How Do Credit Supply Shocks Propagate Internationally? A GVAR Approach

Sandra Eickmeier (Deutsche Bundesbank)
Tim Ng (Reserve Bank of New Zealand)

Bundesbank Spring Conference, 24-25 May 2012

Key questions and motivation

- How do financial shocks propagate internationally? Transmission channels?
  - A lot of interest post-crisis
  - Credit supply shocks capture weakening of financial positions or increased risk aversion of investors.
  - Trade vs. fin. mkts („international financial multiplier“ (Krugman (2008), Devereux and Sutherland (2011), Dedola and Lombardo (2010), van Wincoop (2011); institutions vs. securities)
  - Heterogeneity across countries

- We use the Global VAR (GVAR) (Pesaran et al. (2004))
  - to model dynamic interactions between macro and financial variables from 26 economies.
  - Justification for and effects of the choice of the weighting scheme in GVARs have been little explored.

Outline of the remainder of the presentation

- Contributions
- GVAR framework
- Data and benchmark model selection
- Credit supply shock identification
- Impulse response analysis: Domestic transmission, international transmission, robustness checks
- Conclusions

Contributions

Contributions

- Small empirical literature on the international transmission of financial shocks
  - Helbling et al. (2011), Beaton/Desroches (2011) and Xu (2010)
  - We study effects of US/EA/JP credit shocks to many countries.

- Identified credit supply shocks in GVAR context
  - Most GVAR applications use GIRFs to non-orthogonal shocks.
  - We use sign restrictions to disentangle credit supply from other domestic shocks (shocks still weakly correlated across countries).

- Detailed examination of effects on fit and results of different weighting schemes for foreign aggregates
  - Trade, (inward/outward) portfolio investment, FDI, banking claims

GVAR framework

GVAR model

- Country VARX models for country variables $x_{i,t}$:

$$x_{i,t} = a_{i,0} + a_{i,1}t + \sum_{j=1}^{q_i} \alpha_{i,j} x_{i,t-j} + + \sum_{j=0}^{q_i^*} \beta_{i,j} x^*_{i,t-j} + \sum_{j=1}^{l_i} \gamma_{i,j} d_{t-j} + u_{i,t}$$

$x^*_{i,t}$: country-specific foreign variables, d_t : global variables

- For the g^{th} element of $x^*_{i,t}$,

$$x^*_{i,g,t} = \sum_{j=0}^{N} w_{i,g,j} x_{i,g,t}$$

where weights $w_{i,g,j}$ $(\sum_{j=0}^{N} w_{i,g,j} = 1)$ are chosen a priori.

Estimation (GVAR toolbox by V. Smith/A. Galesi)

- Allow for cointegration across domestic and across domestic and foreign variables
  - Unit roots tests performed using weighted symmetric ADF tests
  - Rank orders found based on Johansen's trace statistic
  - Lag orders determined by AIC

- Each country VECMX is estimated separately
  - Requires weak exogeneity of the foreign aggregates w.r.t. domestic variables (US treated as a special case).

- Country VECMXs stacked together $\longrightarrow$ GVAR

$$\boldsymbol{x}_t = \boldsymbol{b}_0 + \boldsymbol{b}_1 \boldsymbol{t} + \sum_{j=1}^{p} \boldsymbol{F}_j \boldsymbol{x}_{t-j} + \boldsymbol{\varepsilon}_t$$

Data and benchmark model selection

Time series

- Country coverage: 26 advanced and emerging economies
  - 8 individual EA countries aggregated. EA enters as one economy.

