International Macroeconomics - Session III International Real Business Cycles with multiple goods

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Recap: Last session

- "International Real Business cycles": Propagation of shocks in standard model with capital accumulation, intertemporal consumption smoothing and flexible labour supply
- Market structure important for propagation of productivity shocks
- Complete markets
  - Risk sharing implies strong positive consumption correlation across countries
  - Efficiency implies countercyclical NX due to investment dynamics, negative correlation of investment and employment

Recap: Last session

- Incomplete Markets
  - CM and IM almost identical for transitory shocks that spill over to the other country.
  - Only with near-permanent shocks and no spillovers, the two differ, as wealth effects are important.
  - Wealth effects increase consumption at home by more, breaking $c, c*$ link, and making imports more procyclical, so NX countercyclical.
  - Comovement puzzle for labour inputs and investment remains.

Recap: Complete vs. Incomplete markets I

- Complete markets
  1. 1st WT holds
  2. Equilibrium allocation solves planners problem.
  3. Problem: SPP has infinite no of solutions indexed by relative weights on agents. Also, doesn't give us equilibrium prices.
  4. Solution: Negishi approach - use lagrange multipliers as prices, and solve for optimal allocation that is "affordable" at these.
- Incomplete markets
  1. Need to consider individual maximisation given prices

Recap: CM vs. IM II: Budget constraints (with 0 initial wealth)

- Complete markets: Trade only in period 1, s.t.

$$\sum_t \sum_{s_t} \pi(s_t) \frac{q(s_t)}{\pi(s_t)} [y(s_t) - c(s_t)] \geq 0 \tag{1}$$

$$E \sum_t \frac{q(s_t)}{\pi(s_t)} [y(s_t) - c(s_t)] \geq 0 \tag{2}$$

- Incomplete markets: Trade every period

$$c(s_t) + b_{t+1}(s_t) \leq y(s_t) + b_t \tag{3}$$

$$\sum_0^\infty q_t [y(s_t) - c(s_t)] \geq 0 \ \forall s_t q_t = \Pi_{s=0}^t \frac{1}{R_s} \tag{4}$$

- So BC holds in expectation with CM, but state-wise with IM

This session

- Add to intertemporal trade intratemporal trade in different goods. Allows to look at RER and ToT movements.
- Transmission of shocks not just by financial markets but also via RER movements, and fluctuations in ToT?
  1. Traded vs. non-traded goods.
  2. Country specific traded goods.

Learning points

- Relative price movements are important shock transmitters. Allow insurance across countries in principle.
- But standard model doesn't solve IBC puzzles.
- The elasticity of substitution is crucial for equilibrium dynamics. Can lead to NEGATIVE transmission of productivity shocks.

Roadmap: Multigood models

1. Key papers
2. Multigood models: General Issues
3. A reminder on RER facts
4. Complete markets
5. Bond economy and financial autarky.
6. Quantitative results: Heathcote and Perri (2000)
7. The importance of the elasticity of substitution: Corsetti, Dedola and Leduc (2008)

Intratemporal Trade models: Key Papers

1. Cole and Obstfeld (1991): Trade in goods can deliver CM allocation in financial autarky.
2. BKK 1994: Traded goods in 2-good CM model.
3. Heathcote and Perri (2000): 2-good IM economy (Financial autarky and Bond-economy).
4. Corsetti, Dedola and Leduc (2008): IM, non-traded goods, low elasticity and high persistence.

Multigood models - general issues

1. So far: Focus on intertemporal trade. One good for c,i,g, same in both countries. LoOP: relative price 1.
2. Multiple goods
   - *2.1* How do they feature in c,i,g, and c*,i*,g*?
   - *2.2* What are the different production functions?
   - *2.3* What goods are traded?

The biggest problem with multiple goods

- Notation
- Here: P_h, P_f are price indices p_h, p_f goods prices, a $\star$ denotes foreign quantities.

A simple multigood setup

- 2 traded goods H F, with price p_h,p_f in some common numeraire.
- Technology standard, but country-specific: country H produces H good, F F good.
- c,x,g are identical CES "Armington aggregates" of 2 goods

$$z = (\omega_1^{\frac{1}{\sigma}} z_h^{\frac{\sigma-1}{\sigma}} + \omega_2^{\frac{1}{\sigma}} z_f^{\frac{\sigma-1}{\sigma}})^{\frac{\sigma}{\sigma-1}} \text{ for } z = c, x, g \quad (5)$$

$$z^\star = (\omega_1^{\frac{1}{\sigma}} z_f^{\star\frac{\sigma-1}{\sigma}} + \omega_2^{\frac{1}{\sigma}} z_h^{\star\frac{\sigma-1}{\sigma}})^{\frac{\sigma}{\sigma-1}} \text{ for } z^\star = c^\star, x^\star, g^\star \quad (6)$$

for $\omega_1 = (1 - \omega_2)$ the weight of domestic goods in consumption. Assume $\omega_1 > \frac{1}{2}$ (home bias in c).

