

The International Credit Channel and Monetary Autonomy

Hélène Rey
London Business School, CEPR & NBER

Mundell-Fleming Lecture
IMF, 13 November 2014

The views expressed in this lecture are my own and do not represent in any way
the views of the Haut Conseil de Stabilité Financière

Motivation

- At the heart of Mundell-Fleming: international transmission of monetary and fiscal policy depends on the exchange rate regime
- Still a burning issue: channels of transmission of monetary policy within and across jurisdictions
- How valid is the Mundellian trilemma in a world of large cross border capital flows and financial integration?

Motivation

- It is essential to integrate more the international macro and international finance literature
- Taking a step: starting from the trilemma and integrating different ways of thinking
- This is relevant for the design and conduct of monetary and macro prudential policies

Outline

- Transmission channels of monetary policy in closed and open economies

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- Role of the US dollar in international banking and financial markets

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- The Global Financial Cycle: characteristics and drivers
- US monetary policy and flexible exchange rate economies
- The international credit channel

Transmission channels of monetary policy: Models with no capital market frictions

- Mundell Fleming: exchange rate and capital flows sensitivity to interest rate movements are key

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- Open economy versions: tradeoff between output gap stabilization and the terms of trade (Obstfeld and Rogoff (2002), Corsetti and Pesenti (2005), Farhi and Werning (2013))

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- Open economy versions: tradeoff between output gap stabilization and the terms of trade (Obstfeld and Rogoff (2002), Corsetti and Pesenti (2005), Farhi and Werning (2013))
- Gains from international cooperation usually found to be small if "one's house is in order"

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- "Risk taking channel" (Borio and Zhu (2008), Bruno and Shin (2014), Rajan (2005))
- Emphasis is put on risk (Value at Risk constraint)
- In good times, asset prices are high, spreads are compressed and measured risk is low. Leverage is less constrained.

Adding the international dimension

- International transmission of monetary policy via the "credit channel" broadly defined not much studied
- Yet, international currency role of the dollar is large and disproportionate in financial markets
- The dollar is a funding currency world wide with a lot of short term credit and short term debt in dollar
- The dollar is an investing currency world wide and many balance sheets have dollar assets

Dollar Geography

- Dollar credit extended to non financial borrowers outside the US is worth approximately 13% of non US World GDP (McCauley et al. (2014))
- Top three stocks of dollar credit in Euro area, China and UK
- Dollar also widely used around the world by asset managers
- Top 10 global asset management firms have more than \$19 trillion in assets under management
- Important role for global banks, in particular EU based (Shin (2013))

Cross border and local positions in foreign currency

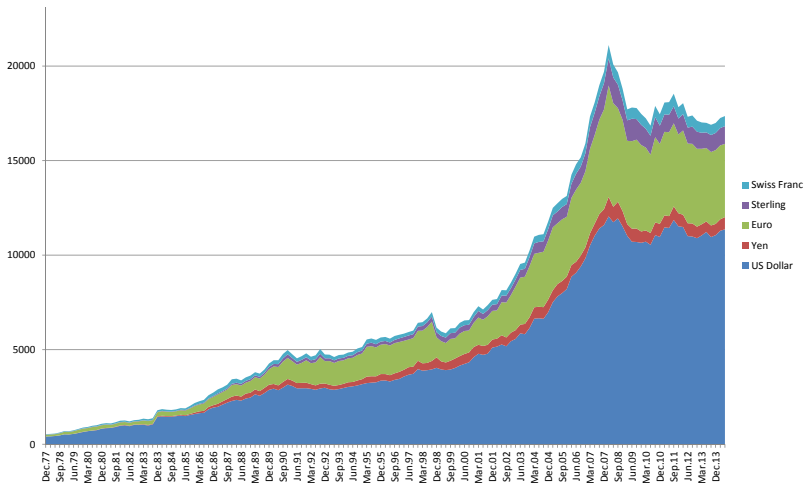


Figure: Cross border positions and local positions by reporting banks in foreign currency disaggregated by currency (bn)
Source: BIS

