Aggregation and the PPP Puzzle in a Sticky Price Model

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- Very interesting paper
  - Contribution to PPP puzzle and macro models of open economies
  - Contribution to aggregation debate
  - Nicely ties into recent micro estimates of price stickiness

- Discussion
  - Give account of way model works
  - Some comments on empirical implications

Simple version of model

- 2 countries, LCP in both countries
- K sectors, Calvo coeff λ_{K} each sector/country
- Complete markets

$$\rho c + p = \rho c^{*} + s + p^{*}$$

- Linear disutility of leisure

$$w = \rho c + p$$

Simple version of model

- Money market equilibrium

$$m = \rho c + p$$

- Random walk money shocks

$$m = m_{-1} + u$$

Simple version of model

- Equilibrium pricing equation in each sector

$$p = (1 - \lambda_k)m + \lambda_k p_{-1}$$

- Exchange rate

$$s = m - m^*$$

Simple version of model

- Sector real exchange rate $q_k = p_k^* + s - p_k$

$$q_k = \lambda_k u + \lambda_k q_{k-1}$$

- Aggregate real exchange rate

$$q = \sum f_k q_k$$

Sum of K AR(1) = ARMA(K,K-1)

- Leads to sector real exchange rate

$$\Pi_1^K (1-\lambda_k L) q$$

$$= \sum_1^K \Pi_{i\neq k}^K (1-\lambda_i L) f_k \lambda_k u$$

- Take an example with 2 sectors

$$q = (\lambda_1 + \lambda_2)q_{-1} - \lambda_1\lambda_2 q_{-2}$$

$$+ \frac{\lambda_1 + \lambda_2}{2}u - \lambda_1\lambda_2 u_{-1}$$

Compare to averaged RER

- Leads to sector real exchange rate

$$q^a = \frac{(\lambda_1 + \lambda_2)}{2} q^a_{-1} + \frac{(\lambda_1 + \lambda_2)}{2} u$$

- Result: persistence is greater for q than for q^a

Take unit shock to u

- Impulse response q

$$q_t = \frac{\lambda_1^t}{2} + \frac{\lambda_2^t}{2}$$

- Impulse response q^a

$$q_t^a = \left(\frac{\lambda_1 + \lambda_2}{2} \right)^t$$

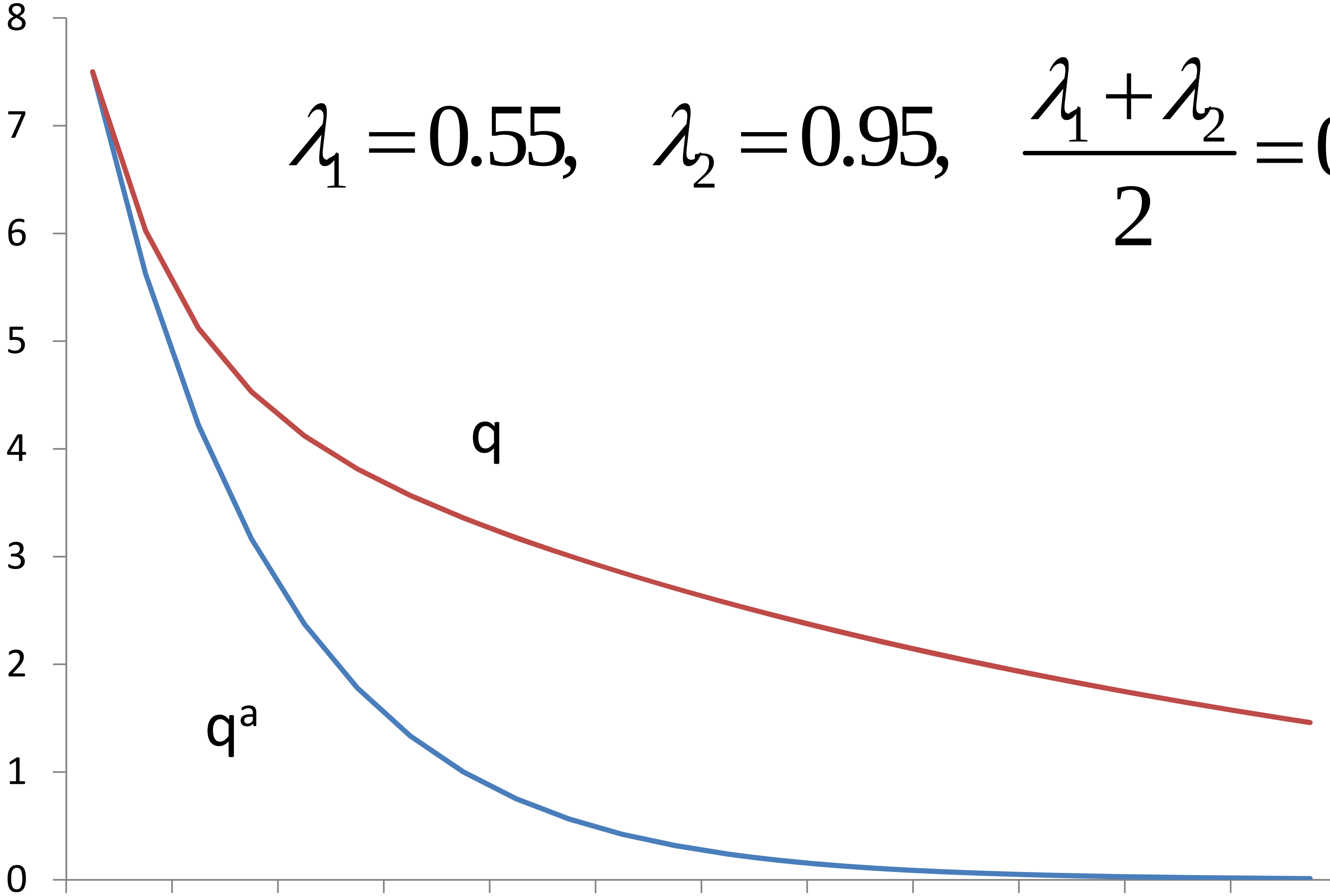
Impulse response is a convex function of roots

