Capital Inflows and the US Housing Boom

Filipa Sá and Tomasz Wieladek

King's College London and Bank of England

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Introduction

- Rapid increase in house prices in the US from the mid-1990s to 2007
- Simultaneous increase in the US current account deficit
- This paper looks at the effect of external shocks which generate capital inflows to the US on the housing market
  - 'Savings-glut' shock
  - Monetary policy expansion abroad
- Domestic shocks
  - Monetary policy expansion in the US
  - Financial-deregulation shock
  - Housing-preference shock

Introduction - Evidence

Chart 1. Current account balance and house prices
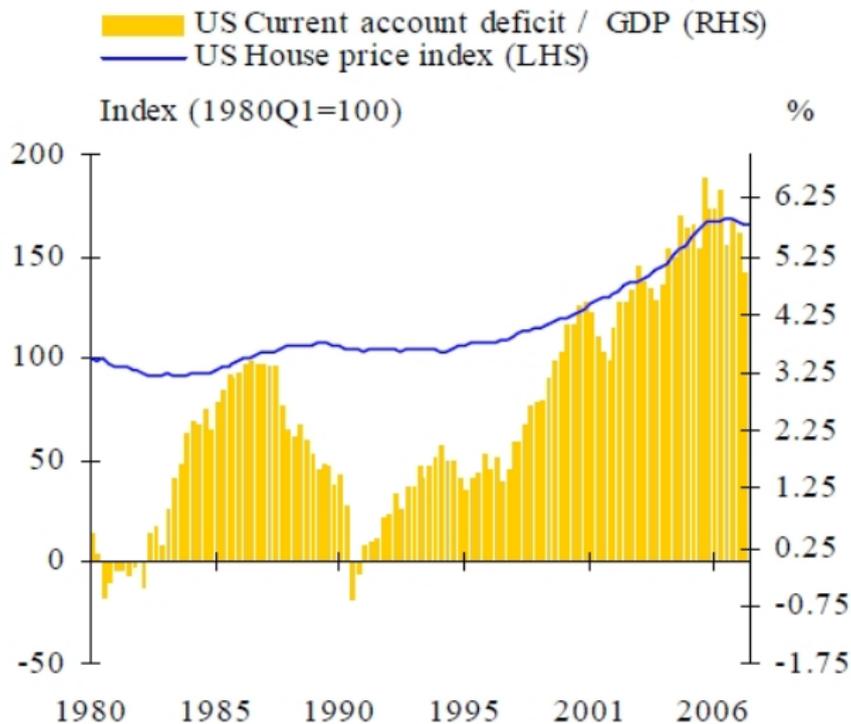
Sources: OECD Economic Outlook, Federal Housing Finance Agency (FHFA).

Introduction - Our contribution

- Use a 2-country DSGE model to derive predictions for how US and ROW variables respond to different types of shocks:
  External shocks

  - 'Savings-glut' shock

    - Preference shock that makes foreign households more patient
    - Risk-premium shock

  - Foreign monetary expansion

  Domestic shocks

  - Domestic monetary expansion
  - Increase in LTV - financial deregulation
  - Housing-preference shock

- Estimate a VAR with sign restrictions to investigate the effect of these shocks on real residential investment and real house prices

Introduction - Results

- 'Savings-glut' shocks have a positive and significant effect on real residential investment and real house prices
- These shocks explain a larger fraction of the variation in the housing variables than the other types of shocks that we identify

Theoretical framework

- Adapt the model in Ferrero (2012) to introduce external shocks

  - 2 countries: US and ROW
  - Households consume tradable goods and housing services. Tradable goods can be produced in the US or in ROW. No capital.
  - Households face an endogenous collateral constraint which limits the amount of private credit that they can obtain as a fraction of the expected value of housing
  - Nominal wage and price rigidities: households and intermediate-goods firms set wages and prices on a staggered basis
  - There is a single bond that is traded internationally and is denominated in US dollars. ROW investors can also hold a ROW bond. UIP holds.

Theoretical framework - External Shocks

- Increase in savings in ROW
  Preference of foreign households:

$$U_t^* \equiv E_t\{\sum_{s=0}^{\infty} \beta^{*s} Z_{\beta^* t+s}[\frac{X_{t+s}^{*1-\sigma}}{1-\sigma} - \frac{1}{1+\nu}\int_0^1 L_{t+s}^*(i)^{1+\nu}di]\}$$

$$\ln Z_{\beta^* t} = \rho_{\beta^*}\ln Z_{\beta^* t-1} + u_{\beta_t^*}, \quad u_{\beta_t^*} \ i.i.d.N(0,\sigma_{\beta^*}^2)$$

- Risk-premium shock
  UIP condition:

$$i_t = i_t^* + \varepsilon_t - E_t\varepsilon_{t+1} + z_{\kappa t}$$

$$z_{\kappa t} = \rho_\kappa z_{\kappa t-1} + u_{\kappa_t}, \quad u_{\kappa_t} \ i.i.d.N(0,\sigma_\kappa^2)$$

The risk-premium shock is an increase in the perceived safety of US assets, i.e. a reduction in $z_{\kappa t}$.

