Pricing to Habits and the Law of One Price

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Stylized facts we wish to address

- The Law Of One Price fails at the good-by-good level even for highly traded goods.
  - Goldberg and Knetter, *JEL* 1997.
  - Crucini and Shintani, 2006.

- A rise in government spending leads to
  - A real exchange rate depreciation.
  - An increase in private consumption.
  - A trade balance deterioration.

  (Ravn, Schmitt-Grohé, and Uribe, 2007; Monacelli and Perotti, 2006; Perotti, 2006; Gali et al., 2006)

- Estimation of empirical impulse responses

  1. Use structural VAR to estimate effects of government purchases shocks.

     $$AX_t = B(L)X_{t-1} + u_t$$

     where

     $$X_t = \begin{bmatrix} \log g_t \\ \log y_t \\ \log c_t \\ \frac{tb_t}{y_t} \\ \log e_t \end{bmatrix}$$

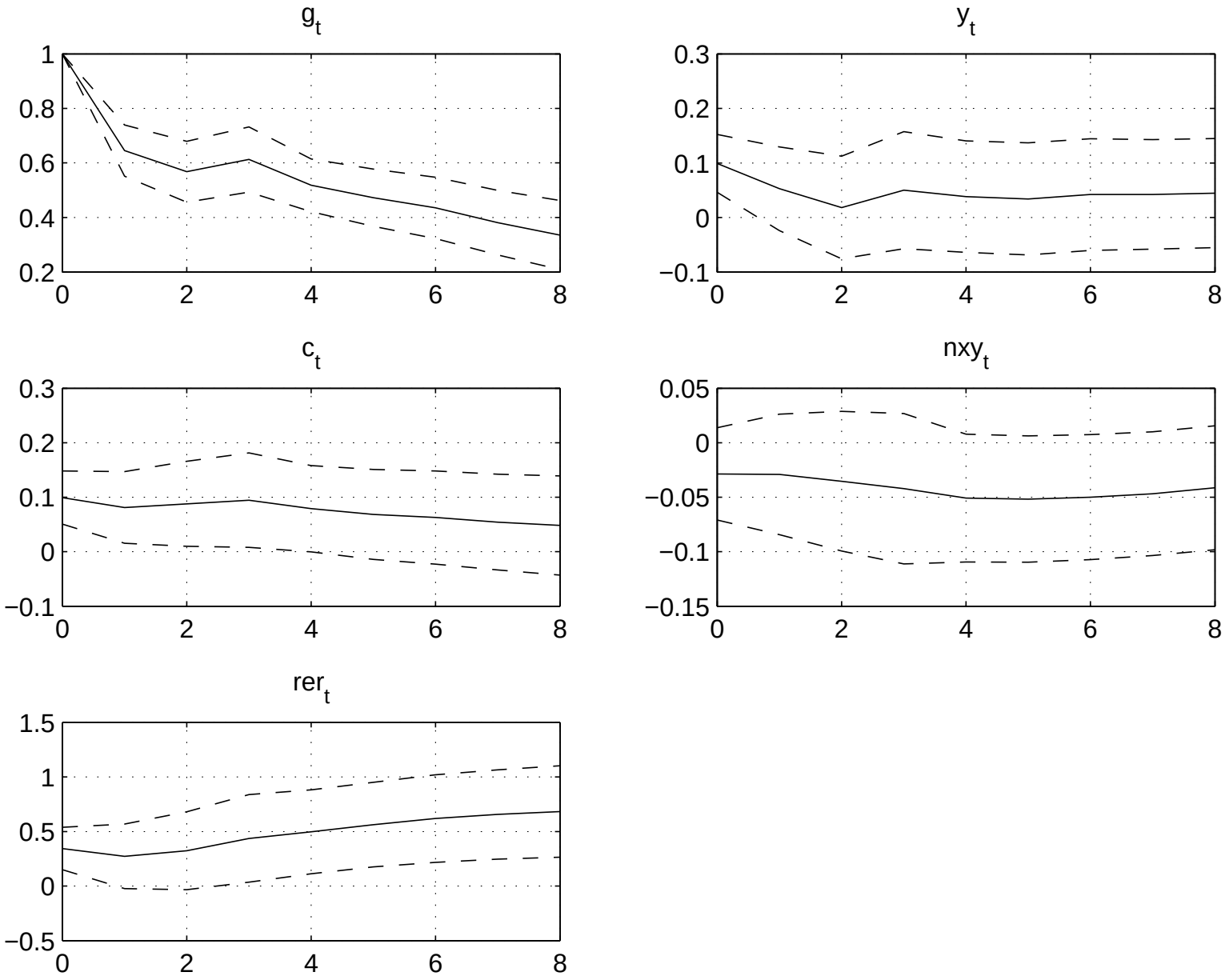
  2. Four lags ($L = 4$).