A simple multigood setup

- Preferences, Technology as before, but c, x, g are now CES "Armington aggregates" of 2 goods

$$c = (\omega_1^{\frac{1}{\sigma}} c_h^{\frac{\sigma-1}{\sigma}} + \omega_2^{\frac{1}{\sigma}} c_f^{\frac{\sigma-1}{\sigma}})^{\frac{\sigma}{\sigma-1}} \tag{7}$$

- Note: Homogeneity of degree 1 implies budget shares independent of level of consumption.
- Also: Utility is time-separable $\longrightarrow$ Can do 2-stage budgeting:
  1. Given period ressources Z, consume optimal basket of goods.
  2. Allocate resources across periods.

The price index

- For 2 stage budgeting, need price of consumption in period t as function of individual prices.
- Define P_i, $i \in \{H, F\}$ as "minimum expenditure per unit of aggregate consumption"

The price index

Take home country:

$$min_{c_h, c_f} \; p_h c_h + p_f c_f \tag{8}$$

$$s.t. \;\; (\omega_1^{\frac{1}{\sigma}} c_h^{\frac{\sigma-1}{\sigma}} + \omega_2^{\frac{1}{\sigma}} c_f^{\frac{\sigma-1}{\sigma}})^{\frac{\sigma}{\sigma-1}} = 1 \tag{9}$$

Solution:

$$c_h = \omega_1 (\frac{p_h}{P_h})^{-\sigma} c \tag{10}$$

$$= \omega_1 (\frac{p_h}{P_h})^{1-\sigma} Z \tag{11}$$

Where $Z = \frac{P_h c}{p_h}$ is expenditure in home goods,for the home consumption price index

$$P_h = [\omega_1 p_h^{1-\sigma} + \omega_2 p_f^{1-\sigma}]^{\frac{1}{1-\sigma}} \tag{12}$$

$\Longrightarrow$ Symmetric for P_f.

Roadmap: Multigood models

1. Key papers
2. Multigood models: General Issues
3. A reminder on RER facts

Real Exchange rates and relative consumption

Table 3. Unconditional Correlations

	With real US$ rate				With real effective exch. rate			
	e^{us}	p^{US}/p^i	c^i	c^i/c^{us}	e^{eff}	p^w/p^i	c^i	c^i/c^w
I. First differences, full sample								
Australia	0.99	0.03	-0.03	-0.02	0.99	0.04	-0.03	-0.03
Canada	0.97	0.18	0.07	-0.01	0.97	0.18	0.02	0.05
Denmark	0.99	-0.07	0.09	-0.01	0.92	0.10	0.07	0.04
France	0.99	-0.12	-0.22	-0.28	0.94	0.24	-0.11	-0.12
Italy	0.99	-0.13	-0.34	-0.40	0.96	0.12	-0.30	-0.26
Japan	0.98	0.12	0.12	0.02	0.97	0.17	0.07	0.09
Netherlands	0.99	0.00	-0.09	-0.20	0.87	0.43	0.03	-0.01
New Zealand	0.98	0.23	0.12	0.11	0.96	0.18	0.11	0.13
Norway	0.98	0.17	0.02	-0.11	0.93	0.23	0.23	0.19
Switzerland	0.99	-0.06	-0.07	-0.21	0.97	0.22	0.04	0.01
UK	0.99	0.04	0.03	-0.04	0.99	0.18	0.12	0.11
US	-	-	-	-	0.99	-0.16	-0.05	-0.13
II. First differences, 1960-1972.4								
Australia	0.81	0.77	0.39	0.34	-	-	-	-
Canada	0.95	0.15	0.06	0.12	0.94	0.17	0.09	0.13
Japan	0.82	0.37	0.25	0.24	0.83	0.47	0.22	0.26
UK	0.97	0.18	0.08	0.10	0.95	0.27	0.32	0.27
US	-	-	-	-	0.97	0.24	0.19	0.19
III. First differences, 1973.1-1998.4								
Australia	0.99	0.00	-0.06	-0.06	-	-	-	-
Canada	0.97	0.19	0.09	-0.05	0.97	0.19	0.02	0.02
Japan	0.99	0.10	0.04	0.02	0.99	0.16	0.09	0.10
UK	0.99	0.10	0.03	-0.07	0.97	0.16	0.10	0.10
US	-	-	-	-	0.99	-0.22	-0.10	-0.18

