Incomplete pass-through in import markets and permanent vs. transitory exchange-rate shocks

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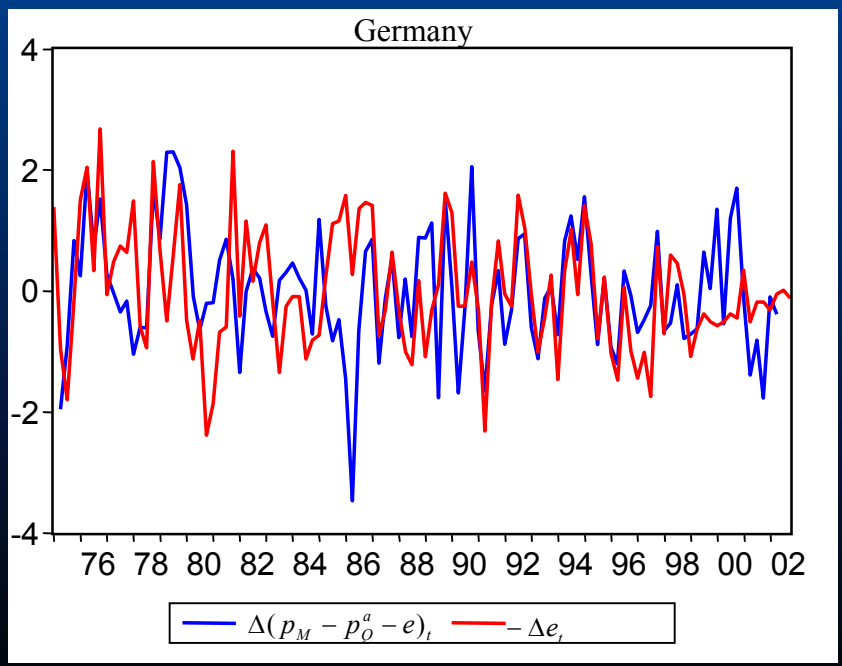
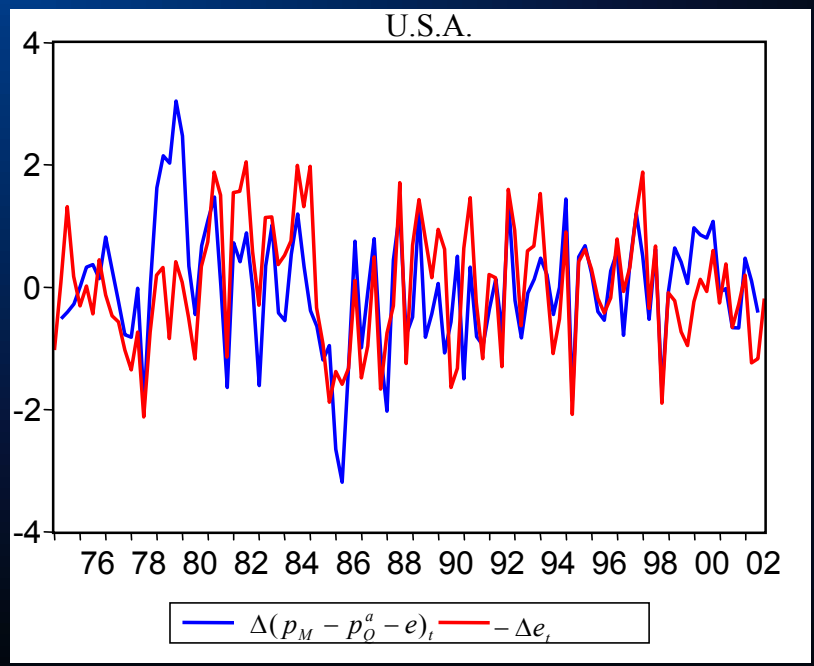
- First-glance empirical evidence for incomplete pass-through (pricing-to-market) and economic rationale
- Estimation of import supply functions for the U.S., Japan, Germany, France, and Italy
- Permanent and transitory exchange-rate changes in the context of dynamic optimizing behavior
- Decomposition of real exchange rates into a permanent and a transitory component
- Re-estimation of import supply functions with decomposed exchange rates
- Conclusion

Changes in the value of a country's currency do not lead to congruent changes of import prices

Latest empirical evidence: e.g. Campa and Goldberg (2002), Pollard and Coughlin (2003)

⇔ Import prices in relation to foreign costs in common currency $[P_M/(P_Q^a \cdot E)]$ vary with the exchange rate (E).