  3. Identification: government spending is not affected by structural innovations to any other variable than government spending itself.

  4. Panel of Countries: Australia, Canada, U.K., and U.S.

  5. Sample: Quarterly data from 1975 to 2005

Estimated Impulse Response Functions To A Unit Innovation in Domestic Government Purchases



Solid lines: point estimate

Dashed lines: point estimate $\pm$ 2 std

Theory

- We abstract from:
  - Nontraded goods.
  - Rule-of-thumb consumers.
  - Distribution costs.
  - Sticky prices or wages.
  - Incomplete asset markets.
  - Tariffs or quotas.
  - Nonseparabilities of preferences across consumption and leisure.

A Model of Pricing to Habits

- Two-country production economy without capital.

- Preferences

$$E_0 \sum_{t=0}^{\infty} \beta^t [\phi \ln(x_t) + (1-\phi) \ln(1-h_t)]$$

- Two traded goods: a and b

$$x_t = \left[\omega {x^c_{a,t}}^{1-\frac{1}{\xi}} + (1-\omega) {x^c_{b,t}}^{1-\frac{1}{\xi}} \right]^{\frac{1}{1-\frac{1}{\xi}}}$$

- External deep habits
  as in Ravn, Schmitt-Grohé, and Uribe (*RES*, 2006)

  – Private Households

    Habit-adjusted consumption of good a

$$x_{a,t}^c = \left[\int_0^1 (c_{i,a,t} - \theta^c s_{i,a,t-1}^c)^{1-\frac{1}{\eta}} di\right]^{\frac{1}{1-\frac{1}{\eta}}}$$

$$s_{i,a,t}^c = \rho s_{i,a,t-1}^c + (1-\rho)\tilde{c}_{i,a,t}$$

    Habit-adjusted consumption of good b

$$x_{b,t}^c = \left[\int_0^1 (c_{i,b,t} - \theta^c s_{i,b,t-1}^c)^{1-\frac{1}{\eta}} di\right]^{\frac{1}{1-\frac{1}{\eta}}}$$

$$s_{i,b,t}^c = \rho s_{i,b,t-1}^c + (1-\rho)\tilde{c}_{i,b,t}$$

  – Public sector

$$x_{a,t}^g = \left[\int_0^1 (g_{i,a,t} - \theta^g s_{i,a,t-1}^g)^{1-\frac{1}{\eta}} di\right]^{\frac{1}{1-\frac{1}{\eta}}}$$

$$x_{b,t}^g = \left[\int_0^1 (g_{i,b,t} - \theta^g s_{i,b,t-1}^g)^{1-\frac{1}{\eta}} di\right]^{\frac{1}{1-\frac{1}{\eta}}}$$

- Domestic Demand for good a

$$d_{i,a,t} = \left(\frac{P_{i,a,t}}{P_{a,t}}\right)^{-\eta} x_{a,t} + \theta s_{i,a,t-1}$$

$$\text{Price elasticity } = -\eta\left(1 - \theta\frac{s_{i,a,t-1}}{d_{i,a,t}}\right)$$

- Foreign Demand for good a

$$d^*_{i,a,t} = \left(\frac{P^*_{i,a,t}}{P^*_{a,t}}\right)^{-\eta} x^*_{a,t} + \theta s^*_{i,a,t-1}$$

$$\text{Price elasticity } = -\eta\left(1 - \theta\frac{s^*_{i,a,t-1}}{d^*_{i,a,t}}\right)$$

Firms

- Firms can price discriminate internationally.