See notes to Table 2

Source: Rose 2001

Roadmap

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4. Complete markets

Intratemporal trade I: Complete markets

Planner's Problem

$$max_{\{c_{it}^{(\star)},x_t^{(\star)},l_t^{(\star)}\}} E_0[\sum \mu^{(\star)} \sum_{t=0}^{\infty} \beta^t u(c_{it}^{(\star)}, 1 - n_t^{(\star)})] \text{ subject to}$$

$$\lambda_t : \ z_t = (\omega_1^{\frac{1}{\sigma}} z_{ht}^{\frac{\sigma-1}{\sigma}} + \omega_2^{\frac{1}{\sigma}} z_{ft}^{\frac{\sigma-1}{\sigma}})^{\frac{\sigma}{\sigma-1}} \text{ for } z = x, g, c \quad (13)$$

$$\lambda_t^\star : \ z_t^\star = (\omega_1^{\frac{1}{\sigma}} z_{ft}^{\star\frac{\sigma-1}{\sigma}} + \omega_2^{\frac{1}{\sigma}} z_{ht}^{\star\frac{\sigma-1}{\sigma}})^{\frac{\sigma}{\sigma-1}} \text{ for } z* = x*, g*, c* \quad (14)$$

$$\nu_{ht} : \ c_{ht} + c_{ht}^\star + x_{ht} + x_{ht}^\star + g_{ht} + g_{ht}^\star \leq exp(A_t)F(k_t, n_t) \quad (15)$$

$$\nu_{ft} : \ c_{ft} + c_{ft}^\star + x_{ft} + x_{ft}^\star + g_{ft} + g_{ft}^\star \leq exp(A_t^\star)F(k_t^\star, n_t^\star) \quad (16)$$

$$k_{t+1}^{(\star)} = (1 - \delta)k_t^{(\star)} + x_t^{(\star)} \quad (17)$$

$$k_0^{(\star)} \text{ given} \quad (18)$$

Meaning of multipliers

- $\lambda_t^{(\star)}$: Impact of change in H (F) country consumption on planner's value - shadow price of consumption.
- ν_{it}: Impact of relaxing good i ressource constraint on panner's value - shadow price of good i.
- So get
  - Terms of trade as the relative price of goods $p_t = \frac{\nu_{ft}}{\nu_{ht}}$
  - RER as the relative price of consumption $q_t = \frac{\lambda_t^{(\star)}}{\lambda_t}$
  - Note: Law of one price holds, but RER fluctuates with relative costs of consumption baskets.

First order conditions I: Risk-sharing

1. $c_t^{(\star)}: \ \mu^{(\star)} u_c(c_t^{(\star)}, 1 - n_t^{(\star)}) = \lambda_t^{(\star)}$
   Risk sharing now takes into account the relative cost of consumption in h and f, so relative MU fluctuates
2. $\longrightarrow$ "Backus-Smith Condition"

$$\frac{u_c(c_t, 1 - n_t)}{u_c(c_t^\star, 1 - n_t^\star)} = \frac{\mu^\star \lambda_t}{\mu \lambda_t^\star} = \frac{\mu^\star}{\mu} \frac{1}{q_t} \tag{19}$$

3. So real exchange rate movements drive wedge between marginal utilities - might solve consumption correlation puzzle.

First order conditions II: Efficiency in production

1. n_t : $\frac{u_n(c_t,1-n_t)}{u_n(c_t^\star,1-n_t^\star)} = \frac{\nu_{ht} exp(A_t)F_n(k_t,n_t)}{\nu_{ft} exp(A_t^\star)F_n(k_t^\star,n_t^\star)} = \frac{1}{p_t}\frac{exp(A_t)F_n(k_t,n_t)}{exp(A_t^\star)F_n(k_t^\star,n_t^\star)}$
2. Efficient provision of labour now takes account of relative value of good i. This might help solve the comovement puzzle, but depends on the impact of productivity shocks on ToT.
3. $\frac{E_{t-1}[\nu_{ht}\ exp(A_t)F_k(k_t,n_t)+\lambda_t(1-\delta)]}{E_{t-1}[\nu_{ft}\ exp(A_t^\star)F_k(k_t^\star,n_t^\star)\mu_t^\star+\lambda_t^\star(1-\delta)]} = \frac{\lambda_{t-1}^\star}{\lambda_{t-1}} = \frac{1}{q_{t-1}}$
4. Similarly, the productivity of h capital depends on the relative price of h goods. The cost of investments depends on the relative price of h consumption basket. Might solve comovement, but again depends on ToT and RER.

