

# **Explaining the Effects of Government Spending Shocks on Consumption and the Real Exchange Rate**

September 3, 2007

# The Observed Effects of Government Spending Shocks

- A rise in government spending leads to
  - **An increase in private consumption.**  
(ex: Fatas and Mihov, 2001; Blanchard and Perotti, 2002; Galí et al., 2007; Perotti, 2007)
  - **A real exchange rate depreciation.**  
(ex: Monacelli and Perotti, 2006)
  - An increase in output  
(ex: Blanchard and Perotti, 2002)
  - A trade balance deterioration.  
(ex: Corsetti and Müller, 2006; Monacelli and Perotti, 2006)

## Estimation of impulse responses to a government spending shock

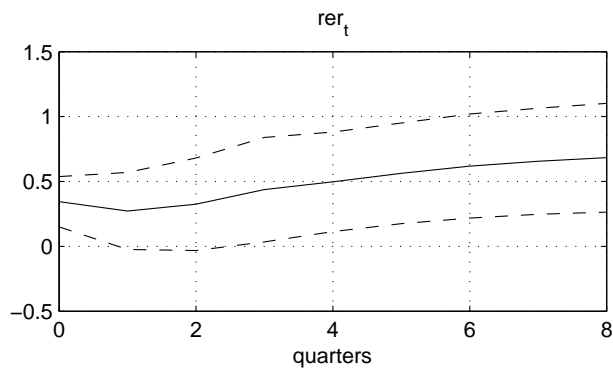
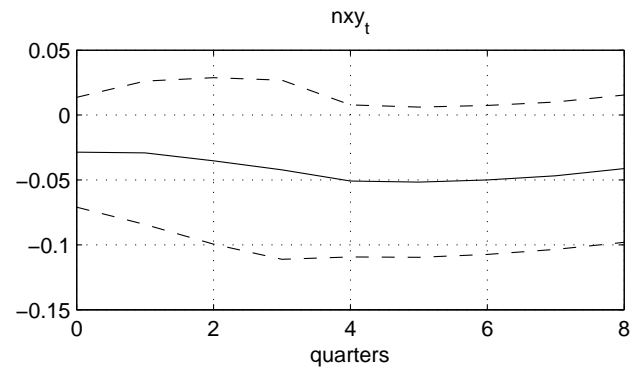
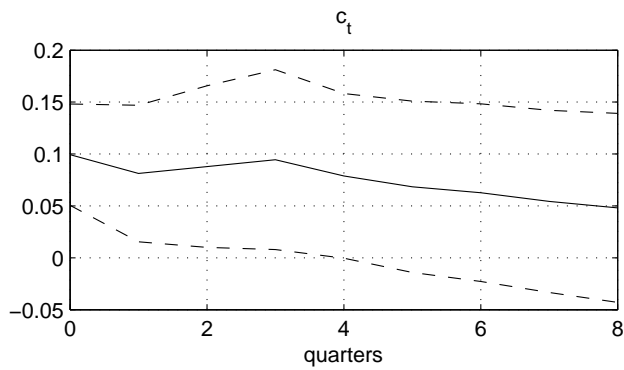
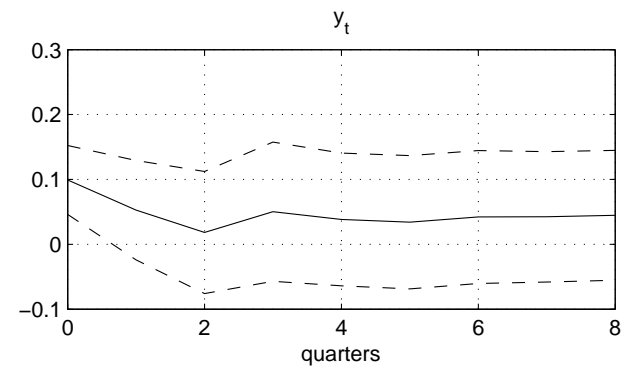
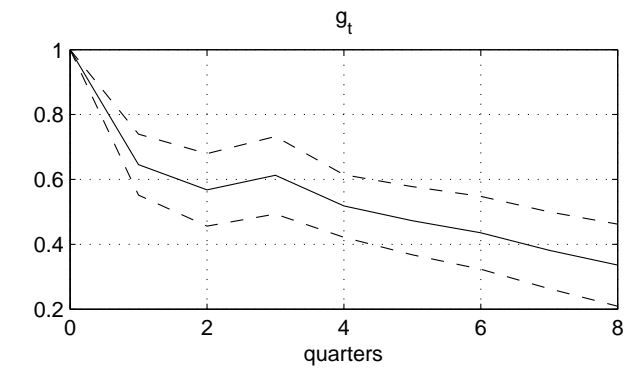
### 1. Structural VAR

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

where  $X_t = \left[ \log g_t \quad \log y_t \quad \log c_t \quad \frac{tb_t}{y_t} \quad \log e_t \right]'$

2. Identification: government spending is not affected by structural innovations to any other variable than government spending itself.
3. Panel of Countries: Australia, Canada, U.K., and U.S.
4. Sample: Quarterly data from 1975Q1 to 2005Q4
5. Four lags ( $L = 4$ ).

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



— Point estimate  
 - - - Point estimate  $\pm$  2std

# Theory

- We abstract from:
  - Nontraded goods.
  - Rule-of-thumb consumers.
  - Distribution costs.
  - Sticky prices or wages.
  - Incomplete asset markets.
  - 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  $b$

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

- 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

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

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

## The Real Exchange Rate

Domestic price index:  $P_t = \gamma P_{a,t} + (1 - \gamma)P_{b,t}$

Foreign price index:  $P_t^* = \gamma^* P_{a,t}^* + (1 - \gamma^*)P_{b,t}^*$

Real exchange rate,  $e_t = \frac{P_t^*}{P_t} = f \left( \begin{array}{ccc} \frac{P_{a,t}^*}{P_{a,t}}, & \frac{P_{b,t}^*}{P_{b,t}}, & \frac{P_{b,t}}{P_{a,t}} \\ + & + & \pm \end{array} \right)$

## Calibration

Parameter	Value	Description
$\beta$	0.99	Subjective discount factor (quarterly)
$\sigma$	1	Intertemporal elasticity of substitution
$\phi$	0.15	Preference parameter
$\omega$	0.5	Preference parameter
$\xi$	1.5	Elasticity of substitution composite
$\eta$	5	Elasticity of substitution varieties
$s_g, s_g^*$	0.2	Government shares

## Estimation

- Goal: Estimate deep-habit parameters:

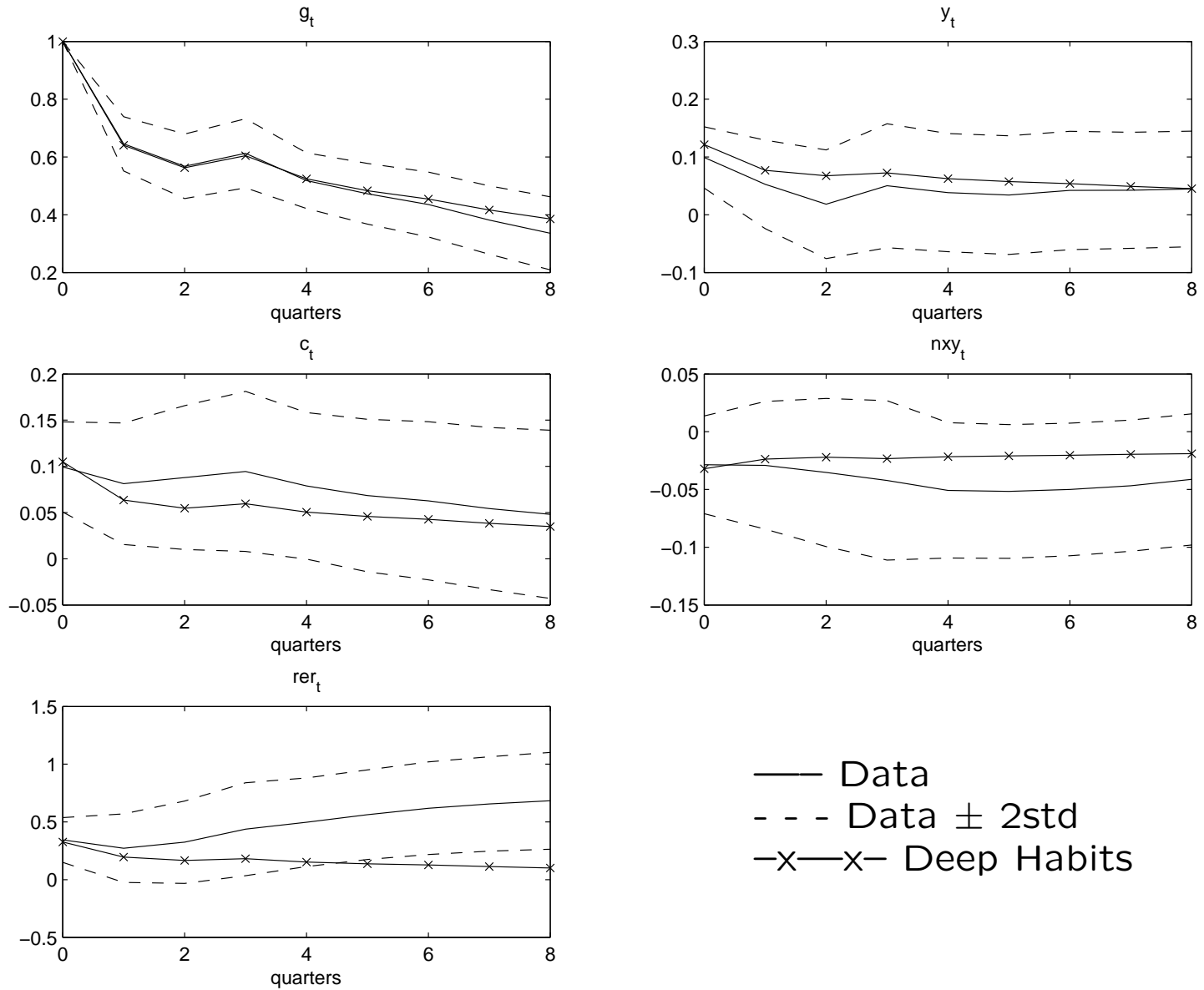
$$\Theta \equiv [\theta^c \quad \theta^g \quad \rho]$$