- Production Function:

$$y_{i,a,t} = h_{i,a,t}$$

- Optimal pricing

$$P_{a,t} = \left[1 - \frac{1}{\eta\left(1 - \theta\frac{d_{a,t-1}}{d_{a,t}}\right)} + \theta\Omega_{a,t}\right]^{-1} MC_t$$

$$P^*_{a,t} = \left[1 - \frac{1}{\eta\left(1 - \theta\frac{d^*_{a,t-1}}{d^*_{a,t}}\right)} + \theta\Omega^*_{a,t}\right]^{-1} MC_t$$

$\Rightarrow$ Time-varying deviation from the Law of One Price ($P^*_{a,t}/P_{a,t} \neq 1$ and moves over time).

Calibration

Parameter	Value	Description
β	0.99	Subjective discount factor (quarterly)
σ	1	Intertemporal elasticity of substitution
ϕ	0.15	Preference parameter
ω	0.5	Preference parameter
ξ	1.5	Elasticity of substitution composite
η	5	Elasticity of substitution varieties
s_g, s_g^*	0.2	Government shares

Estimation

- Goal: Estimate deep-habit parameters:

$$\Theta \equiv [\theta^c \quad \theta^g \quad \rho]$$

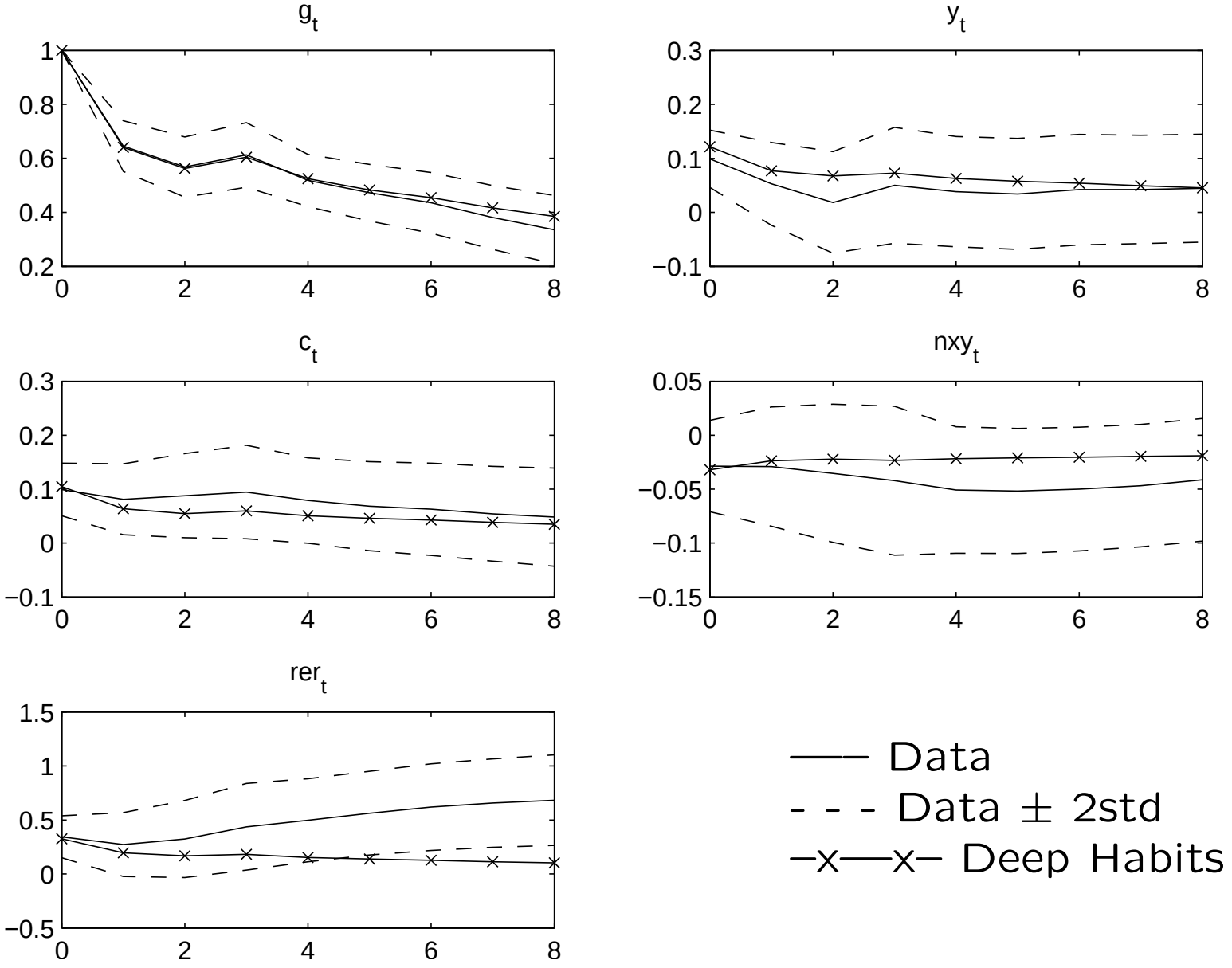
- Strategy: Pick Θ to minimize the distance between empirical and theoretical impulse responses.