Interpretation

1. The relative price of home and foreign goods breaks the link between the efficiency conditions for labour and investment at home and abroad: Higher home good supply raises demand for foreign goods in consumption and investment, and so makes production of the latter more valuable. This might explain why labour and investment comove positively.
2. The different consumption shares ω_1, ω_2 introduce fluctuations in the relative cost of consumption (RER) in response to supply shocks. This can break risk-sharing link between the levels of consumption.
3. But Backus-Smith condition predicts strong comovements between RER and relative consumption.
4. Effect of productivity shocks on ToT and ReR is crucial.

Excursion: The ReR and the ToT

1. We can write the real exchange rate as

$$q_t = \left[\frac{1 + \frac{\omega_2}{\omega_1} p_t^{1-\sigma}}{p_t^{1-\sigma} + \frac{\omega_2}{\omega_1}}\right]^{\frac{1}{\sigma-1}} \tag{20}$$

2. So the real exchange rate is independent of the ToT only if $\omega_2 = \omega_1$. For home bias in consumption $\omega_1 > \omega_2$, the RER responds positively to the ToT: when home products become cheaper, home consumption becomes cheaper, relative to foreign consumption.

Excursion: The ReR and the ToT

1. Also, in equilibrium, the TOT have to equal the MRS between h and f goods in consumption

$$p_t = \frac{\omega_2}{\omega_1}\left[\frac{c_h}{c_f}\right]^{\frac{1}{\sigma}} \ (equiv.\ for\ F) \tag{21}$$

2. So elasticity of substitution σ is key in determining the ToT (and thus RER) response to supply shocks.
3. Low σ
   - 3.1 Small change in quantity has large price effects. So productivity shocks spill over strongly to foreign country.
   - 3.2 The RER becomes more responsive to changes in prices / ToT (less substitution to counteract price movements).

Roadmap

1. Key papers
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4. Complete markets
5. Bond economy and financial autarky.

Intratemporal Trade II: Bond economy

1. Countries trade uncontingent bond that pays off in numeraire.
2. As before, income shocks have wealth effects.
3. Shocks get transmitted via relative price of goods and interest rate.

First order conditions

1. Euler equation now takes into account changes in consumption price - or "consumption based real interest rate"

$$\frac{U'(c)}{P_H} = E[R\beta \frac{U'(c')}{P'_H}] \tag{22}$$

   So RER movements drive wedge between EXPECTED MRS.

2. FOC for labour and investment unchanged, subject to lack of risk sharing.

Intratemporal Trade III: Financial autarky

1. Balanced trade:

$$p_h c_h^\star = p_f c_f \tag{23}$$

2. Budget constraint

$$P_h c = p_h Y, \; P_f c^\star = p_f Y_F \tag{24}$$

3. Can deliver higher volatility in relative prices.

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6. Quantitative results: Heathcote and Perri (2000)

A step back: Questions

1. Can trade in goods solve puzzles (Cons corellation, Comovement) and deliver countercyclical NX?
2. Do the models deliver realistic volatility, and comovement, of ToT and RER?

A quantitative model: Heathcote et al 2000

1. Symmetric world (US plus clone), apart from shocks
2. Elasticity of substitution $\sigma = 0.9$
3. Shocks: SD 0.0073, correlation 0.29, and AR(1) parameter matrix R

0.97	0.025
0.025	0.97

Results Heathcote et al 2000: Benchmark calibration

B) Correlations with output

	correlation between							
Economy	c,y	x,y	n,y	ex,y	im,y	nx,y	p,y	rx,y
U.S. Data	0.86	0.95	0.87	0.32	0.81	-0.49	-0.24	0.13
Complete markets	0.96	0.96	0.97	0.55	0.89	-0.64	0.65	0.65
Bond economy	0.95	0.96	0.97	0.59	0.86	-0.65	0.65	0.65
Financial autarky	0.92	0.99	0.99	1.00	0.15	0.00	0.65	0.65

