Mortgage markets, collateral constraints and monetary policy: Do institutional factors matter?

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Motivation

- Rising housing prices and household indebtedness has renewed interest in the role of **housing wealth** in the economy

- A key question is whether **monetary policy** affects consumption via a **housing-related** transmission channel

- Comparison across countries suggests that **institutional** set-ups in mortgage markets matter

This paper

- Focuses on how **cross-country institutional heterogeneity** in mortgage markets determines differences in monetary policy transmission

- Theoretical framework: literature on macroeconomic implications of **credit frictions** (Bernanke and Gertler 1989, Carlstrom and Fuerst 1997, Kiyotaki and Moore 1997, Iacoviello 2005, Campbell and Hercowitz 2006)

This paper (ctd.)

1. Documents heterogeneity across national mortgage markets in
   (a) development
   (b) prevailing contractual arrangements
   (c) extent of home equity release

This paper (ctd.)

2. Shows that cross-country differences in

   (a) **correlation** between consumption and house prices

   (b) timing and strength of consumption responses to monetary policy shocks (based on VAR analysis)

   are systematically related to **institutional** differences in mortgage markets

This paper (ctd.)

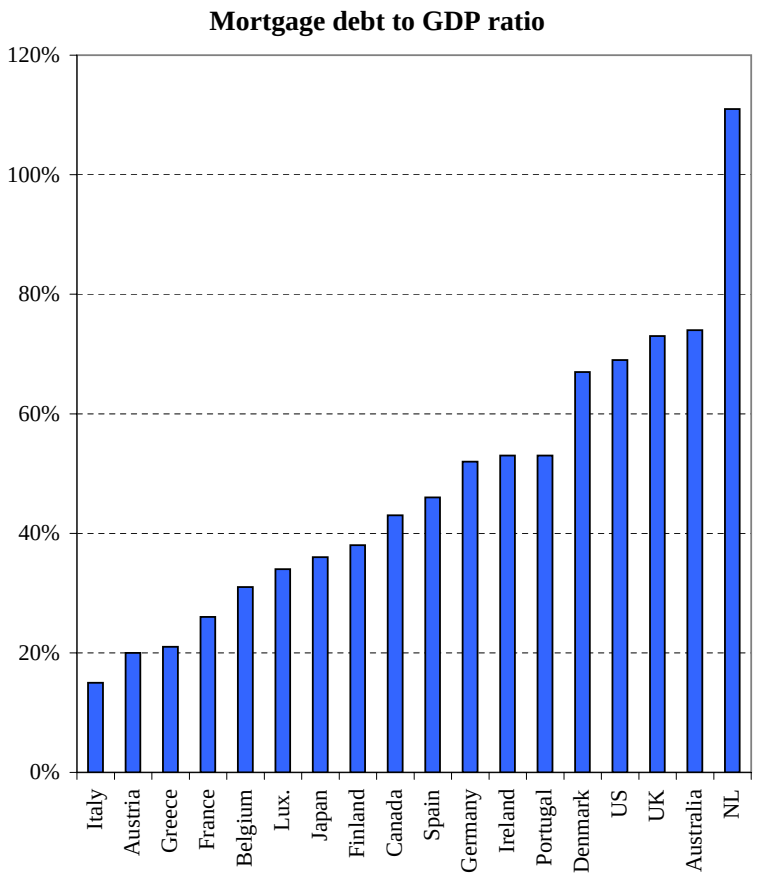
3. Builds a two-sector NK DSGE model with

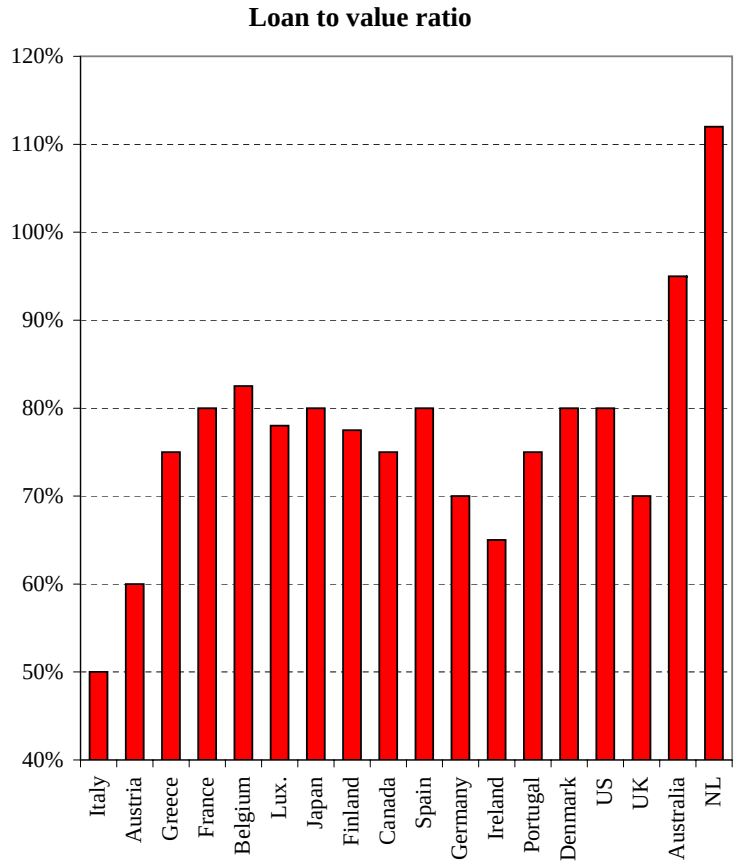
   – heterogeneous patience rates

   – and endogenous collateral constraints

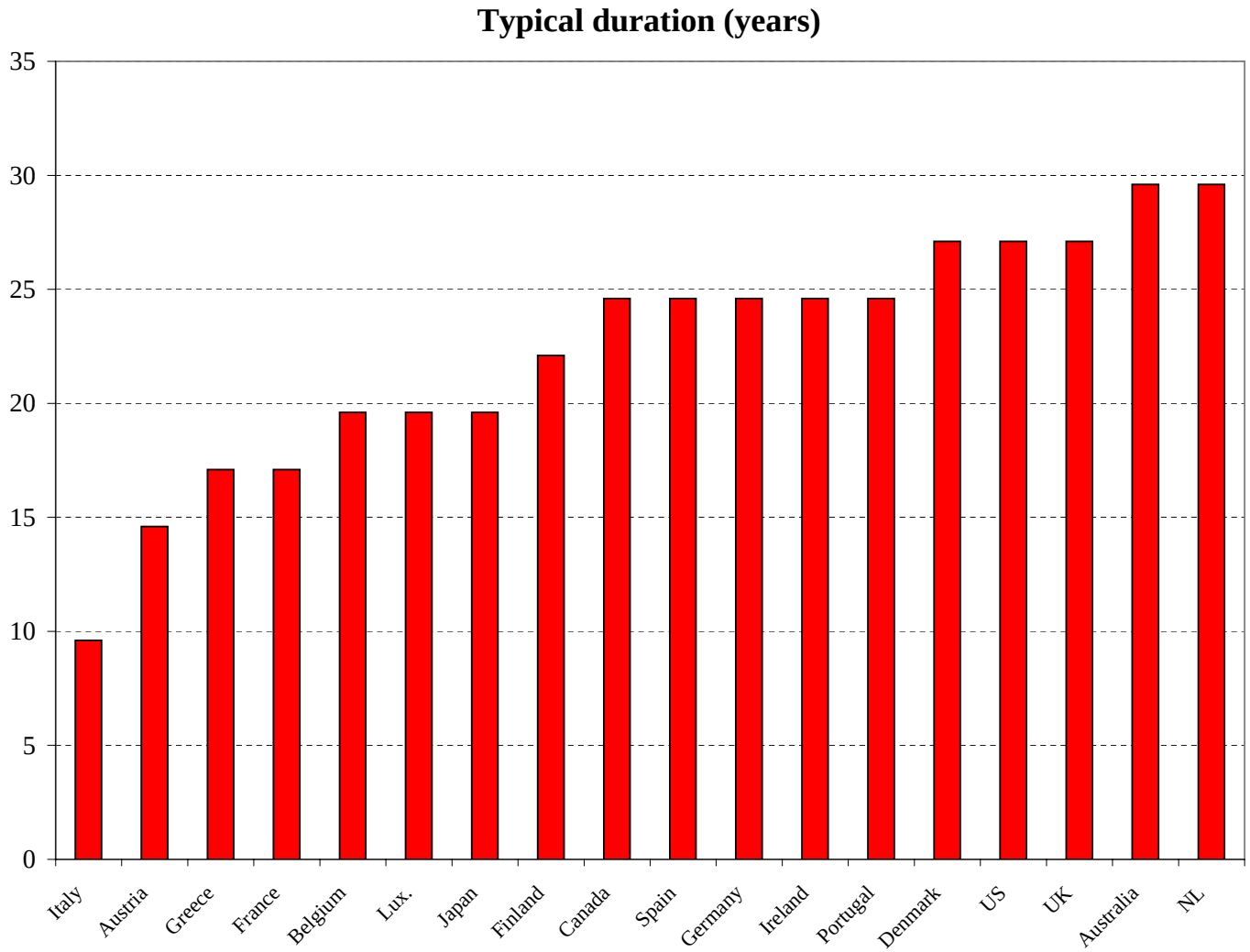
   to account for the relationship between consumption responses to monetary policy shocks and cross-country institutional characteristics of mortgage markets.