- Sample period: 1983Q4-2009Q4

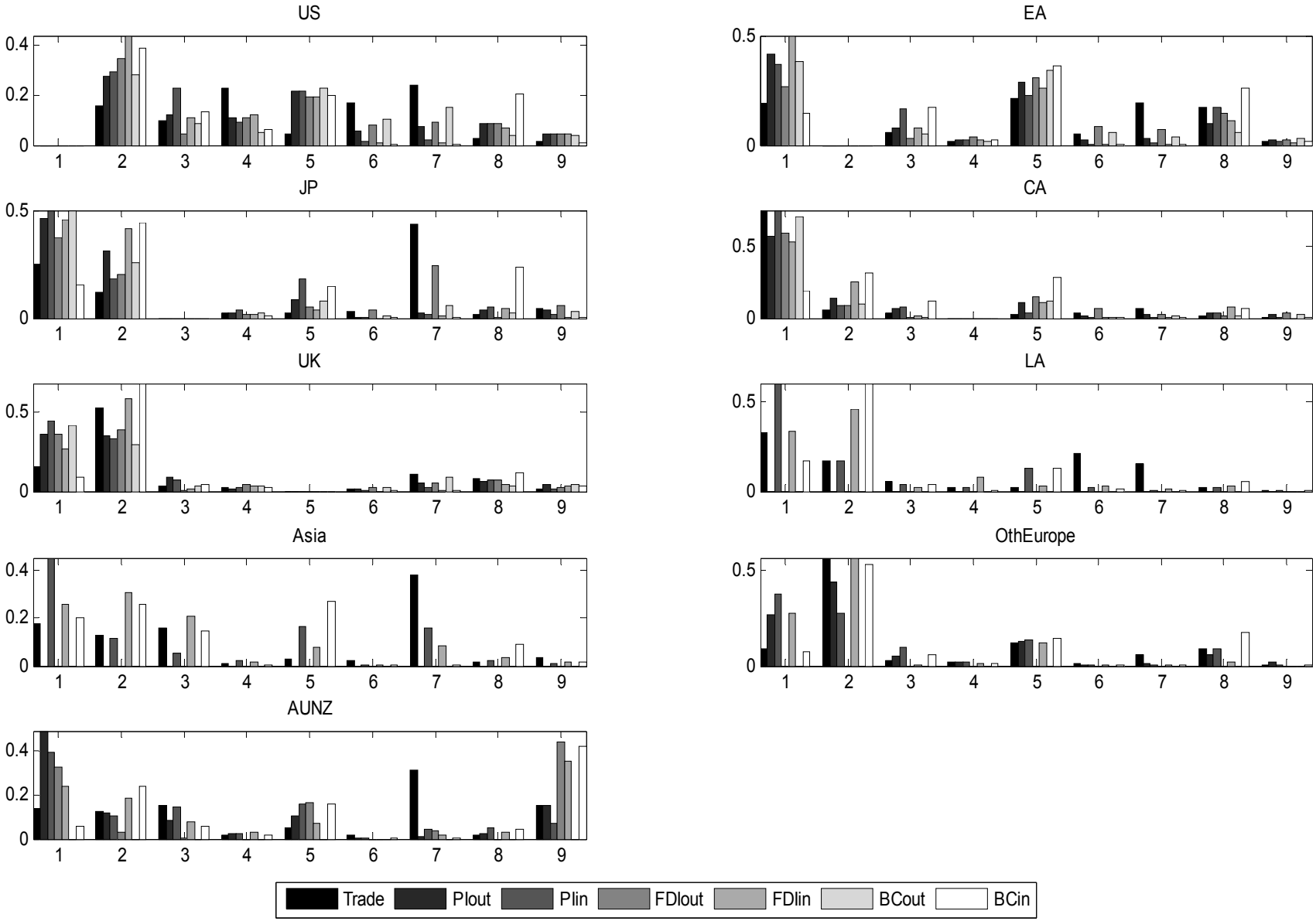
- Time series
  - GDP, CPI inflation, short-term interest rates, long-term government bond rates, equity prices, real bilateral exchange rate with the US dollar, oil price (as in Dees et al. 2007)
  - Credit to the non-financial private sector (except CN, BR, SA)
    - (source: Basel Committee on Banking Supervision (2010), IMF/IFS)
  - Corporate bond spreads (for AU, CA, US, UK, DE, SE, CH, JP)
    - (source: BIS, Datastream)

Weights used to construct foreign aggregates

- Bilateral weights (fixed over time)
  - for GDP and inflation
    - Trade (exports+imports) weights (source: IMF/DOT)
  - for financial variables
    - Trade
    - PIout, PIin: outward/inward portfolio (debt+equity) investment (source: IMF/CPIS)
    - FDIout, FDIin: outward/inward foreign direct investment (source: IMF/CDIS)
    - BCout, BCin: outward/inward banking claims (source: BIS international banking statistics)

- more variations possible

Weights used to construct foreign aggregates



1: US, 2: EA, 3: JP, 4: CA, 5: UK, 6: LA, 7: Asia, 8: Other Europe, 9: AU-NZ

Correlation btw. GVAR factors and PC and PLS factors, average over all countries

	Trade	PIout	PIin	FDIout	FDIin	BCout	BCin	PC
Credit growth								
PC	0.84	0.83	0.84	0.80	0.84	0.83	0.84	1.00
PLS	0.79	0.78	0.73	0.78	0.73	0.80	0.71	0.83
Equity price growth								
PC	0.95	0.93	0.93	0.92	0.93	0.93	0.92	1.00
PLS	0.96	0.94	0.94	0.95	0.93	0.93	0.92	1.00

- High correlations of all GVAR factors with PC and PLS factors
- Similar results for other variables

In-sample GVAR forecasts

- Average relative (GVAR/random walk) RMSEs

	GDP				all variables			
	h = 1	h = 2	h = 3	h = 4	h = 1	h = 2	h = 3	h = 4
Trade	0.64	0.64	0.68	0.70	0.81	0.87	0.93	0.96
Plout	0.64	0.61	0.59	0.58	0.78	0.77	0.77	0.76
Plin	0.61	0.57	0.55	0.55	0.75	0.75	0.74	0.74
FDlout	0.63	0.59	0.56	0.55	0.75	0.74	0.73	**0.72**
FDlin	**0.61**	**0.56**	**0.54**	**0.53**	**0.74**	0.74	0.74	0.74
BCout	0.63	0.58	0.56	0.55	0.75	**0.73**	**0.73**	0.73
BCin	0.63	0.58	0.56	0.56	0.82	0.82	0.80	0.79

- Trade weights not sufficient. FDlin and BCout most successful.

Information criteria and model selection

- Sum over modified AICs/BICs for all country VECMs (Phillips/McFarland 1997).