- Therefore

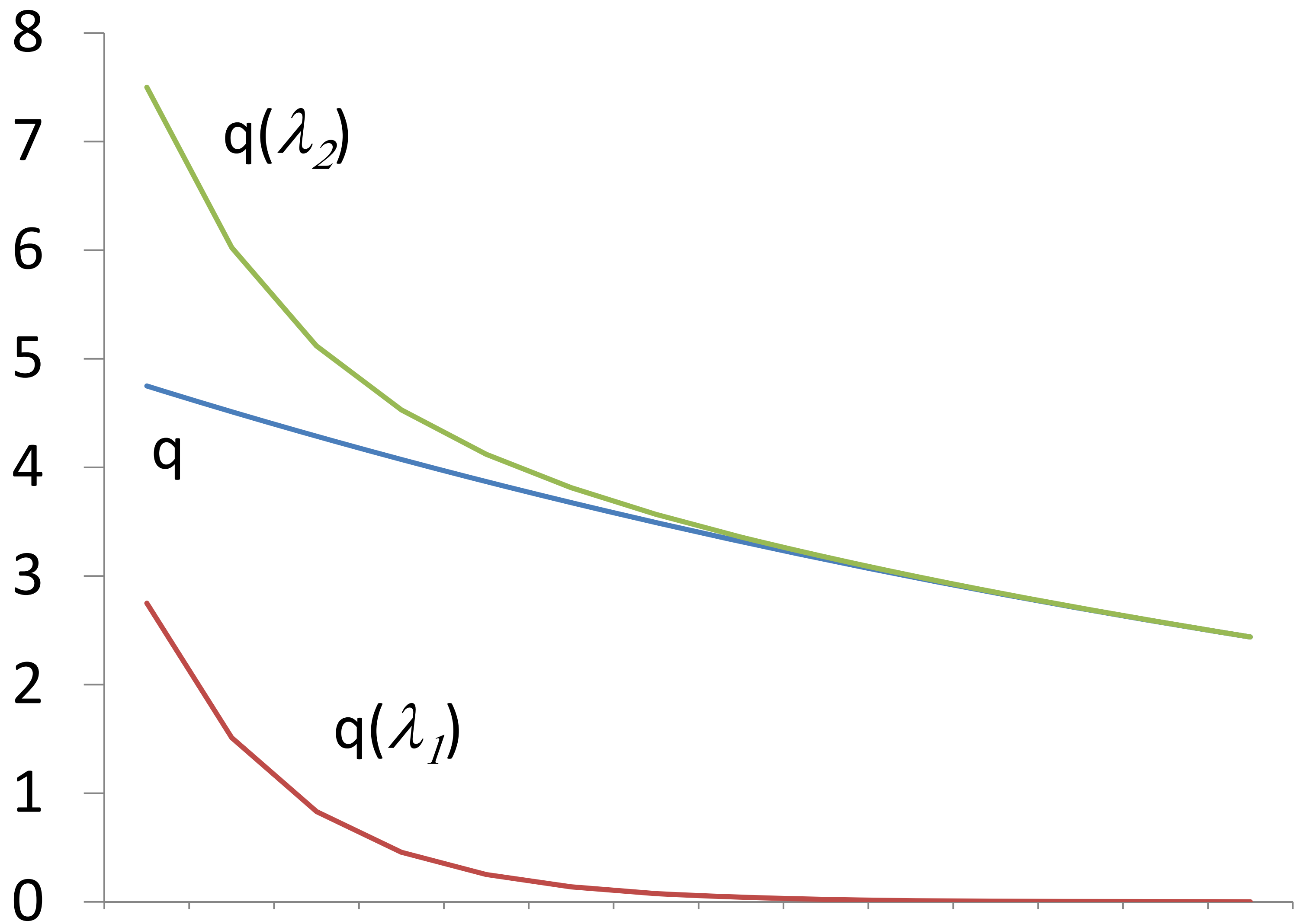
$$q_t > q_t^a$$

In this example, roots are:

$$\lambda_1 = 0.55, \quad \lambda_2 = 0.95, \quad \frac{\lambda_1 + \lambda_2}{2} = 0.75$$



