# International Recessions

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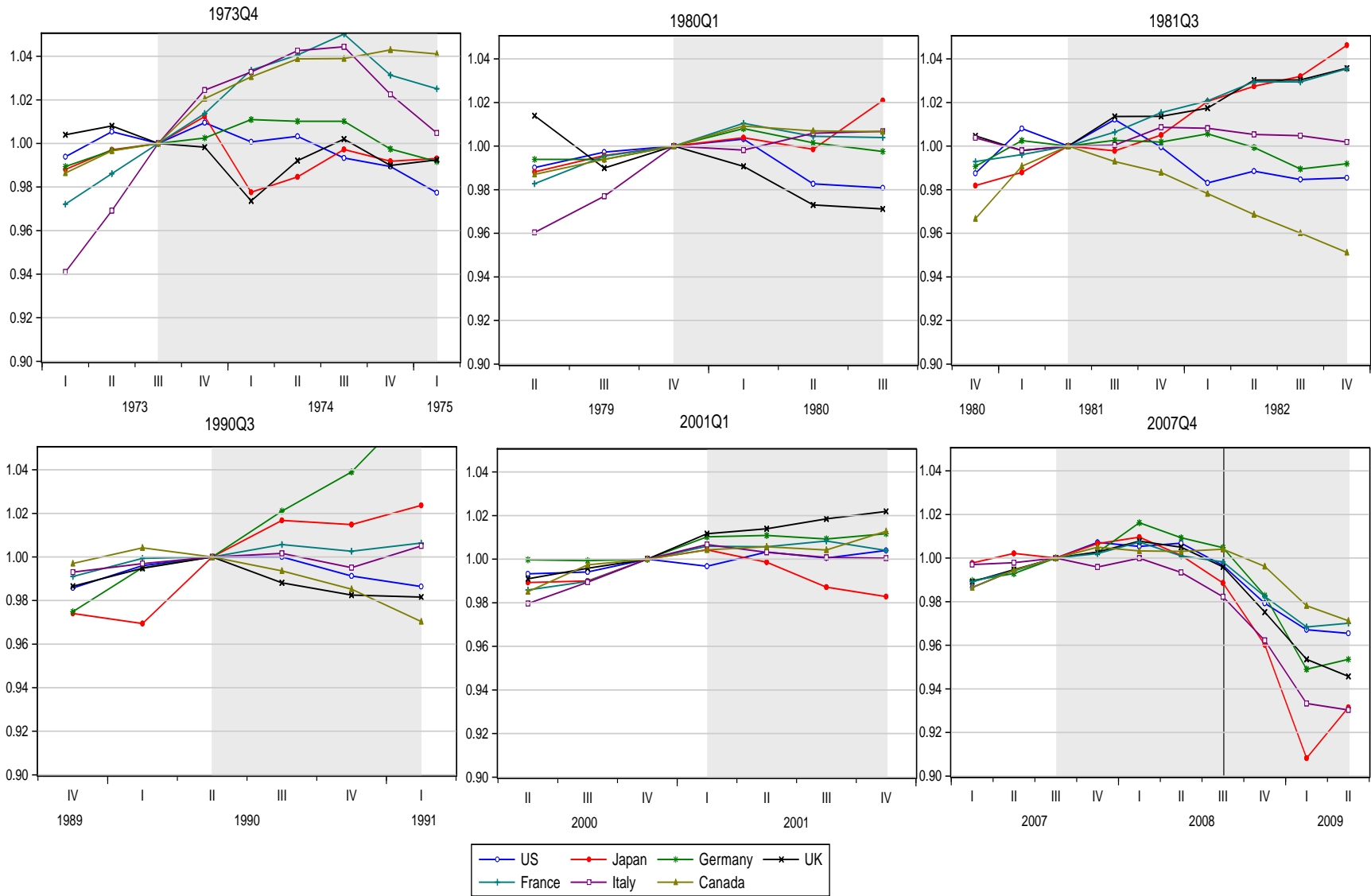