- Strategy: Pick  $\Theta$  to minimize the distance between empirical and theoretical impulse responses.
- Match 9 quarters of impulse responses of five variables.

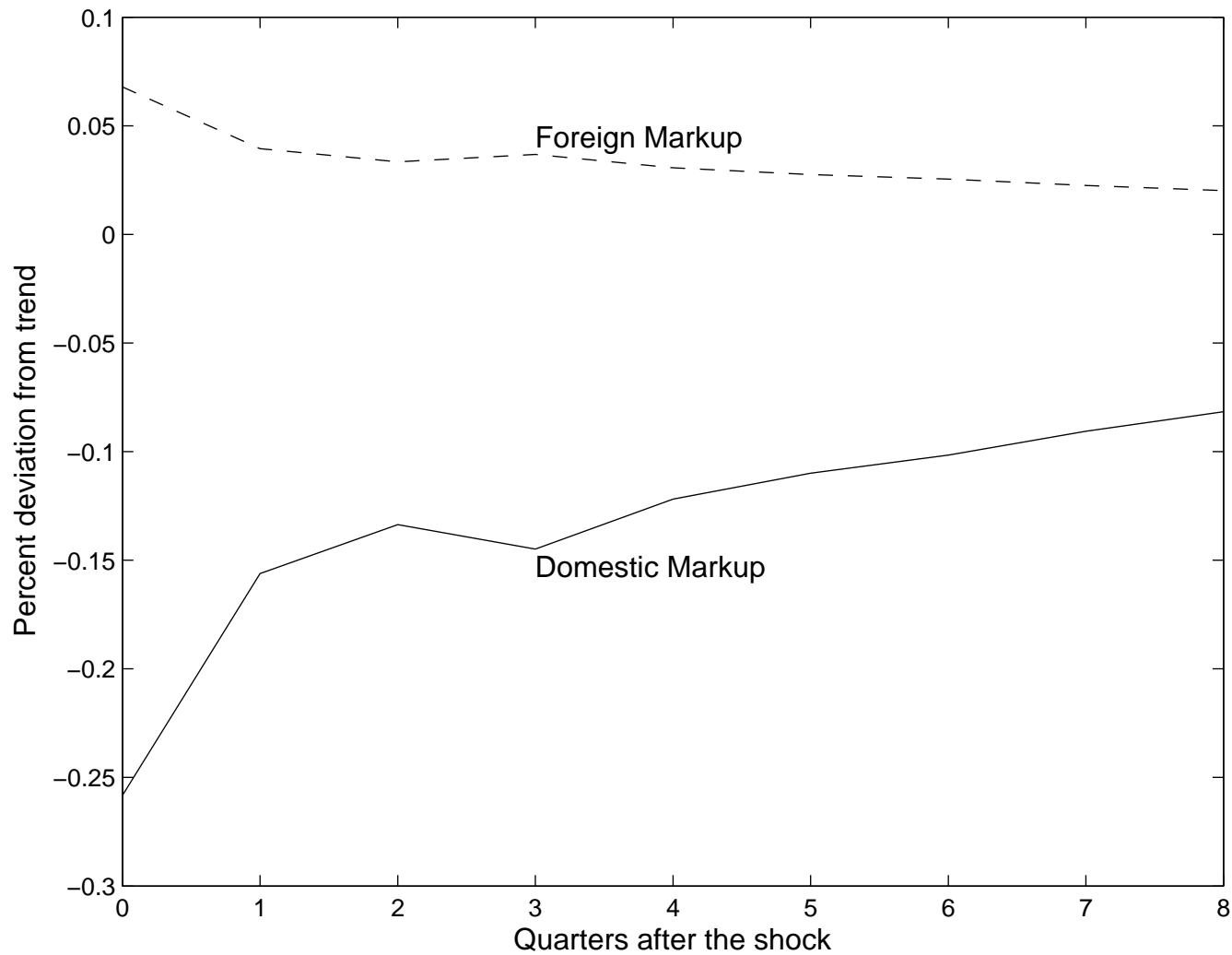
## Estimated Parameters

Parameter	Point Estimate	Standard Deviation
$\theta^c$	0.52	0.08
$\theta^g$	0.57	0.15
$\rho$	0.9876	0.03

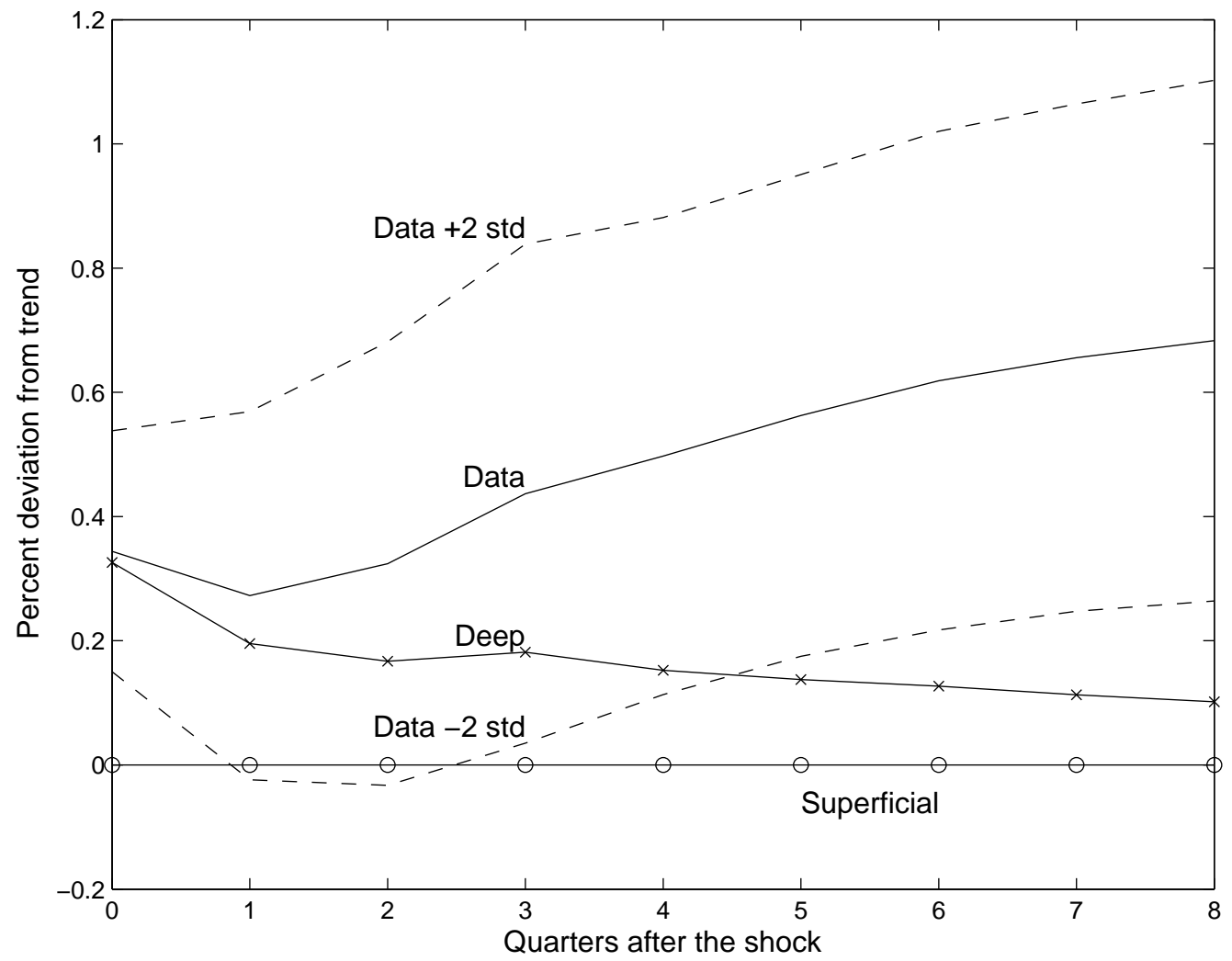
# Predicted and Estimated Impulse Responses