- Expansionary monetary-policy shock in ROW
  Interest-rate rule:

$$i_t^* = \rho i_{t-1}^* + (1-\rho)(\varphi_\pi \pi_t^* + \varphi_y y_{Ft}) + \varphi_\varepsilon(\varepsilon_t - \varepsilon_{t-1}) + z_{i^*t}$$

$$z_{i^*t} = \rho_i z_{i^*t-1} + u_{i_t}, \quad u_{i_t} \ i.i.d.N(0, \sigma_i^2)$$

Theoretical framework - Domestic Shocks

- Expansionary monetary-policy shock in the US
  Interest-rate rule:

$$i_t = \rho i_{t-1} + (1-\rho)(\varphi_\pi \pi_t + \varphi_y y_{Ht}) + z_{it}$$

$$z_{it} = \rho_i z_{it-1} + u_{i_t}, \quad u_{i_t} \; i.i.d. N(0, \sigma_i^2)$$

- Financial-deregulation shock

$$(1 + i_t) B_t \leq \theta Z_{\theta t} E_t(Q_{t+1} H_t)$$

$$\ln Z_{\theta t} = \rho_\theta \ln Z_{\theta t-1} + u_{\theta_t}, \quad u_{\theta_t} \; i.i.d. N(0, \sigma_\theta^2)$$

- Housing-preference shock
  Consumption index:

$$X_t \equiv [\eta C_t^{\frac{\epsilon-1}{\epsilon}} + (1-\eta) e^{\omega_t} H_t^{\frac{\epsilon-1}{\epsilon}}]^{\frac{\epsilon}{\epsilon-1}}$$

$$\omega_t = \rho_\omega \omega_{t-1} + u_{\omega_t}, \quad u_{\omega_t} \; i.i.d. N(0, \sigma_\omega^2)$$

Theoretical framework

- We derive theoretical impulse responses that are robust across a range of parameter values:

Table 1. Parameter ranges

Parameter	Description	Range
α	Preference share for home goods	$0.6 - 0.8$
γ	Elasticity of substitution between home and foreign tradables	$1.5 - 2.5$
ϵ	Elasticity of substitution between consumption and housing	$0.15 - 1.5$
σ	Coefficient of relative risk aversion	$1.5 - 2.5$
ν	Inverse of Frisch elasticity of labour supply	$1.5 - 2.5$
ϕ_p	Elasticity of substitution between intermediate goods	$3 - 11$
ϕ_w	Elasticity of substitution between labor inputs	$3 - 11$
ς_p	Probability that the price does not adjust	$0.6 - 0.9$
ς_w	Probability that the wage does not adjust	$0.6 - 0.9$
ρ	Smoothing coefficient in Taylor rule	$0.5 - 0.9$
φ_π	Response to CPI in Taylor rule	$1 - 3$
φ_y	Response to output in Taylor rule	$0.3 - 0.7$
φ_ε	Response to nominal exchange rate depreciation in foreign Taylor rule	$0 - 3$
ρ_η	Persistence of preference for housing shock	$0.95 - 0.99$
ρ_θ	Persistence of financial deregulation shock	$0.95 - 0.99$
ρ_κ	Persistence of risk-premium shock	$0.95 - 0.99$
ρ_i	Persistence of monetary-policy shock	$0.4 - 0.7$
ρ_{β^*}	Persistence of foreign preference shock	$0.95 - 0.99$