- Match 9 quarters of impulse responses of five variables.

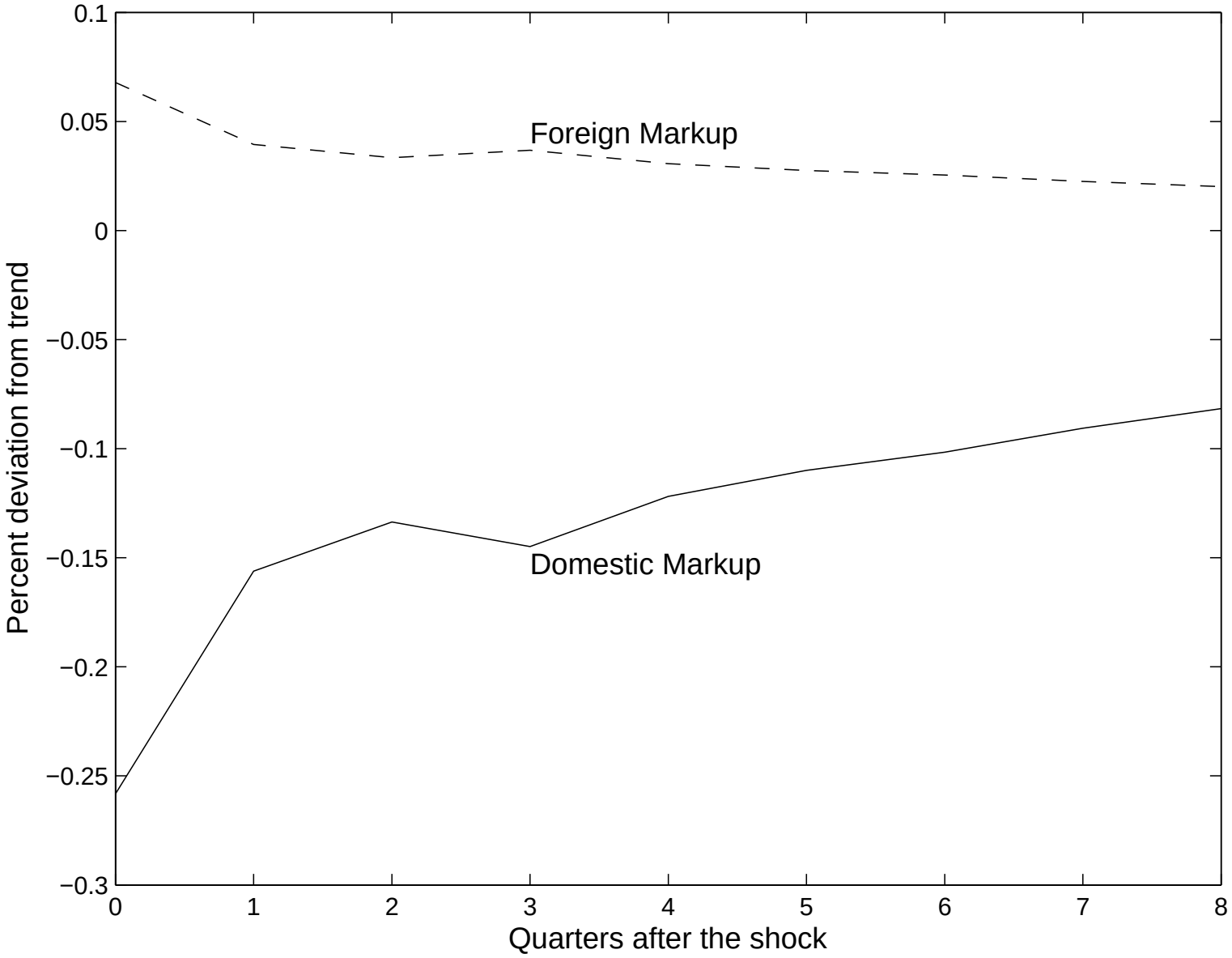
Estimated Parameters

Parameter	Point Estimate	Standard Deviation
θ^c	0.52	0.08
θ^g	0.57	0.15
ρ	0.99	0.03