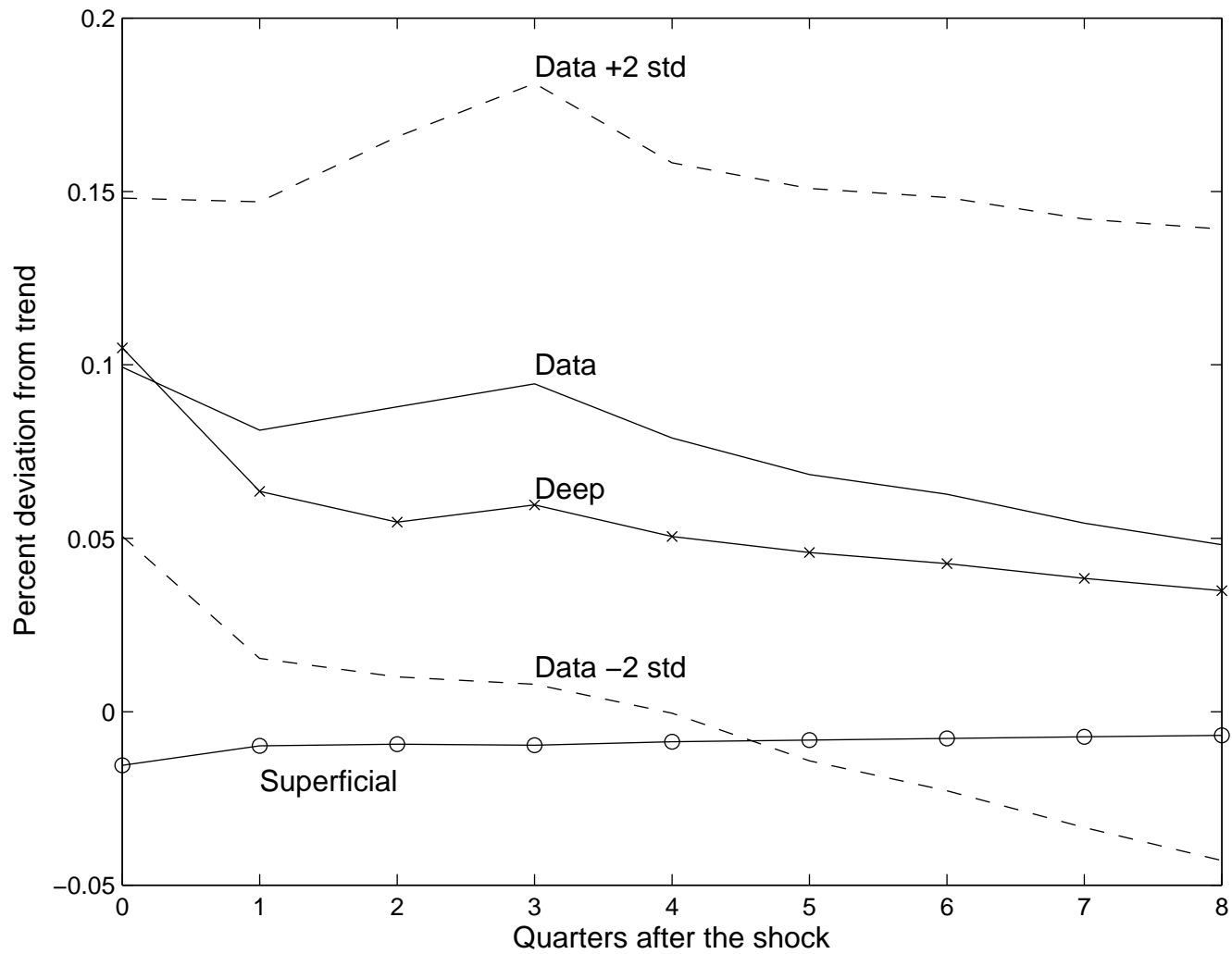
# Response of the Domestic and Foreign Markups to a One-Percent Government Spending Shock



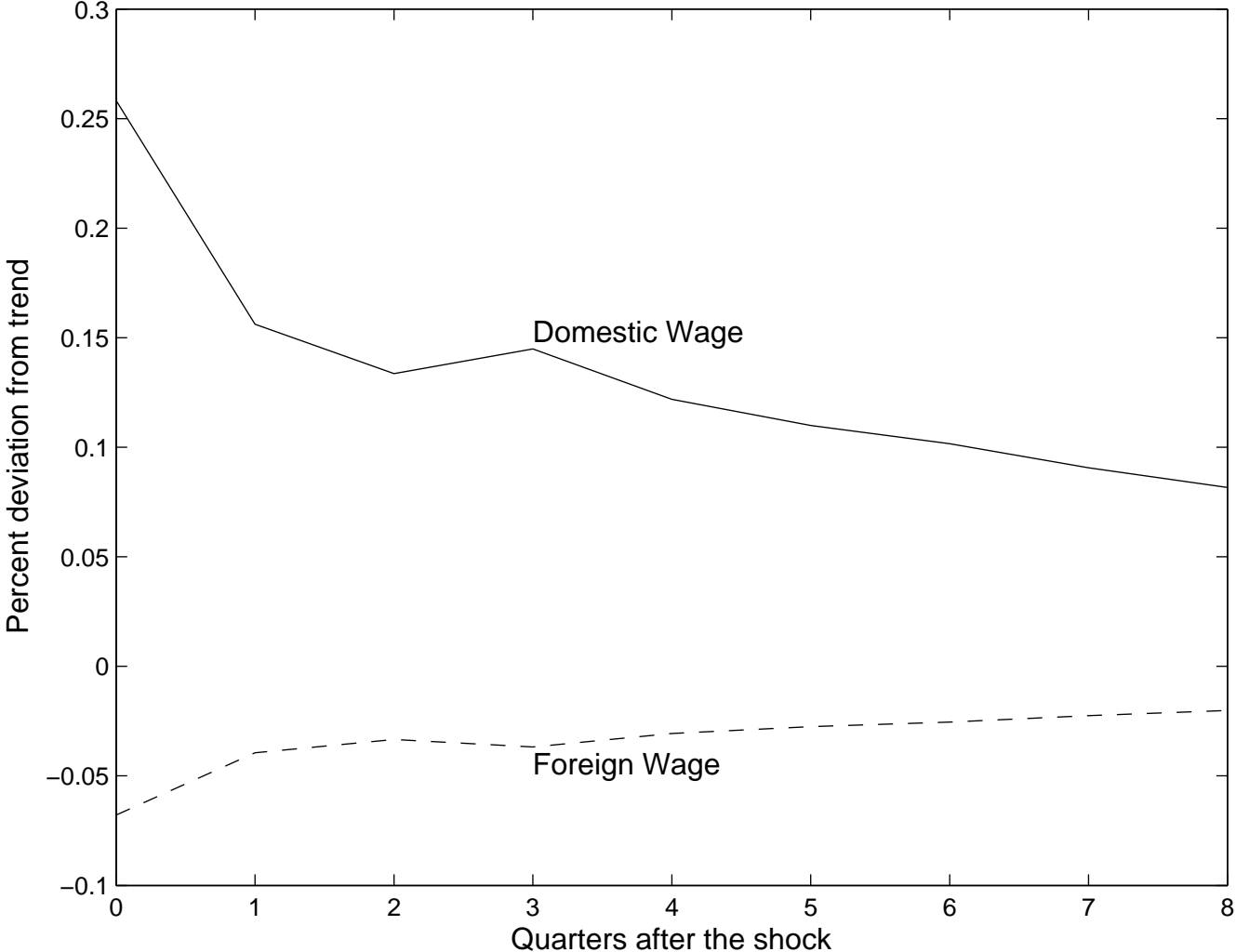
# Response of the Real Exchange Rate to a Government Spending Shock