Most persistent sector dominates



Decomposition

- Aggregation effect

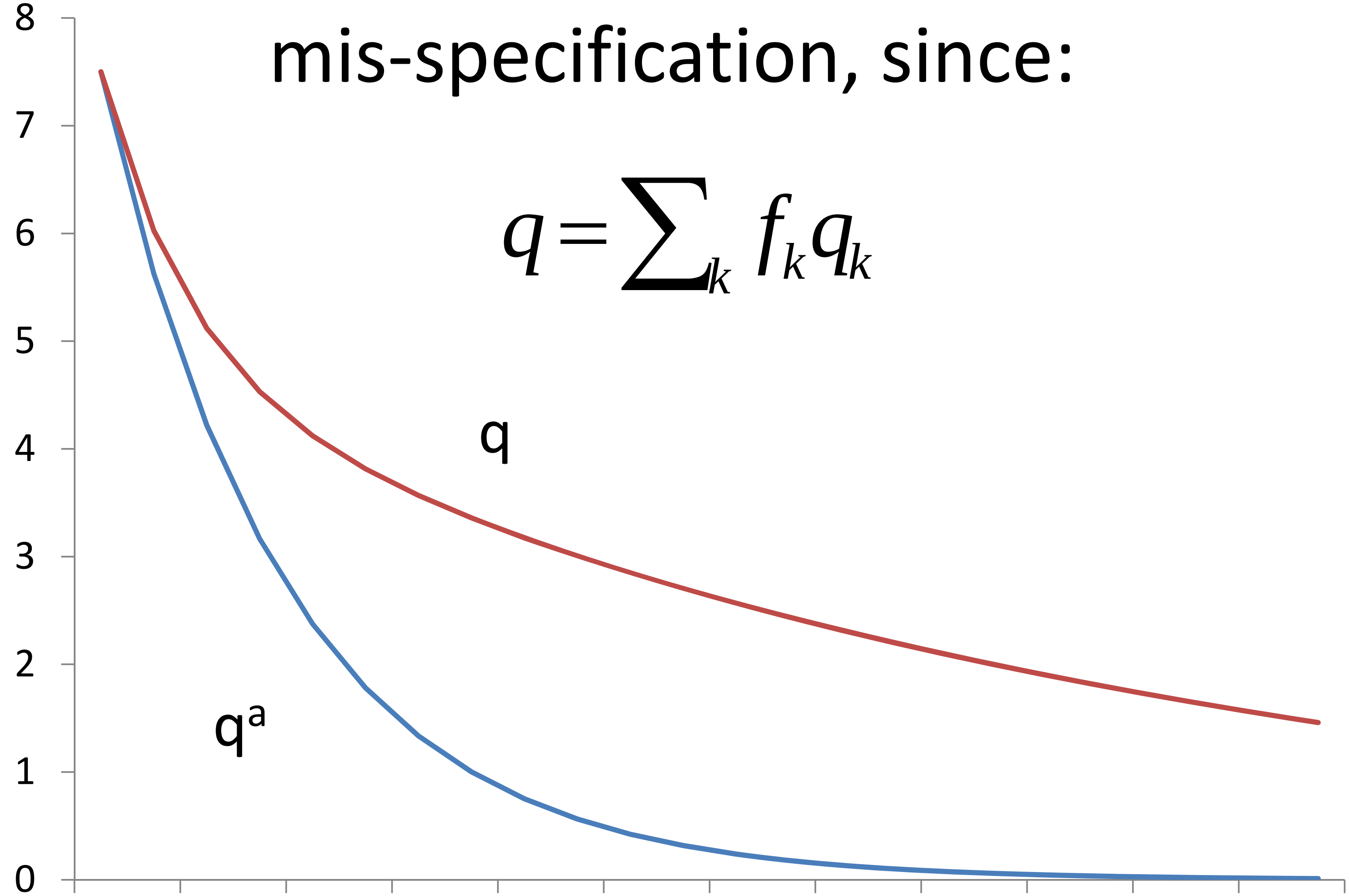
$$P(q_t) - \sum_k f_k P(q_k)$$

- Mis-specification effect

$$\sum_k f_k P(q_k) - P(q^a)$$

Note, in IRF, there is only mis-specification, since:

$$q = \sum_k f_k q_k$$



Heterogeneity effects

- Increases persistence (u=.3u(-1))

$$q = (0.95)q_{-1} + u$$

$$q^a = (0.86)q^a_{-1} + u$$

- Increases volatility

$$\sigma_q = 1.67\sigma_{q^a}$$

Contribution

- PPP puzzle
  - Why RER so volatile and persistent?
  - Chari et. al. (2002): Sticky price models cannot easily explain this
  - This paper gets much closer
  - But number of other mechanisms
    - Lahiri and Johri
    - Steinsson
    - Kollman