Static PTM: Dornbusch (1987), Krugmann (1987)

$$P_M^f = \frac{\varepsilon}{1+\varepsilon} C^f{}'(M, P_Q^a) \qquad \varepsilon = \varepsilon(P_Q / \bar{P}_M^f \cdot E)$$

$$(1) \quad P_M^f = \left[\frac{P_Q}{P_M^f \cdot E}\right]^{\psi} \cdot C^f{}'(M, P_Q^a)$$

$$r = e + p_Q^a - p_Q$$

$$(2) \quad p_M - p_Q = \gamma_0 + (1-\gamma_1) r$$

Dynamic PTM: Baldwin (1988), Froot and Klemperer (1989), Kasa (1992)

$$(3) \quad L_t = E_t \sum_{i=0}^{\infty} \theta^i [\lambda (p_{t+i} - \tilde{p}_{t+i})^2 + \Delta p_{t+i}{}^2] \qquad p_t = p_{M\,t} - p_{Q_t}$$

$$E_t\ \tilde{p}_{t+i} = (1-\gamma_1) E_t\ r_{t+i}$$

$$(7) \quad \Delta p_t = -(1-\mu)[p_{t-1} - (1-\gamma_1) r_{t-1}] + \iota' G(\theta, \mu, \Pi, A) \Delta z_t$$

Oil price as additional determinant of import prices:

Table 1: Pair-wise correlations of oil prices with exchange rates and import prices

	U.S.	*Japan*	*Germany*	*France*	*Italy*
$Corr(\Delta r_t, \Delta p_{Oil\,t})$	0.00	0.10	0.04	0.17	0.08
$Corr(\Delta p_t, \Delta p_{Oil\,t})$	0.54	0.43	0.44	0.38	0.43

Unit-Root tests:

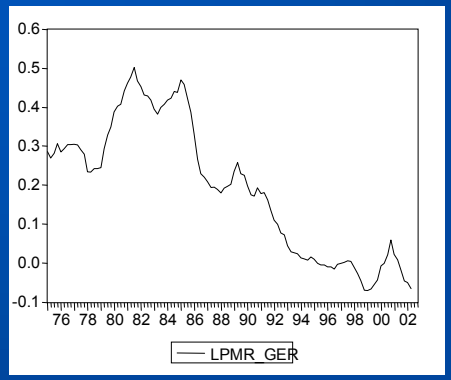
Augmented Dickey-Fuller: H_0: $\alpha = 1$

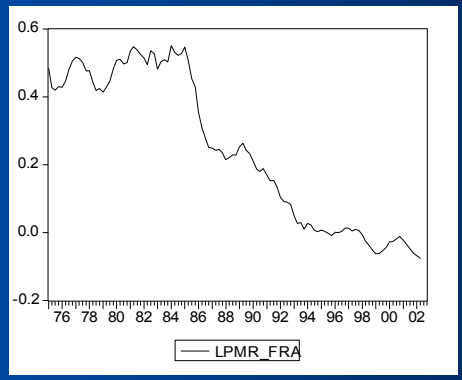
$$\Delta y_t = c_0 + (\alpha - 1) y_{t-1} + c_1 t + \sum_{i=1}^{k-1} \beta_i \Delta y_{t-i} + \varepsilon_t \qquad \varepsilon_t \sim IID(0, \sigma^2)$$