# Response of Private Consumption to a Government Spending Shock



# Response of the Real Wage to a Government Spending Shock

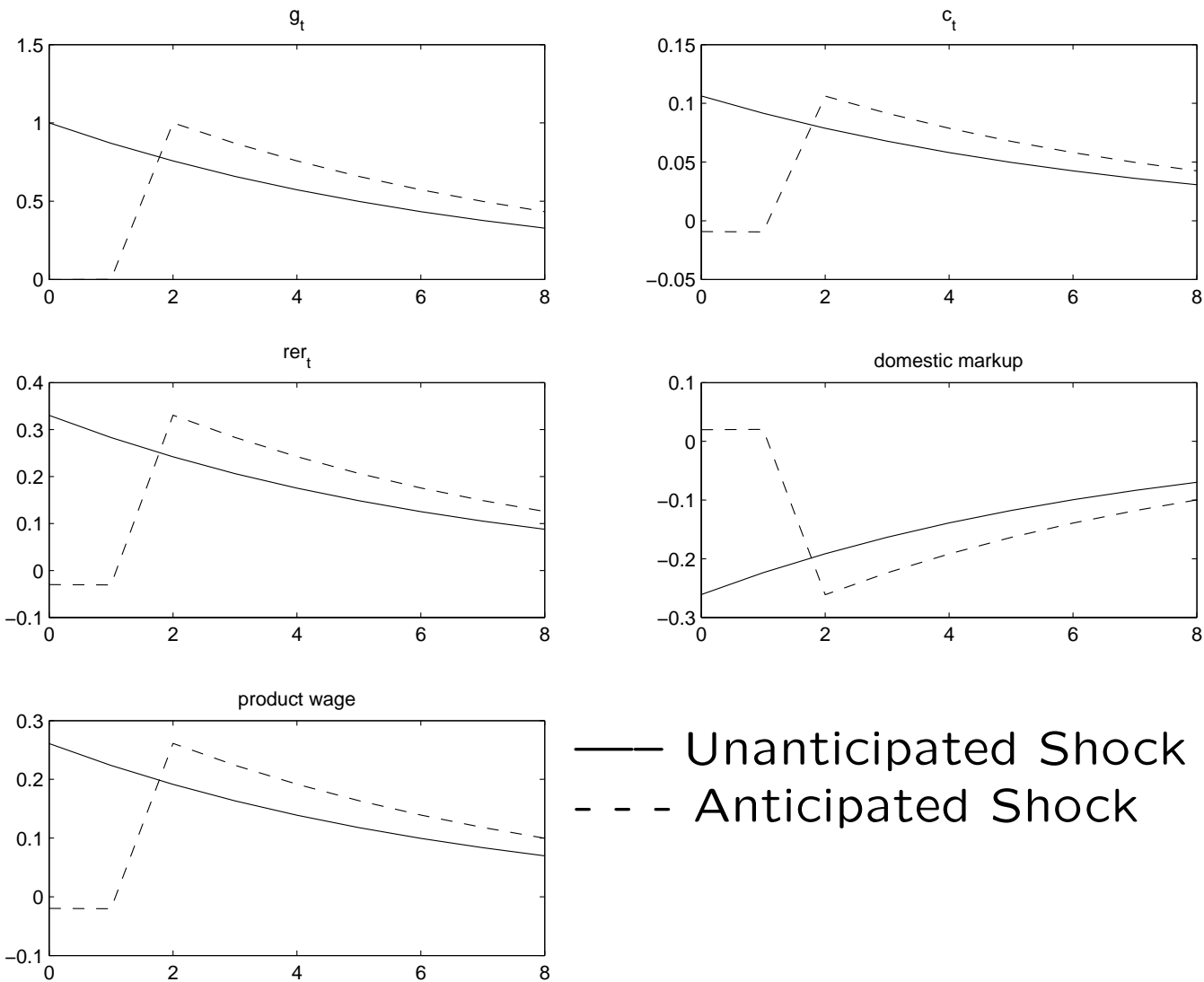


## Anticipated Government Spending Shocks

$$\ln\left(\frac{g_t}{\bar{g}}\right) = \rho^g \ln\left(\frac{g_{t-1}}{\bar{g}}\right) + \epsilon_t^0 + \epsilon_{t-2}^2$$

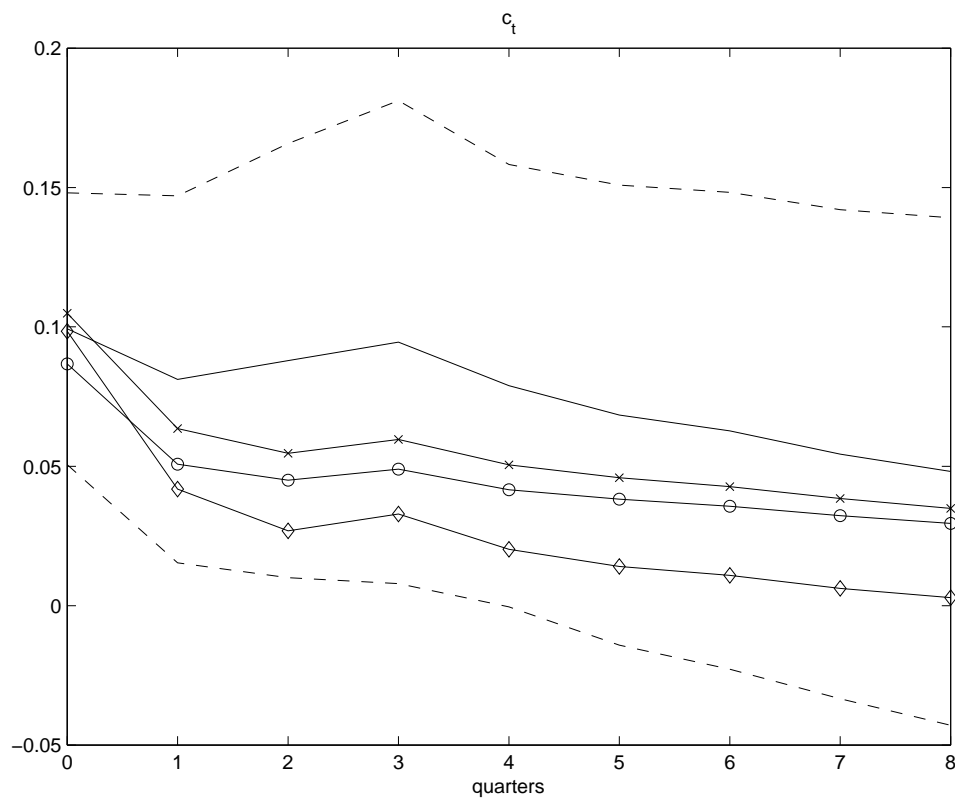
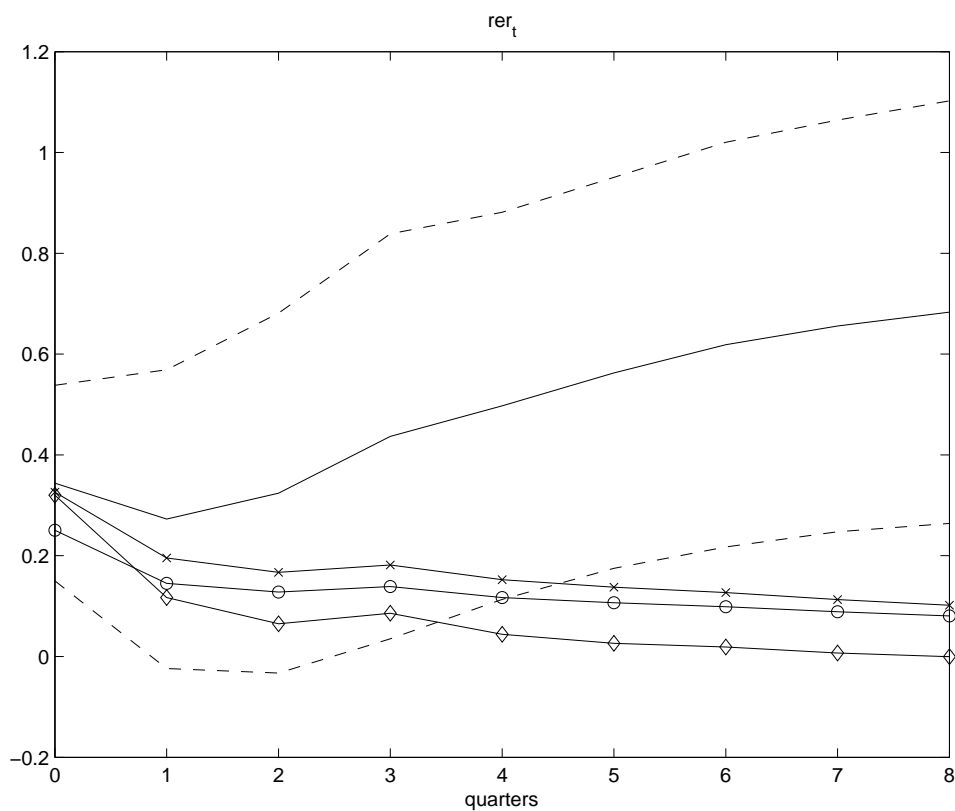
$$\rho^g = 0.87$$