1. Cross-country heterogeneity: Debt-to-GDP and LTV ratios

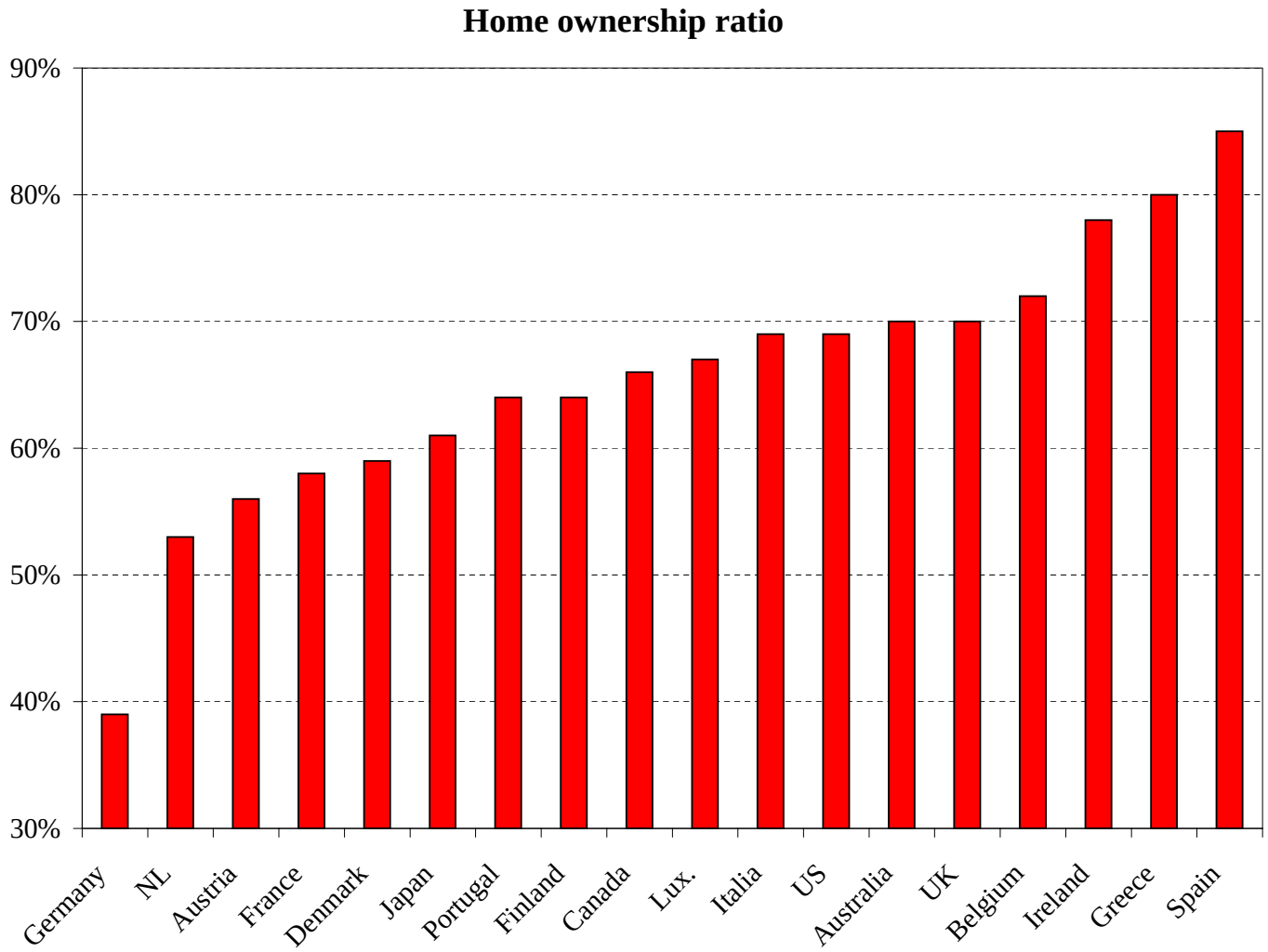




1. Cross-country heterogeneity: Typical duration



1. Cross-country heterogeneity: Home ownership ratio



1. Cross-country heterogeneity: Summing up

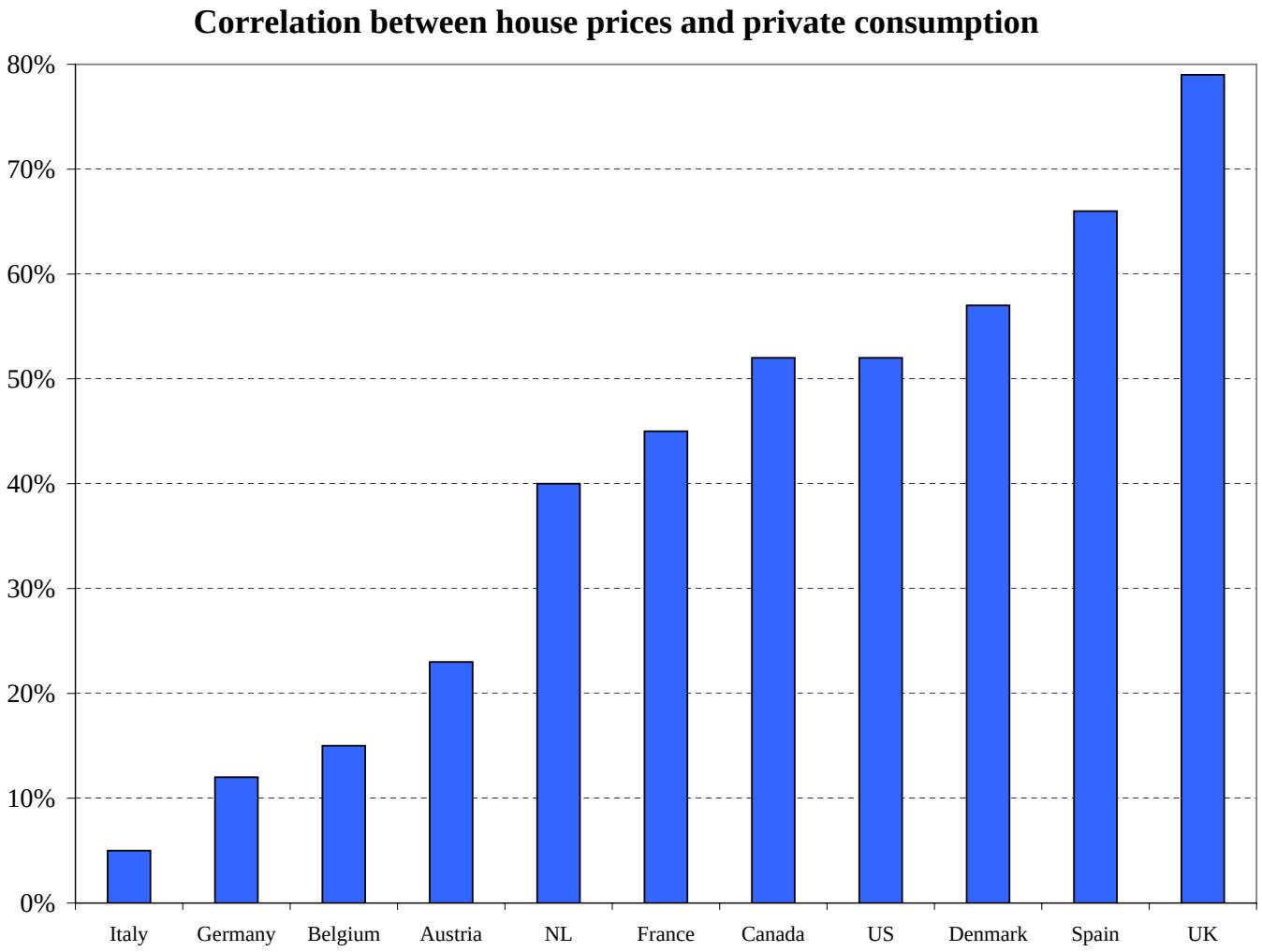
- Heterogeneity is significant across most indicators

- Can countries be **clustered**?