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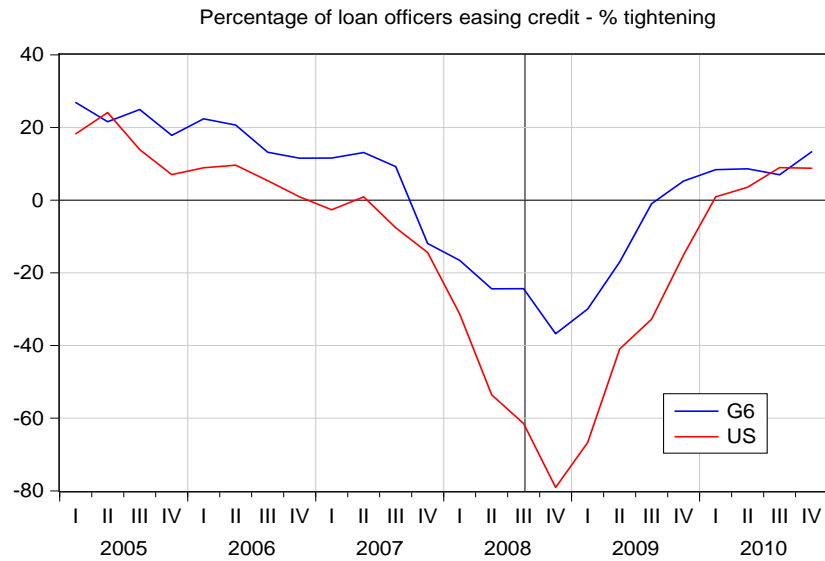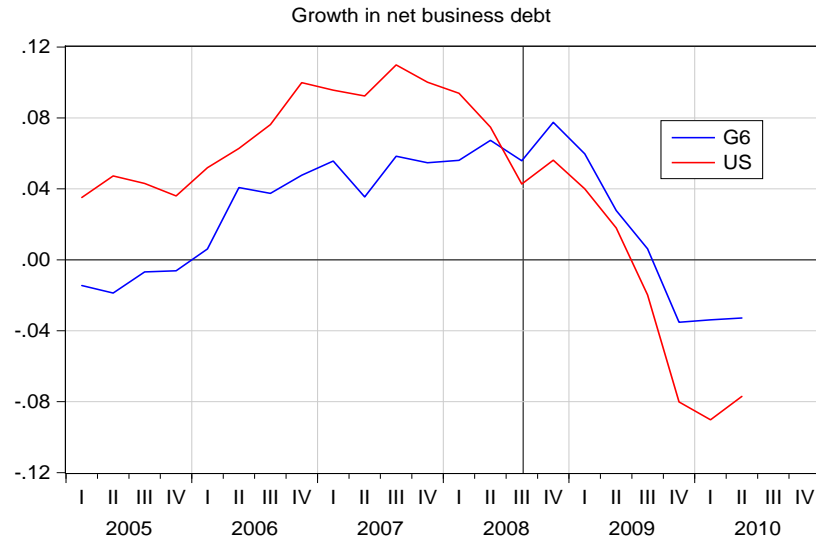# Feature of the 2007-2008 crisis