	#param	AIC	BIC
Trade	51943	-583.89	729.01
Plout	50194	-614.02	654.67
Plin	53549	-553.38	800.11
FDIout	43848	-720.80	387.49
FDIin	43848	-738.08	370.21
BCout	41375	**-758.88**	**286.91**
BCin	52752	-564.38	768.97

- $\longrightarrow$ FDIin is our benchmark.

Credit supply shock identification

Credit supply shock identification

- We use sign restrictions to disentangle credit supply shocks from other domestic shocks.

Variable	Restrictions	
y	↓	
credit	↓	credit sup. vs.
corp. bond rate	↑	credit dem.
corp. bond spread	↑	credit risk premium ↑
credit-y	↓	macro vs. credit
corp. bond rate-sr	↑	credit vs. MP
Dp, sr, lr, eq, ep		

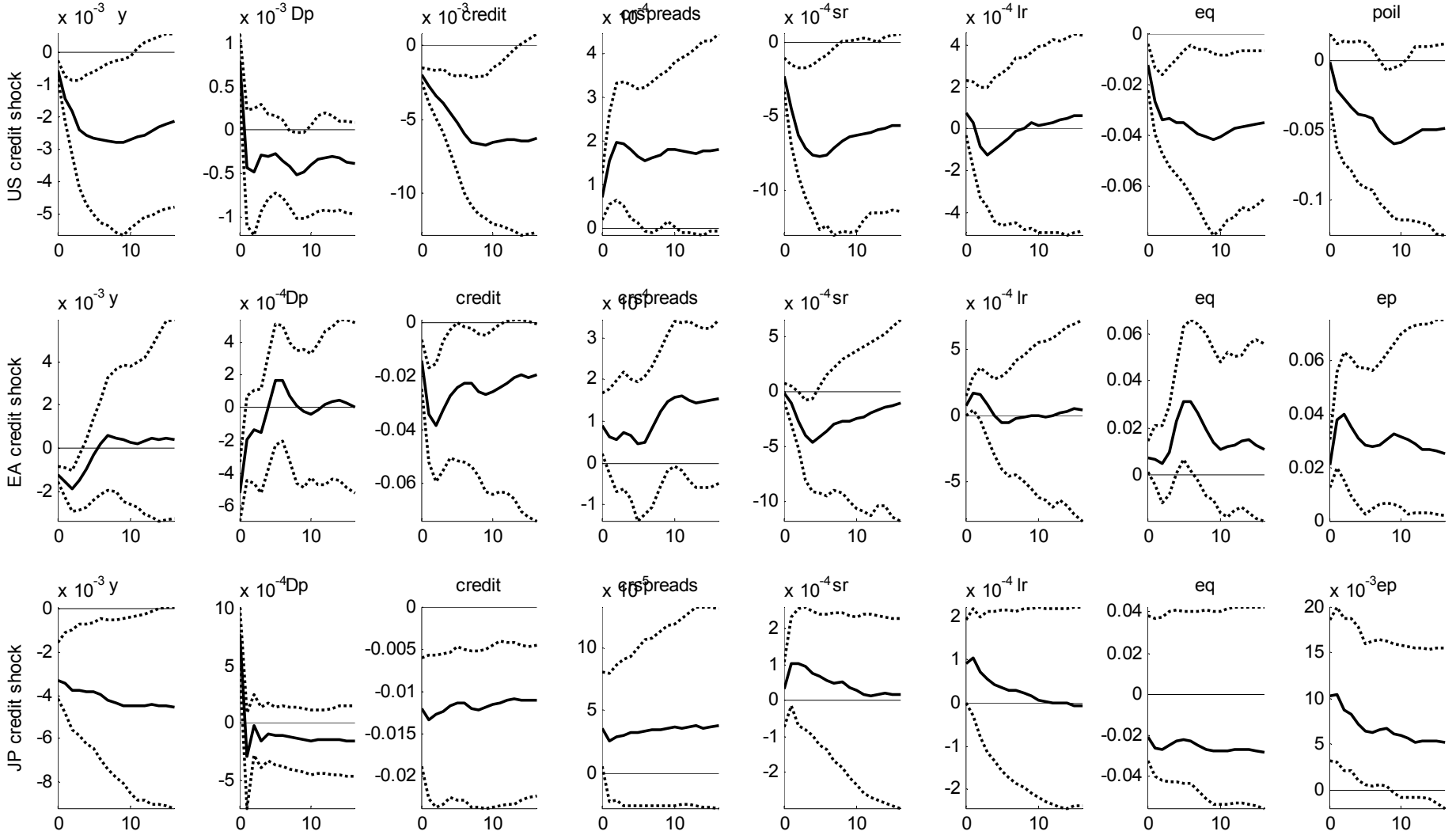
- Consistent with
  - DSGE models featuring a banking sector (Gerali et al. 2010, Atta-Mensah/Dib 2008, Curdia/Woodford 2010, Gertler/Karradi 2009)
  - empirical papers (e.g. Helbling et al. 2011, Peersman 2010, Hristov et al. 2011, Bean et al. 2010, De Nicolo/Lucchetta 2010)

Credit supply shock identification

- Shocks across countries only weakly correlated because of inclusion of contemporaneous foreign aggregates in country VECMXs
  - Max./mean absolute average pairwise bilateral correlation btw. GVAR residuals: 0.17/0.04
  - Correlation btw. identified credit shocks: -0.03 (US-EA), 0.12 (US-JP), 0.08 (EA-JP)