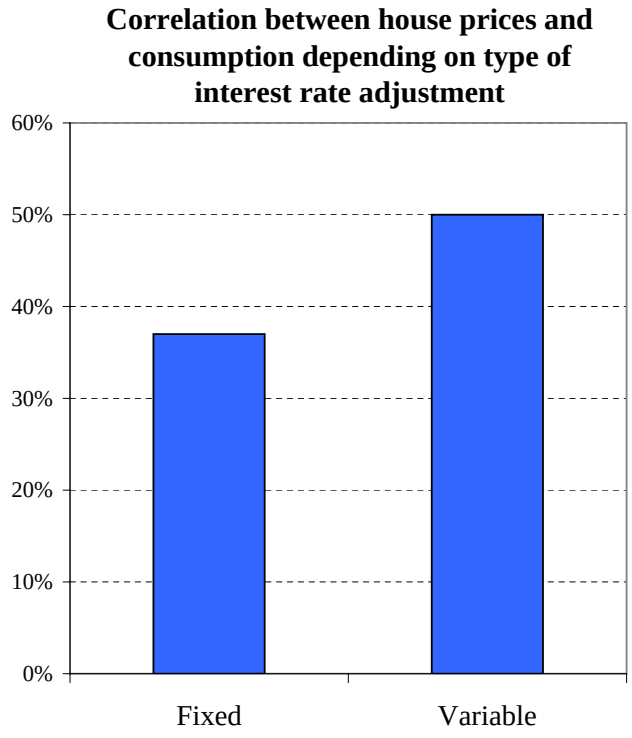
⇒ countries with larger and more developed mortgage markets where home equity release is significant: US, UK, Australia, Netherlands, Denmark, etc.

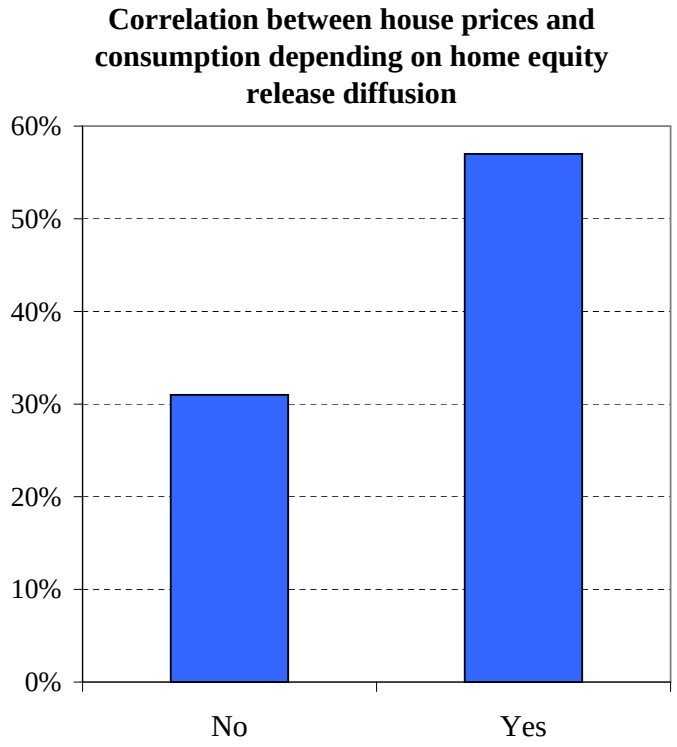
⇒ Countries with less developed and more regulated mortgage markets where home equity release is uncommon: Germany, Austria, Italy, Belgium, etc.

2.a Correlation between house prices and consumption



2.a Correlation between house prices and consumption (ctd.)





2.a Correlation between house prices and consumption

- Higher in countries with
  - more developed mortgage markets
  - higher loan-to-value ratios
  - home equity release more common
  - variable interest rate mortgage contracts

2.b VAR analysis

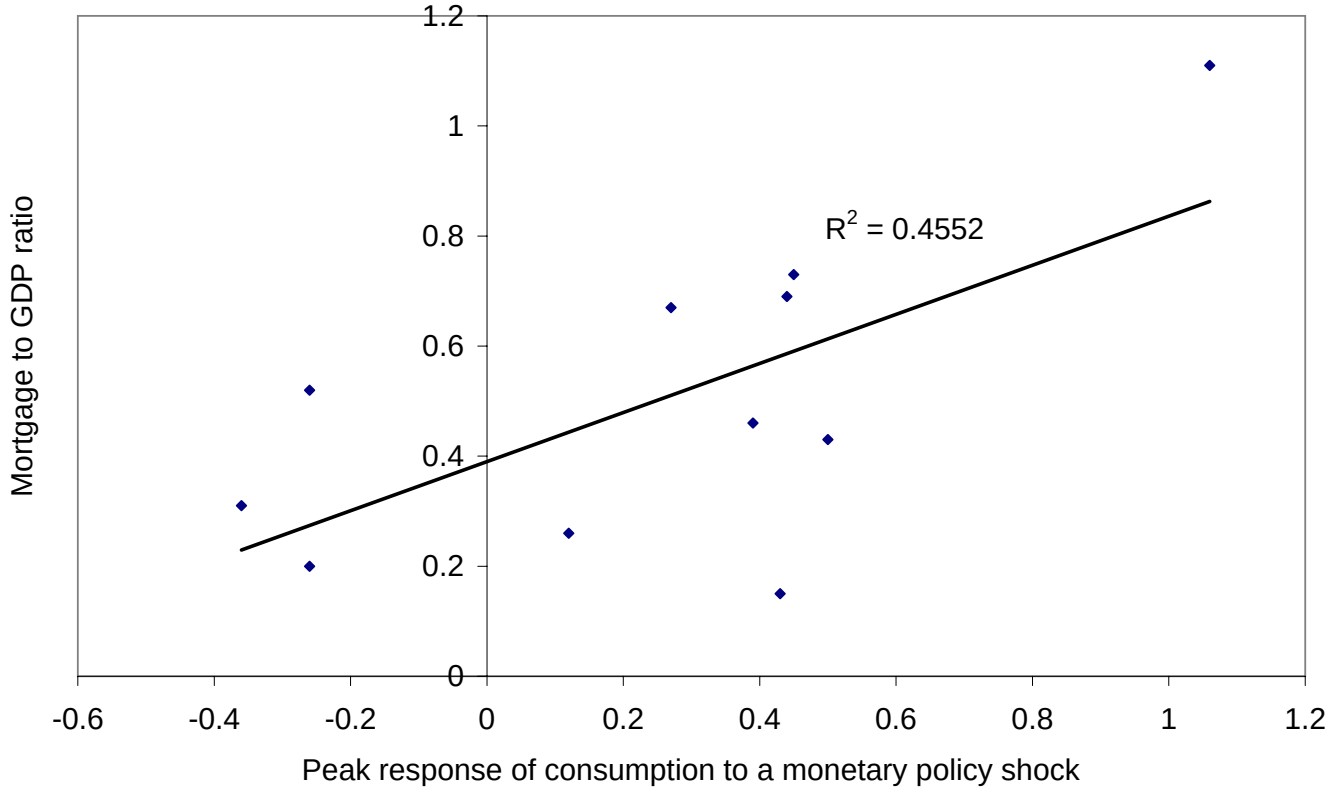
- Variables: Private consumption, CPI, real house prices, short-term interest rate and REER

- Countries: three Anglo-Saxon countries (US, UK, CA), eight EU countries (DE, FR, IT, ES, BE, NL, AT and DK)