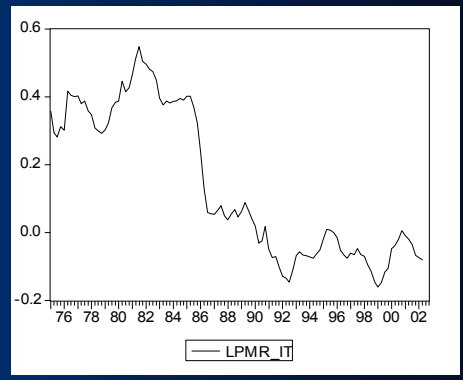
Kwiatkowski et al.: H_0: $d = 0$

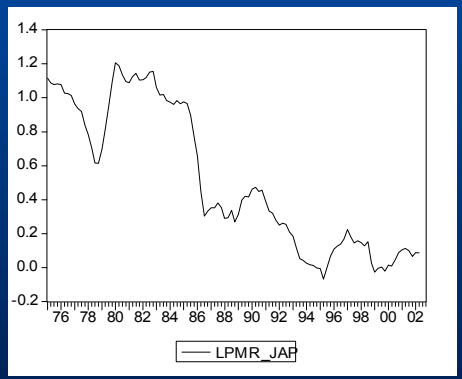
$$y_t = \alpha + \beta t + d \sum_{i=1}^{t} u_i + \varepsilon_t \qquad LM = \sum_{t=1}^{T} S_t^2 / \hat{\sigma}_\varepsilon^2 \qquad S_t = \sum_{i=1}^{t} e_i$$

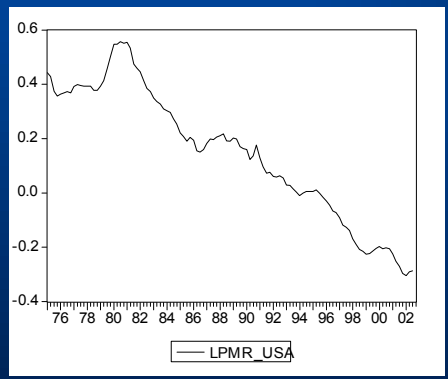
Relative import prices and real exchange rates