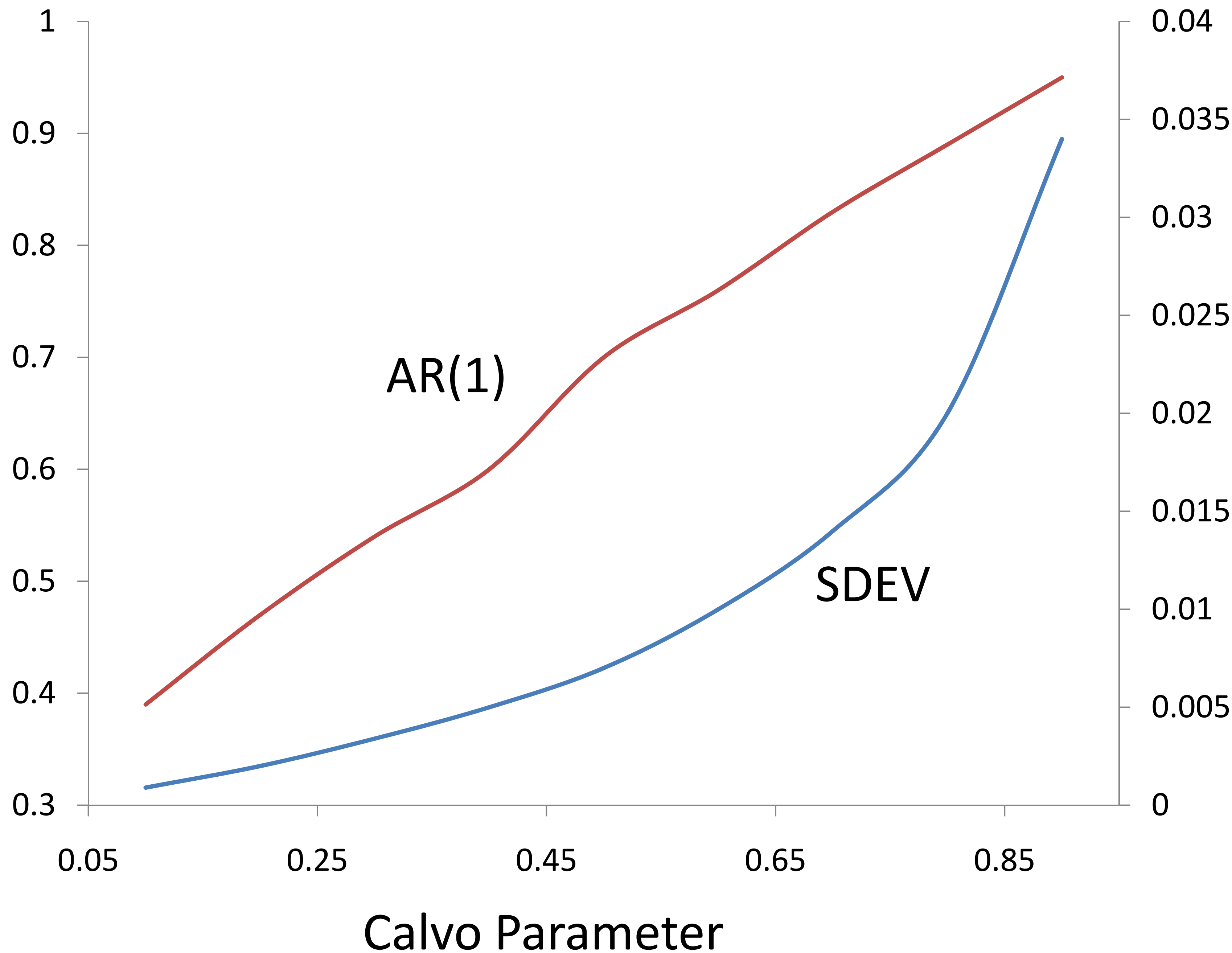
Contribution

- Motivation of paper
  - Make more attempt to quantify macro moments – how does it do on other macro aggregates?
  - Need fully specified model as in CKM

- Deeper puzzle
  - Disconnect – not solved by this model
  - RER change equals relative consumption growth

Sectoral issues

- Model implies substantial differences across sectors in persistence and variability of RER
- Kehoe and Midrigan: this is not in data



