GLOBAL BANKING AND INTERNATIONAL BUSINESS CYCLES

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Financial Crisis:

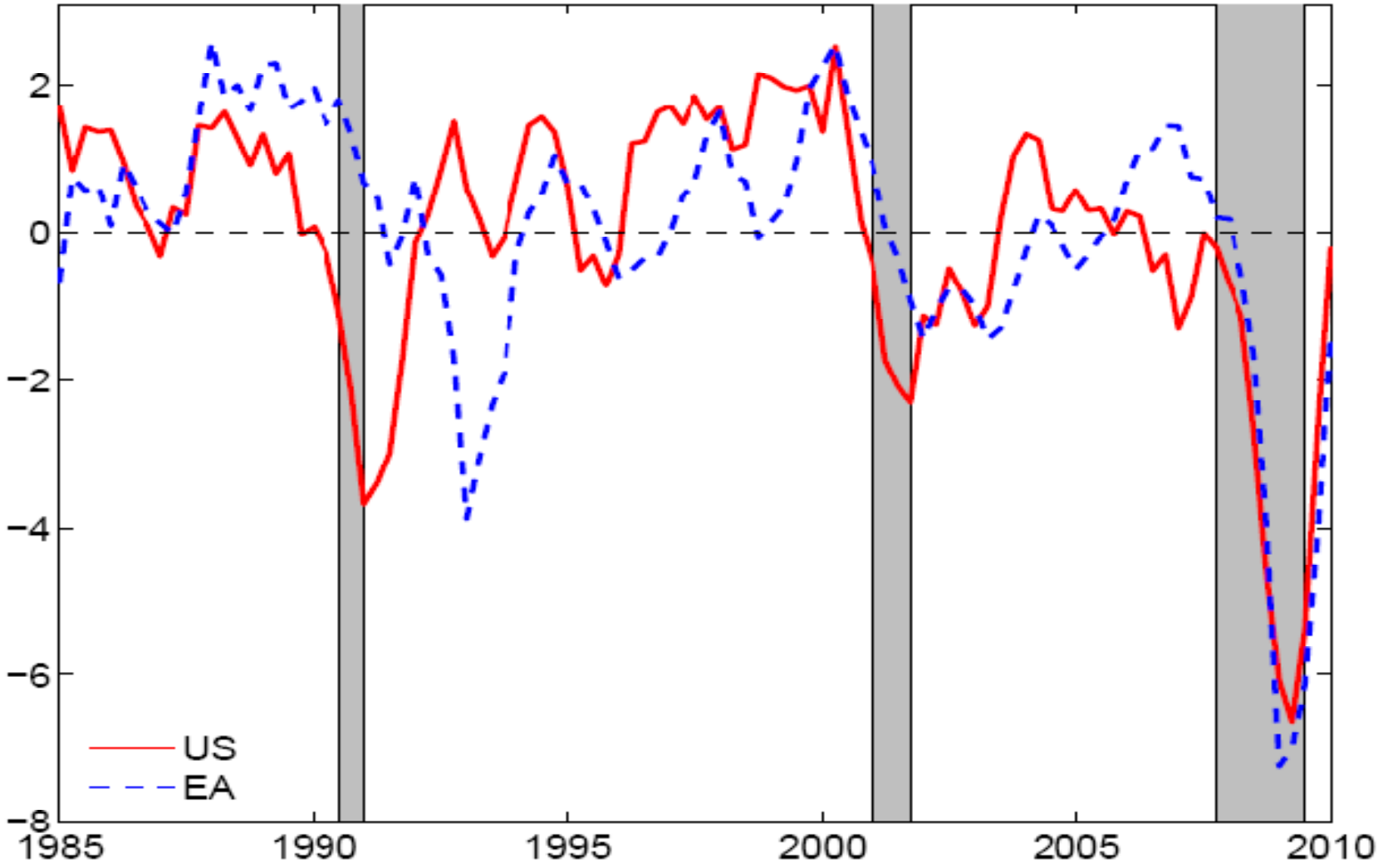
Local origin: credit losses in US mortgage mkt

But global effect: simultaneous GDP decline in US, EA (Euro Area)