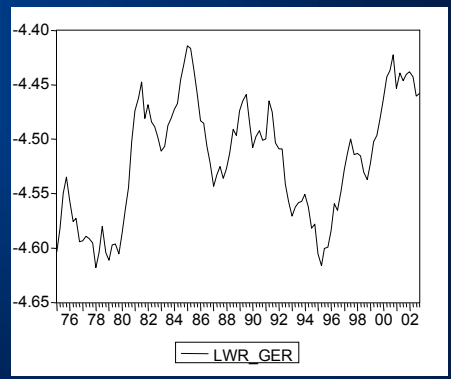


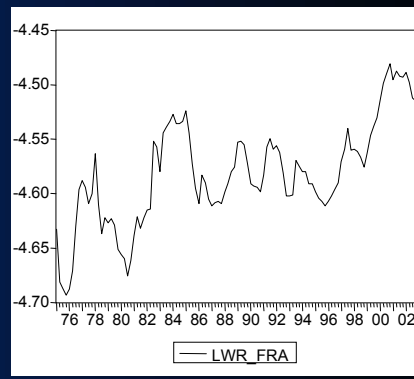


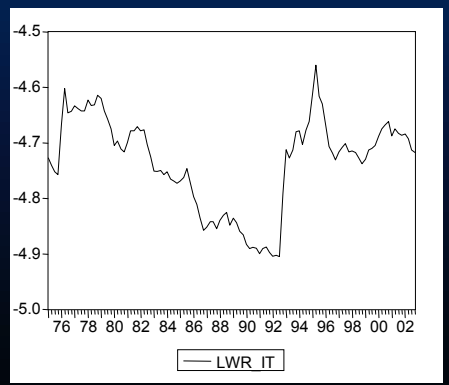


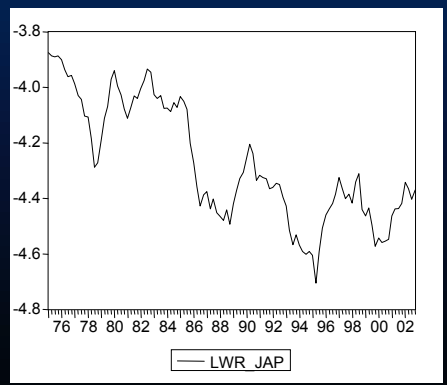


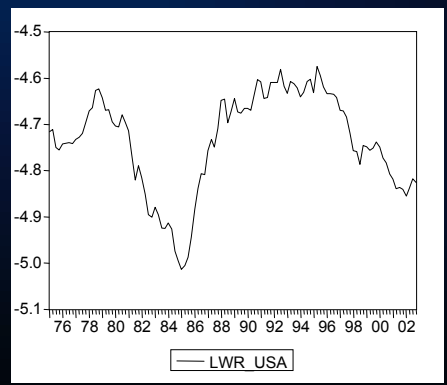












Results of the unit root tests

Table 1: Unit root tests for the real exchange rates

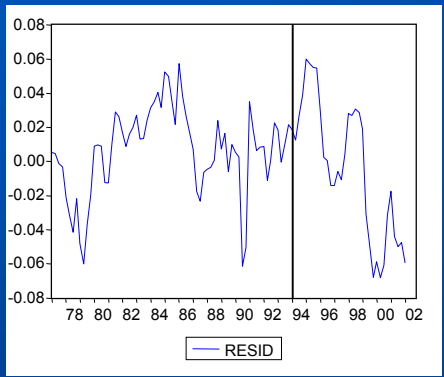
variable	Lags (k)	det. comp. in test	ADF	ADF 1st diff.	KPSS (l = 8)	KPSS 1st diff. (l = 8)
R_GER	4	C,T	-3.30*	-5.03***	0.128*	0.083
R_FRA	5	C,T	-3.31*	-5.32***	0.074	0.074
R_ITA	4	C,T	-2.46	-5.55***	0.157**	0.123
R_USA	5	C,T	-2.61	-3.55***	0.105	0.050
R_JAP	6	C,T	-2.70	-4.98***	0.133*	0.199

Table 2: Unit root tests for the relative import prices and the oil price

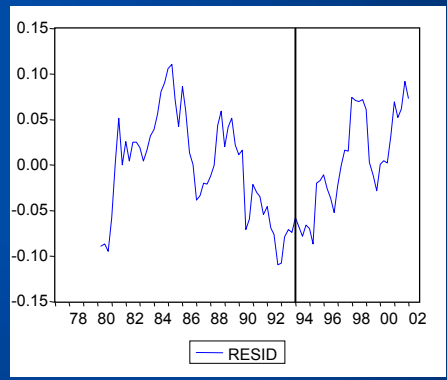
variable	Lags (k)	det. comp. in test	ADF	ADF 1st diff.	KPSS (l = 8)	KPSS 1st diff. (l = 8)
P_GER	6	C,T	-2.25	-3.74***	0.180**	0.147
P_FRA	5	C,T	-2.58	-4.15***	0.157**	0.118
P_ITA	7	C,T	-1.81	-3.96***	0.147**	0.096
P_USA	7	C,T	-3.25*	-3.85***	0.136*	0.142
P_JAP	7	C,T	-2.53	-4.14***	0.111	0.072
POIL	1	C	-1.37	-5.23***	0.117	0.109

Structural shifts in the European supply functions

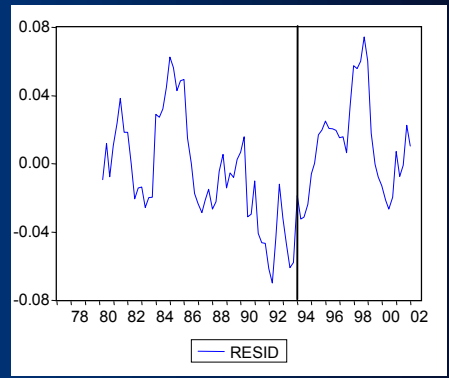
Germany



Italy



France



Summary of ECM estimations: sample 1975:1-2002:2, T=110

Significance of $(1-\mu)$ suggests cointegrating import supply relations – except for France

	long run $(1-\gamma_1)$	short run
U.S.	0.48	0.28
Japan	0.86	0.75
Germany	0.95	0.65
France	0.92	0.69
Italy	0.83	0.50