Role of the Dollar

- Dollar as a funding currency: monetary policy has a direct effect on interest payments, cash flow and net worth
- Dollar as an investment currency: a change in discount rate has an effect on valuation of dollar assets, which can be used as collateral
- Monetary loosening decreases the external finance premium and relaxes value at risk constraints
- All this suggests focusing on the **international credit channel** and the global financial cycle

Smoking gun: the Global Financial Cycle

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$$\textit{common}(t) = \textit{global factor}(t) + \textit{regional factors}(t)$$

- Role of financial intermediaries and leverage in transmitting financial conditions around the world

Increase in EU G-SIB Leverage (left); Increase in EU loans-to-deposits (right)

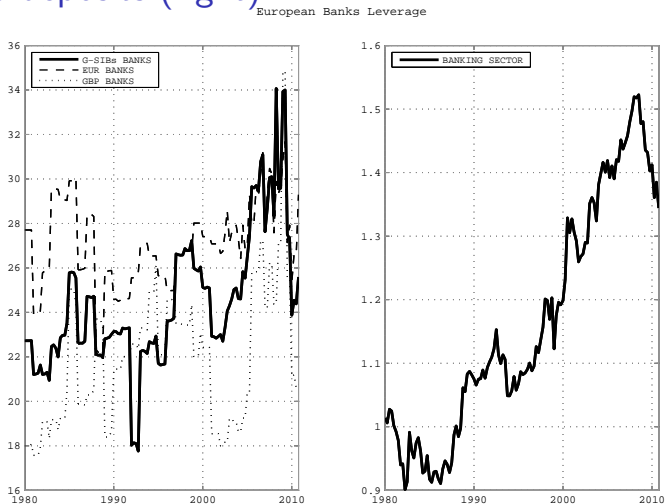
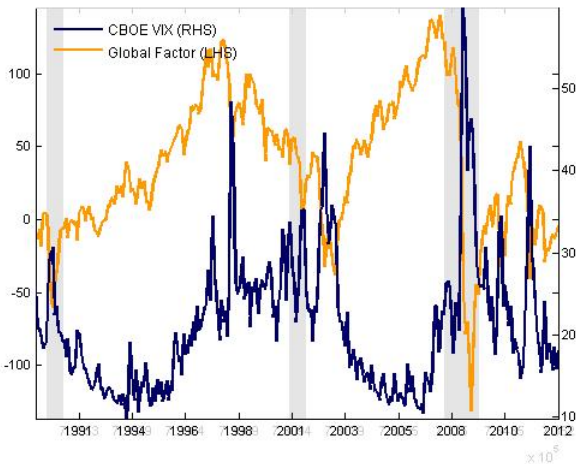


Figure: Banking Sector Leverage. *Source:* raw data from IFS, Bloomberg and Datastream, Miranda-Agrippino and Rey (2014)

Global Factor for World Asset Prices.



▶ RegionalFactors

▶ LocalCurrency

Global Factor and Risk in World Financial Markets

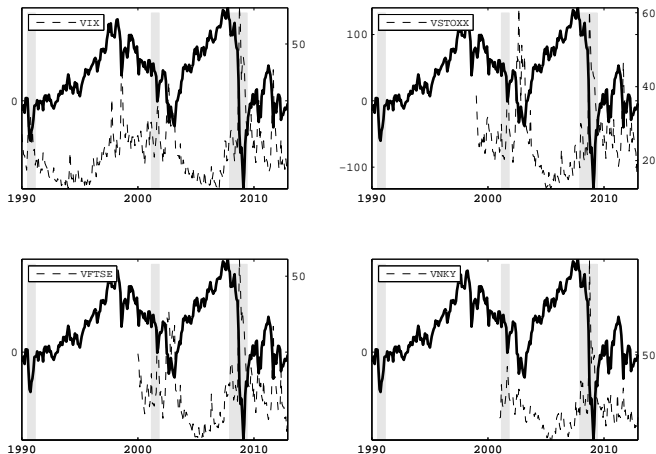


Figure: Global Factor (bold line) and major volatility indices (dotted lines); clockwise from top left panel: US; EU; JP and UK. *Source:* Agrippino and