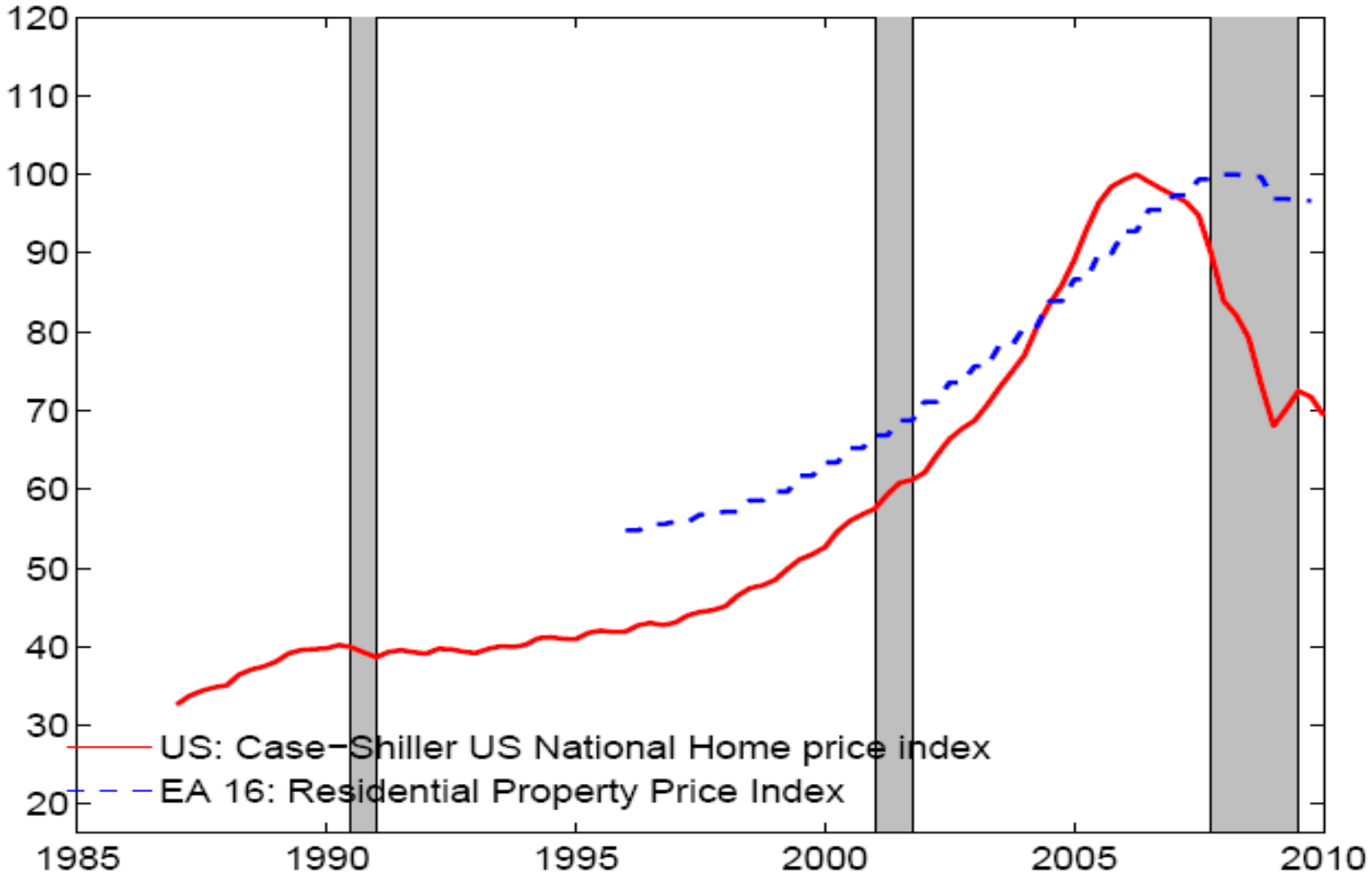
Different from typical cycle:

Typically US GDP leads EA GDP

Output growth (deviation from average rates, yoy)



House prices



Can country-specific shock trigger global output collapse ?

Standard international business cycle models predict little international co-movement

We explore role of BANKS for international transmission

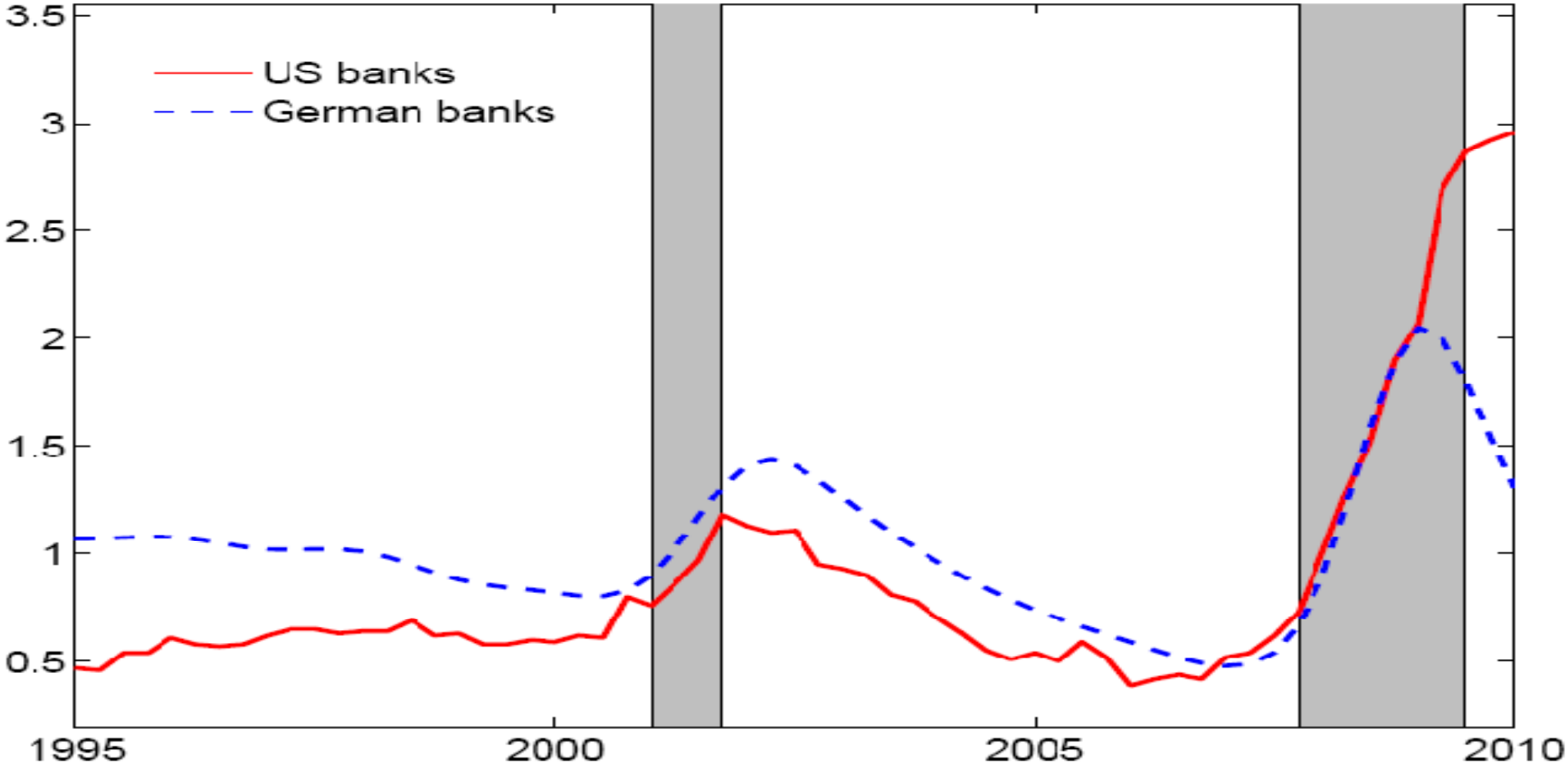
- capital requirement/balance sheet constraint
- international spillovers of a local credit loss