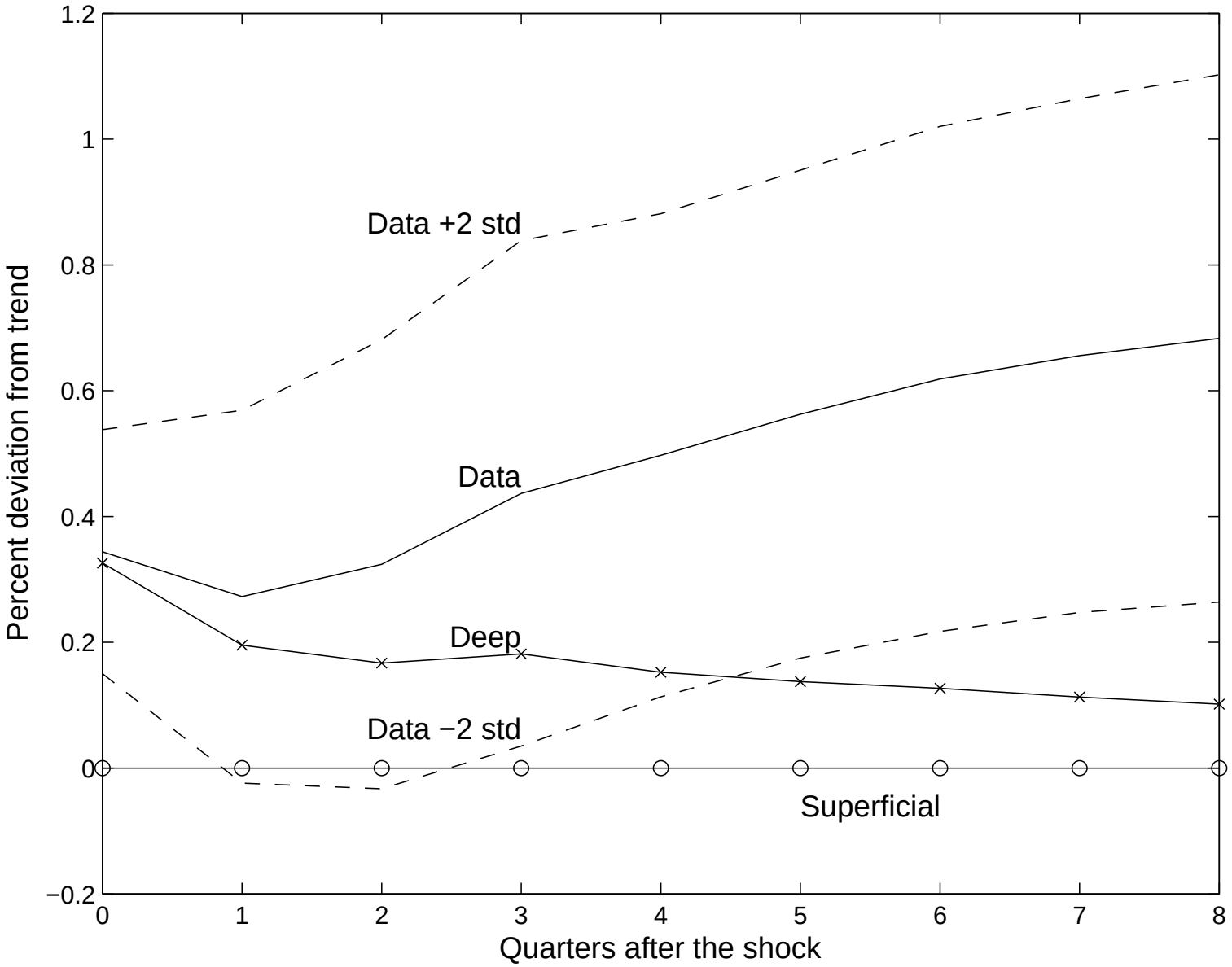
Predicted and Estimated Impulse Responses