Impulse responses to credit supply shocks - Domestic and internat. transmission (FDIin benchmark)

Domestic transmission



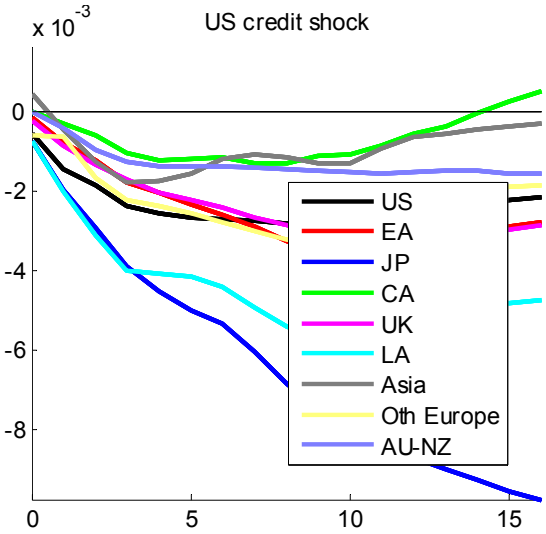
Domestic transmission - summary of results

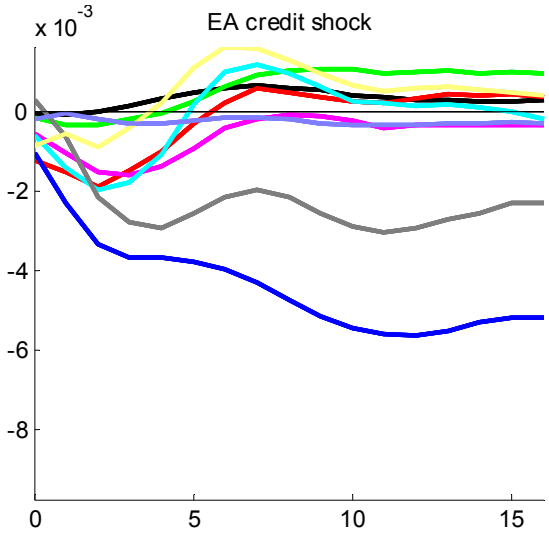
- Stronger effects of US shocks on US GDP (relative to credit) compared to effects of EA or JP shocks on EA or JP GDPs (relative to credit).

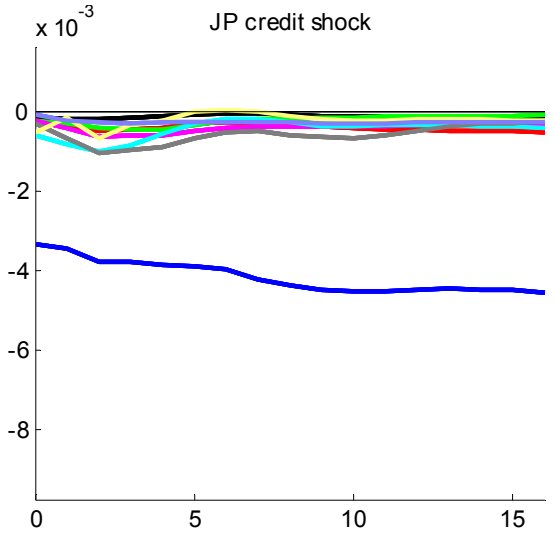
- Mechanisms
  - Strong equity price decline in the US (loss of confidence or ↓ asset demand by leverage constrained investors), but no or opposite movement of equity prices in the EA or JP after EA or JP shocks
  - Stronger negative effects of US shock on rest of the world with feedback effects on US
  - Appreciation of US dollar after US shock. Depreciations of EA and JP currencies after EA or JP shocks against US dollar and other currencies. → flight to „safe haven“ US dollar
  - MP loosening in US and EA cushions effect on GDP in US and EA, but not in Japan.