→ Coherence with results of previous studies

→ Hypothesis: different response to permanent and transitory exchange-rate changes matters

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A simple model for the decomposition of real exchange rate into a permanent component q_t and a transitory component s_t

$$(10a) \quad r_t = q_t + s_t$$

$$(10b) \quad q_t = q_{t-1} + u_t \qquad (s_t\,,\, u_t) \sim \text{iid}[0,\ \text{diag}(\sigma_s^2,\ \sigma_u^2)]$$

$$\rightarrow \quad \Delta r_t = u_t + \Delta s_t$$

Prediction of the target path in the adjustment cost model:

$$E_t\ r_{t+i} = r_t - s_t$$

Corresponding ECM for dynamic import supply function:

$$(11) \quad \Delta p_t = -(1-\mu)[p_{t-1} - (1-\gamma_1) r_{t-1}] + (1-\mu)(1-\gamma_1)\Delta r_t - (1-\mu)\theta\mu(1-\gamma_1)s_t$$

Implications for conventional estimates:

a) potential bias in estimated pass-through coefficients
b) imprecise forecasts

a) Monte-Carlo experiments to evaluate bias in estimates based on the simple model with AR(1) process for the transitory component s_t:

$$r_t = q_t + s_t$$

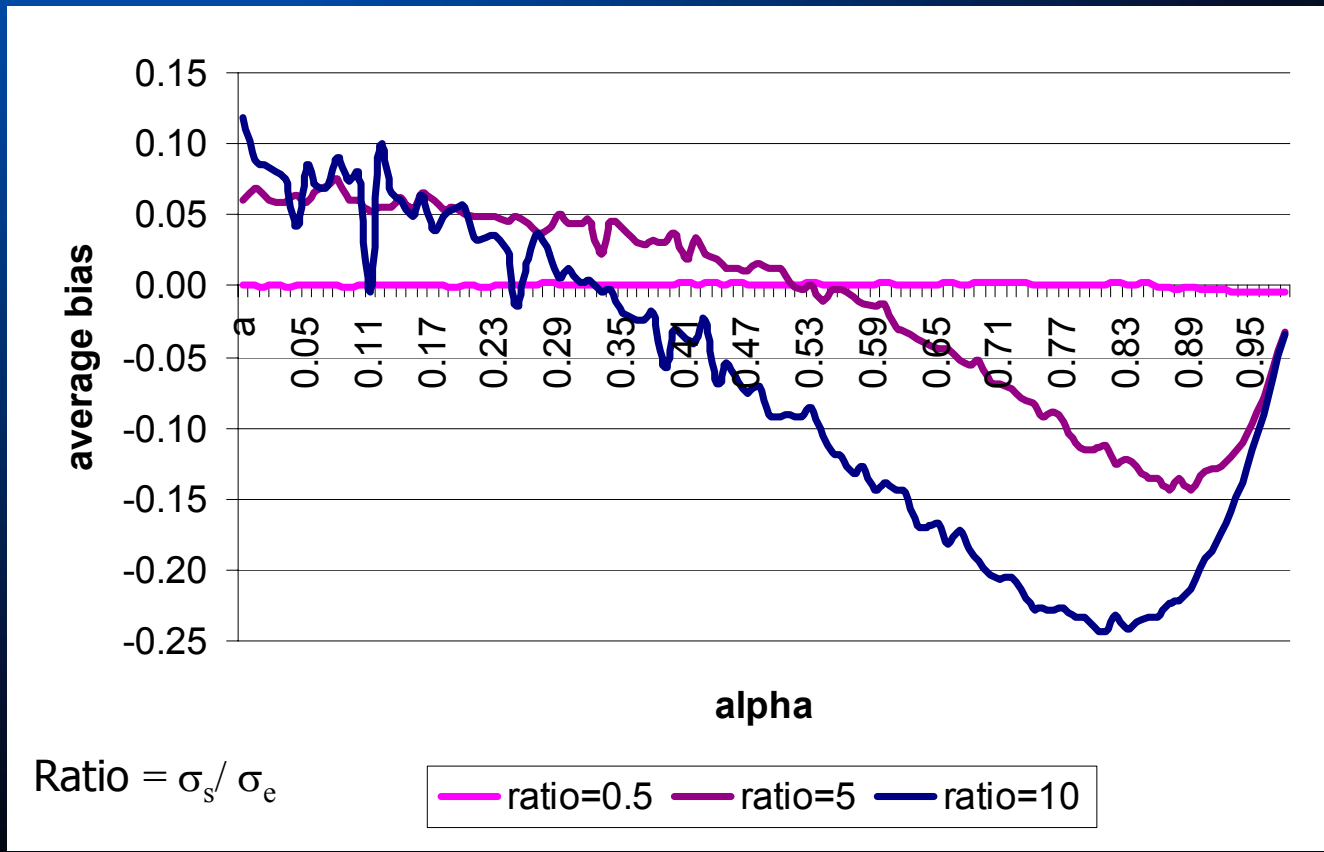
$$s_t = \alpha s_{t-1} + e_t \qquad 0 \le \alpha < 1 \qquad e_t \sim iidN(0, \sigma_e^2)$$