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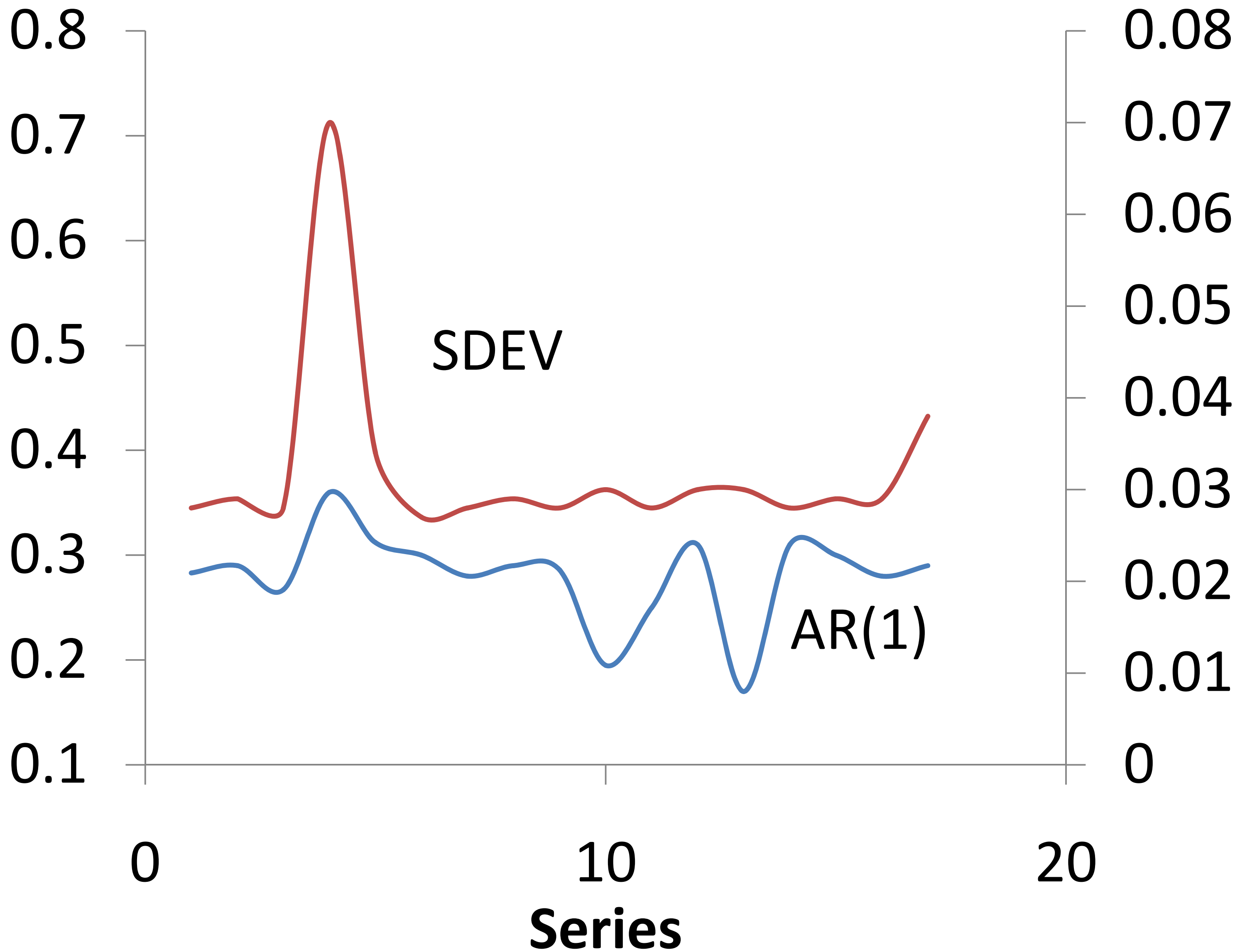