with $\beta = 0.98$, $\beta^* = 0.99$, $\theta = 85\%$
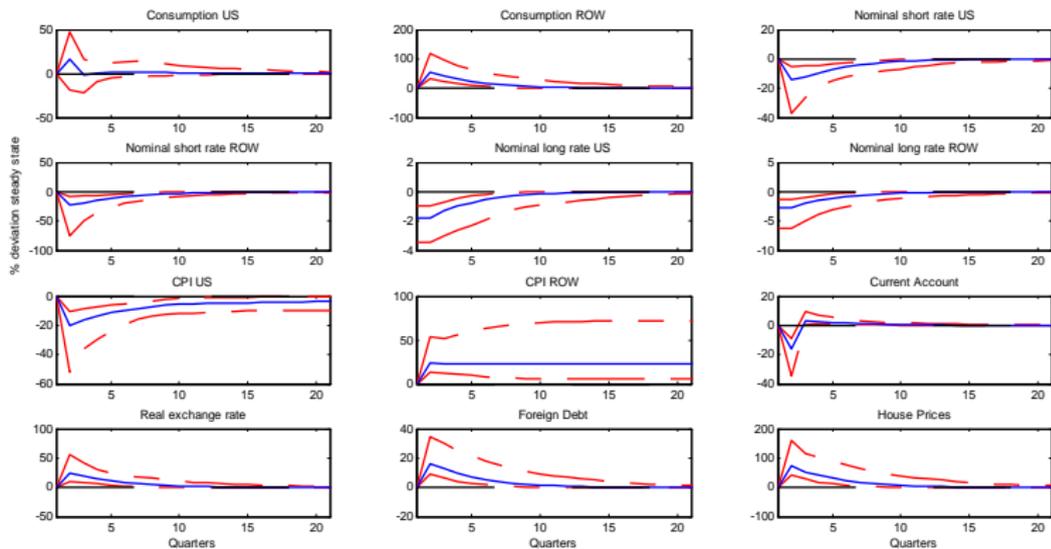
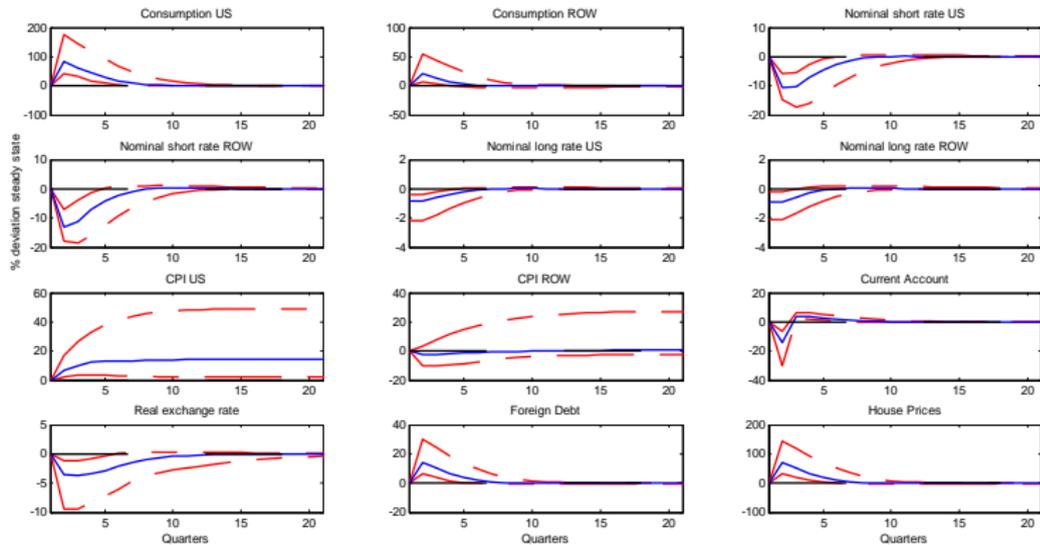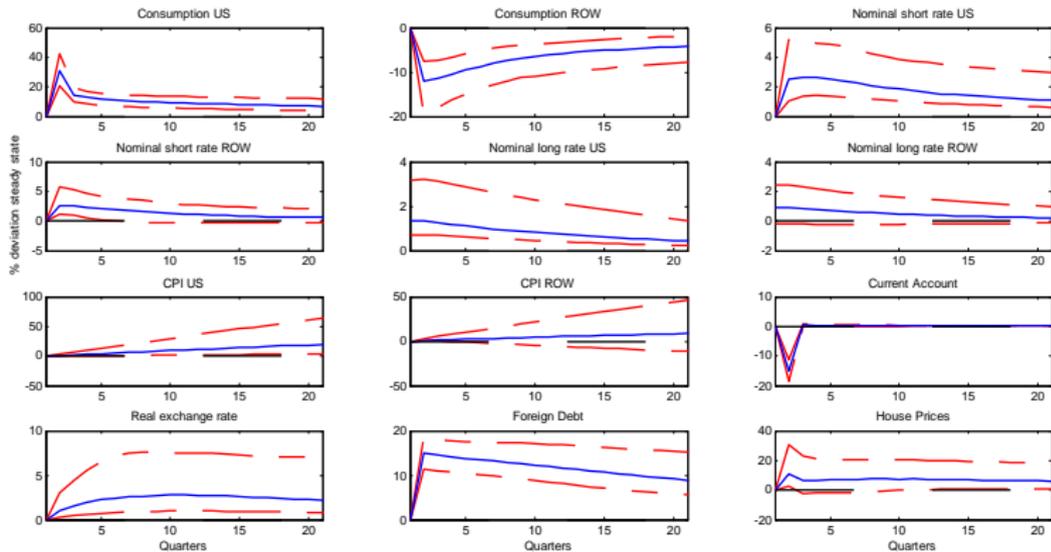# Increase in savings in ROW