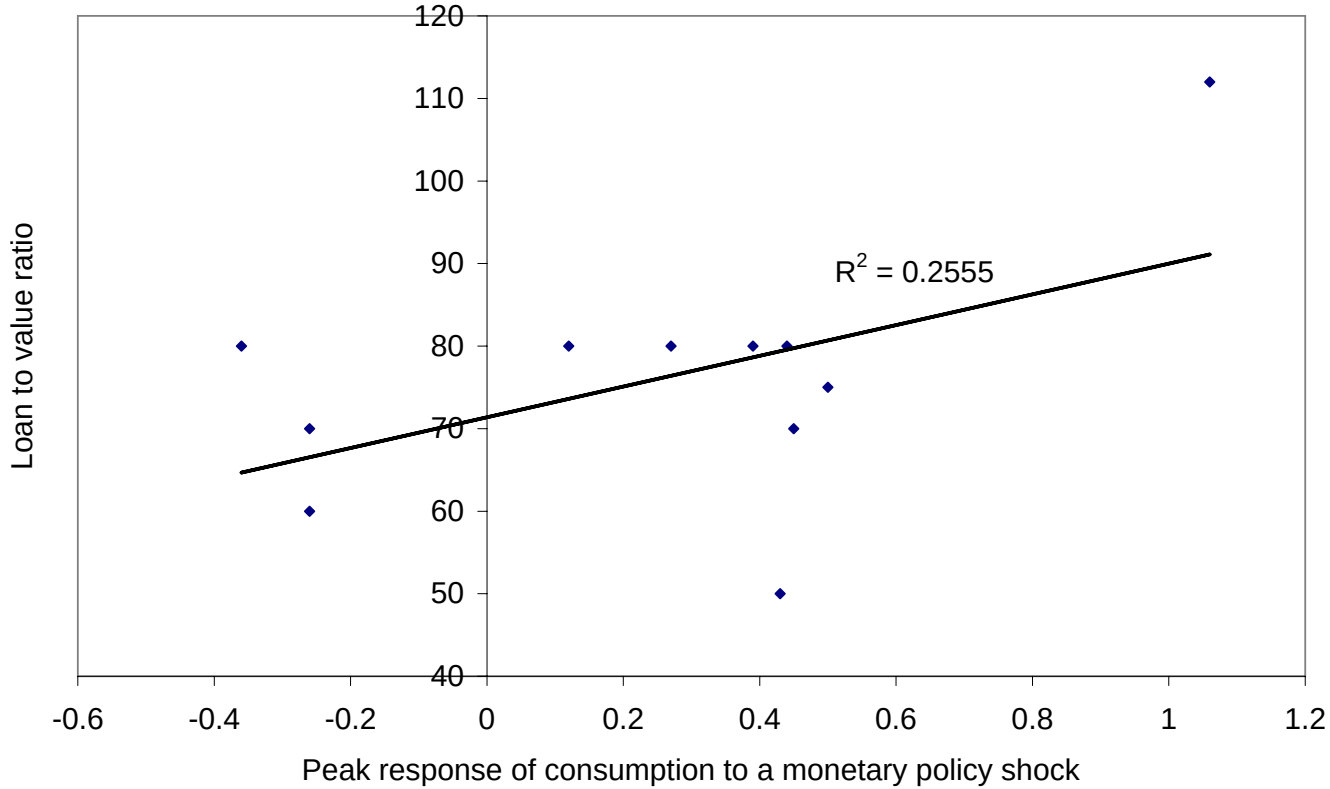
- Sample period: 1980:Q1-2004:Q4 (AT from 1986)

- Recursive identification scheme

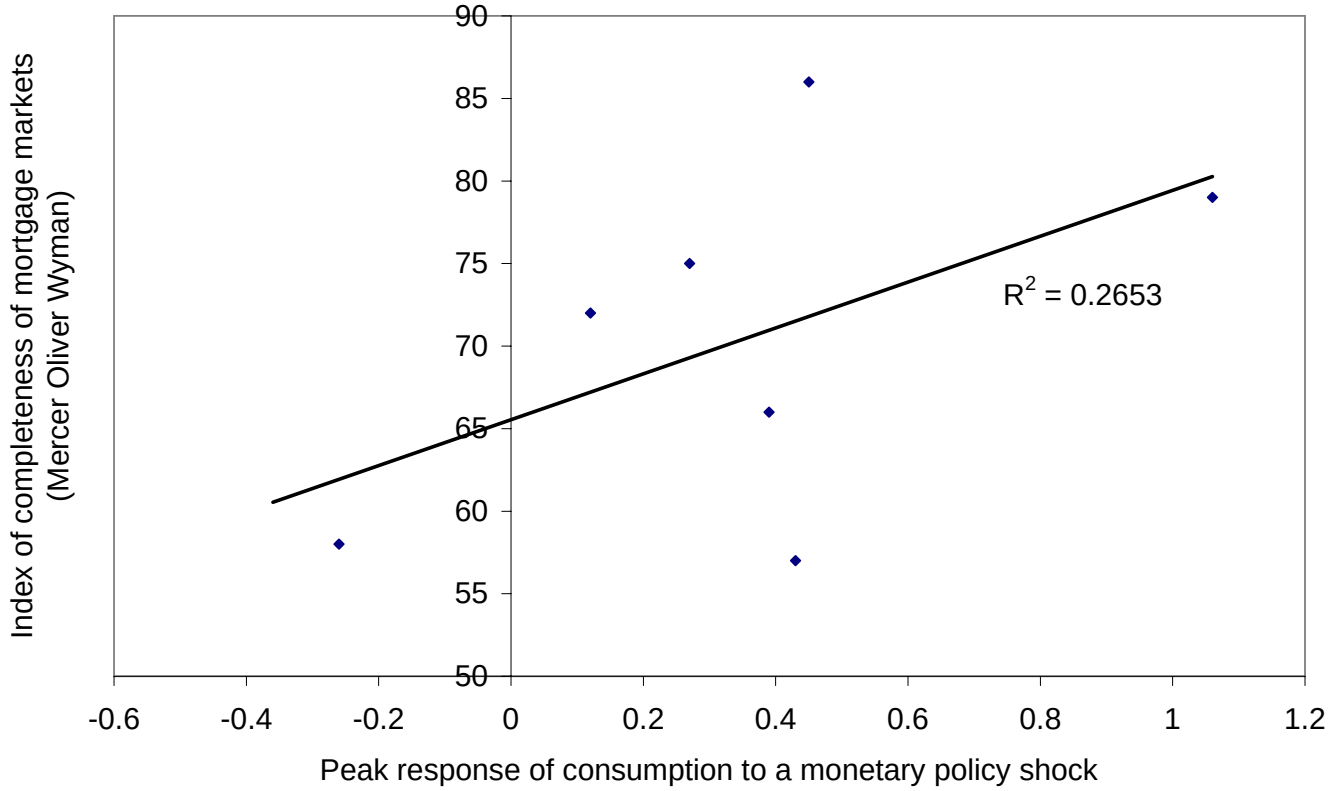
Peak consumption response: Varying debt-to-GDP ratio



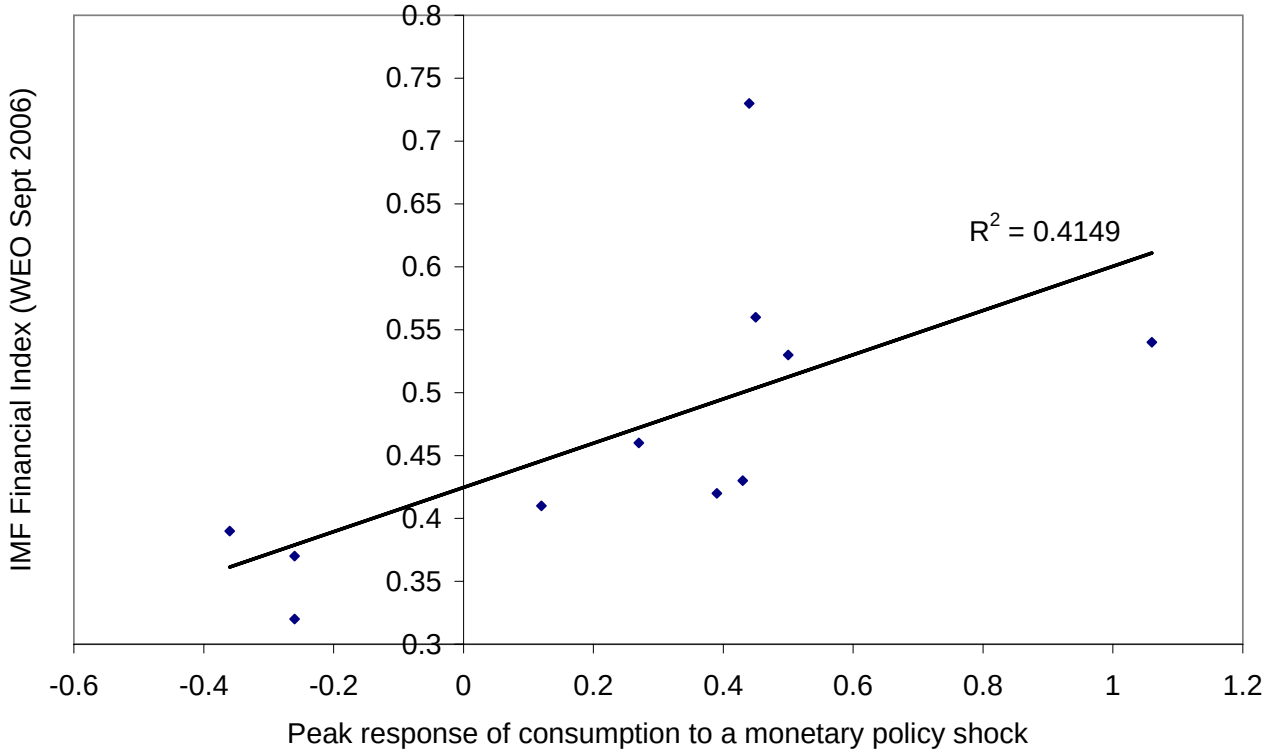
Peak consumption response: Varying LTV ratio