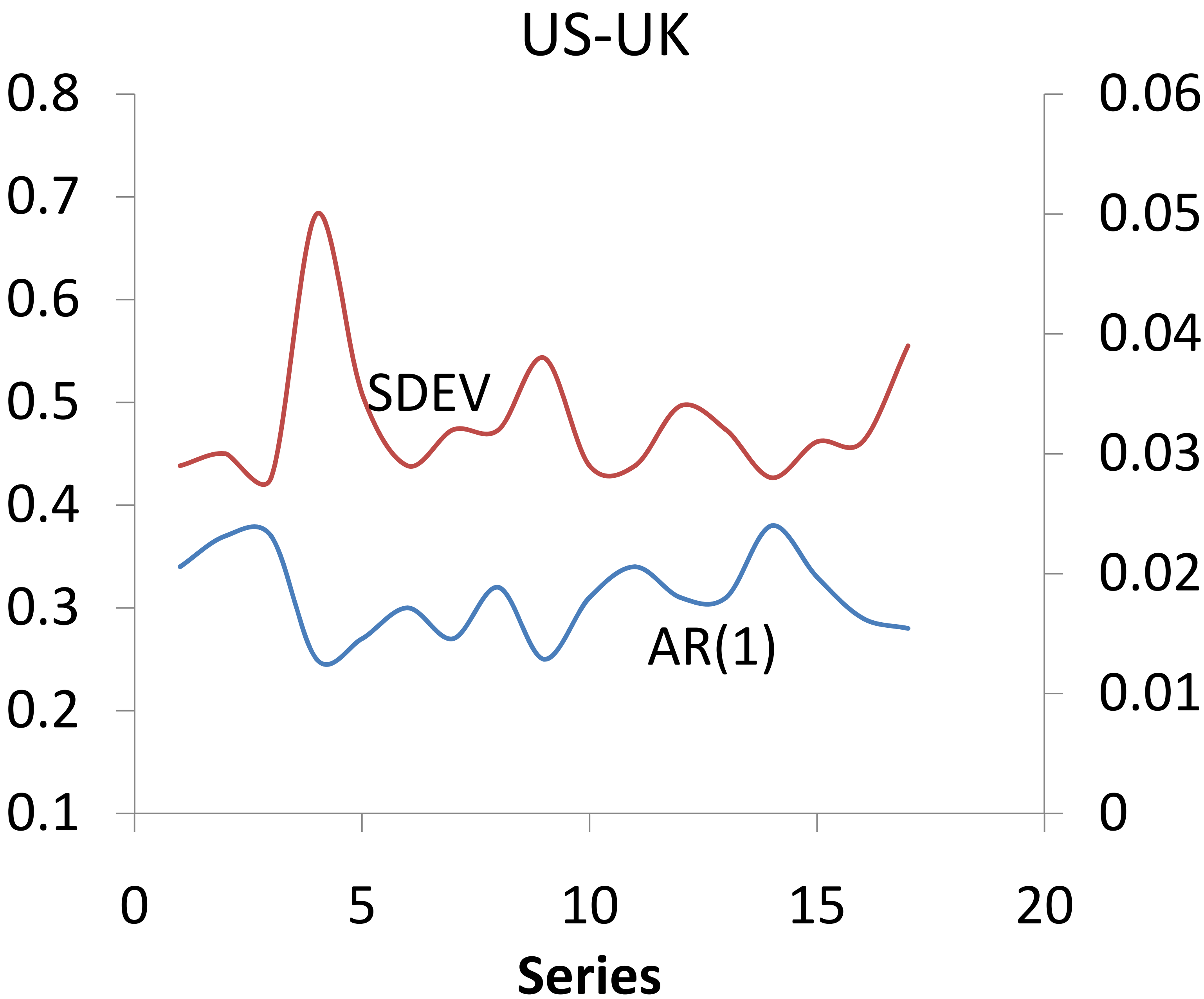
Calvo Parameter