P = terms of trade
rx = real exchange rate

C) Cross country correlations and international relative price volatility

	correlation between				*% std dev*	
Economy	y_1,y_2	C_1,c_2	x_1,x_2	N_1,n_2	p	Rx
Data	0.58	0.36	0.30	0.42	2.99	3.73
Complete markets	0.18	0.65	-0.29	-0.14	0.78	0.55
Bond economy	0.17	0.68	-0.29	-0.17	0.84	0.59
Financial autarky	0.24	0.85	0.35	0.14	1.68	1.18

Source: Heathcote et al 2000

Discussion

1. Disappointing!
2. Cons-Correlations puzzle remains, so does Comovement puzzle in CM and with bond trade.
3. ToT and RER volatility far too small with CM and bond trade. Correlation $c/c^\star$ with RER far too high.
4. Again, Bond trade and CM similar overall.
5. But: Financial autarky fares better on comovement and price volatility! (but worse on cons-correlation).
6. And: Results are sensitive to value of σ and to persistence of shock.

Results Heathcote et al 2000: Sensitivity

Table 3: Varying shock persistence and degree of substitutability – no spill-overs

	Low persistence shocks ρ = 0.95			*Unit root shocks* ρ = 1.0		
	σ = 0.5	σ = 1.0	σ = 1.5	σ = 0.5	σ = 1.0	σ = 1.5
A) corr(y_1,y_2)-corr(c_1,c_2)						
Data			0.22			
Complete markets	0.13	-0.13	-0.30	0.08	-0.32	-0.56
Bond economy	-0.37	-0.14	-0.18	-0.14	-0.22	0.02
Financial autarky	-0.08	-0.29	-0.17	-0.12	-0.31	-0.17
B) corr(x_1,x_2)						
Data			0.30			
Complete markets	0.29	0.14	0.02	0.75	0.21	-0.17
Bond economy	0.46	0.14	0.02	0.44	0.19	-0.13
Financial autarky	0.66	0.61	0.46	0.39	0.55	0.41
C) % std. dev terms of trade (p)						
Data			2.99			
Complete markets	1.05	0.75	0.57	1.57	1.05	0.73
Bond economy	2.22	0.76	0.49	6.32	0.89	0.27
Financial autarky	5.74	1.41	0.80	6.41	1.27	0.70

Source: Heathcote et al 2000

Solving the puzzles: The importance of the elasticity of substitution

1. Corsetti, Dedola and Leduc 2008

Recap

- Efficiency: c_i high when P_i low.
- Bond economy: holds, but in expectations, via the expected path of consumption based real interest rate.
- But data: positive relation between $c/c^\star$ and p_h/p_f or P_h/P_f.

Recap

- Solution in 1 good world: strong wealth effects.
- Here: change in LEVEL of consumption $\longrightarrow$ change in demand for H vs F goods. Could drive a wedge in Backus-Smith correlation.
- Wealth effects: from rise in PDV of Y_h, or p_h/p_f, or both.
- But with supply shocks, Y_h and p_h/p_f usually negatively linked - back to Backus-Smith puzzle!
- 2 solutions:
  1. Make wealth effect from Y_h big, reaction in p_h/p_f small, and supply sluggish. Short-term excess demand for H goods yields positive correlation $c/c^\star$ p_h/p_f.
  2. Create positive comovement Y_h and p_h/p_f.

Income and substitution effects: the role of σ

1. In financial autarky, fall in price of home goods affect home consumption according to

$$c_h = \omega_1 \left(\frac{p_h}{P_h}\right)^{-\sigma} C = \omega_1 \left(\frac{p_h}{P_h}\right)^{-\sigma} \frac{p_h Y_H}{P_h} = \frac{\omega_1}{\omega_1 + \omega_2 p^{1-\sigma}} Y_H \quad (25)$$

2. Given Y_H a deterioration in ToT p has negative income effect, but positive substitution effect for domestic h good demand.
3. Net effect positive (negative) when $\sigma > 1$ (< 1). No net effect for CD preferences (cf. Cole and Obstfeld (1991)).
4. Effect of lower p_h on foreign demand always positive.

Wealth effects and σ

1. For very high σ, strong positive wealth effect from movements in Y_H (as in one-good model). With sluggish supply, get also right movement in ToT.
2. For very low σ, a deterioration in terms of trade leads to a large fall in domestic demand. If home bias is high, can the small home good share of foreign consumption make up for this to clear market for h goods? Not always!
3. Corsetti et al (2008): For very low σ, the ToT (and thus the real exchange rate) IMPROVE (appreciates) from a positive shock to Y_H. Transmission is negative!