$$q_t = q_{t-1} + u_t \qquad u_t \sim iidN(0, \sigma_u^2)$$

In general: tendency to underestimate the adjustment coefficient (1-μ), and the short run pass-through elasticity

Downward bias increases with the variance of transitory shocks e_t in relation to permanent shocks u_t

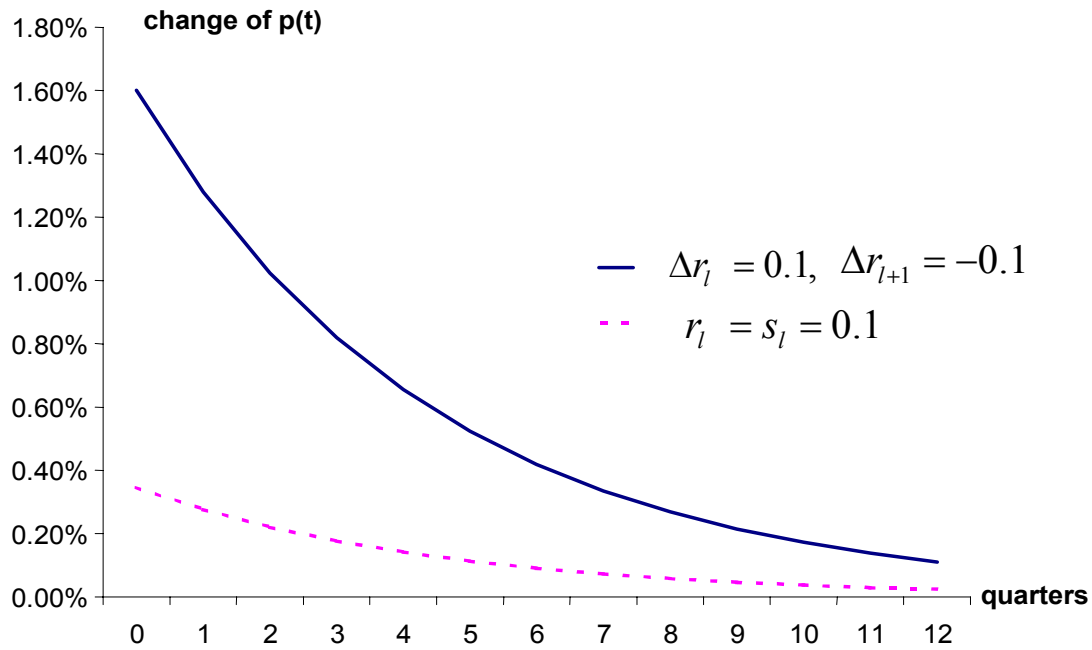
- Ambiguous results for the long run pass-through elasticity ($1-\gamma_1$).
- Downward bias peaks at a relatively high degree of serial correlation in s_t.