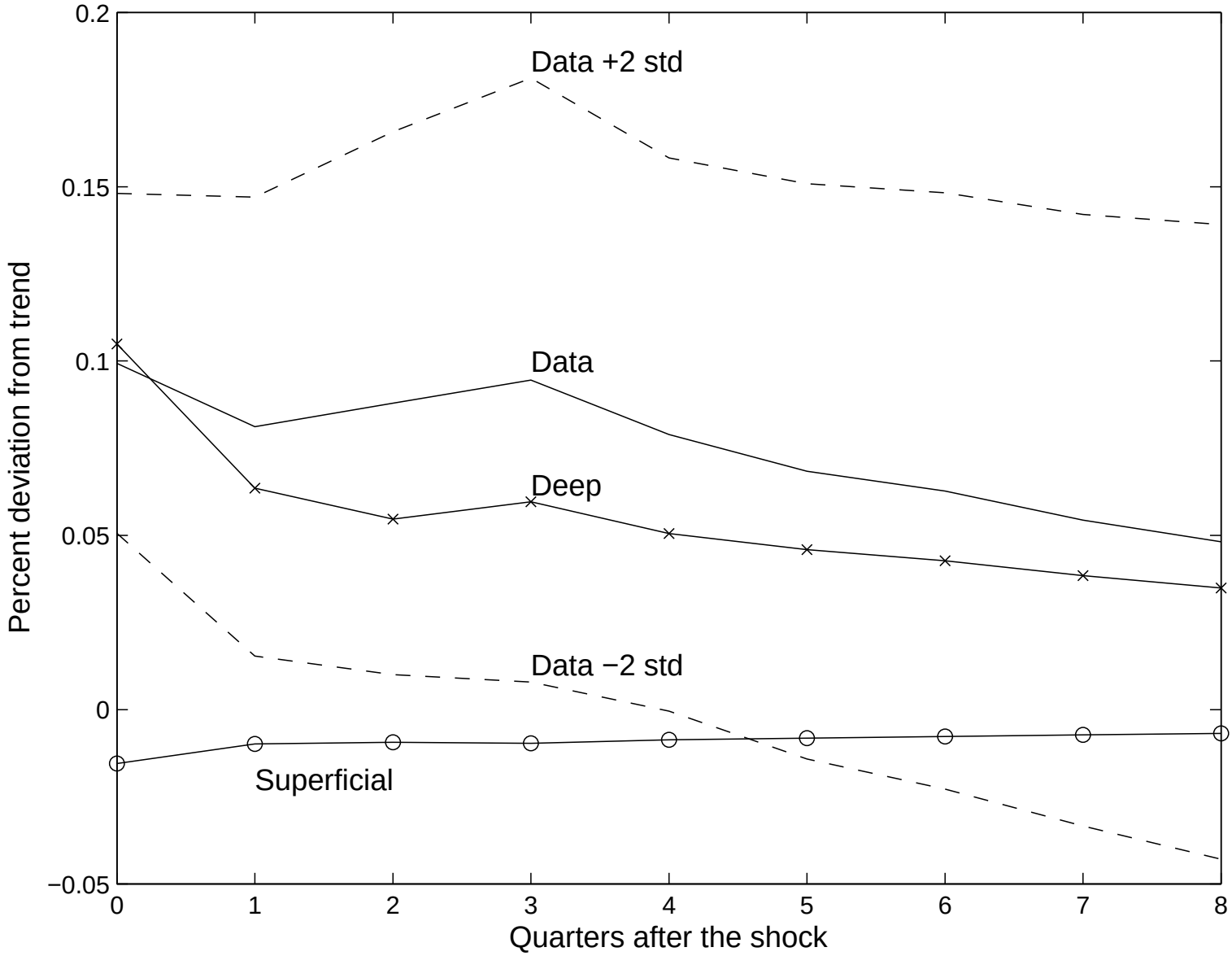
Response of the Domestic and Foreign Markups to a One-Percent Government Spending Shock