Data don't seem to support that? US-Germany

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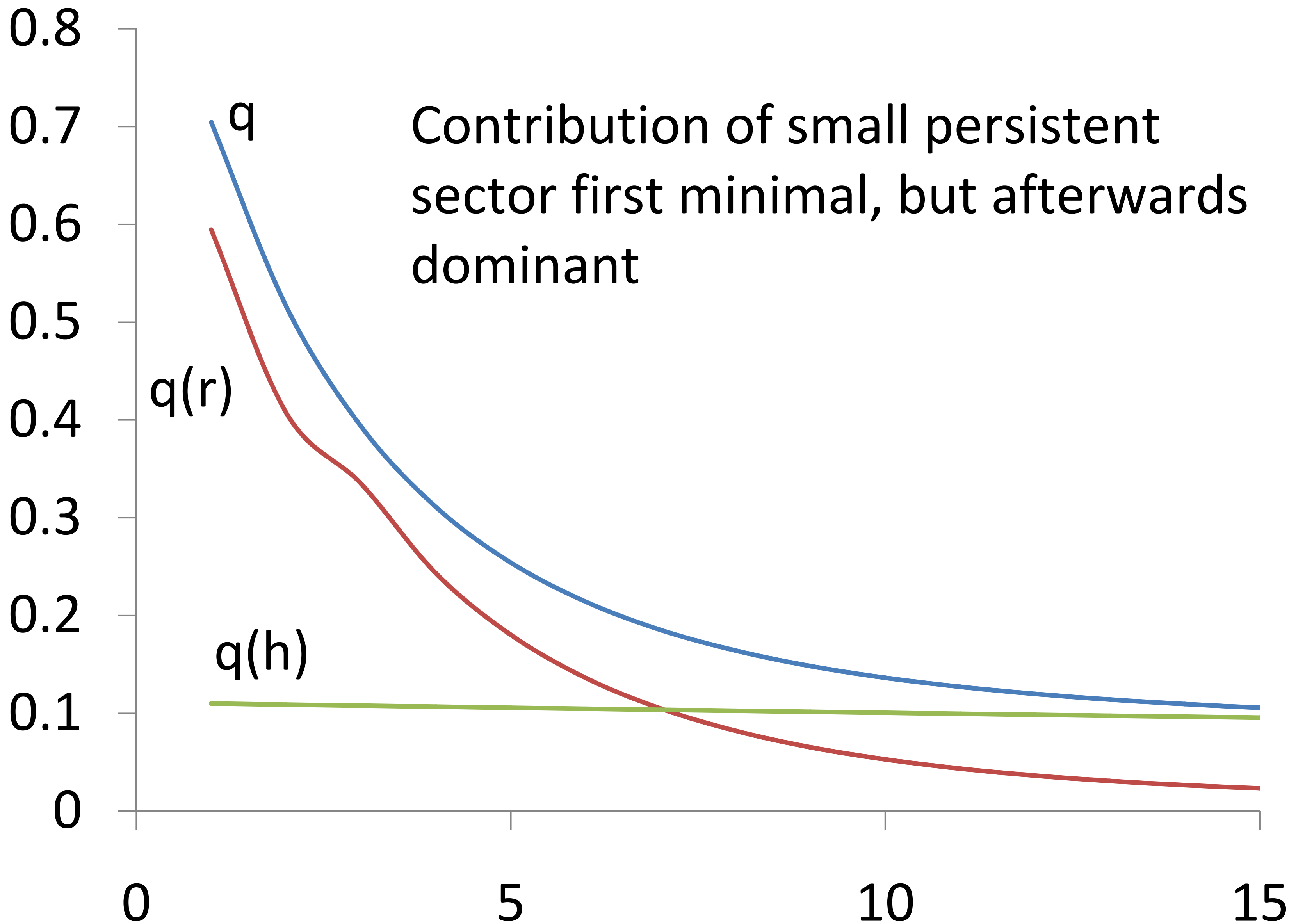
Series

Related issue

- Are monetary non-neutralities very different across sectors?
  – By product of sticky price model