High degree of <span style="color:red">real</span> and <span style="color:red">financial</span> co-movement in industrialized countries.

# GDP DURING RECESSIONS



### 1973Q4

### 1980Q1

### 1981Q3

### 1990Q3

### 2001Q1

### 2007Q4

Legend: US, Japan, Germany, UK, France, Italy, Canada

# FINANCIAL CO-MOVEMENT

Growth in net business debt



Percentage of loan officers easing credit - % tightening

# WHAT DOES EXPLAIN CO-MOVEMENT?

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2. Country-specific shocks propagate to other countries (spillover).

3. Our proposal: propagation mechanism that makes shocks correlated.

# WHAT DO WE DO?

We propose a two-country model where

- Credit expansions and contractions are generated by self-fulfilling expectations (multiple equilibria).

- Multiple equilibria arise because of occasionally binding constraints.

- Credit contractions generate sharp recessions while the macroeconomic impact of credit expansions is more gradual (asymmetry).

- Recessions are more severe after long periods of credit and macroeconomic expansions (history dependence).

- The model generates large movements in asset prices.

# MODEL WITH SEGMENTED MARKETS

- Two types of agents (sectors):

  - Investors: They are the shareholders of firms and consume dividends.

  $$\max E \sum_{t=0}^{\infty} \beta^t u(d_t)$$

  - Workers: Supply labor and lend funds to firms with bonds.

  $$\max E \sum_{t=0}^{\infty} \delta^t U(c_t, h_t)$$

- Different discount factors: $\beta < \delta$.

# FIRMS

- There is unit mass of firms owned by investors.

- 'Concave' production function $F(\bar{k}, h_t)$. Fixed capital for the moment.

- Budget constraint: $\quad b_t + d_t = \frac{b_{t+1}}{R_t} + F(h_t) - w_t h_t$.

- Discount factor: $\quad m_{t+1} = \frac{\beta u_c(d_{t+1})}{u_c(d_t)}$.

- Also borrow intra-temporally for working capital $l_t = F(h_t)$.

- Limited enforcement: $\quad \xi_t \cdot \bar{k} \geq \frac{b_{t+1}}{R_t} + l_t$

# RECURSIVE PROBLEM FOR THE FIRM

$$V(\mathbf{s};b) \quad = \quad \max_{d,h,b'} \left\{ d + Em'V(\mathbf{s}';b') \right\}$$

subject to:

$$b + d = \frac{b'}{R} + F(h) - wh$$

$$\xi \cdot \bar{k} \geq \frac{b'}{R} + F(h)$$

# First order conditions

$$F_h(h) = w \cdot \left( \frac{1}{1 - \color{red}{\mu}} \right)$$

$$REm' = 1 - \color{red}{\mu}$$

$\color{red}{\mu}$ $\qquad \Rightarrow \qquad$ Multiplier for the enforcement constraint.

Positive if binding.

# OPEN ECONOMY

- Two symmetric countries.

- Households borrow and lend internationally. They own domestic bonds, $b_t$, and foreign bonds, $n_t$.

- Investors are allowed to hold shares of domestic and foreign firms. The implication is full diversification.

# OPEN ECONOMY

- Because of investors' diversification, the common discount factor is:

$$m_{t+1} = \frac{\beta u_c(d^1_{t+1} + d^2_{t+1})}{u_c(d^1_t + d^2_t)}$$

- Back to first order conditions of firms:

$$F_h(h^1) = w^1 \cdot \left(\frac{1}{1 - \mu^1}\right) \qquad\qquad F_h(h^2) = w^2 \cdot \left(\frac{1}{1 - \mu^2}\right)$$

$$REm' = 1 - \mu^1 \qquad\qquad\qquad REm' = 1 - \mu^2$$

# PROPERTY WITH EXOGENOUS $\xi_t$

**Proposition.**   *An unexpected change in $\xi_t$ (domestic credit shock) has the same impact on employment and output of domestic and foreign countries.*

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## HOWEVER

Unless shocks are internationally correlated, the model does not generate co-movement in financial flows.

# ENDOGENOUS $\xi_t$

- The enforcement constraint is occasionally binding,

$$\xi_t \cdot \bar{k} \geq \frac{b_{t+1}}{R_t} + F(h_t)$$

- Capital can be sold to households at price $\xi_t = \underline{\xi}$.

- Alternatively, capital can be sold to firms at price $\xi_t = \bar{\xi}$.

- However, firms can make the purchase only if they have liquidity.

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- However, firms can make the purchase only if they have liquidity.

- Multiple equilibria:

  - If the market expects $\xi_t = \bar{\xi}$, firms will not borrow up to the limit and the ex-post price of the liquidated capital is $\xi_t = \bar{\xi}$.
  - If the market expects $\xi_t = \underline{\xi}$, firms will borrow up to the limit and the ex-post price of the liquidated capital is $\xi_t = \underline{\xi}$.