$\Rightarrow$ capital of global banks $\downarrow$

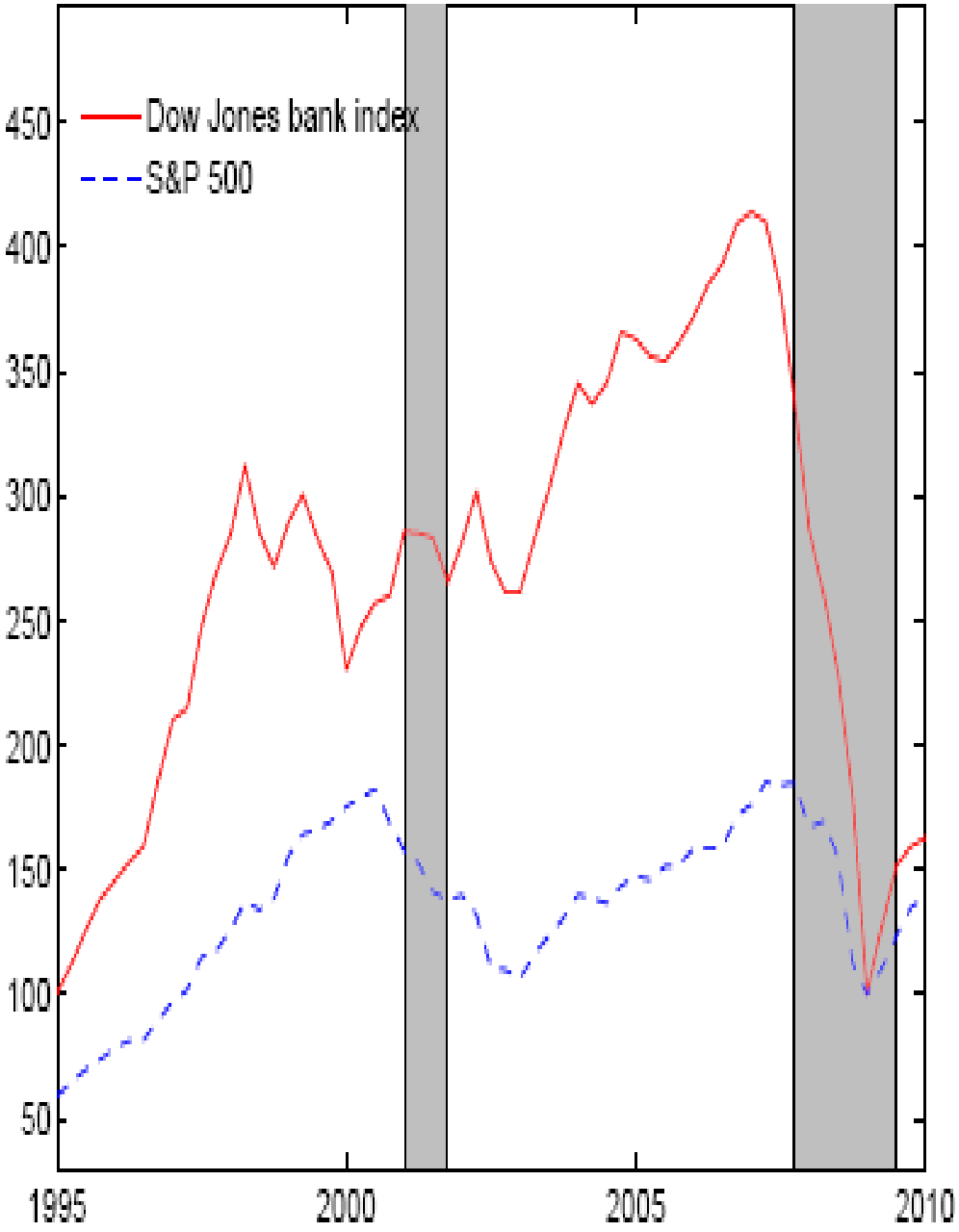
credit spreads globally $\uparrow$

home & foreign lending, GDP, Investment $\downarrow$

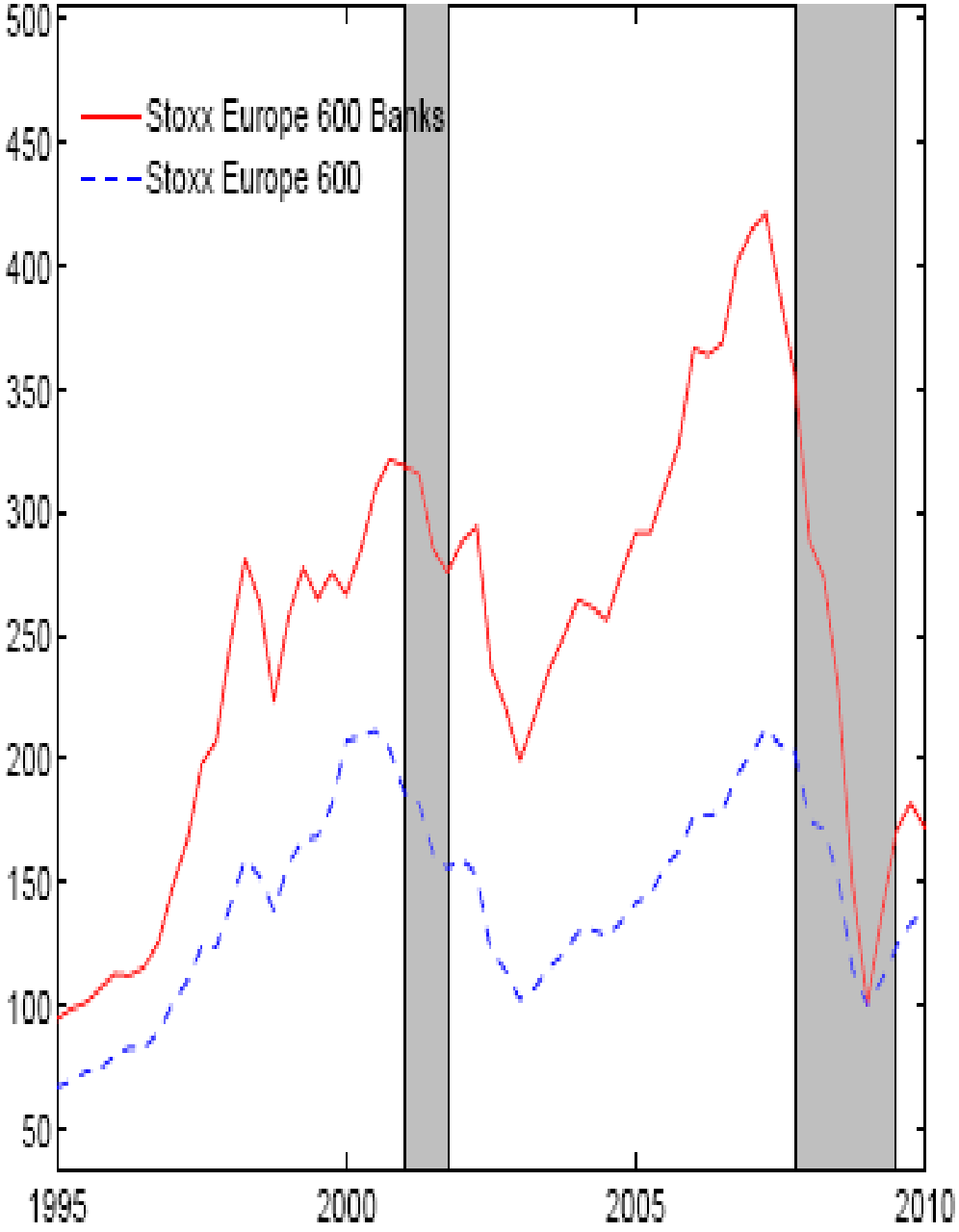
Loan losses



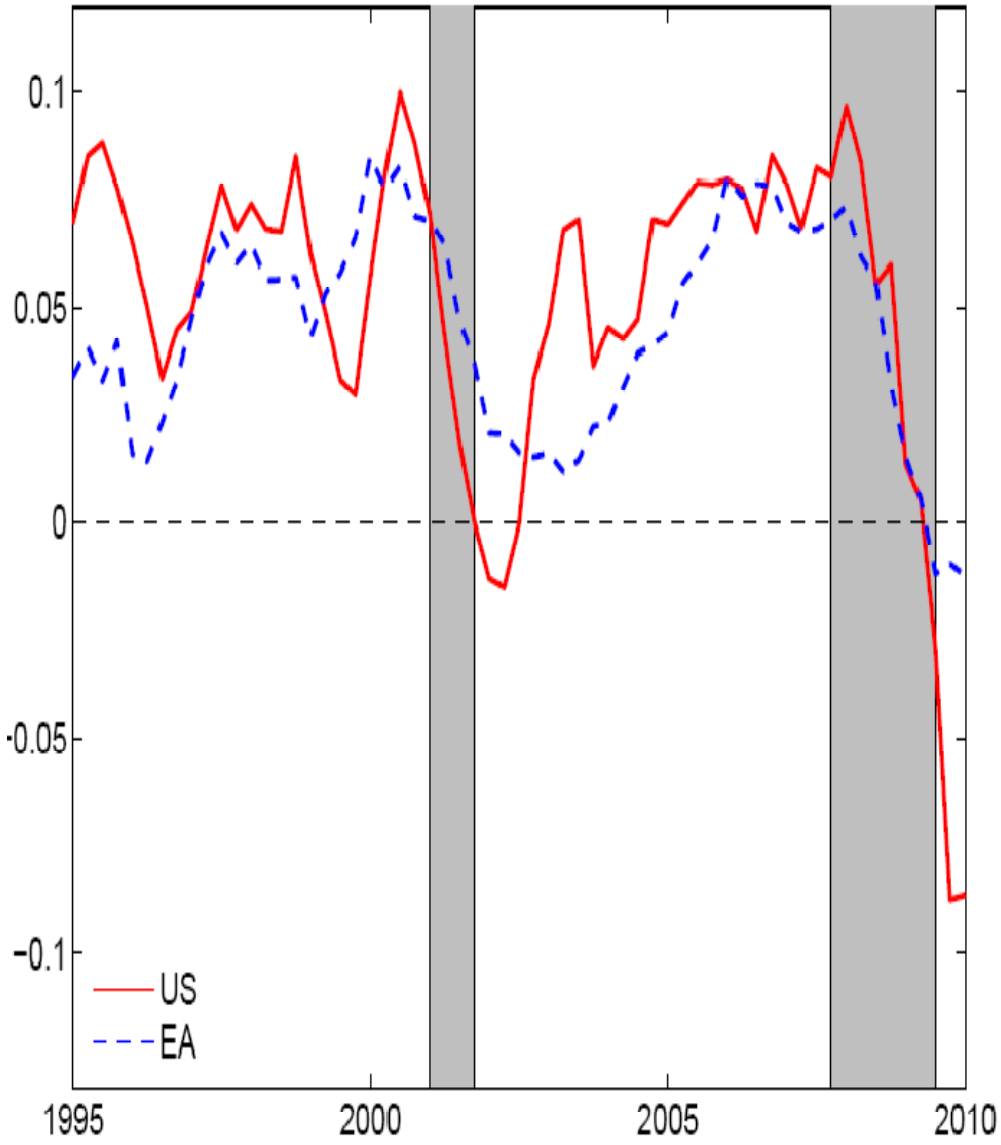
US stock market



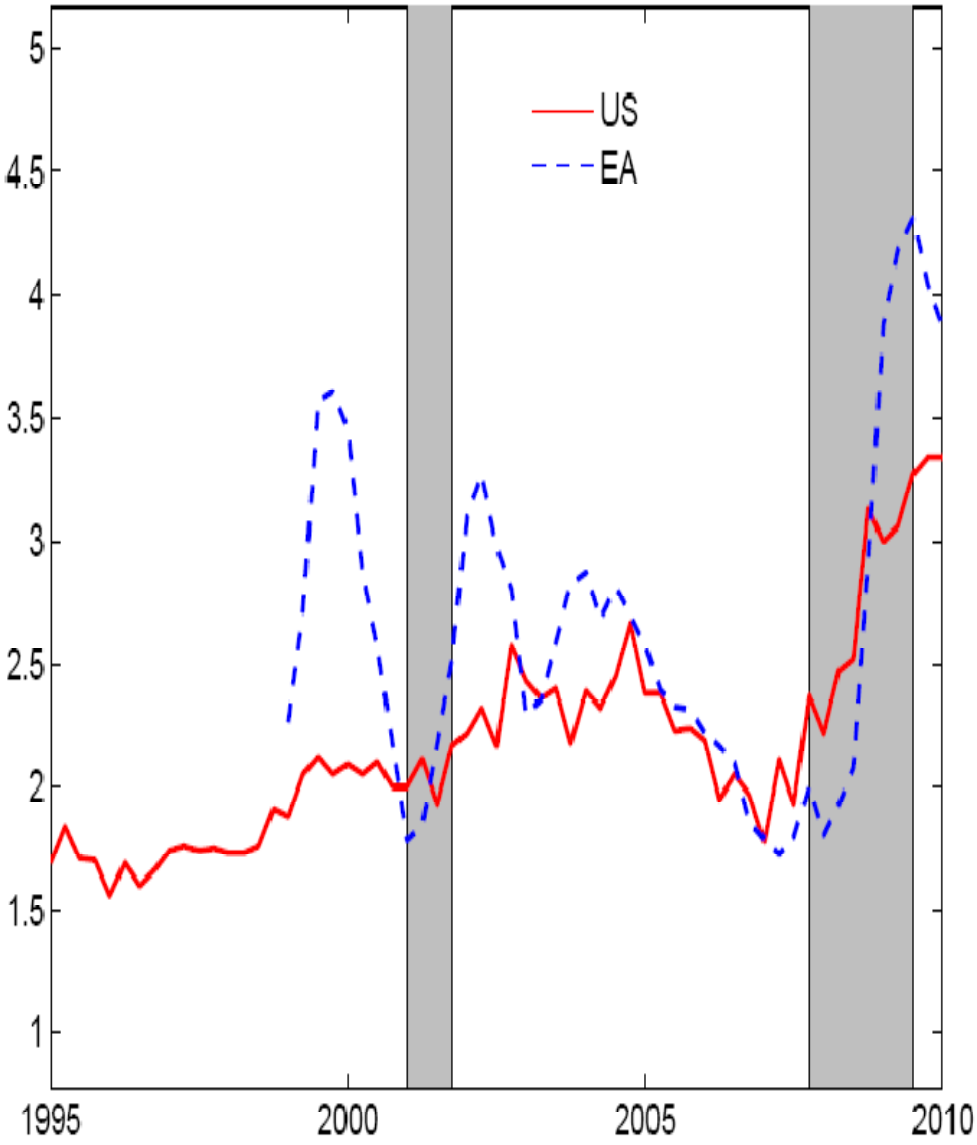
EA stock market



Loan growth



Interest rate spreads



What we do

Model

- Two-country (Home, Foreign), one-good world
- Global bank:
  - deposits from H,F households,
  - makes loans to H,F entrepreneurs
  - Capital requirement
- TFP and loan default shocks

RESULTS:

- Bank capital requirement matters little for (international) transmission of productivity shocks
- Loan losses matter little for business cycles in normal times
- An exceptionally large loan loss can trigger a large and simultaneous output decline in both countries

Literature:

Before financial crisis, standard DSGE models abstracted from financial frictions and financial intermediaries.

Eg CEE, Smets-Wouters

(Instead focused on nominal and real frictions in goods and labor markets.)

The crisis revealed limitations of these models

Very recent work puts banks into closed-economy DSGE models:

- Bank capital and interest rate spreads:

Goodfriend &McCallum (07), Van den Heuvel (08)

de Walque et al (10)

- Medium-scale DSGE: Meh&Moran (10), Roeger (10), Dib (10), Gerali et al (10), Iacoviello (10)

Our contribution:

Focus in international dimension of banking

Show how a country-specific loan loss triggers a global recession in presence of global bank facing capital requirement

Aggregate perspective on international banking sector—abstract from interbank market

Take bank's capital constraint as given

(don't take stand on where it is coming from: regulation/market pressure)

THE MODEL

Two symmetric countries

- Workers provide labor effort, deposit savings with bank
- Entrepreneurs hire workers, accumulate capital, borrow from banks
- Global bank: faces capital requirement,

bank partially finances loans using own funds

► Loan rate exceeds deposit rate

Interest rate spread rises when bank capital falls (marginal valuation of bank capital is higher when bank capital is low)

Homogenous good used for consumption and capital accumulation; all markets perfectly competitive

The key mechanism:

Why does a credit loss trigger recession?

Response to credit loss:

● banks seek to smooth dividend (consumption) by lowering lending (bank assets):

i.e. bank capital falls

● At lower levels of bank capital,

the marginal value of bank capital is larger

● Thus gap between equilibrium loan rate and deposit rate rises after a credit loss

● The credit loss worsens financial friction:

► less financial intermediation,

►fall in investment and output

In a multi-country world with global bank (deposits and loans in several countries):

- a credit loss in ONE country lowers capital of global bank
- this raises loan/deposit rate spread
- worldwide recession

Note: credit loss (default) is wealth transfer from bank to debtor

Bank capital requirement is crucial ingredient for this to trigger recession

Without bank capital requirement,

or without bank (direct lending from household to entrepreneur):

► When borrower defaults by 1€,

● then borrower permanently raises her consumption by r € (r: interest rate), by PIH

● creditor permanently reduces C by r €

● NO effect on output

► Bank (capital requirements) make economy MUCH more responsive to credit losses

► But: banks make dampen effect of TFP shocks.