b) simulation of a temporary 10% depreciation at time $t = l$:

1. considering model (10a) and (10b): $r_l = s_l = 0.1$
2. setting $\Delta r_l = 0.1$ and $\Delta r_{l+1} = -0.1$ in conventional ECM

Figure 3: Forecasting the impact of a transitory exchange rate shock



→ Extract transitory component s_t and include contemporaneous and possibly lagged values when estimating the dynamic import supply functions

Bivariate Blanchard-Quah decomposition:

- Joint process of two variables (x_t, z_t) is governed by two shocks
- One variable is stationary $\Rightarrow$ no impact of shocks on long-run level
- Other variable is non-stationary, but one of the shocks is assumed to have no long-run impact

$\Rightarrow$ identification of two independent shocks from VMA representation of $(\Delta x_t, z_t)$

Lee and Chinn (2002): joint process of r_t and current account in relation to nominal GDP (CA_t) satisfy BQ assumptions:

- Two shocks govern the joint process: real demand and supply shocks (ε^r_t) and nominal (financial market) shocks (ε^n_t)
- CA is stationary
- Nominal shocks only have a temporary impact on r_t

Bivariate Blanchard-Quah decomposition

based on the joint process of r_t and current account in relation to nominal GDP (CA_t) - Lee and Chinn (2002):

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- CA is stationary
- Nominal shocks only have a temporary impact on r_t

Hypothesized model: $\begin{bmatrix} \Delta r \\ CA \end{bmatrix}_t = C(L) \begin{bmatrix} \varepsilon^r \\ \varepsilon^n \end{bmatrix}_t$

Steps in the decomposition :

1. Unit-root tests for CA_t

   → stationarity cannot be rejected

2. Estimation of the bivariate VAR: $\begin{bmatrix} \Delta r \\ CA \end{bmatrix}_t = A(L) \begin{bmatrix} \Delta r \\ CA \end{bmatrix}_{t-1} + \begin{bmatrix} e_1 \\ e_2 \end{bmatrix}_t$

   → selection of lag order using Akaike and Schwarz Bayesian criterion

3. Transformation into VMA: $\begin{bmatrix} \Delta r \\ CA \end{bmatrix}_t = (I - A(L)L)^{-1} \begin{bmatrix} e_1 \\ e_2 \end{bmatrix}_t = (I - A(L)L)^{-1} C(0) \begin{bmatrix} \varepsilon^r \\ \varepsilon^n \end{bmatrix}_t$

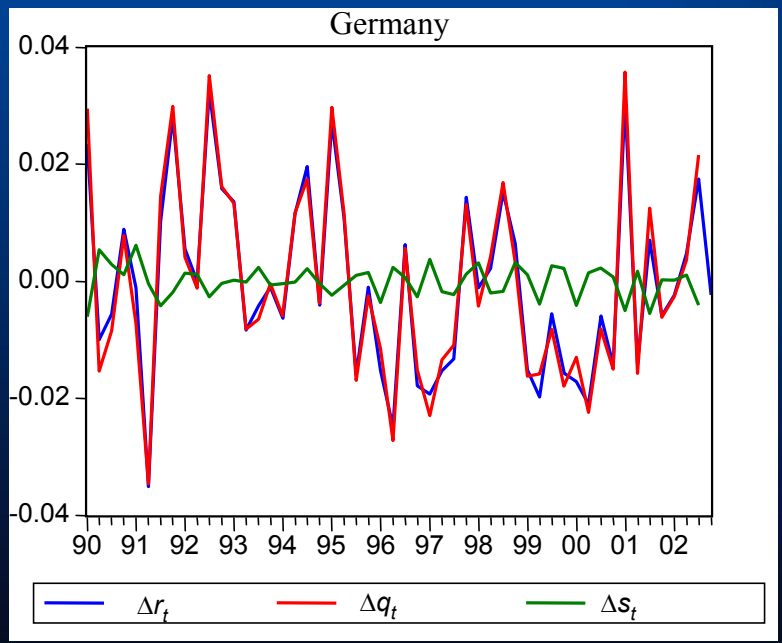
4. Identification of C(0)shocks making use of: $[[I - A(1)]C(0)]_{1,2} = 0$