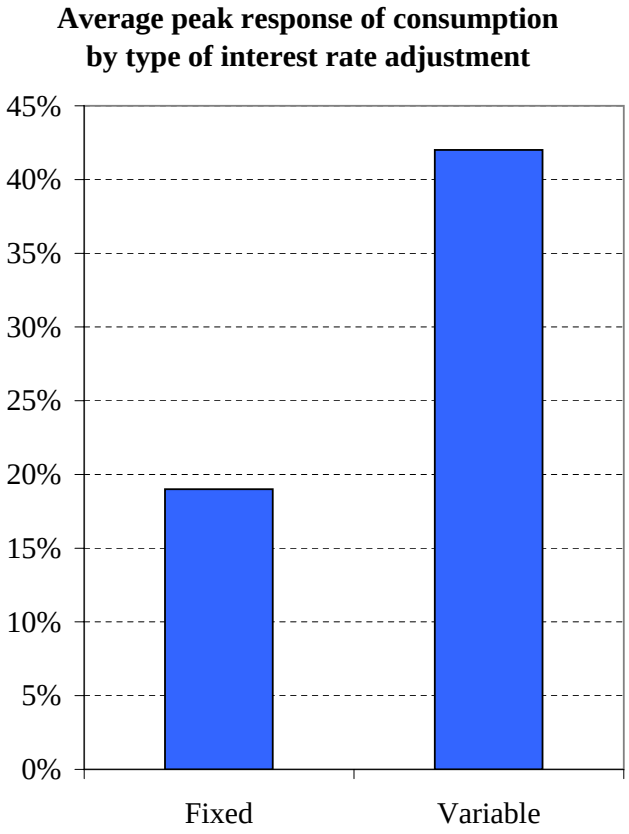
Peak consumption response: Varying MOW index

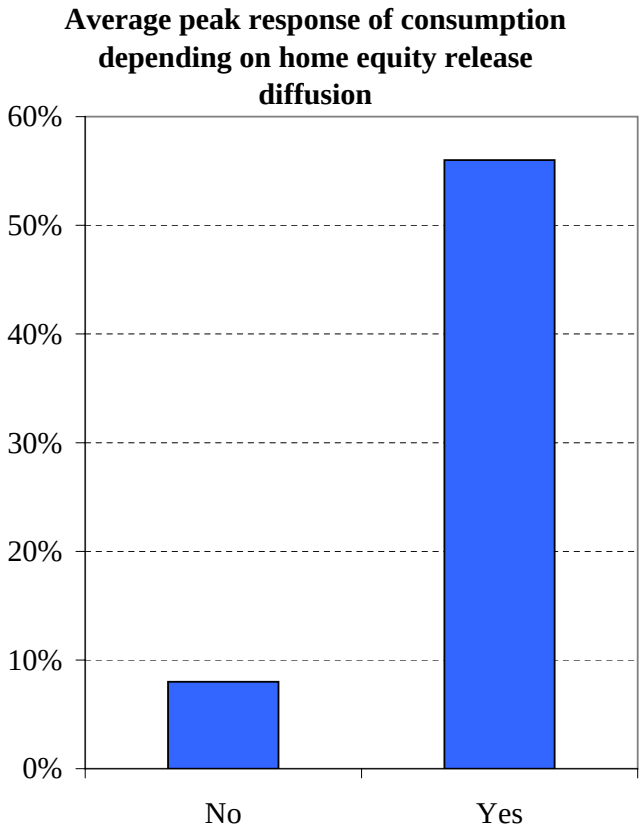


Peak consumption response: Varying IMF financial index



Peak consumption response: Interest adjustment and home equity release





2.b Summary of VAR analysis of monetary policy shocks

- Peak response of **consumption** tends to be higher in countries where
  - mortgage markets are more **developed** (reflecting a host of factors, e.g LTV ratios, cost of intermediation, technology, etc.)
  - **variable** interest rate mortgage contracts prevail (changes in monetary policy have an immediate impact on the debt servicing cost)
  - **home equity release** is more common

3. A NK model with a collateral constraint

- Evidence of larger response of consumption in countries with more developed mortgage markets (and financial markets in general) is **puzzling**

- Need a model of monetary transmission with two main ingredients:

  (i) a fraction of agents does not act as permanent-income consumers

  (ii) collateral constraint

Key features of the model

1. Two **final-good** sectors: consumption + new housing

2. **Heterogeneity** in preferences (patience rates) (Becker 1980, Krusell-Smith 1998, Kiyotaki-Moore 1997, Iacoviello 2005, Campbell and Hercowitz 2006)

3. **Impatient agent** (*Borrower*) has preferences tilted towards current consumption ($MUconsumption > MUsaving$)

4. Borrower is subject to a **collateral constraint** (avoids impatient accumulates debt indefinitely)

$\rightarrow$ In **equilibrium**, borrower is opposite to a standard permanent-income consumer

Borrowers

$$E_0 \left\{ \sum_{t=0}^{\infty} \beta^t U(X_t, N_t) \right\}, \qquad \beta < \gamma$$

$$X_t \equiv \left\{ (1-\alpha)^{\frac{1}{\eta}} \ (C_t)^{\frac{\eta-1}{\eta}} + \alpha^{\frac{1}{\eta}} \ (D_t)^{\frac{\eta-1}{\eta}} \right\}^{\frac{\eta}{\eta-1}}$$

subject to sequence of:

1. budget constraints

2. collateral constraints

Budget constraint (in units of consumption)

$$C_t + q_t(D_t - (1-\delta)D_{t-1}) + \frac{R^m_{t-1} b_{t-1}}{\pi_{c,t}} = b_t + \frac{W_t}{P_{c,t}} N_t + T_t$$

$$q_t \equiv \frac{P_{d,t}}{P_{c,t}}, \qquad b_t \equiv \frac{B_t}{P_{c,t}}$$

- **Inflation** affects real ex-post cost of service and borrowers' net worth

Collateral constraint

$$B_t \leq \underbrace{(1-\chi)}_{\text{LTV ratio}} \underbrace{\left[\sum_{s=0}^{\infty}(1-\xi)^s(D_{t-s}-(1-\delta)D_{t-1-s})\right] P_{d,t}}_{\text{value of accumulated stock of durables}}$$

$\chi \equiv$ **down-payment** rate (1 - LTV ratio)

$\xi \equiv$ **repayment** rate

$$\xi \geq \delta$$

Borrower's Efficiency Conditions

(i) **Housing/ Consumption margin**:

$$U_{c,t}\ Z_t = U_{d,t} + \beta(1-\delta)\ E_t\left\{U_{c,t+1}\ Z_{t+1}\right\}$$

$$Z_t \equiv q_t\left[1-(1-\chi)\psi_t\right] \text{ (effective relative price of housing)}$$

(ii) **Pseudo-Euler** :

$$\psi_t = 1 - \beta E_t\left\{\frac{U_{c,t+1}}{U_{c,t}}\frac{R_t^m}{\pi_{c,t+1}}\right\} + (1-\xi)\,\beta E_t\left\{\frac{U_{c,t+1}}{U_{c,t}}\psi_{t+1}\frac{q_{t+1}}{q_t}\right\}$$

$\psi_t = 0$ all t $\longrightarrow$ back to standard Euler

Interpretation

$\rightarrow$Define *Euler gap*

$$\Delta_t \equiv U_{c,t} - \beta E_t \left\{ U_{c,t+1} \frac{R_t^m}{\pi_{c,t+1}} \right\}$$

$\rightarrow$Housing/Consumption margin has **two dynamic components**

$$
\begin{aligned}
U_{c,t}q_t &= E_t\left\{\sum_{j=0}^{\infty}\left[\beta(1-\delta)\right]^j U_{d,t+j}\right\} + (1-\chi)U_{c,t}q_t\psi_t \\
&= \underbrace{E_t\left\{\sum_{j=0}^{\infty}\left[\beta(1-\delta)\right]^j U_{d,t+j}\right\}}_{(1)} + (1-\chi)\underbrace{E_t\left\{\sum_{j=0}^{\infty}\left[\beta(1-\xi)\right]^j q_{t+j}\Delta_{t+j}\right\}}_{(2)}
\end{aligned}
$$