A TFP increase raises household supply of deposits, which lowers bank capital.

Thus: increase in credit spread, which dampens rise in output

- **Home country Worker:**

$$Max \quad E_0 \sum_{t=0}^{\infty} \beta^s [u(C_t) + \Psi^d u(D_{t+1}) - N_t]$$

s.t. $$C_t + D_{t+1} = W_t N_t + D_t R_t^D$$

C : consumption,

D, R^D :deposits, gross interest rate on D

W, N : wage rate, hours

- **Home Entrepreneur:**

Max $E_0 \sum_{t=0}^{\infty} \beta^t u(d_t^E)$

s.t. $L_t R_t^L (1-\delta_t^L) + K_{t+1} + W_t N_t + d_t^E =$

$$L_{t+1} + \theta_t (K_t)^{\alpha} (N_t)^{1-\alpha} + (1-\delta) K_t$$

L_{t+1}: **1-period loan received in t**

δ_t^L**: exogenous default rate on loans (t-1 to t)**

Note: entrepreneur has SAME rate of time preference as household and is NOT credit constrained (difference from Kiyotaki-Moore).

- **Global Bank**

Global deposits and loans (end of period t)

$$D^W_{t+1} = D_{t+1} + D^*_{t+1},\ L^W_{t+1} = L_{t+1} + L^*_{t+1}$$

Could model bank capital requirement as

$$L^W_{t+1} - D^W_{t+1} \geq \gamma L^W_{t+1}$$

Inequality constraints technically difficult.

Also, seems plausible that banks can, to some extent, circumvent capital requirement,

eg by creative accounting (expensive)

Instead use 'penalty' function approach

Excess capital: $x_t \equiv L^W_{t+1} - D^W_{t+1} - \gamma L^W_{t+1}$

Bank bears convex cost $\phi(x_t)$**,**

$\phi(0)=0, \;\; \phi'(x_t)<0, \; \phi''(x_t) \geq 0$

I.e. bank suffers when $L^W_{t+1} - D^W_{t+1} - \gamma L^W_{t+1}$

is too low. NB here bank can choose

$L^W_{t+1} - D^W_{t+1} < \gamma L^W_{t+1}$**, but this is expensive**

Bank decision problem:

Max $E_0 \sum_{t=0}^{\infty} \beta^t u(d_t^B)$ **s.t.**

$$L_{t+1}^W + D_t^W R_t^D + \phi(L_{t+1}^W(1-\gamma) - D_{t+1}^W) + d_t^B =$$

$$L_t R_t^L (1-\delta_t^L) + L_t^* R_t^{L*} (1-\delta_t^{L*}) + D_{t+1}^W$$

D_{t+1}^W: **deposits (end of t)**

L_{t+1}^W: **loans (end of t)**

R_t^L: **Home loan rate (t-1 to t)**

δ_t^L: **Home default rate on loans (t-1 to t)**

First order conditions for bank:

- $R_{t+1}^{D} E_{t+1} \beta u'(d_{t+1}^{B}) / u'(d_t^{B}) = 1 + \phi_t'$;
- $R_{t+1}^{L} E_{t+1} (1 - \delta_{t+1}^{L}) \beta u'(d_{t+1}^{B}) / u'(d_t^{B}) = 1 + (1-\gamma)\phi_t'$
- $R_{t+1}^{L^*} E_{t+1} (1 - \delta_{t+1}^{L^*}) \beta u'(d_{t+1}^{B}) / u'(d_t^{B}) = 1 + (1-\gamma)\phi_t'$

Up to 1st order approximation:

$$\widetilde{R_{t+1}^{L}} \equiv R_{t+1}^{L} E_{t+1} (1 - \delta_{t+1}^{L}) = R_{t+1}^{L^*} E_{t+1} (1 - \delta_{t+1}^{L^*})$$

Effective loan rates (net of expected default) are equated across countries

$$\widetilde{R^L_{t+1}} - R^D_{t+1} \cong -\gamma\phi'(L^W_{t+1}(1-\gamma) - D^W_{t+1}) > 0$$

If loans and deposits rise by 1$, then bank capital is unaffected, but required capital rises by $\gamma$$. Thus, excess capital falls by $\gamma$$ this raises bank's cost by $-\gamma\phi'$>0

Hence $\widetilde{R^L_{t+1}} - R^D_{t+1} = -\gamma\phi' > 0$

$$\widetilde{R_{t+1}^{L}} - R_{t+1}^{D} \cong -\gamma\phi''(0) \cdot (L_{t+1}^{W}(1-\gamma) - D_{t+1}^{W})$$

When $\phi''(0)$>0, then

Lending spread $\widetilde{R_{t+1}^{L}} - R_{t+1}^{D}$ is decreasing in excess bank capital

- **anticipated default does NOT matter for real activity (is reflected in loan rate R_{t+1}^{L})**

Special case: log utility. Then:

- $d_t^B = (1-\beta)\{L_t R_t^L (1-\delta_t^L) + L_t^* R_t^{L^*} (1-\delta_t^{L^*}) - D_t^W R_t^D\}$;
- $L_{t+1}^W - D_{t+1}^W + \phi(L_{t+1}^W(1-\gamma) - D_{t+1}^W) =$

$$\beta\{L_t R_t^L (1-\delta_t^L) + L_t^* R_t^{L^*} (1-\delta_t^{L^*}) - D_t^W R_t^D\}$$

► **As R_t^L, R_t^D are predetermined, a credit loss innovations <u>lowers</u> bank (adjusted) bank capital (almost 1:1) and RAISES loan spread**