# Impulse Responses To a Two-Period Anticipated Innovation in Government Spending



— Unanticipated Shock  
 - - - Anticipated Shock

# Sensitivity Analysis: Home Bias and Less Persistent Habit Stock

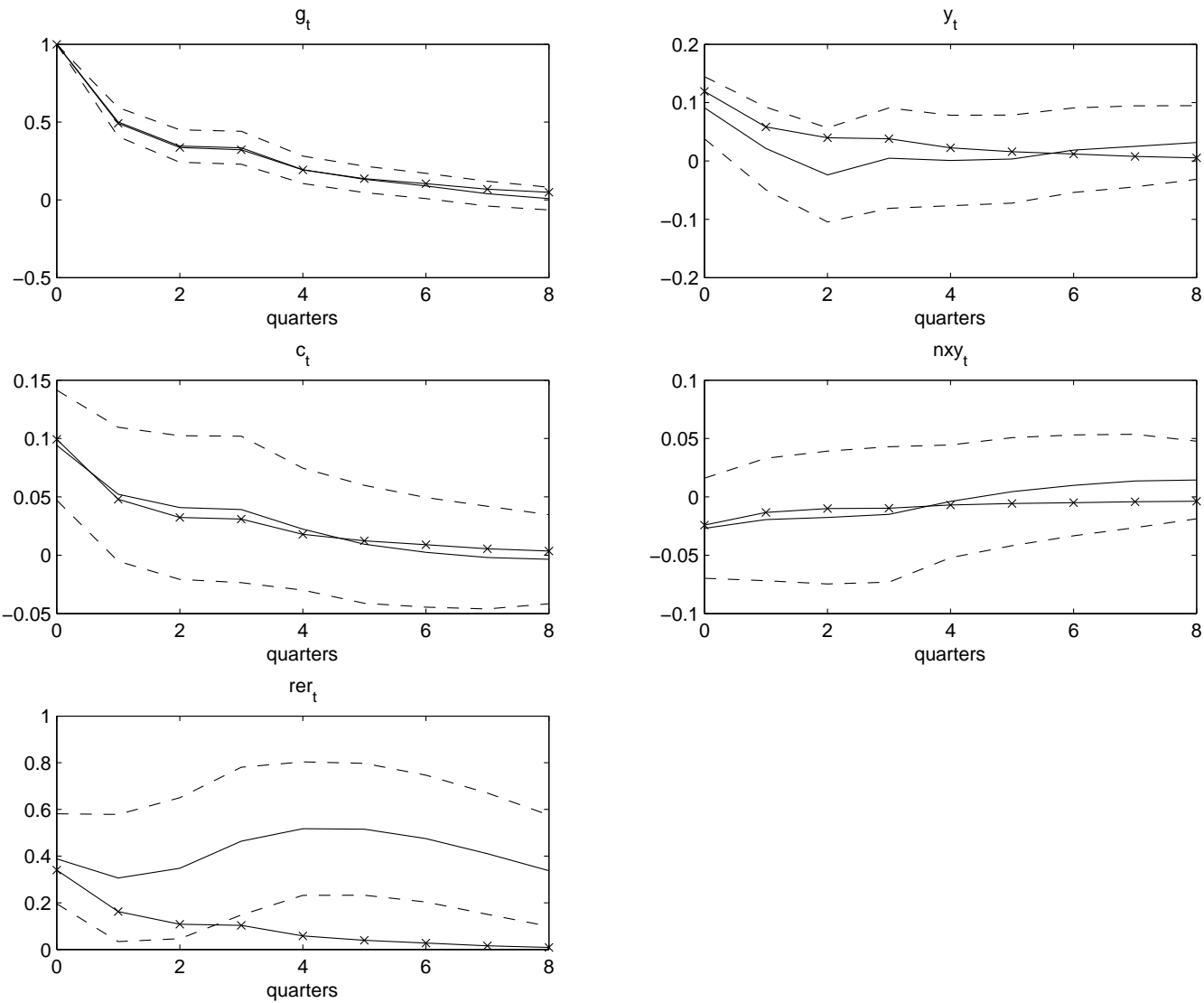


-x-x-x-: Baseline

-o-o-o-: Home bias,  $\omega = 0.7$

-d-d-d-: Less persistence,  $\rho = 0.87$

# Observed and Predicted Impulse Responses: HP Filtered Data

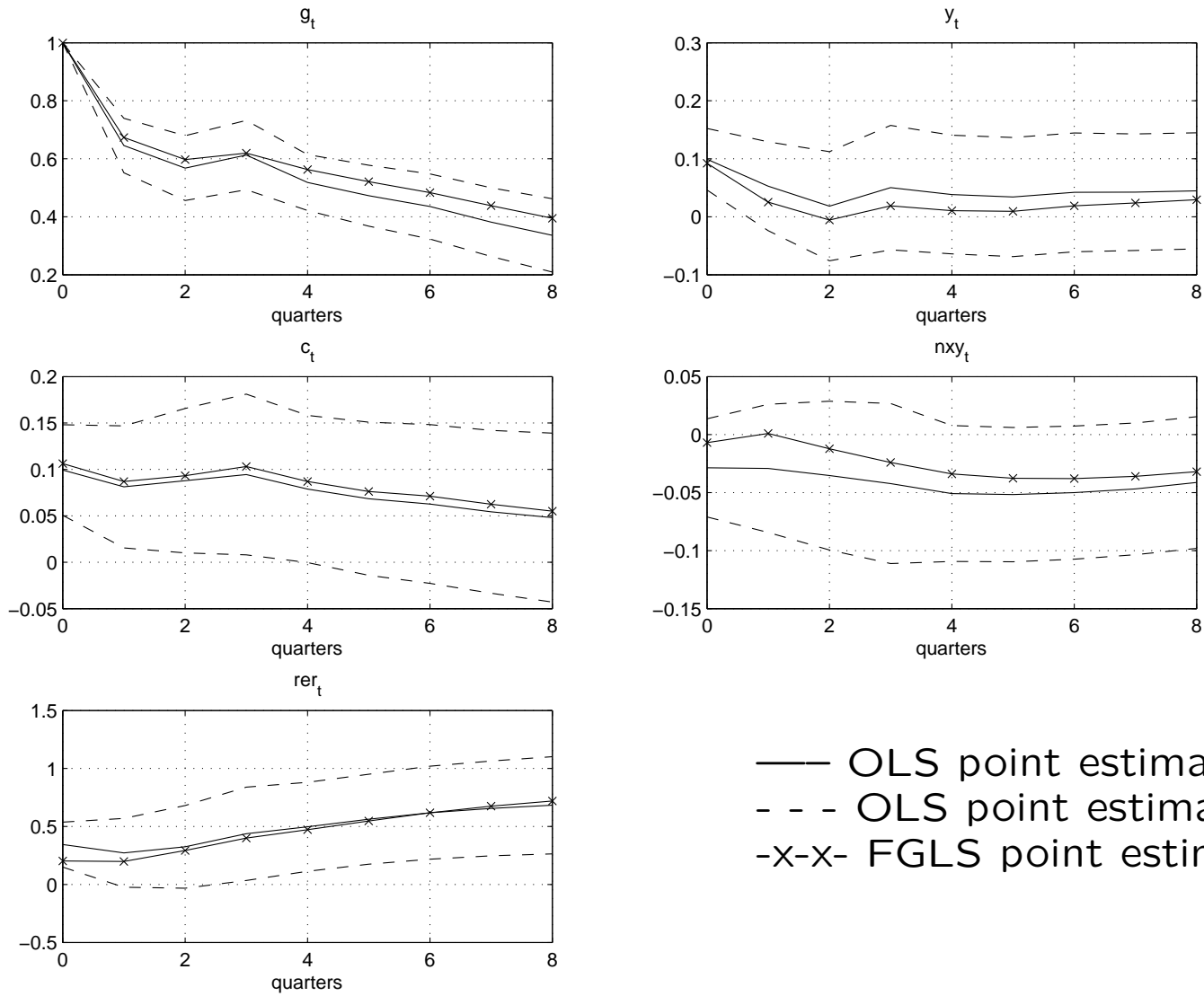


## Conclusions

- Pricing to Habits can account quantitatively for the empirical regularity that in response to an **unanticipated** demand shock
  - private consumption rises
  - the real exchange rate depreciates
  - the trade balance deteriorates
- At the same time, Pricing to Habits can account for the empirical regularity that in response to an **anticipated** demand shock
  - private consumption fails to rise on impact
  - real product wages fails to rise on impact