$\rightarrow$ (1) PDV of direct marginal utility of housing (very smooth if δ low)

$\rightarrow$ (2) PDV of Euler gap

Monetary transmission: $\boxed{\uparrow \text{ nominal interest rate}}$

1. **Nominal debt** $\longrightarrow$ Interest rate hike rises real service cost of outstanding debt$\longrightarrow$ Negative **income** effect $\longrightarrow$ Reduce both consumption and housing demand

2. **Collateral constraint** effect: policy tightening $\longrightarrow$ $\boxed{\uparrow \psi_t}$ $\longrightarrow$ $\boxed{\uparrow \text{ PDV of Euler gap}}$ $\downarrow$ consumption (for given q)

3. **Asset-price** effect: $\boxed{\downarrow q_t}$ $\longrightarrow$ reduce borrowing capability $\longrightarrow\downarrow$ consumption

Intuitively

1. Monetary contraction is a negative income shock

2. Borrower wishes to decrease borrowing$\rightarrow$*Decrease* consumption

3. Parameters χ and ξ measures the speed at which can vary borrowing in light of a change in income

Savers

$$E_0 \left\{ \sum_{t=0}^{\infty} \gamma^t U(\widetilde{C}_t, \widetilde{D}_t) \right\}, \quad \ldots \text{with} \quad \gamma > \beta$$

- rigid labour supply

- subject to sequence of budget constraints

$$\widetilde{C}_t + q_t(\widetilde{D}_t - (1-\delta)\widetilde{D}_t - 1) + R^m_{t-1}\widetilde{b}_{t-1} = \widetilde{b}_t + \widetilde{T}_t + \frac{\widetilde{\Gamma}_{j,t}}{P_{c,t}}$$

Variable vs. Fixed-Rate Contracts

$R_t^m =$ interest rate on a mortgage contract of maturity m

$$R_t^m = \left(\sum_{k=0}^{m-1} \tau^k \right)^{-1} \sum_{k=0}^{m-1} \tau^k E_t \left\{ R_{t+k} \right\}$$

with $\tau \in [0, 1]$

$m = 1 \longrightarrow$ mortgage and policy rate coincide.

$\tau = 0 \longrightarrow$ mortgage rate perfectly indexed to policy rate

$\tau = 1 \longrightarrow$ mortgage rate fixed to the m-period interest rate

Intermediate goods producer in sector j=c,d

- Owned by saver

- Price setting subject to quadratic adjustment costs (Rotemberg, 1982)

$$\max \; E_0 \left\{ \sum_{t=0}^{\infty} \Lambda_{j,t} \left(P_{j,t}(i) Y_{j,t}(i) - W_t N_{j,t}(i) - \frac{\vartheta_j}{2} \left(\frac{P_{j,t}(i)}{P_{j,t-1}(i)} - 1 \right)^2 P_{j,t} Y_{j,t} \right) \right\}$$

- Phillips curve in sector j

$$\pi_{j,t}\left(\pi_{j,t}-1\right) = \gamma E_t\left\{\frac{\widetilde{\Lambda}_{j,t+1}}{\widetilde{\Lambda}_{j,t}}\,\pi_{j,t+1}\left(\pi_{j,t+1}-1\right)\right\} + \frac{\varepsilon_j}{\vartheta_j}\left(mc_{j,t}-\frac{\varepsilon_j-1}{\varepsilon_j}\right)$$

- In log-linearized form (NKPC)

$$\pi_{j,t} = \beta E_t\left\{\pi_{j,t+1}\right\} + \left(\frac{\varepsilon_j-1}{\vartheta_j}\right)\widehat{mc}_{j,t}$$

Monetary Policy Rule

$$\frac{R_t}{R} = \left(\frac{\widetilde{\pi}_t}{\widetilde{\pi}}\right)^{\phi_\pi} \varepsilon_t \qquad \phi_\pi > 1$$

Steady-state indebtedness

- Leverage ratio of borrowers

$$\frac{b}{D} = \frac{(1-\chi)\,\delta}{1-(1-\xi)} \tag{1}$$

  the leverage ratio increases with:

  - lower χ
  - lower ξ

Simulations

- Simulate the effects of monetary policy shocks under alternative values of:

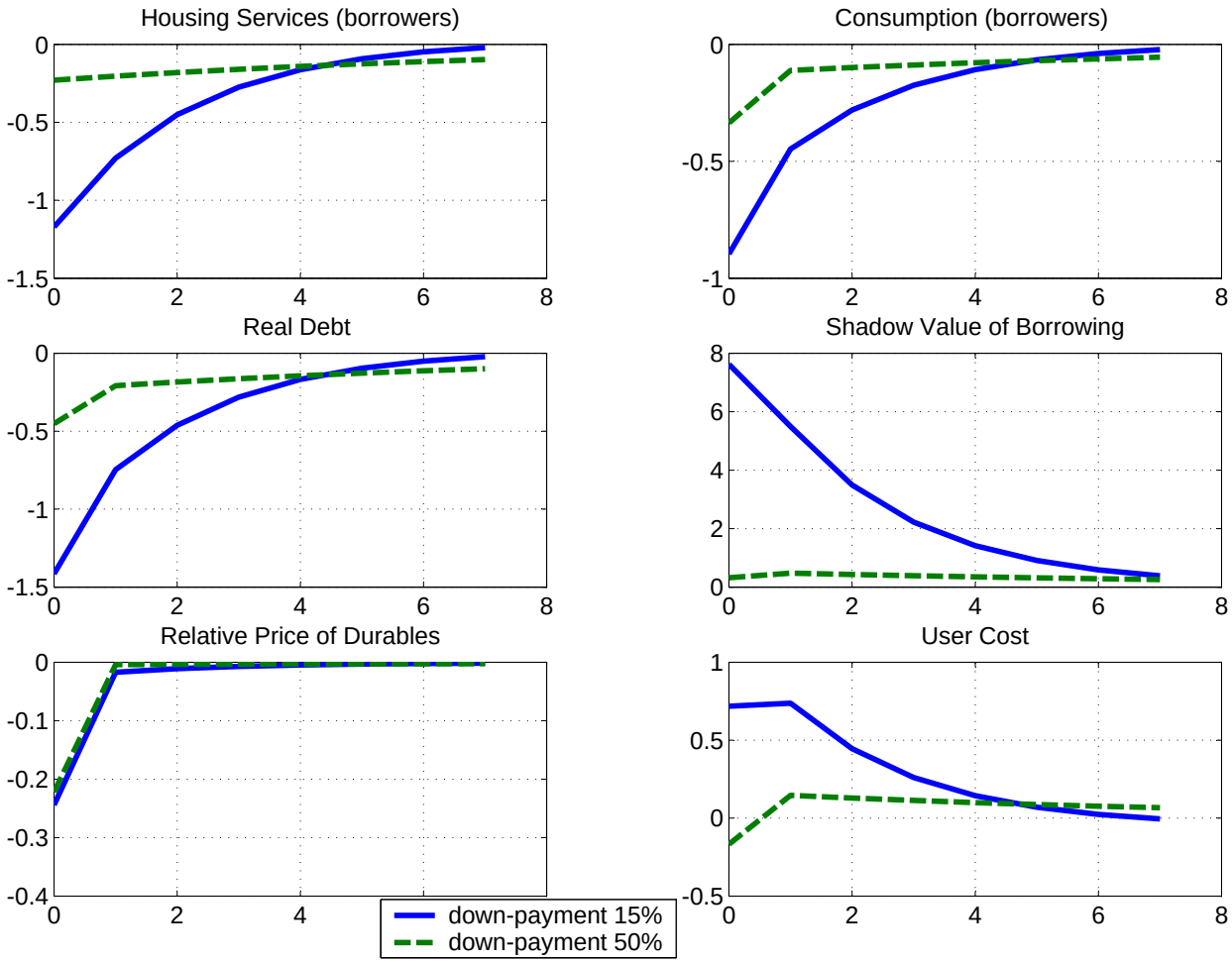
  1. Down-payment ratio (χ)