$\Rightarrow$ fall in deposits, loans, GDP, investment WORLDWIDE

► **TFP innovations do NOT affect bank Capital, but raises wages and deposits (household savings), and thus EXCESS bank capital falls, which raises loan spread**

$\Rightarrow$ **bank capital requirement dampens response of GDP to TFP shock**

Calibration

Log utility for worker & bank

Entrepreneur: almost risk neutral (CRRA=.01)

Required bank capital ratio: $\gamma = 0.05$

$\delta^L = 0.95\%$ **p.a. loan default rate**

$R^D - 1 = 1\%$ **p.a.**

$\widetilde{R^L} - 1 = 2.5\%$ **p.a.: effective loan rate**

$R^L - 1 = 3.48\%$ **p.a.: contractual loan rate**

$R^L - R^D = 2.48\%$ **p.a.: loan spread**

(This pins down ϕ')

Pin down $\phi''(0)$ by running regression (using US and EA data)

$$\widetilde{R^L_{t+1}} - R^D_{t+1} \cong -\gamma\phi''(0)\cdot(L^W_{t+1}(1-\gamma) - D^W_{t+1})$$

$\phi''(0) = 0.25/Y^W$, Y^W: **world GDP**

Implies: reduction in bank capital ratio

$(L^W_{t+1} - D^W_{t+1})/L^W_{t+1}$ **by 1 percentage point**

(eg from 5% to 4%) raises loan spread by 16 bp per annum

Micro evidence (individual banks) that individual banks with low (excess) capital charge higher loan spreads:

Hubbard, Kuttner & Palia (2002)

Santos & Winton (2009)

Log TFP, loan default rate:

Independent AR(1) processes, fitted to US, EA data 1995-2010

Estimated autocorr. 0.97

TFP innovations correlated across H&F (.82)

Default innovations correlated across H&F (.76)

TFP & default innov corr.: -0.63

Model performance

	Standard deviation	Correlation with domestic GDP	Cross-country correlation
Data 1995–2010			
GDP	1.27	1.00	0.76
Aggregate consumption	0.70	0.78	0.76
Investment	3.34	0.86	0.90
Deposits	0.80	-0.15	0.56
Loans	2.03	0.67	0.78
Interest rate spread	0.27	-0.25	0.61
Baseline model			
GDP	1.37	1.00	0.79
Aggregate consumption	0.42	0.78	0.89
Investment	3.34	0.94	0.62
Deposits	0.60	0.23	0.73
Loans	0.61	0.34	0.54
Interest rate spread	0.10	-0.62	0.77

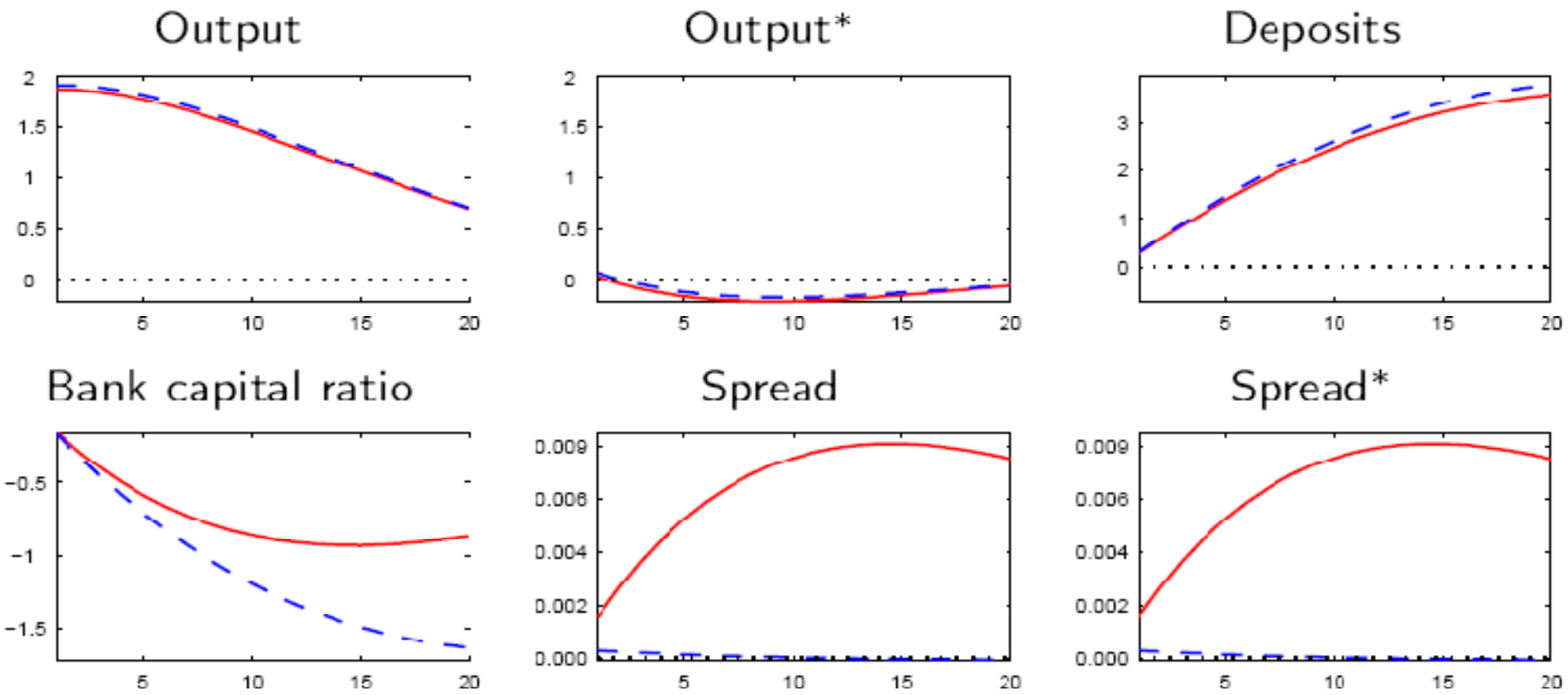
Limited effect of defaults for cyclical properties