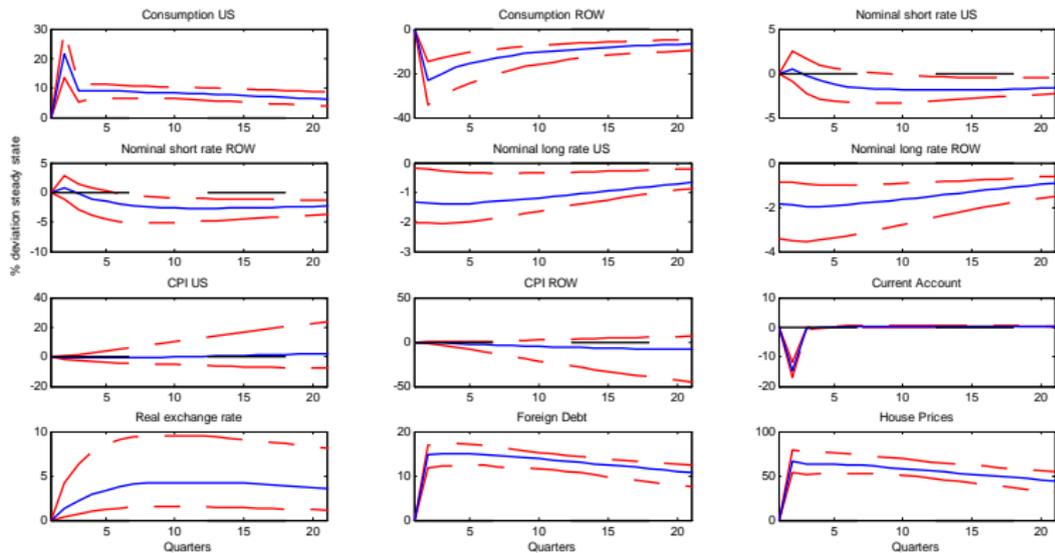
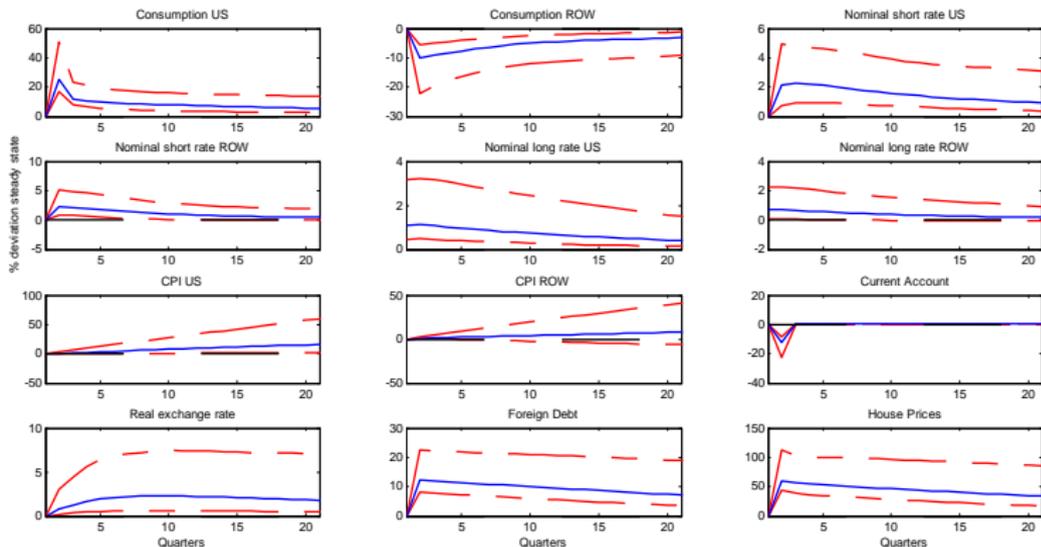# Risk-premium shock
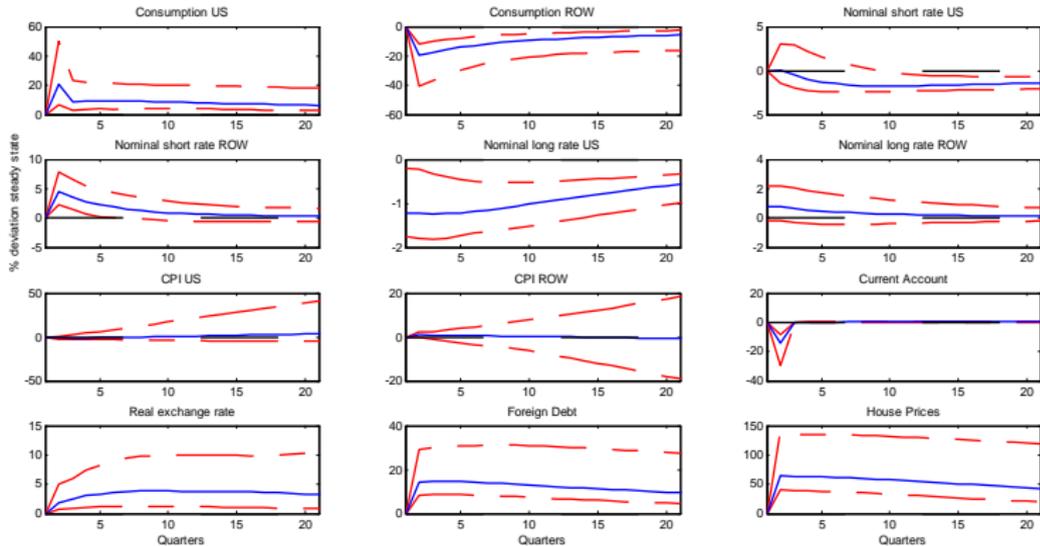
ROW monetary-policy expansion