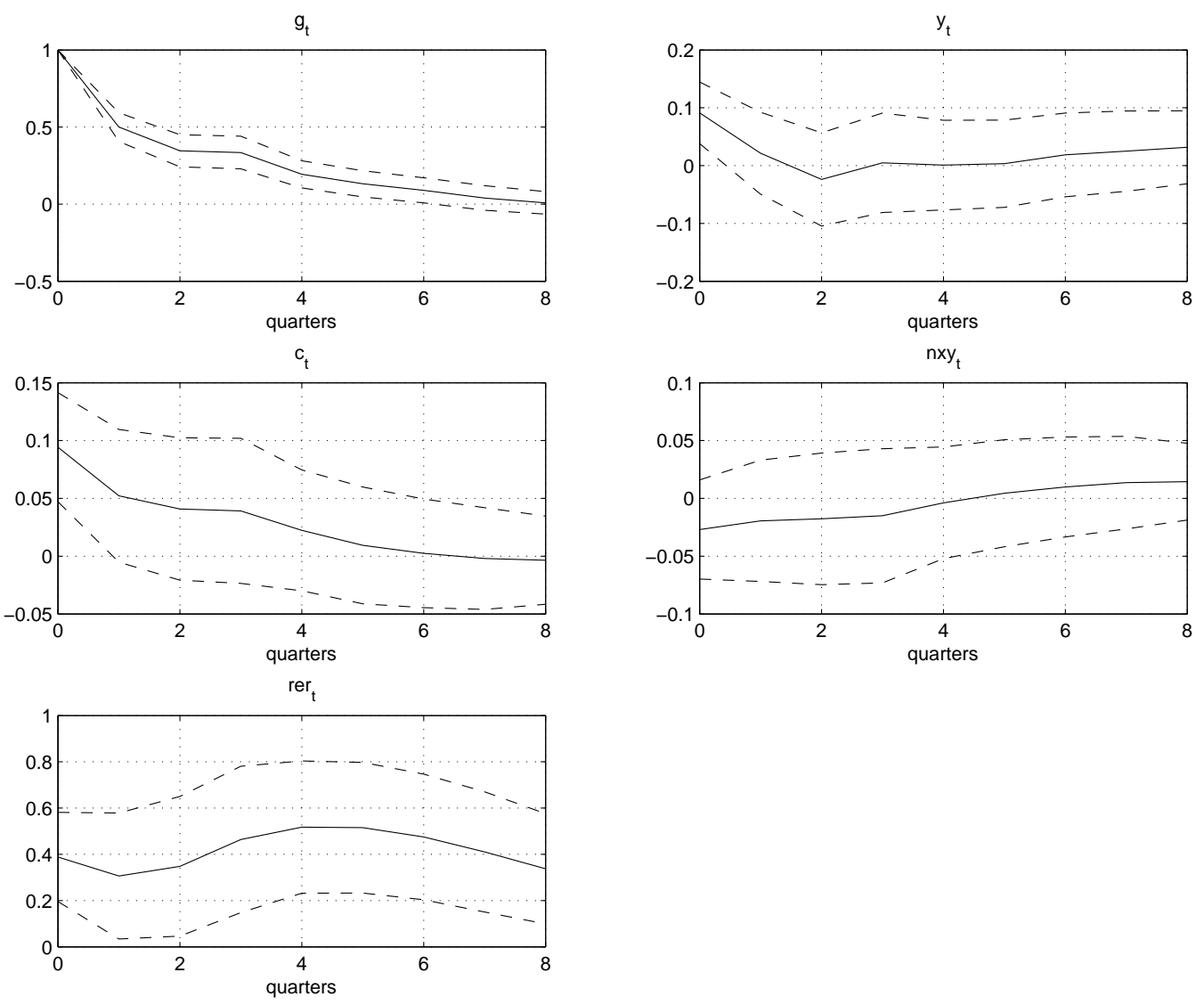
**Extras**

# FGLS Estimation:



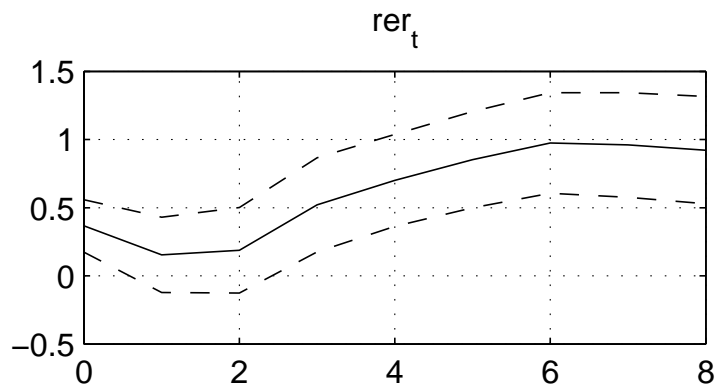
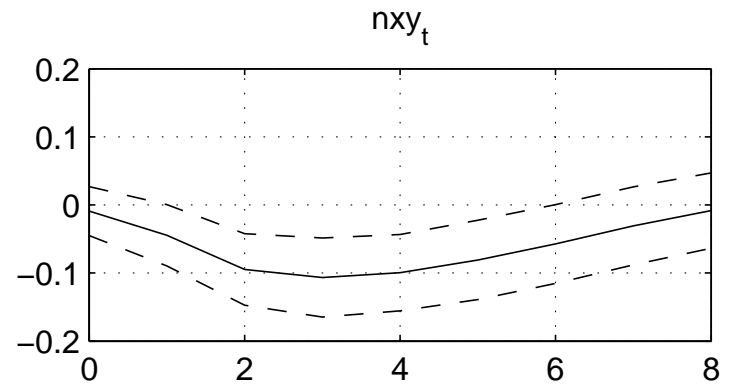
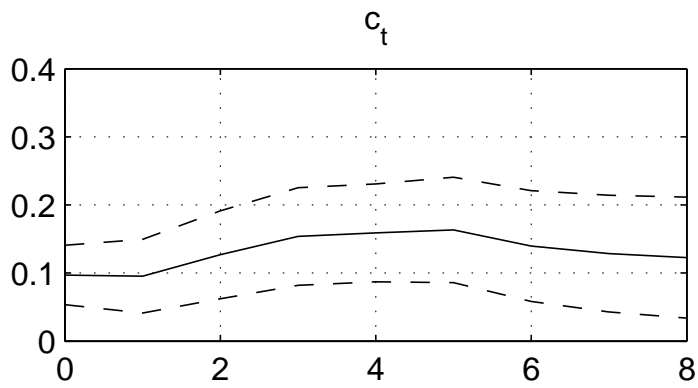
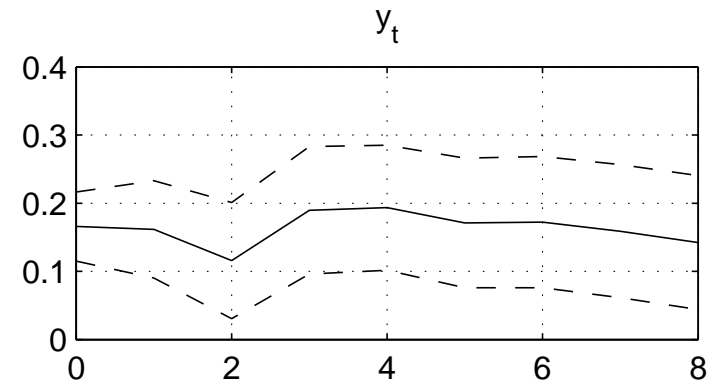
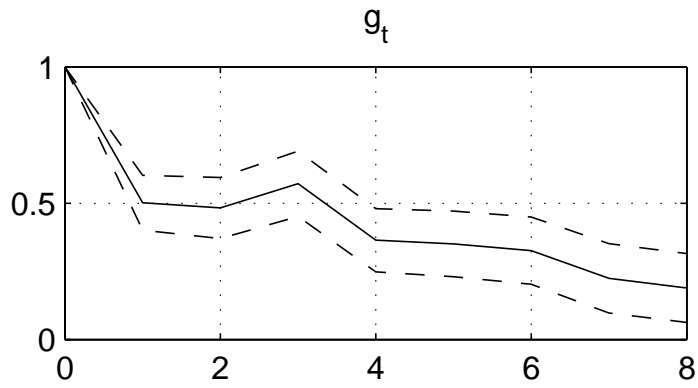
— OLS point estimate  
 - - - OLS point estimate  $\pm 2$  OLS std  
 -x-x- FGLS point estimate