# PROPERTY WITH ENDOGENOUS $\xi_t$

**Proposition.** *A credit contraction in the domestic country (decline in $\xi_t$) is always associated with a credit contraction in the foreign country (decline in $\xi_t^*$). Thus, both countries experience the same responses in macroeconomic and financial variables.*

# Result 1: Asymmetry

**<span style="color:blue">Credit contractions have larger macroeconomic and asset price effects than expansions</span>**
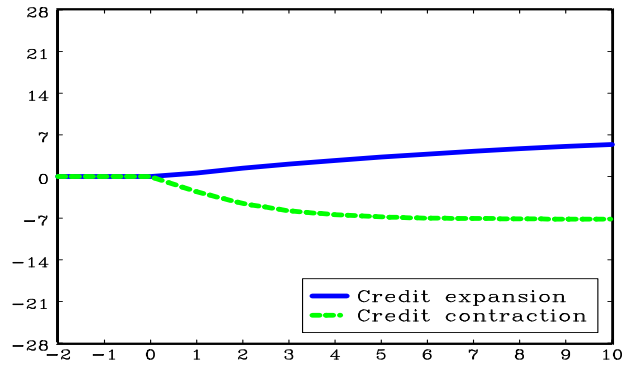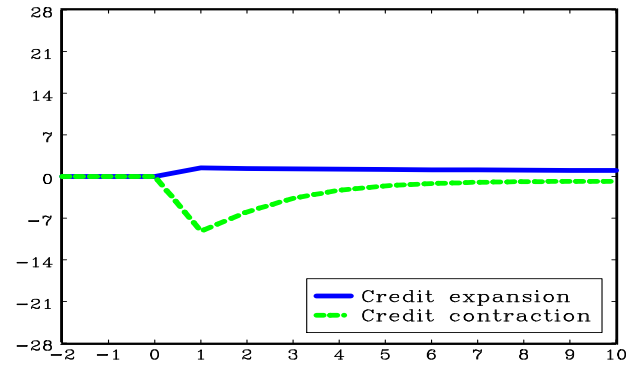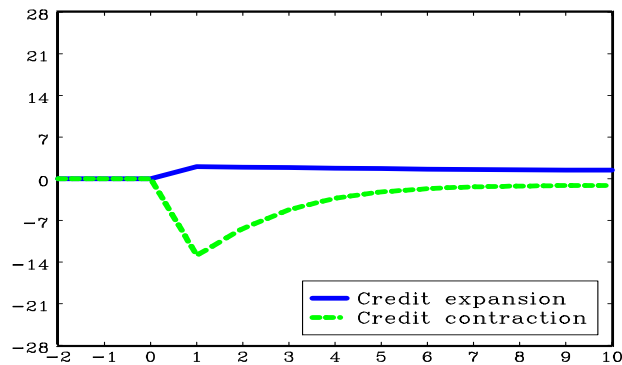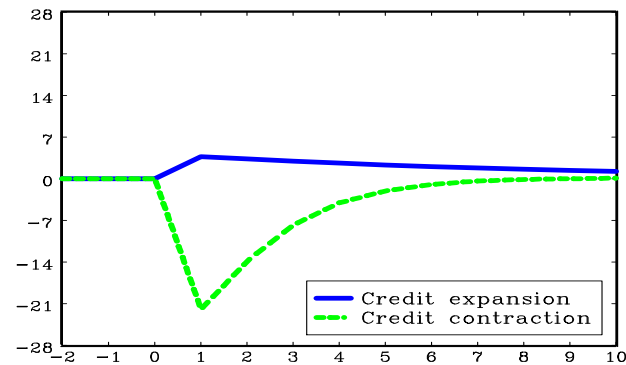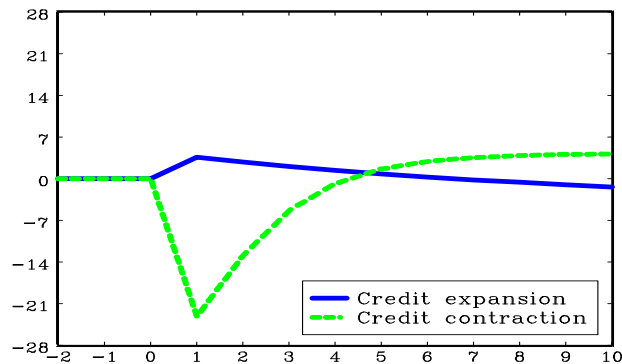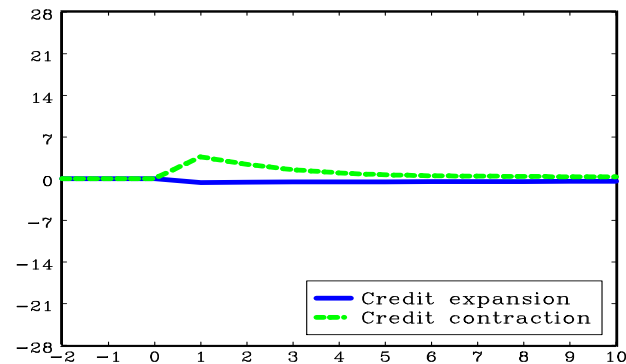
# Result 2: Recessions led by credit booms