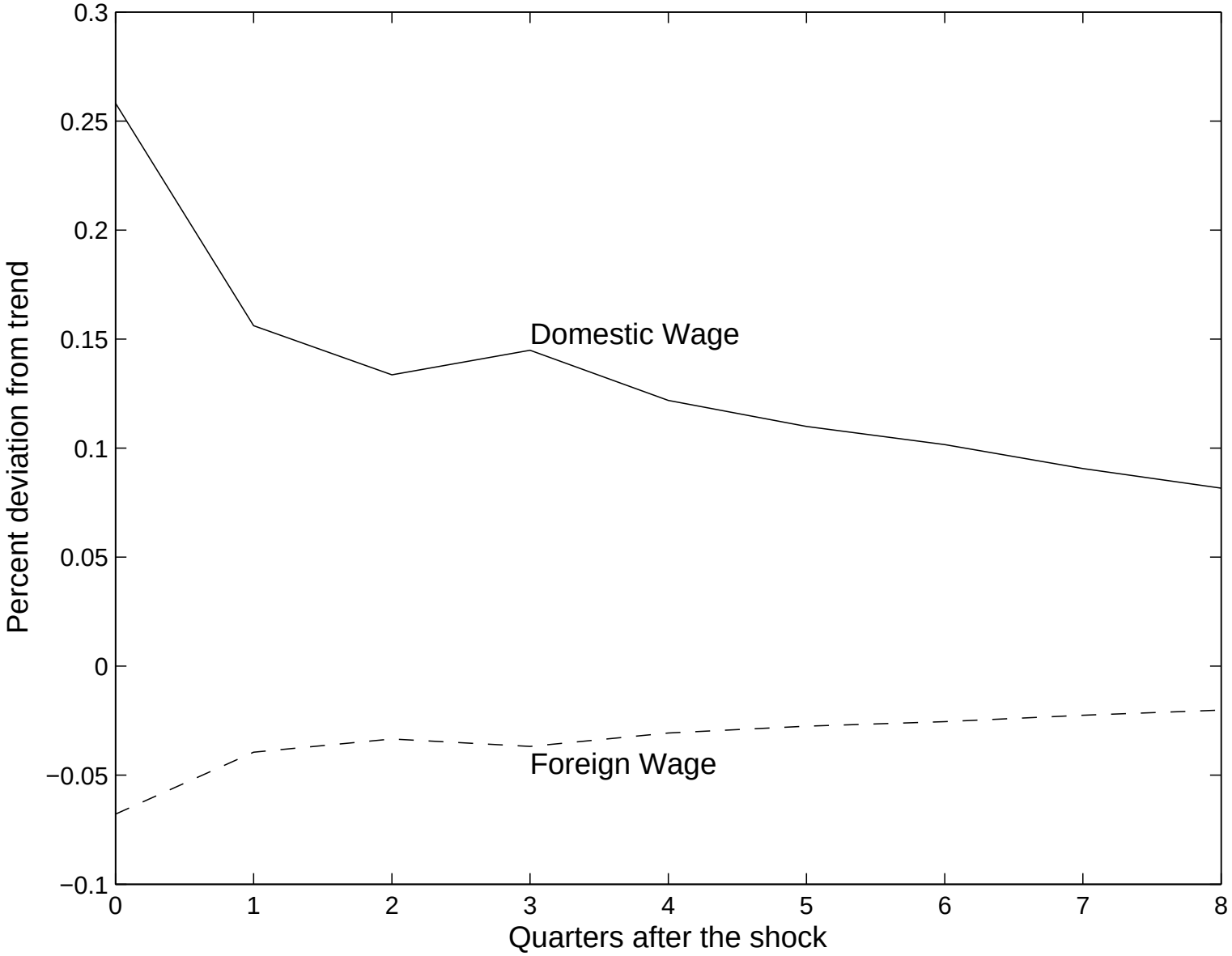
Response of the Real Exchange Rate to a Government Spending Shock



Response of Private Consumption to a Government Spending Shock



Response of the Real Wage to a Government Spending Shock



Conclusion:

- Under Pricing to Habits there are deviations from the LOOP

- Deviations from the LOOP are time varying

- Pricing to Habits can explain why in response to a demand shock
  - the real exchange rate depreciates
  - private consumption rises
  - the trade balance deteriorates

- Estimation of the model yields:
  $\theta^c = 0.52$, $\theta^g = 0.57$, and $\rho = 0.99$