# HP Filtered Data

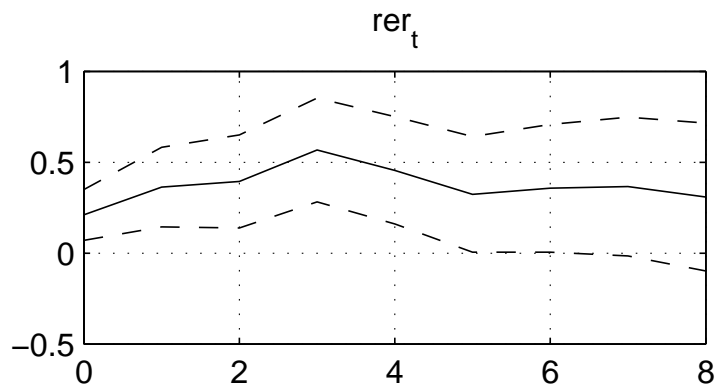
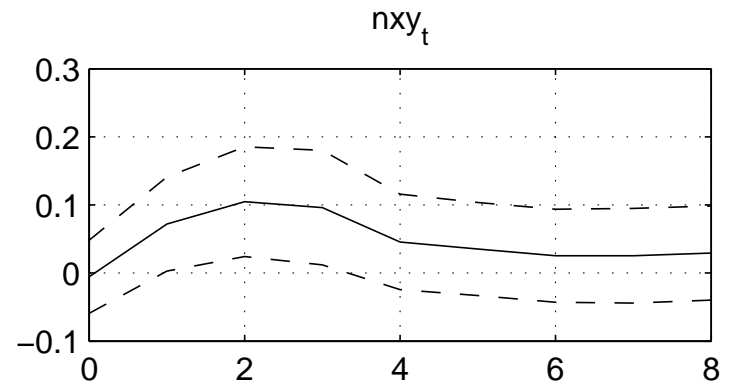
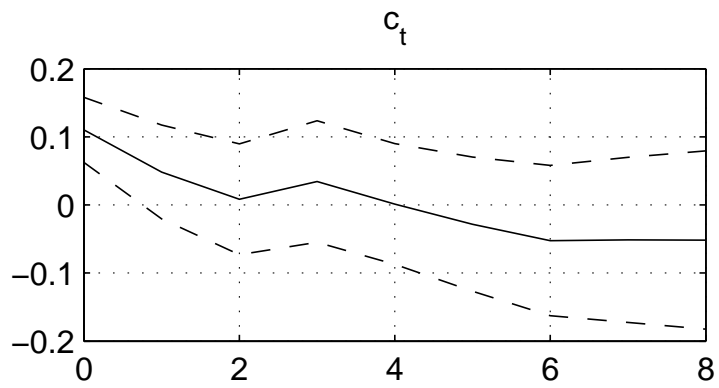
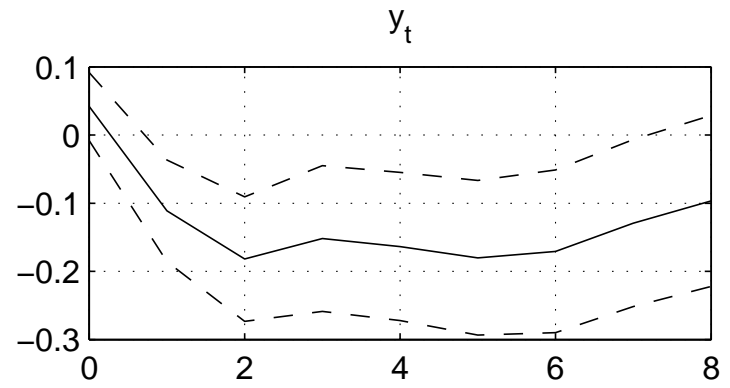
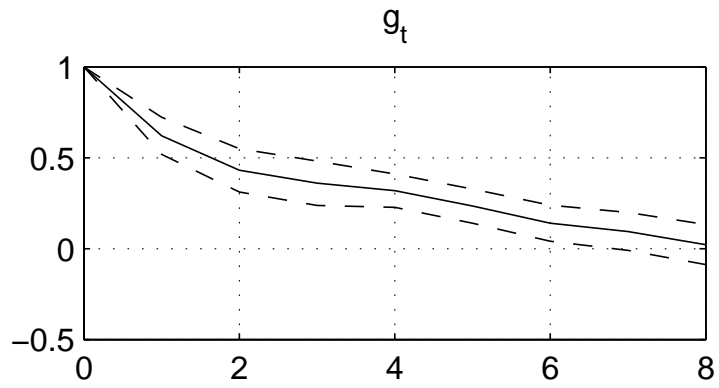


# **Country-by-Country Regressions**

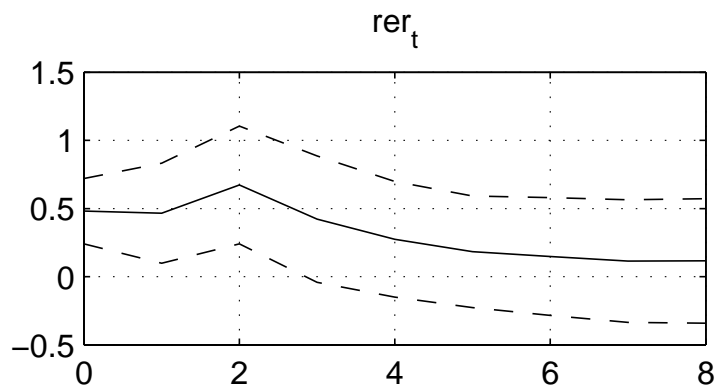
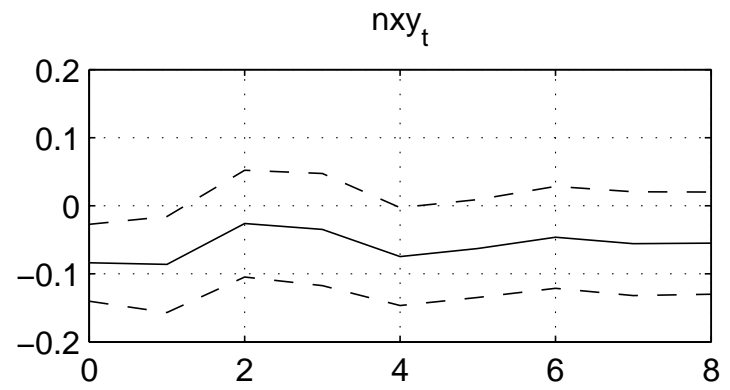
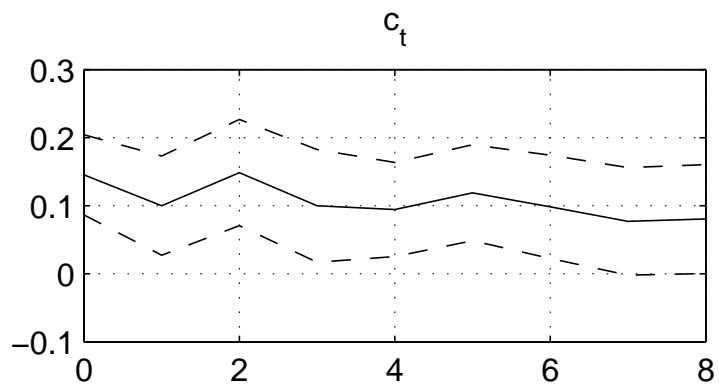
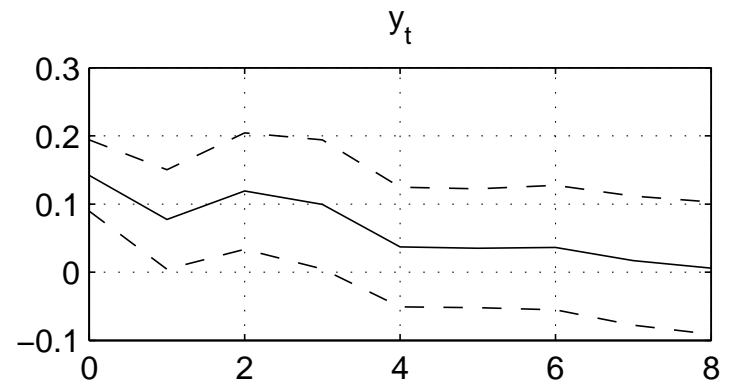
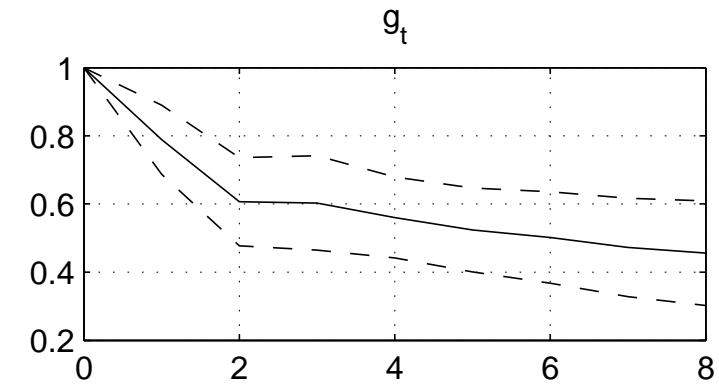
# Australia



