pass-through

CPI pass-through for U shock

(d) Inflation

Other suggestions

- Why leave out commodities?
    - Suggestion is commodities prices not sticky
    - But if the regression results look similar, can we interpret the non-commodity results through a sticky price model?

General Question: Why DCP, Sustainability of DCP?

- ▶ Obviously outside the model
- ▶ Literature on endogenous invoicing as firm's choice
  - ▶ Mukhin 2018, Devereux Engel Stoorgard, 2004, Bachetta and Van Wincoop, 2005
  - ▶ DCP may be related to monetary policy stance Devereux Shi Xu 2007, Mukhin, 2018
- ▶ Endogenous vehicle currency Rey, 1998
  - ▶ Country size, openness
- ▶ Existing models suggest invoicing currency variation should be greater than observed
- ▶ But problem of multiple equilibria, network externalities makes inference difficult

Welfare

- Does US gain from DCP?
- Gains from use as a vehicle currency (seigniorage)
- Gains from exorbitant privelage (excess returns on NIIP assets)
- But maybe losses from DCP
  - Devereux Shi and Xu 2007 - DCP country worse off due to lack of expenditure switching

In conclusion

- Great paper, major accomplishment, great research area