  2. Mortgage repayment rate (ξ)

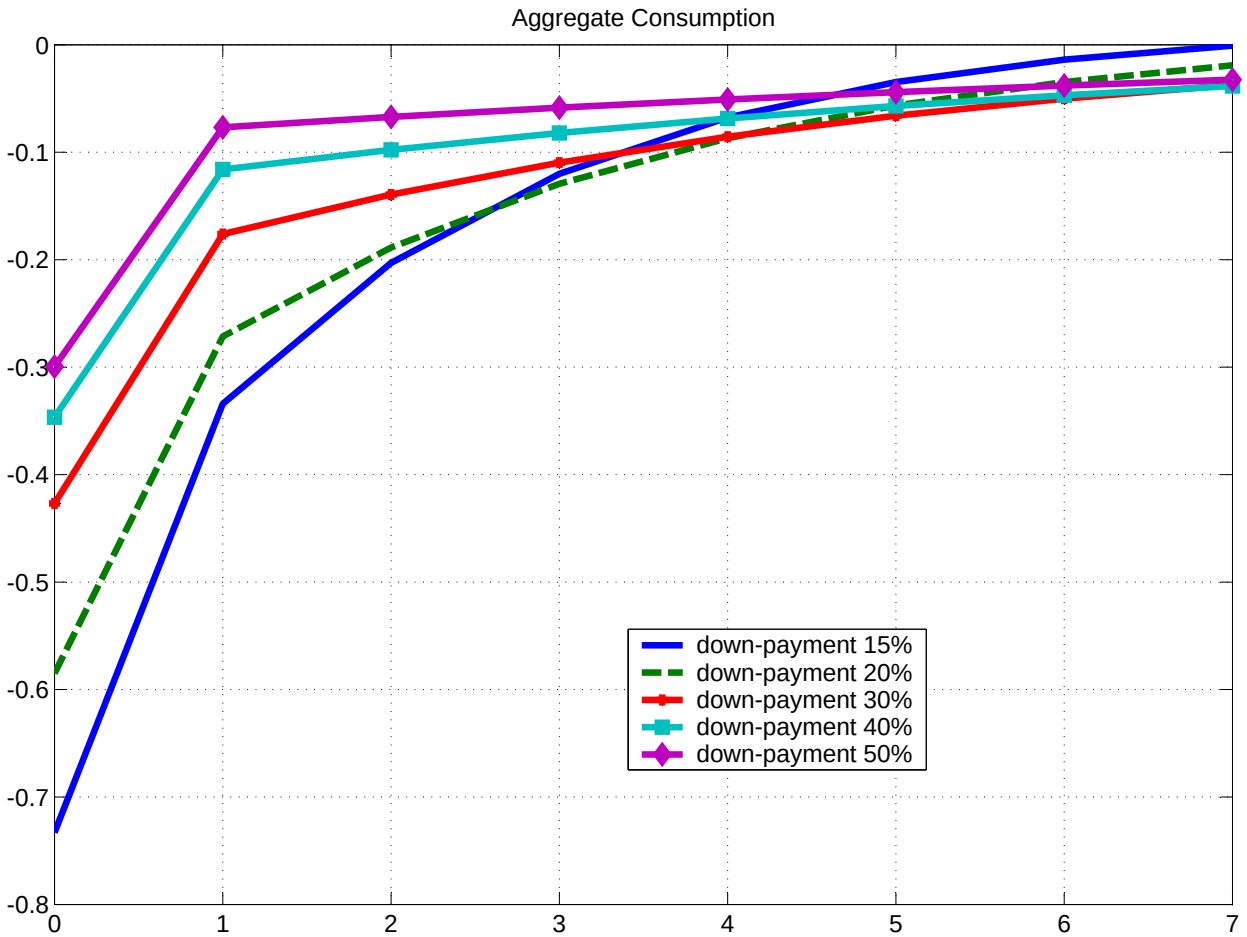
  3. Interest-rate adjustment (τ)

- Also under different degrees of consumption price stickiness

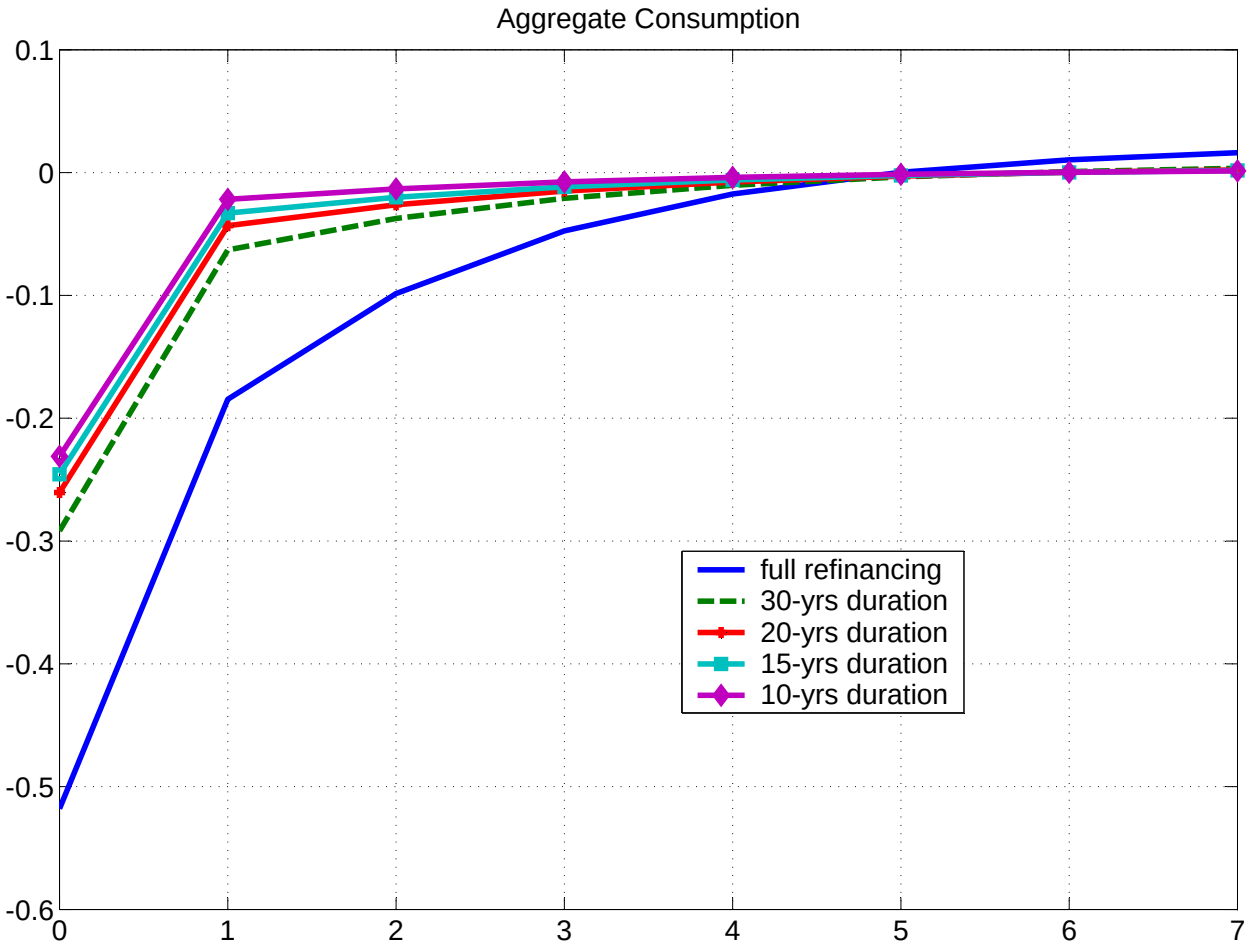
Responses to a monetary policy tightening