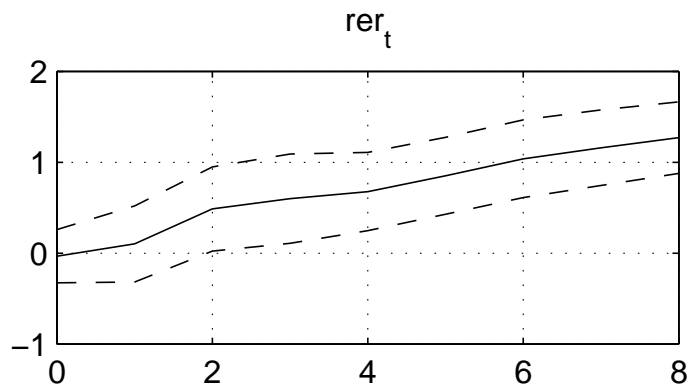
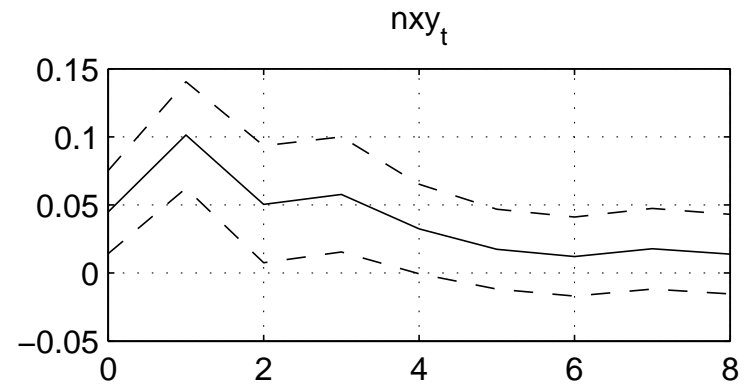
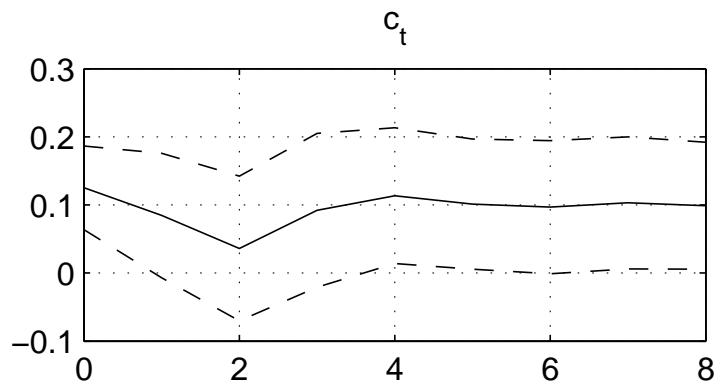
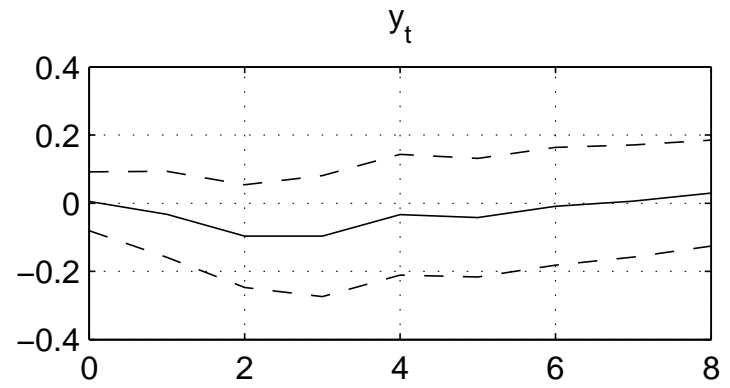
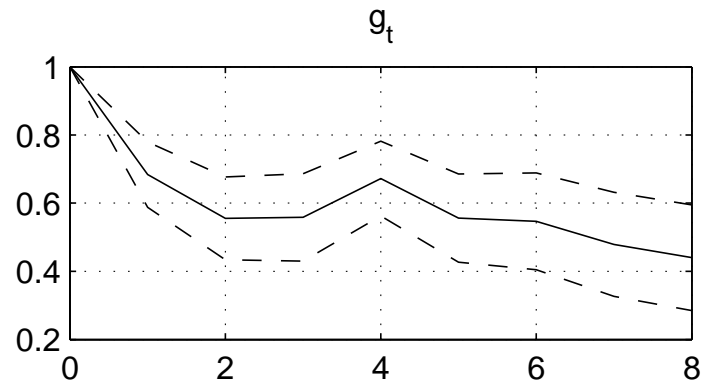
# Canada



# United Kingdom



# United States



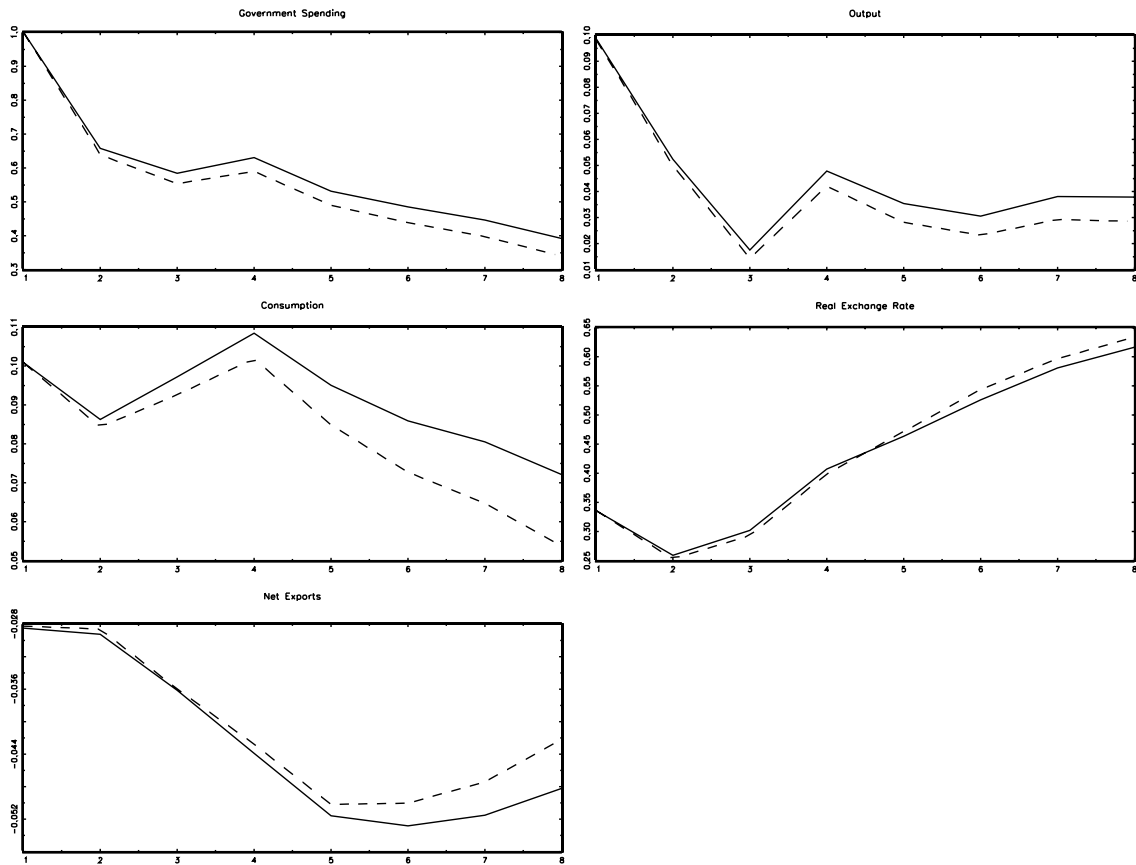


Figure 1: The full lines show the "true" impulse responses. The dashed lines show the median impulses computed over 10000 experiments.