**The severity of crises increases with the duration of the credit expansion**

Debt (4 quarters expansion)     Debt (20 quarters exapansion)
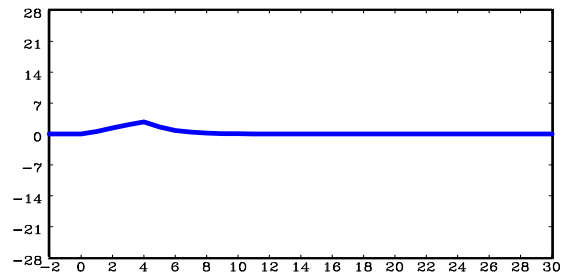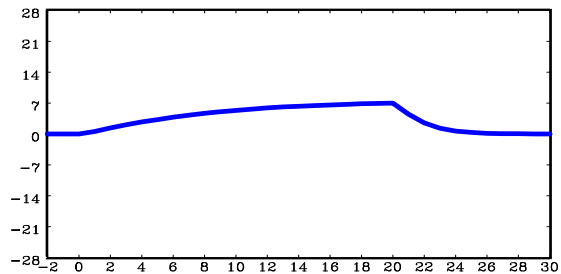
Labor (4 quarters expansion)     Labor (20 quarters expansion)
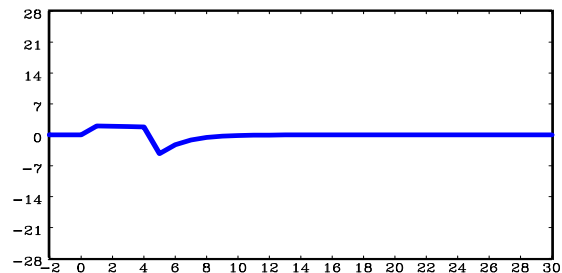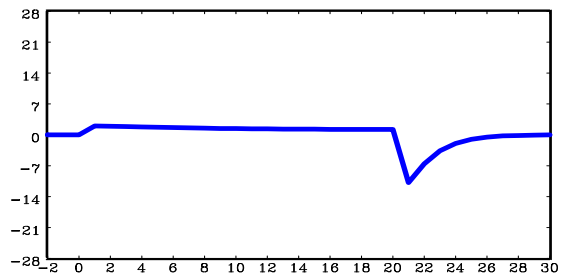
Investment (4 quarters expansion)     Investment (20 quarters expansion)
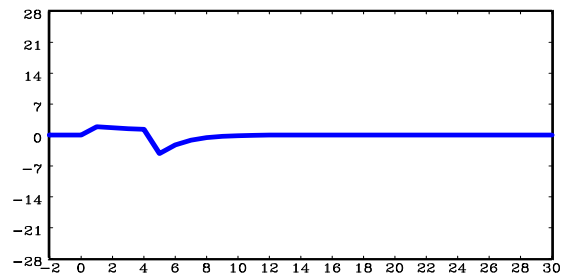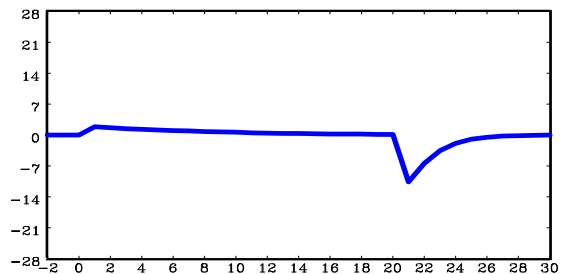
Stock market (4 quarters expansion)     Stock market (20 quarters expansion)
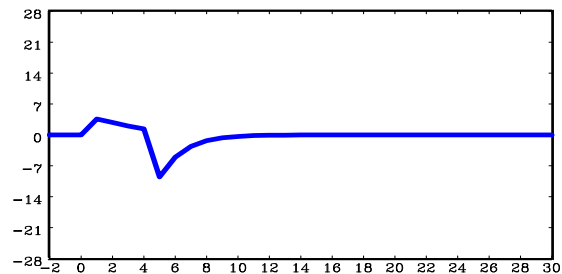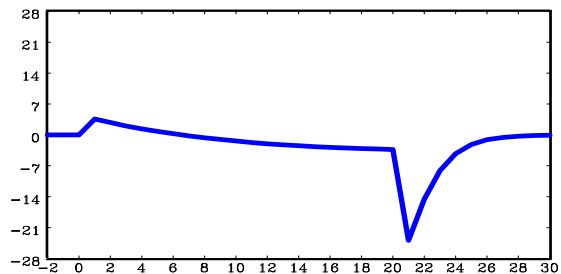
# Result 3: Employment and asset price volatility