	Standard deviation	Correlation with domestic GDP	Cross-country correlation
Baseline: all shocks			
GDP	1.37	1.00	0.79
Aggregate consumption	0.42	0.78	0.89
Investment	3.34	0.94	0.62
Deposits	0.60	0.23	0.73
Loans	0.61	0.34	0.54
Interest rate spread	0.10	-0.62	0.77
Productivity shocks only			
GDP	1.36	1.00	0.79
Aggregate consumption	0.42	0.79	0.89
Investment	3.39	0.93	0.61
Deposits	0.60	0.23	0.72
Loans	0.61	0.34	0.54
Interest rate spread	0.01	0.42	1.00

Limited effect of bank's balance sheet constraint

	Standard deviation	Correlation with domestic GDP	Cross-country correlation
Baseline			
GDP	1.37	1.00	0.79
Aggregate consumption	0.42	0.78	0.89
Investment	3.34	0.94	0.62
Deposits	0.60	0.23	0.73
Loans	0.61	0.34	0.54
Interest rate spread	0.10	-0.62	0.77
$\phi'' = 0$			
GDP	1.41	1.00	0.81
Aggregate consumption	0.42	0.78	0.89
Investment	3.34	0.94	0.64
Deposits	0.63	0.21	0.77
Loans	0.63	0.32	0.60
Interest rate spread	0.10	0.62	0.75

Effect of TFP shock: baseline (solid) vs $\phi'' = 0$ (dashed)



Bank capital had to absorb large loss during crisis

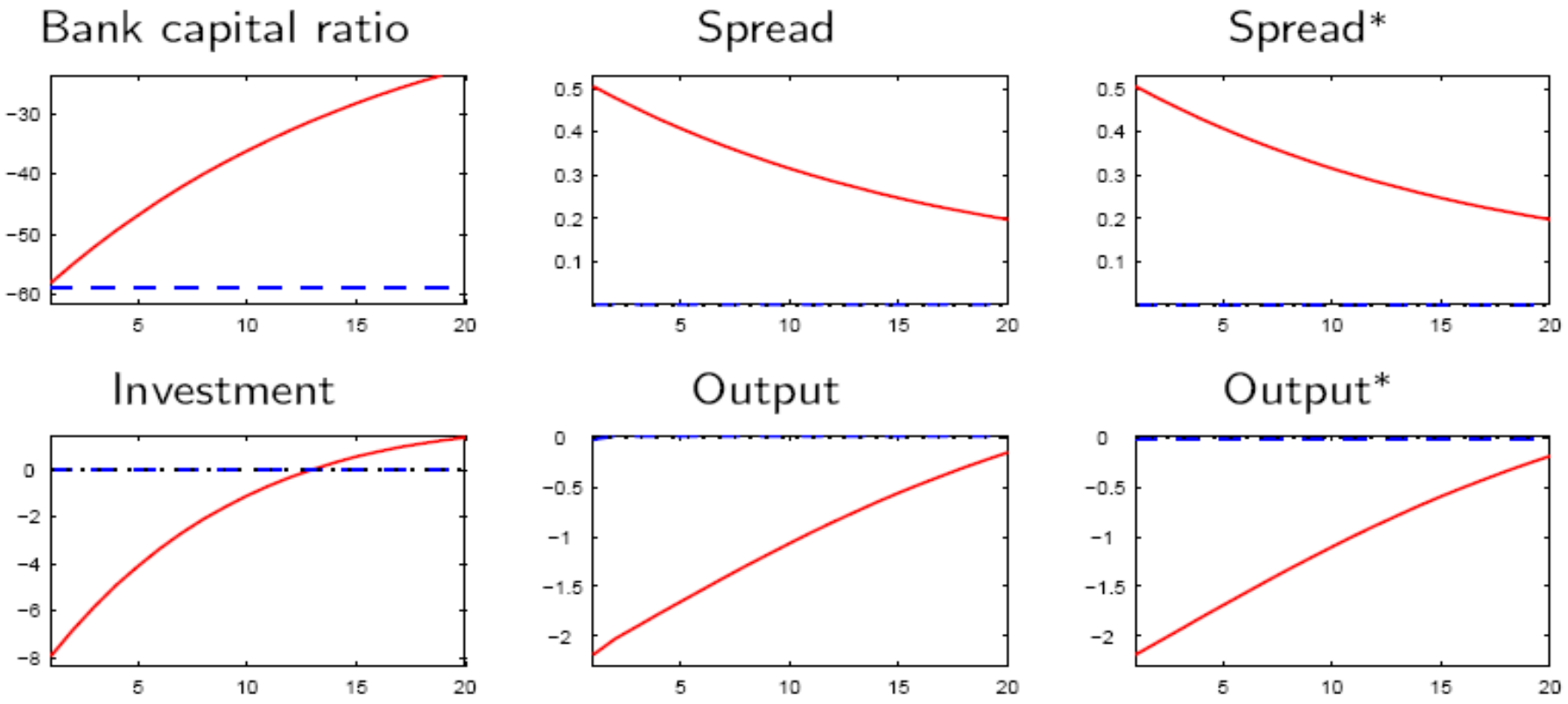
Estimates by GFSR (IMF, April 2010)

- Total losses due to loans and securities to be absorbed by banks 2007–2010: 2300 billions USD
- US banks' losses due to loans: 588 billions (90 percent on domestic loans)
- EA banks' losses due to loans: 440 billions (40 percent on domestic loans)

We assume default shock in Home equal to 5% of GDP

Pure transfer $\Rightarrow$ balance sheet constraint crucial

Effect of default shock: baseline (solid) vs $\phi'' = 0$ (dashed)



Conclusion

Exceptionally large loss of bank capital has sizeable effect on activity

- Pure transfer from global bank to entrepreneurs in one country
- Simultaneous output decline in both countries

Nevertheless, introduction of global bank in otherwise standard model

- Does not affect transmission of productivity shocks very much
- 'Normal' default shocks of little consequence for business cycles

Thank you !!