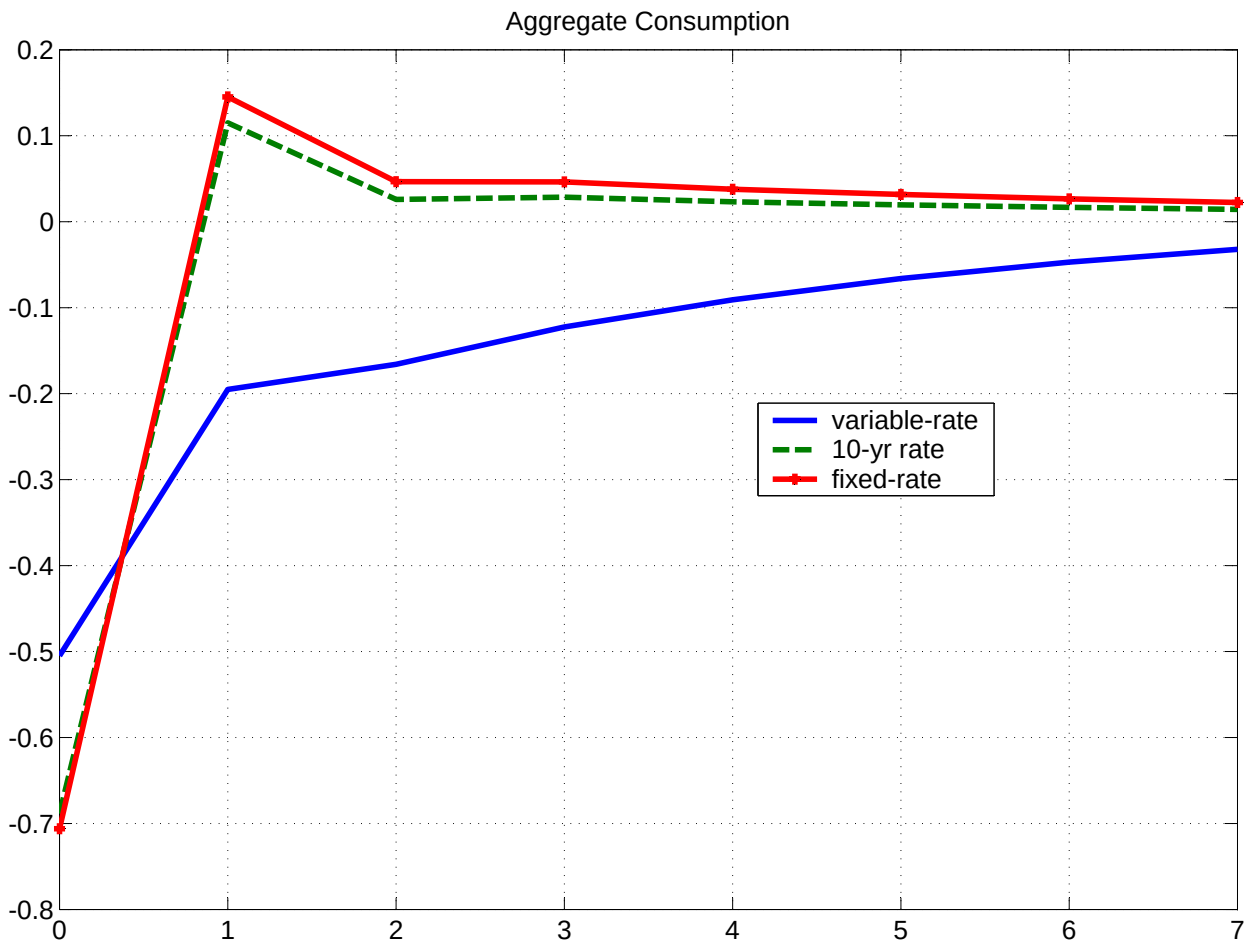
Consumption response to i.i.d. MP shock: Varying values of χ



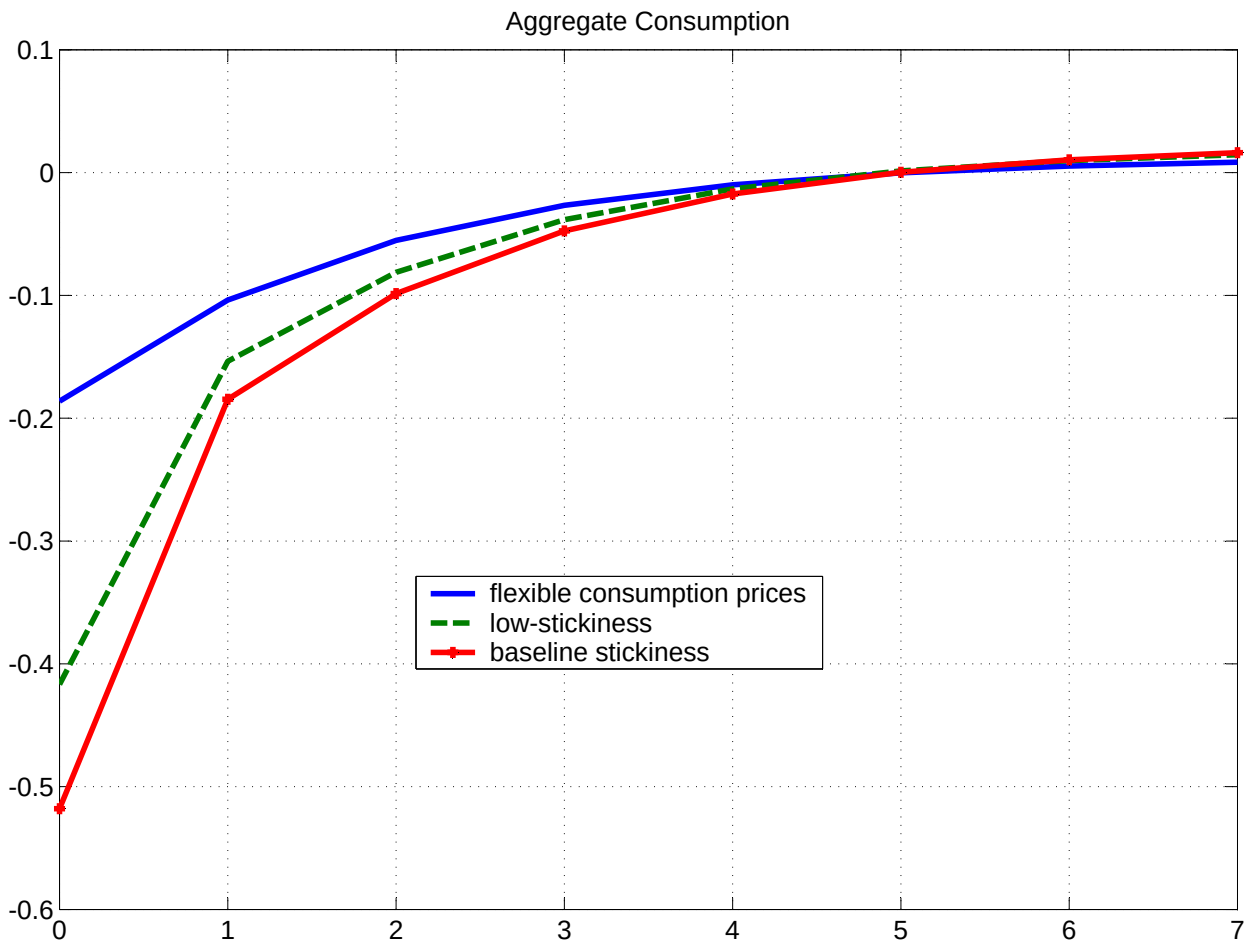
Consumption response to i.i.d. MP shock: Varying values of ξ



Consumption response to i.i.d. MP shock: Varying values of τ



Consumption response to i.i.d. MP shock: Varying values of ϑ_c



Conclusions

- Role of **institutional** characteristics of mortgage markets for monetary policy transmission

- Provided evidence of **three** facts:
  - significant cross-country heterogeneity in the structure of mortgage markets
  - over the business cycle, the correlation between consumption and house prices increases with the degree of flexibility/development of mortgage markets
  - the transmission of monetary policy shocks on consumption and house prices is stronger in countries with more flexible/developed mortgage markets

Conclusions (ctd.)

- New Keynesian model of monetary transmission with non-standard features (two sectors, heterogeneous consumers and collateral constraint)

- Can rationalise the apparent puzzle that consumption is more responsive to monetary policy shocks in economies with more developed mortgage markets.

The End

Baseline calibration

Parameter		Value
Households		
ω	Share borrowers	0.6
β	Discount factor borrowers	0.96
γ	Discount factor savers	0.99
α	Share housing in consumption spending	0.16
η	Elasticity substitution between housing and non-durables	
φ	Inverse elasticity of labour supply	
N	Steady state labour supply	0.3
Firms		
ε_j	Sectoral elasticity substitution between varieties	7.5
ϑ_d	Nominal price rigidity durables	0
ϑ_c	Nominal price rigidity non-durables	76
Mortgage contracts		
δ	Physical depreciation rate	0.0025
ξ	Mortgage repayment rate	0.0025
χ	Down-payment rate	0.30
τ	Interest rate adjustment	0
Monetary Policy		
ϕ_r	Degree interest rate smoothing	

Facts (3): Many **borrowers**, few wealthy **savers** (source SCF 2004, Campbell and Hercowitz, 2006)

United States	
Share of **mortgage debt** over total h.h debt	80%
Share of mtg. debt owned by **10-90th** percentile	80%
Share of **financial assets** owned by percentile $\geq 90th$	73%

Calibration

- **Down-payment** rate $\chi = 0.3$ (euro-area average)

- **Repayment** rate $\xi = \delta$ (baseline case, full mortgage refinancing)

$\longrightarrow$Average duration of mortgage contracts in euro area ranges between 15 and 30 years:

Mortgage duration	*Quarterly repayment rate* ξ
30 yrs	0.0083
20 yrs	0.0125
15 yrs	0.0166
10 yrs	0.025