International transmission

GDP

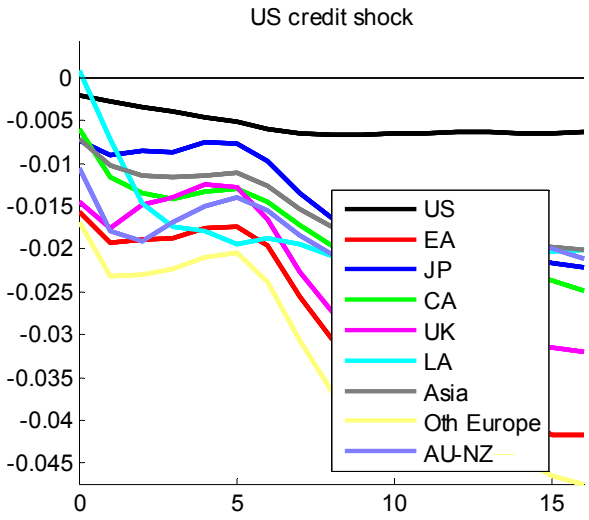


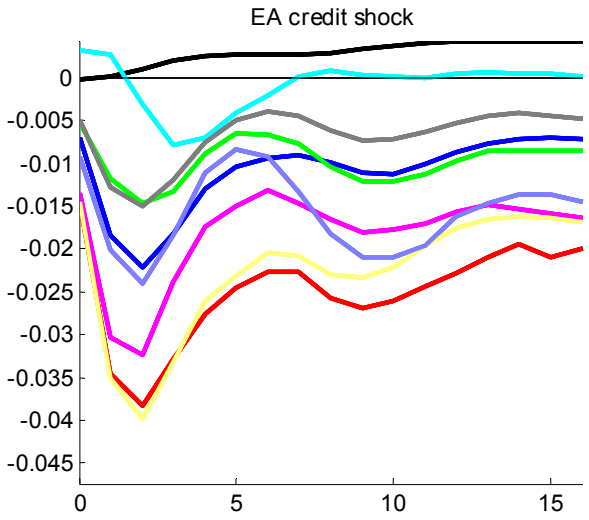


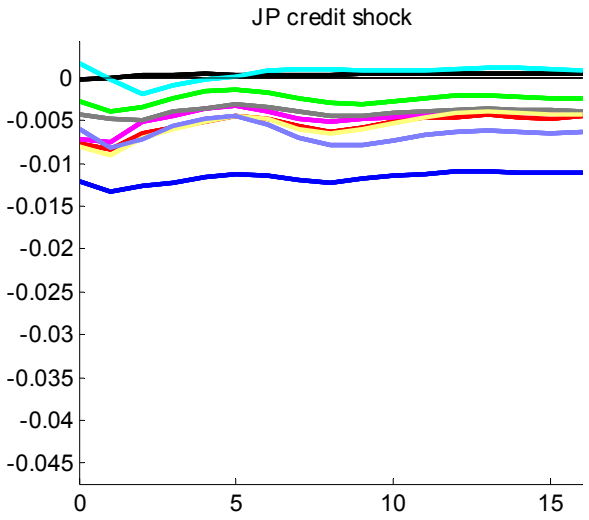


International transmission

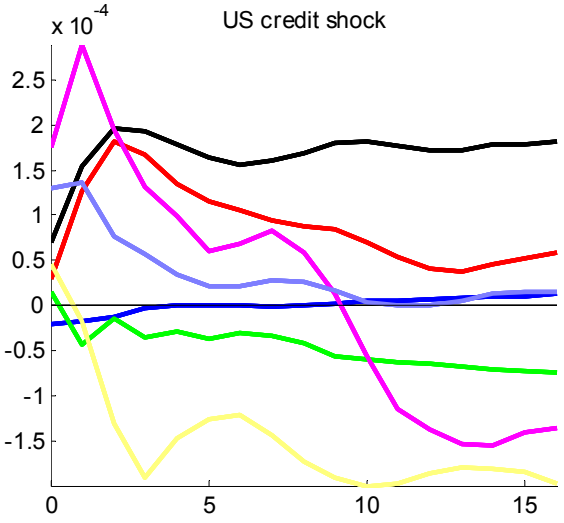
Credit

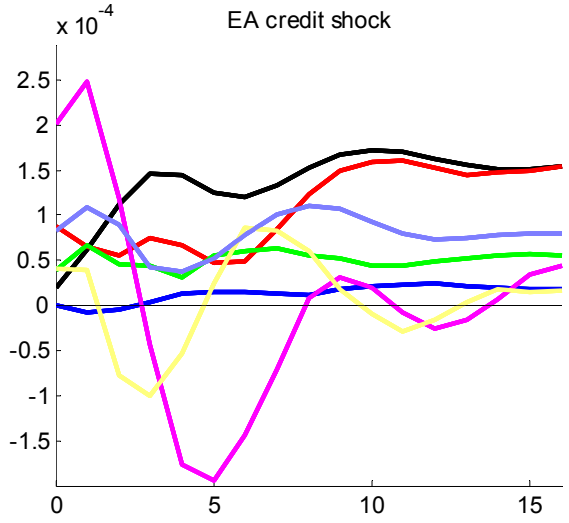


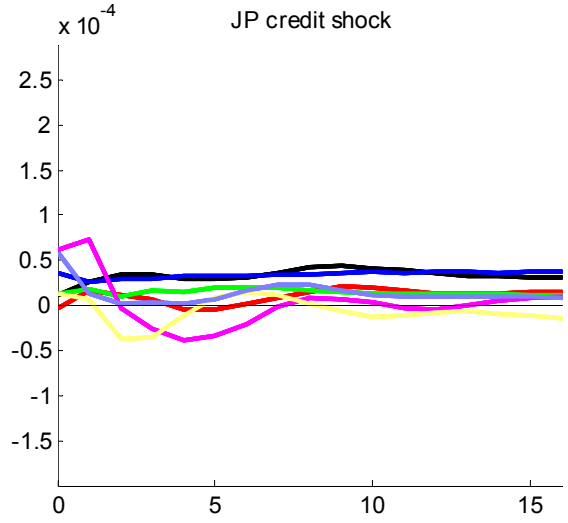




Corporate bond spreads