**Credit shocks generate large fluctuations in employment and asset prices**

# Business cycle statistics

| | Credit shocks only | Productivity shocks only | Both shocks |
|---|---|---|---|
| | *Standard deviations* | | |
| Output | 0.88 | 0.76 | 1.16 |
| Consumption | 0.68 | 0.44 | 0.77 |
| Labor | 1.26 | 0.26 | 1.26 |
| Investment | 2.27 | 0.77 | 2.36 |
| Tobin's q | 1.14 | 0.38 | 1.18 |
| Stock market value | 2.46 | 0.54 | 2.45 |
| Interest rate | 0.48 | 0.25 | 0.48 |
| Return on equity | 5.82 | 0.37 | 5.82 |
| | *Expected returns (% annualized)* | | |
| Interest rate | 1.40 | 1.56 | 1.40 |
| Return on equity | 6.96 | 5.62 | 6.96 |
| Equity risk premium | 1.56 | 0.06 | 1.56 |
| Nonbinding constraints, % | 96.44 | 99.99 | 96.04 |

HETEROGENEOUS DYNAMICS OF LABOR
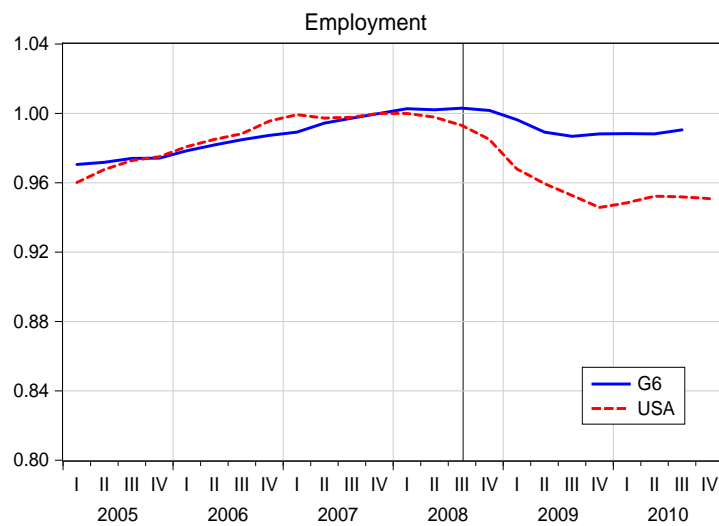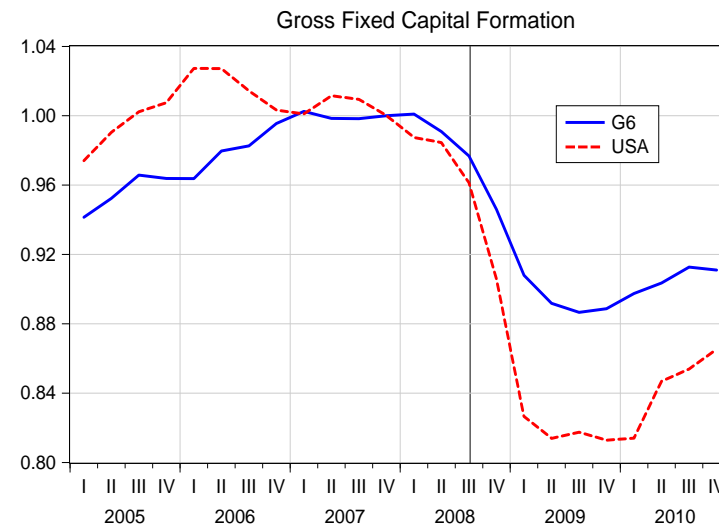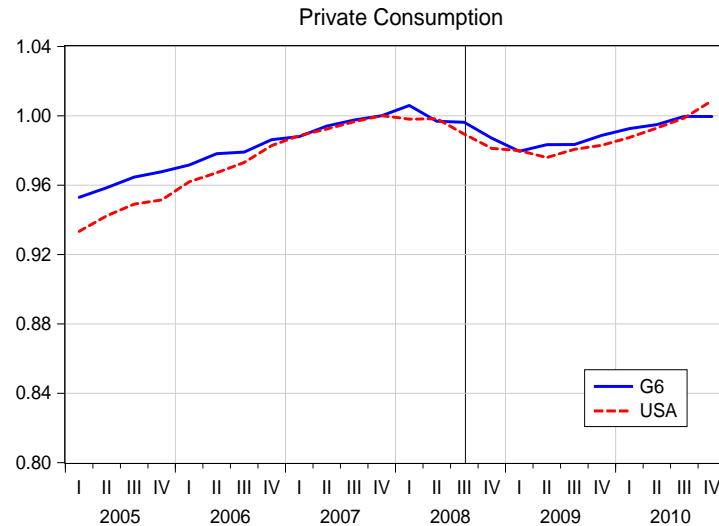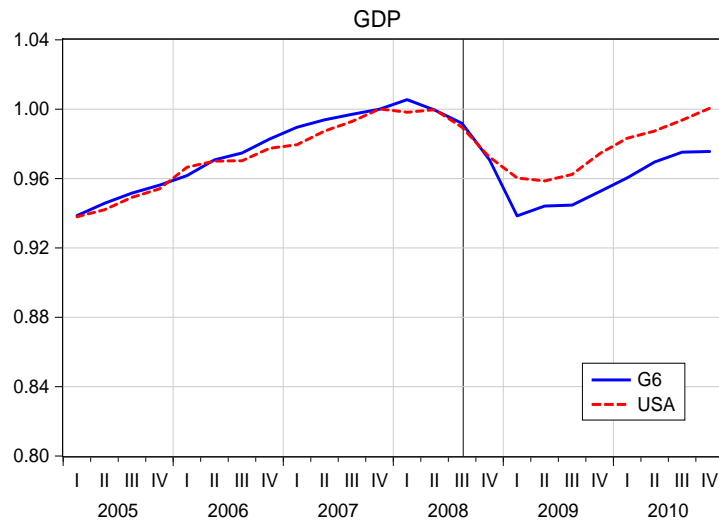
# Result 4: Heterogeneous responses of labor