Global Factor Decomposition

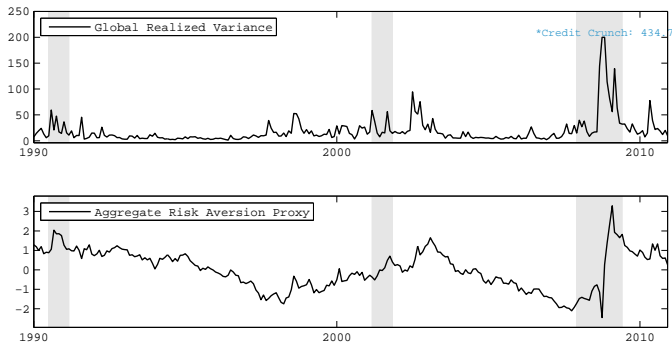


Figure: Decomposition of the global factor in a volatility component and a risk aversion component; the measure of realized monthly global variance is computed using daily returns of the MSCI world index.

Source: Agrippino and Rey (2014).

US monetary policy and the global financial cycle

- We estimate a Bayesian VAR (in levels) with 4 lags where we augment the typical set of macroeconomic variables, including output, inflation, investment and labor data, with our variables of interest: global credit, cross border flows, financial leverage, asset prices, risk premium, term spread.
- The monetary policy shock is identified using the effective federal funds rate as the instrument for monetary policy and block-ordering the variables into slow-moving and fast-moving ones. We also instrument movements in the Fed Funds rate using the narrative approach of Romer and Romer (2004)

Results

- A 100 bp increase in the effective fed funds rate has the expected effects on production (-), inflation (-), investment (-), housing starts (-), employment (-),...
- Interestingly, an increase in the effective fed funds rate also has strong effects on:

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- Interestingly, an increase in the effective fed funds rate also has strong effects on:
 - the global component of asset prices (-)
 - the risk premium (+)
 - the volatility of asset prices (+)
 - bank leverage in the US and the EU (-)
 - global domestic credit (with or without US) and cross border credit (-)

Decrease in Global Domestic and Cross Border Credit

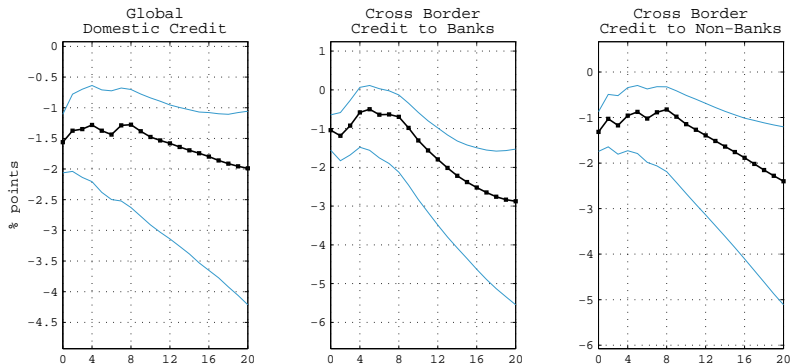


Figure: Response of Global and Cross border Credit (% points) to a monetary policy shock inducing a 100bp increase in the Effective Fed Funds Rate.

Increase in volatility, decrease in the global component of asset prices, increase in bond premium

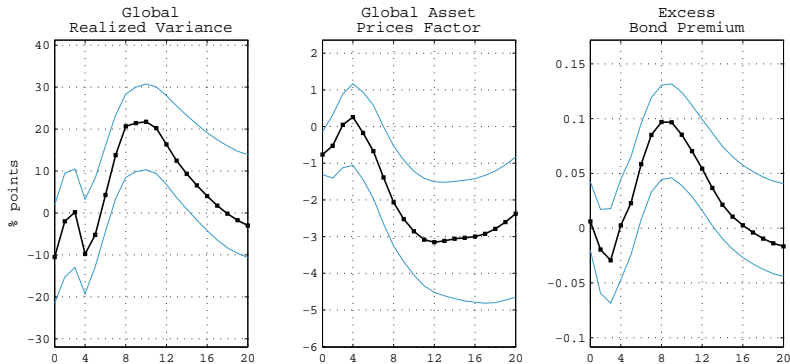


Figure: Response of Financial Variables (% points) to a monetary policy shock inducing a 100bp increase in the Effective Fed Funds Rate.