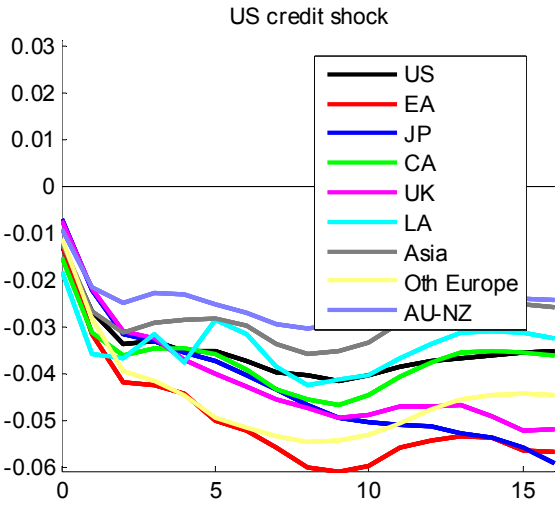


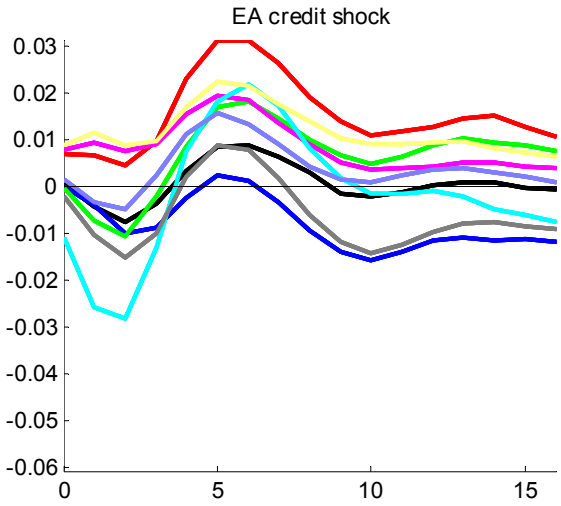


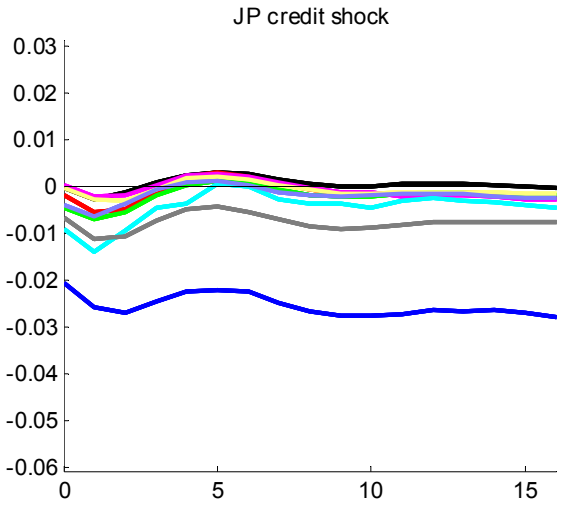


International transmission

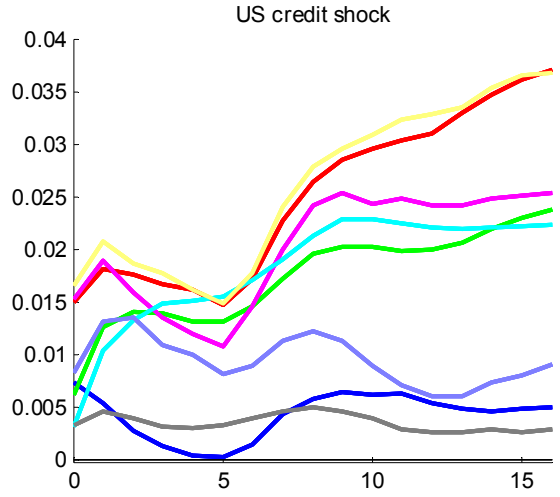
Equity prices

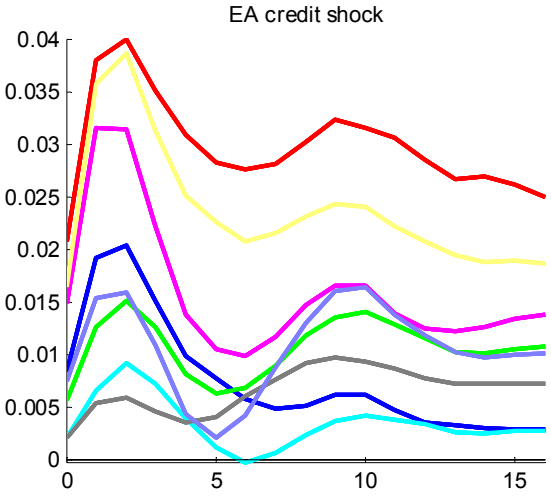


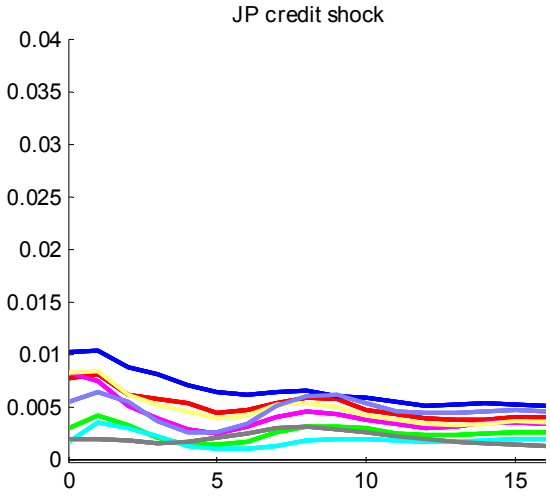




Exchange rates (against US dollar)