Negative transmission and σ

1. Can write relation of relative supply and ToT $p = \frac{p_f}{p_h}$ as

$$\frac{Y_H}{Y_F} = \frac{p(\omega_2 + \omega_1 p^{\sigma-1})}{(\omega_2 + \omega_1 p^{1-\sigma})} \tag{26}$$

2. Log-linearization yields:

$$\widehat{p} = \frac{\widehat{Y_H} - \widehat{Y_F}}{1 - 2\omega_1(1-\sigma)} \tag{27}$$

- So for $\sigma < \frac{2\omega_1 - 1}{2\omega_1}$, get
  - Negative transmission ("Immiserizing growth"): positive shocks to Y_H depress foreign consumption.
  - Positive Relation $c/c^\star, p_h/p_f$.

Corsetti et al (2008): Key elements

1. Bond economy
2. 2 country-specific goods, CES aggregator
3. Non-traded goods enter in consumption, but also in "distribution sector"
4. Look at 2 different scenarios:
   - *4.1* Low σ (0.85) and low persistence.
   - *4.2* High σ (8) and high persistence.

Corsetti et al (2008): Results

Statistics	Data	Baseline economy		Baseline with taste shocks		Baseline with high elasticity	Persistent tradable shocks	Persistent aggregate shocks
		Bond economy $\omega = 0{\cdot}85$	Arrow–Debreu $\omega = 0{\cdot}85$	Bond economy $\omega = 0{\cdot}82$	Arrow–Debreu $\omega = 0{\cdot}85$	Bond economy $\omega = 8$	Bond economy $\omega = 8$	Bond economy $\omega = 8$
(a) Exchange rates and prices in the theoretical economies								
S.D. relative to GDP								
Real exchange rate	3·90	2·99	0·73	2·94	0·99	1·17	1·60	0·35
Terms of trade	1·68	2·42	0·83	2·45	1·07	0·48	0·70	0·39
Relative price of non-tradables	0·86	0·77	0·51	0·76	0·48	0·55	0·67	0·06
Cross-correlations								
Between real exchange rate and								
Relative GDPs	−0·19	−0·54	0·21	−0·55	−0·28	−0·20	−0·55	−0·69
Relative consumptions	−0·71	−0·24	0·98	−0·30	−0·29	0·73	−0·12	−0·67
Real net exports	0·60	0·96	−0·62	0·93	0·57	0·79	0·87	0·96
Terms of trade	0·52	0·99	0·16	0·99	0·59	0·74	0·90	0·99
Between terms of trade and								
Relative GDPs	−0·33	−0·55	0·87	−0·56	0·11	0·45	−0·66	−0·71
Relative consumptions	−0·74	−0·27	0·31	−0·40	−0·54	0·98	−0·33	−0·69
Real net exports	0·67	0·97	0·63	0·97	0·82	0·99	0·98	0·97
(b) Business cycle statistics in the theoretical economies								
S.D. relative to GDP								
Consumption	0·94	0·48	0·48	0·53	0·67	0·42	0·48	0·76
Investment	4·33	3·20	3·21	3·13	2·91	3·25	2·86	1·90
Employment	1·19	0·53	0·52	0·59	0·85	0·55	0·49	0·2
Absolute (in per cent)								
Import ratio	4·94	1·62	0·55	1·63	0·81	3·06	2·91	1·25
Real net exports over GDP	0·64	0·17	0·03	0·18	0·13	0·20	0·16	0·12
Cross-correlations								
Between foreign and domestic								
GDP	0·68	0·38	0·39	0·38	0·33	0·31	0·18	0·28
Consumption	0·60	0·30	0·37	0·16	−0·01	0·60	0·16	0·17
Investment	0·25	0·45	0·45	0·45	0·44	0·35	0·03	0·03
Employment	0·54	0·45	0·49	0·35	0·16	0·26	−0·43	0·54
Between real net exports and GDP	−0·48	−0·38	0·21	−0·39	−0·28	0·22	0·50	−0·49

Summary

- Fluctuations in relative price of traded goods, and RER, can potentially solve comovement and cons-corr puzzle.
- But for intermediate values of elasticity of substitution, and shocks with spill-overs, the puzzles remain.
- But with extreme values of elasticity, model can account for facts:
- Extremely low σ: negative transmission and procyclical relative prices of home goods in short and long-run
- Extremely high σ and sluggish capital adjustment: long-run transmission is positive, but wealth effects cause short run excess demand and procyclical relative price of home goods

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