US monetary-policy expansion

Financial deregulation in the US

Positive shock to housing preferences in the US

Implied sign restrictions

Variables/shock	Savings glut	ROW monetary expansion	US monetary expansion	US financial deregulation/ housing preference
US consump	≥ 0		≥ 0	≥ 0
ROW consump	≤ 0	≥ 0	≥ 0	≤ 0
US short rate			≤ 0	
ROW short rate		≤ 0		
US long rate	≤ 0		≤ 0	≥ 0
ROW long rate		≤ 0		
US CPI			≥ 0	
ROW CPI		≥ 0		
Current account	≤ 0	≤ 0	≤ 0	≤ 0
Exchange rate	≥ 0	≥ 0	≤ 0	≥ 0

Empirical model and data

- VAR

$$Y_t = c + \sum_{k=1}^{L} A_k Y_{t-k} + u_t \quad t = 1, \dots T \quad u_t \sim N(0, \Sigma)$$

$L = 2$ lags

- 12 variables:
    - real consumption in US and ROW
    - short-term (typically 3 month) nominal interest rates in US and ROW
    - long-term (typically 10 year) nominal interest rates in US and ROW
    - CPI in US and ROW
    - ratio of US current account balance to GDP
    - dollar real trade-weighted exchange rate
    - real residential investment
    - real house prices