FEVD of GDP growth (shares explained by credit supply shocks in percent)

	US credit sup	EA credit sup	JP credit sup
1 year			
US	17.5	0.0	0.2
EA	6.5	14.2	1.0
JP	11.0	7.7	24.5
CA	1.8	0.2	0.4
UK	4.7	5.8	1.0
LA	6.1	0.7	0.4
Asia	1.0	1.2	0.4
Oth Europe	6.8	2.0	0.6
AU-NZ	2.0	0.1	0.2
4 years			
US	25.3	0.3	0.1
EA	20.1	1.4	0.8
JP	26.5	7.7	12.7
CA	5.3	2.0	0.3
UK	15.3	0.9	0.4
LA	20.3	0.9	0.3
Asia	4.4	2.6	0.9
Oth Europe	17.5	1.3	0.4
AU-NZ	8.7	0.3	0.3

International transmission – summary of results

- Strong internat. effect of US shocks (as large as domestic effects) which explain up to 1/4 of GDP fluctuations.
  Effects of EA and JP shocks weaker and less significant.

- Mechanisms
  - Strong involvement of international credit and securities mkts, especially after US shocks
    - Stronger direct exposures to US
    - „International financial multiplier“ effective after US shocks
    - Strong ↑ corporate bond spreads in the US, UK, AU-NZ (where corporate bond mkts are more developed; Borio (1995)) after all shocks
  - Significant response of GDP in financial center UK to all shocks
  - Strong responsiveness of foreign exchge mkts. Flight to „safe haven“ US dollar adversely affects US GDP response to all shocks

Results robust if

- alternative weighting schemes used
  - not a contradiction to forecasting results
- 2007-2009 crisis period dropped from sample
- EA replaced by DE (corporate bond yields only available for DE, not for other EA countries)