Role of highly persistent sectors

- Evidence that long run real exchange rate movement is dominated by small number of sectors?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Contribution of small persistent sector first minimal, but afterwards dominant

Sectoral vs. aggregate

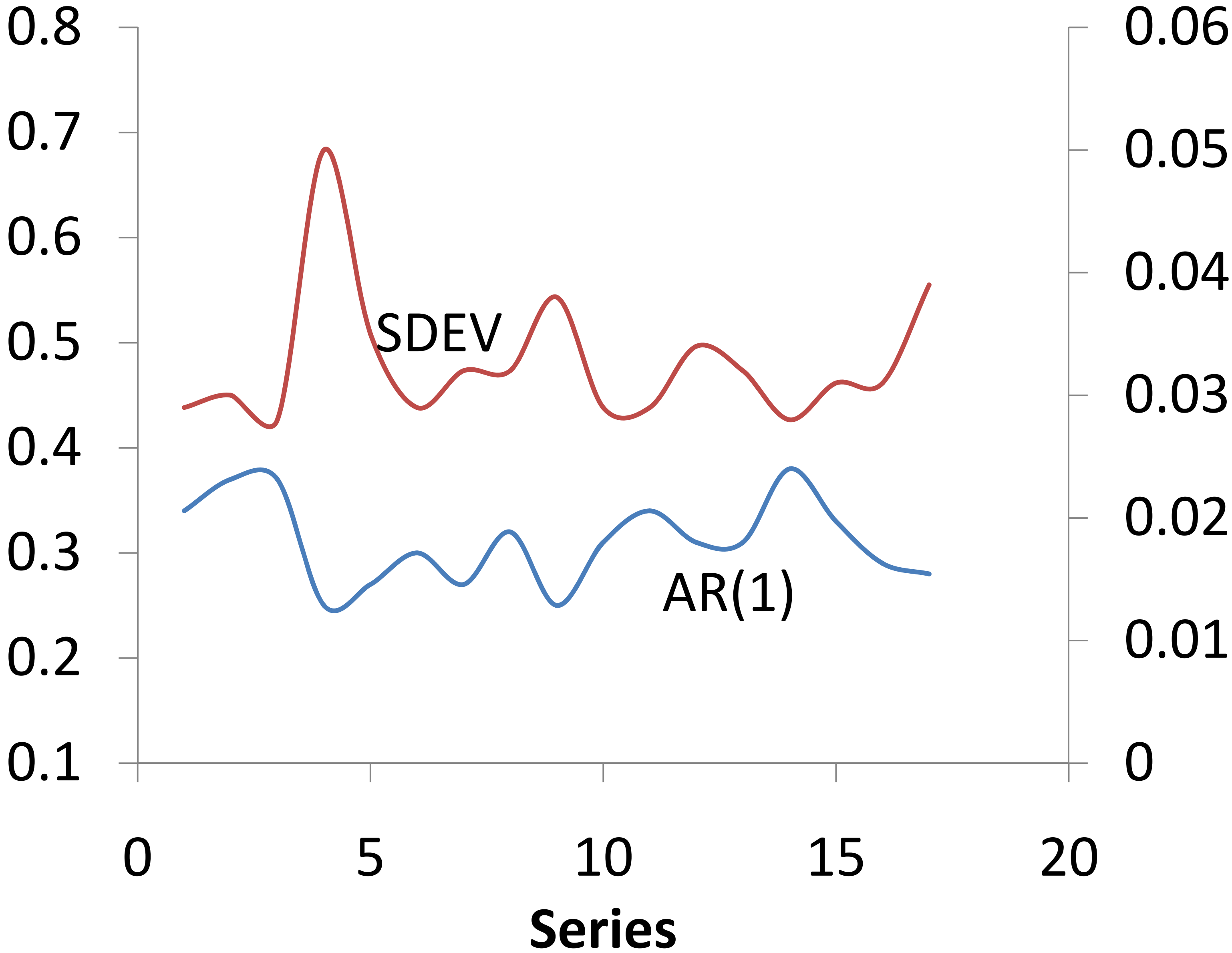
- Dynamic behavior of sectoral RER very different from aggregates?
- Sectoral AR(2)
- Aggregate ARMA(K+1,K-1)
  - Evidence of this?

Aggregation vs. Misspecification

- Depends on statistic used
- If aggregation biased measured by AR(1) coefficient, then most heterogeneity if due to aggregation

Conclusion

- Promising paper
- Needs to provide more support for importance of mechanism at sector level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