Empirical model and data

- ROW variables constructed using trade weights. Data from Pesaran, Schuermann and Smith (2009)
- All variables in log levels except interest rates
- Baseline period: 1979Q1 to 2006Q4
- Use Litterman prior to deal with large dimension of the VAR
  - variables centred around a random walk with a drift
  - prior of white noise for interest rates and exchange rate
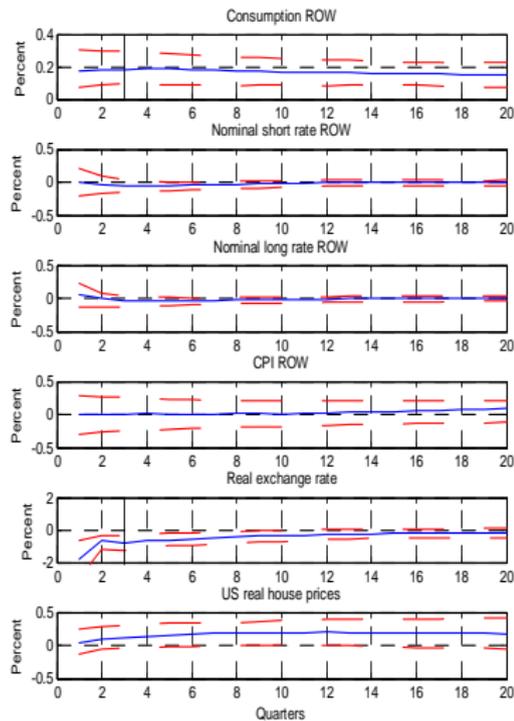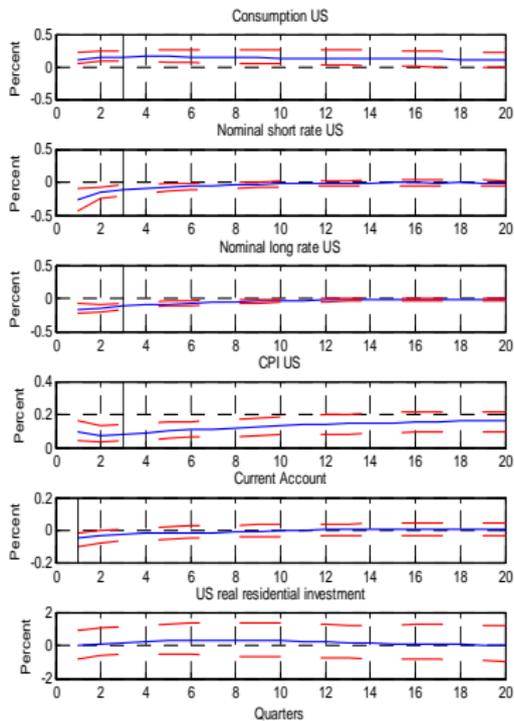- Identification using sign restrictions: imposed on impact for the CA and on impact plus two quarters for all other variables
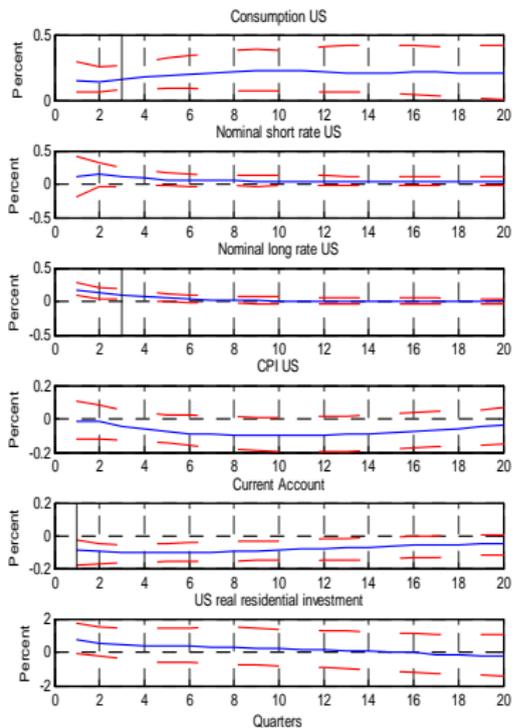
'Savings-glut' shock
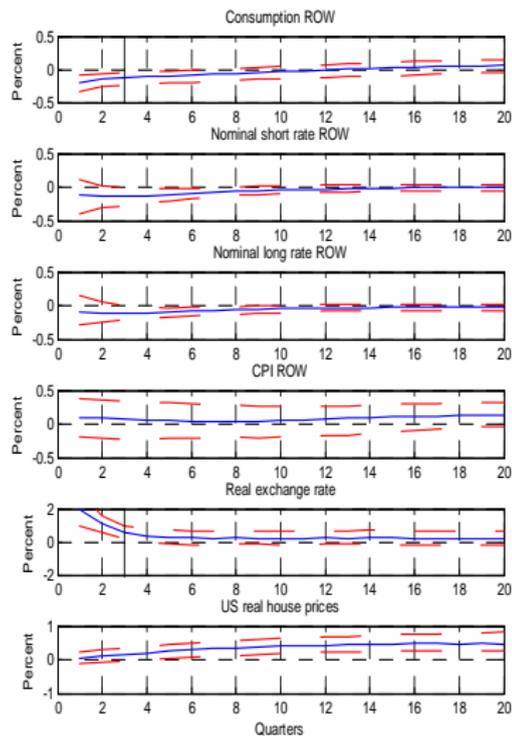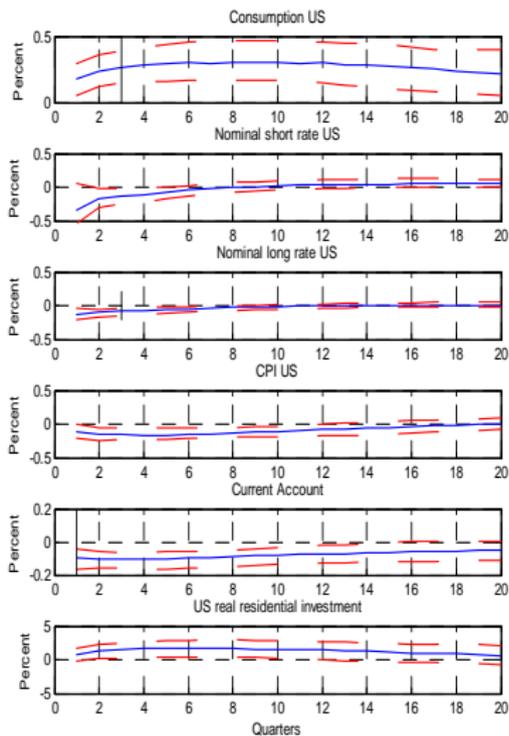
ROW monetary-policy expansion
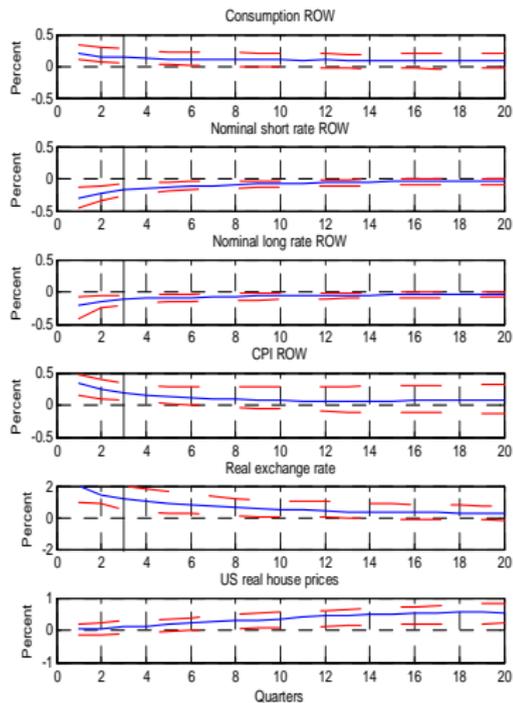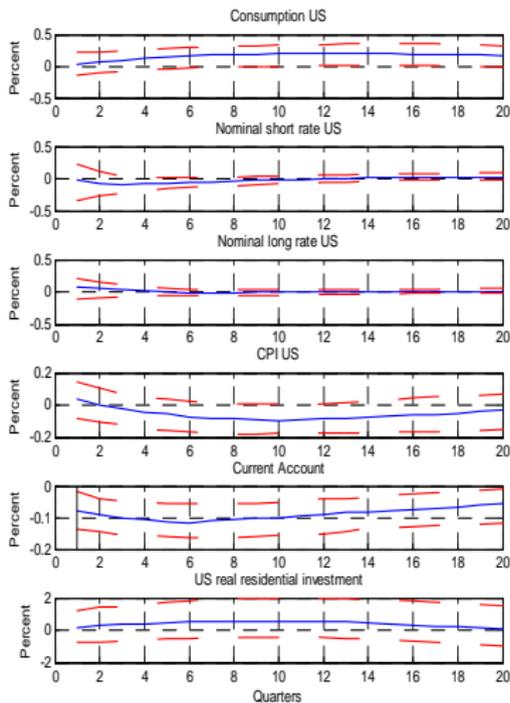
US monetary-policy expansion