**Heterogeneous response of employment but similar responses of financial variables and other real variables**
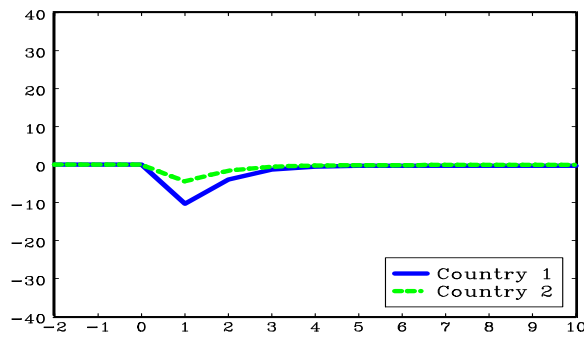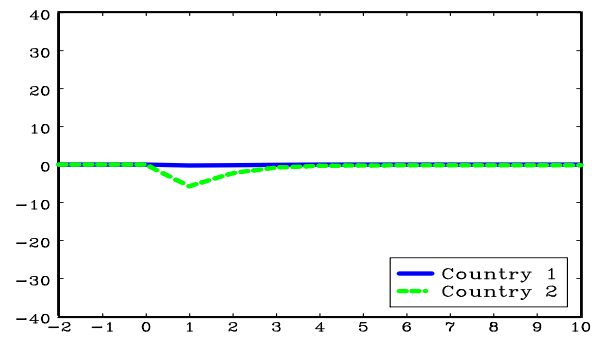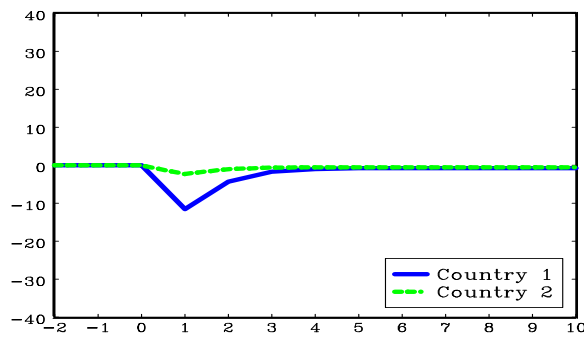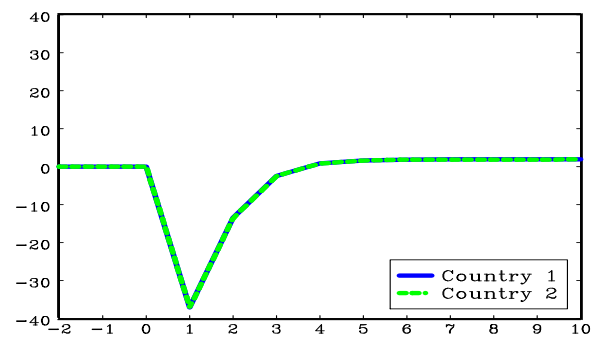
# CONCLUSION
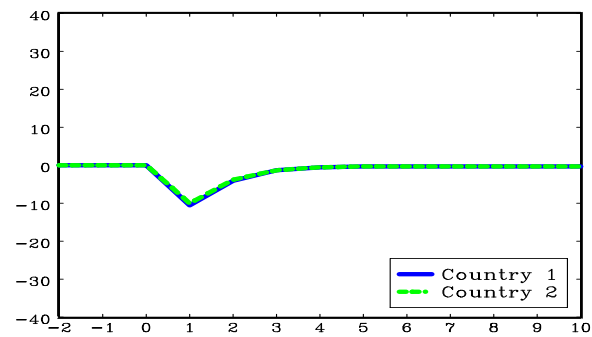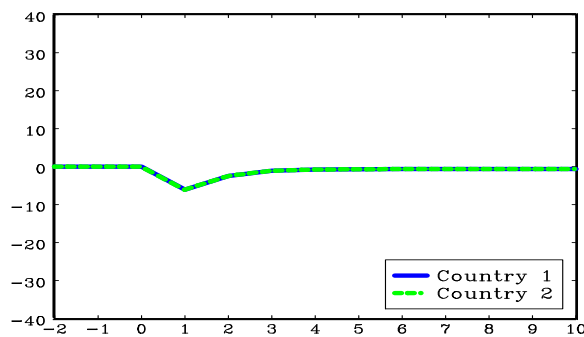
- At a broad level a model with <span style="color:red">endogenous</span> credit shocks and <span style="color:red">financial integration</span> helps understanding the recent macroeconomic development:

  1. <span style="color:blue">Non-productivity driven recessions</span>,
  2. <span style="color:blue">High international correlation in real and financial variables</span>.

- The next step is to ask whether policies can do something about them?