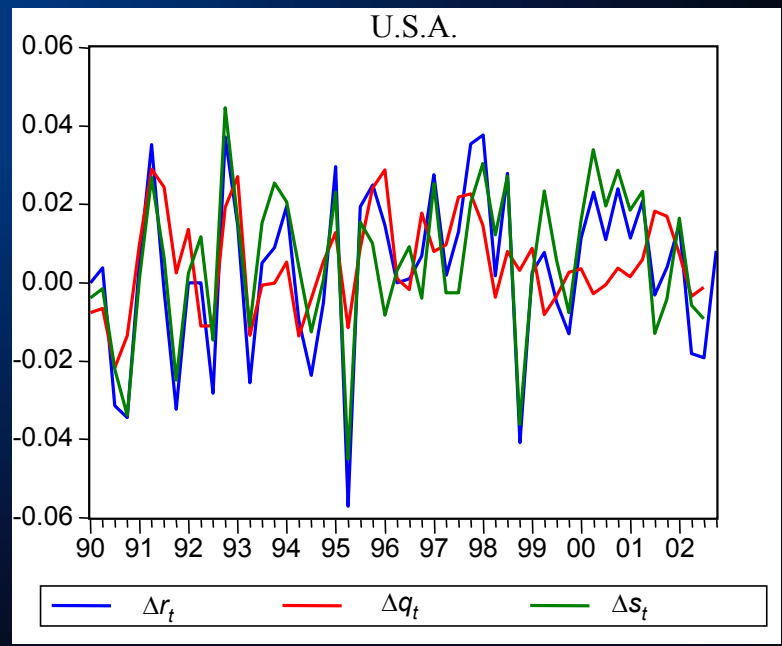
5. Calculation of transitory and permanent components in r_t

$$\Delta q_t = (1,0) \left[(I - A(L)L)^{-1} C(0) \begin{bmatrix} \varepsilon^r \\ 0 \end{bmatrix}_t \right] \qquad \Delta s_t = (1,0) \left[(I - A(L)L)^{-1} C(0) \begin{bmatrix} 0 \\ \varepsilon^n \end{bmatrix}_t \right]$$

- For Japan, Germany, France, and Italy real shocks and permanent exchange rate movements dominate

- U.S. real exchange rate is dominated by nominal shocks and transitory changes





Results for the augmented ECMs including transitory exchange rate components s_t, s_{t-1},...:

- Only for the U.S. import price s_{t-1} has a significant impact, for other countries at most s_t.
- Transitory component enters with correct (negative) sign
- In many cases increase in short and long run pass-through

	long run ($1-\gamma_1$)	short run
U.S.	0.79 ↑	0.44 ↑
Japan	0.85 ~	0.75 ~
Germany	1.00 ↑	0.63 ~
France	1.38 ↑	0.74 ↑
Italy	1.04 ↑	0.49 ~

- Changes in coefficients are broadly consistent with simulations, exception is adjustment coefficient ($1-\mu$)

- Estimation of ECMs for import supply relationships confirms incomplete pass-through of exchange rates

- Quadratic adjustment cost model highlights role of expected persistence of exchange rate changes
  - implications for estimation and forecasting

- Accounting for permanent and transitory exchange-rate movements in many cases increases ECM estimates of short and long run pass-through

- Predictions of simulations for bias in estimates are not fully supported by the data
  - indicative character of results
  - more extensive study about implications for estimation
  - alternative decompositions