Financial-deregulation/housing-preference shock in the US
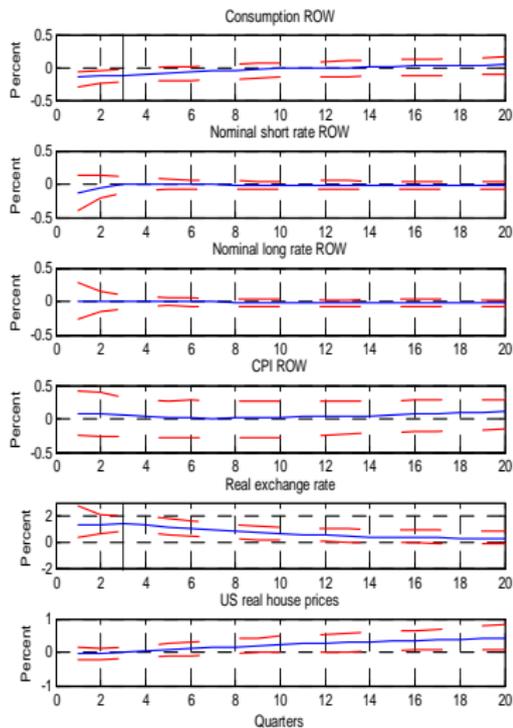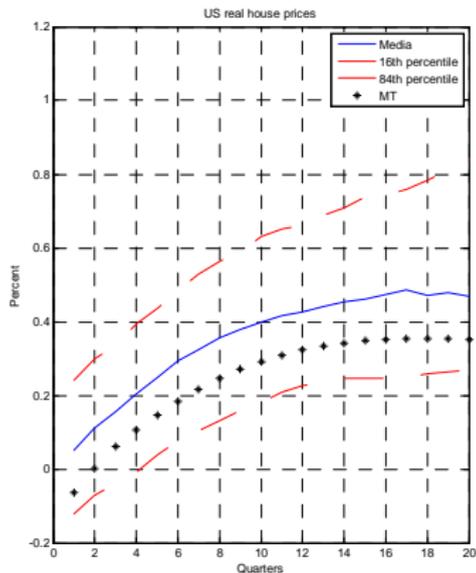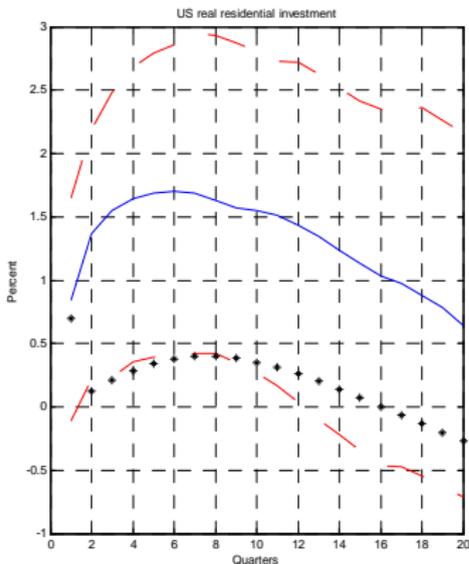
Variance decompositions