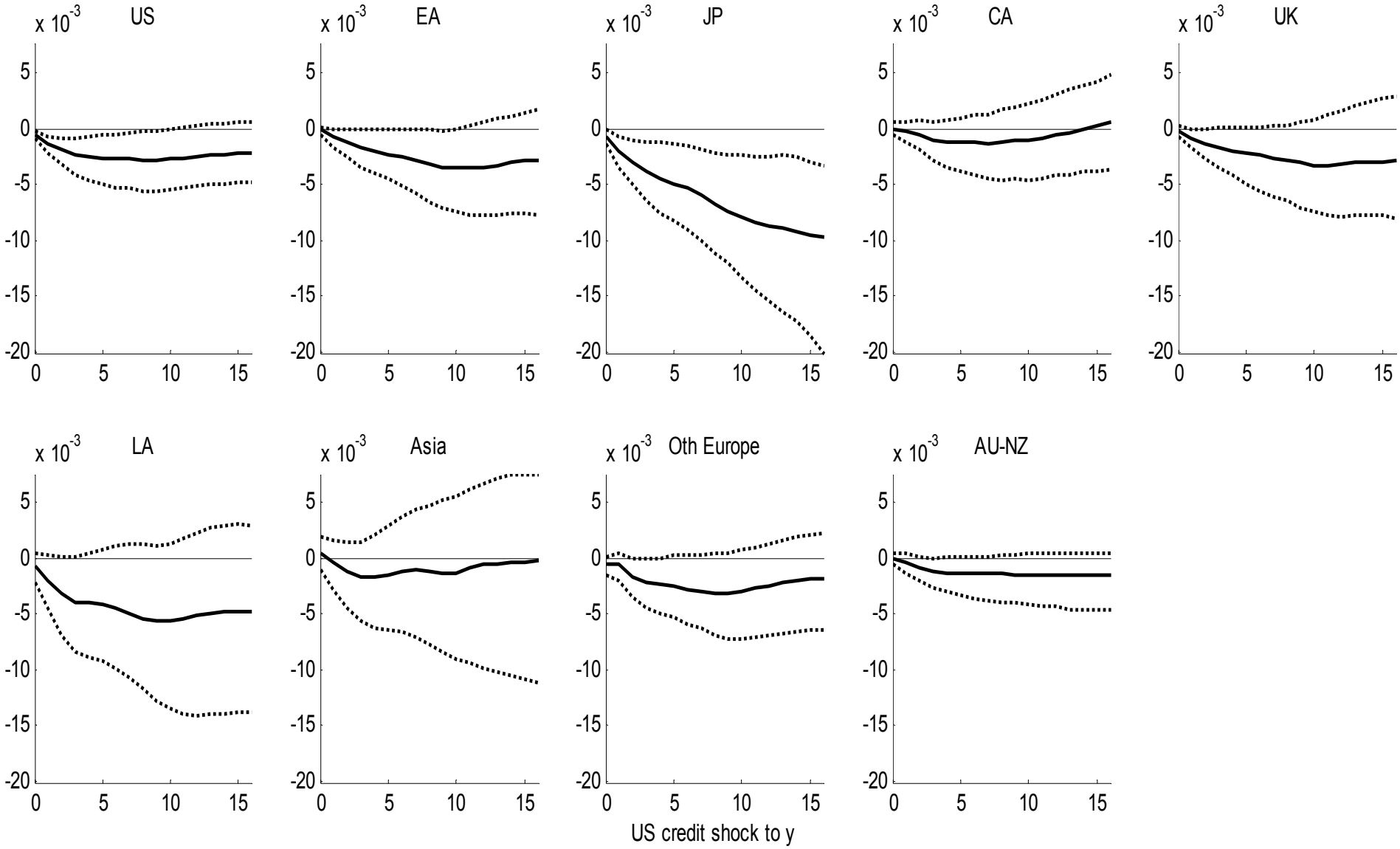
Conclusion

Summary of results

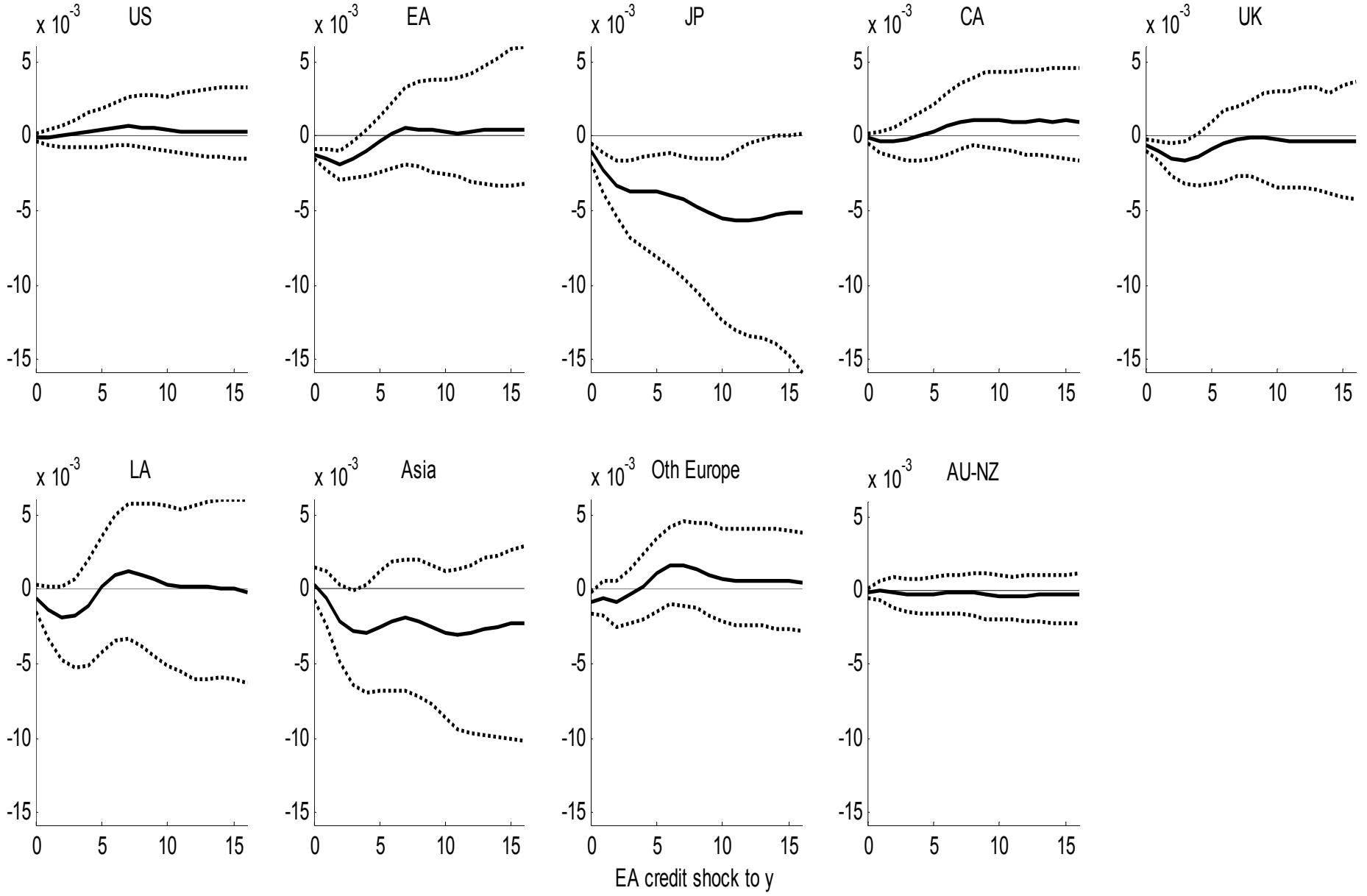
- Careful choice of weighting scheme for foreign variables in GVARs important for model fit
  - Trade and financial weights preferable to trade weights only
- Strong international transmission of US credit supply shocks. Transmission of EA and JP shocks weaker.
- Foreign credit, equity mkts, especially of fin. centers, and exchange rates respond strongly to US credit supply shocks.
- Results robust to exclusion of crisis period.

Backup

International transmission of a US shock to GDP



International transmission of a EA shock to GDP



International transmission of a JP shock to GDP