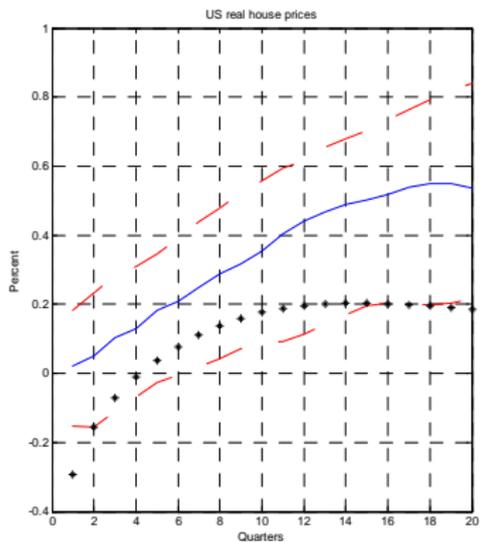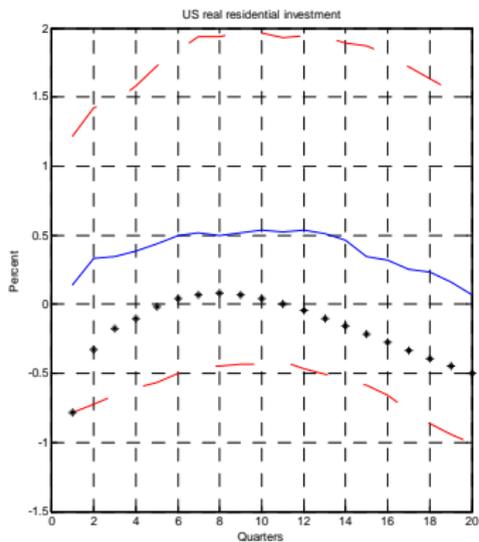|	Real residential investment			Real house prices		
	1 Year	3 Years	5 Years	1 Year	3 Years	5 Years
Savings glut	6.7%	13.2%	10.9%	5.9%	10.8%	12.2%
Monetary expansion ROW	3.9%	3.4%	3.7%	4.1%	5.1%	7.1%
Monetary expansion US	2.1%	2%	2.4%	4%	3.7%	3.1%
LTV/housing preference US	4.3%	3.4%	4.2%	4.5%	9.1%	11.2%

Conclusion

- 'Savings-glut' shocks have a statistically significant and positive effect on real house prices and residential investment
- 'Savings-glut' shocks contributed more to the housing boom than the other types of shocks that we identify
- Domestic financial deregulation and housing preference shocks also explain a large fraction of the variation in real house prices at longer horizons, but are less important in explaining real residential investment
- Domestic and foreign monetary shocks have a statistically-insignificant effect on these housing variables and explain a much smaller fraction of their variance
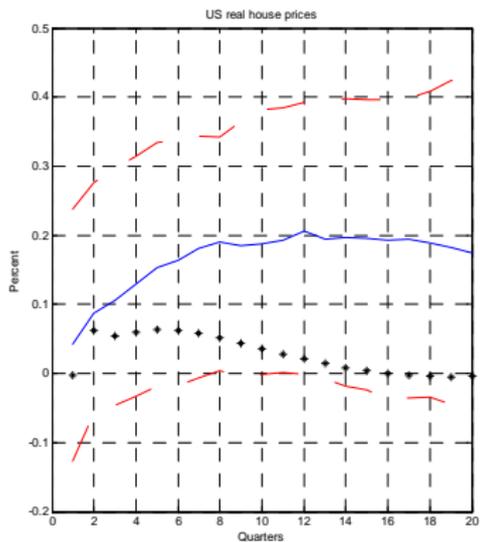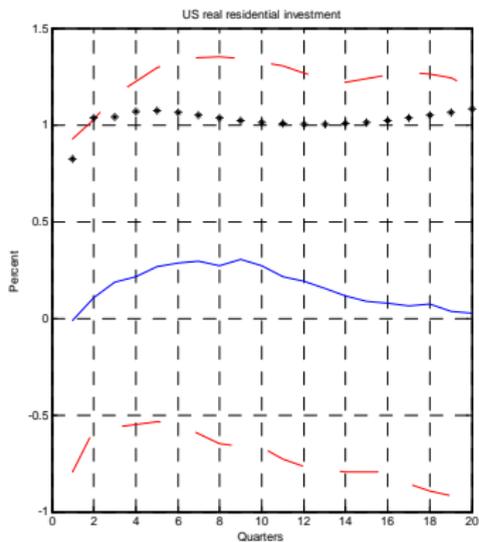
Median-target (MT) empirical impulse responses

'Savings-glut' shock

ROW monetary-policy expansion

US monetary-policy expansion

Financial-deregulation/housing-preference shock in the US