Decrease in leverage: US Broker Dealer, Euro area G-SIB, UK G-SIB

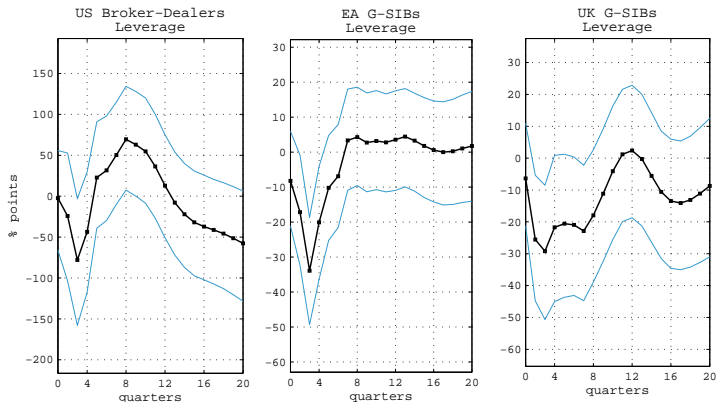


Figure: Response to a 100bp increase in the Effective Fed Funds Rate

International credit or risk taking channel

- US monetary policy:
 - affects credit spreads and risk premia globally
 - affects leverage and credit flows internationally
- Global Financial Cycle is in part driven by US monetary policy
- Countries may import monetary and financial conditions (even asset price bubbles!) which do not necessarily fit their economies.

International credit channel and the trilemma

- Are these results driven mostly by economies with fixed exchange rate regimes?
- What do Wellington, Sidney, Stockholm, Ottawa, London have to say about the international credit channel?
- These are all advanced open economies with developed capital markets, inflation targeters, free floaters

High Frequency Instruments and Monetary Policy VAR

- Effects of US monetary policy on the Global Financial Cycle and on small open economies with flexible exchange rates:
 - The one year US rate is instrumented: short-term rates vs forward guidance;
 - Monetary policy can be treated as a multidimensional factor;
- Identify monetary policy shock using an external instrument; [Proxy SVAR: Stock and Watson (2008), Mertens and Ravn (2013)]
- HFI: select instrument from a pool of high frequency indicators which measure the surprise element in financial time series (i.e. Fed Funds Futures and Exchange Rates) in correspondence of FOMC announcements. [Gertler and Karadi (2014); Gurkaynak, Sack and Swanson (2005)]

US monetary policy and the Global Financial Cycle

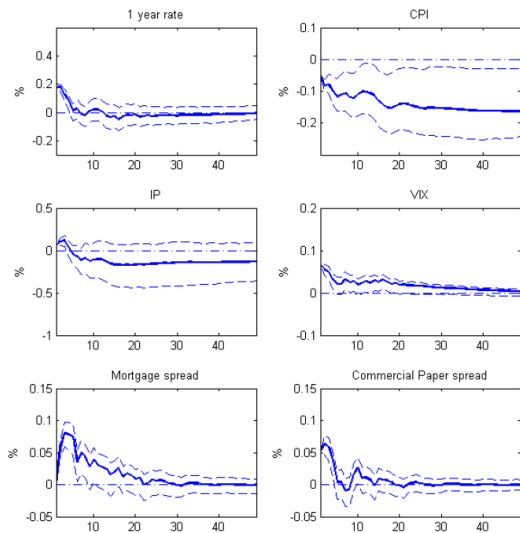


Figure: Response of the VIX to a 20bp increase in the US one year rate. Gertler and Karadi (2014) have very graciously shared their instruments. Source: Passari and Rey (2014)

What is the effect of a US monetary policy shock on ... Canada?

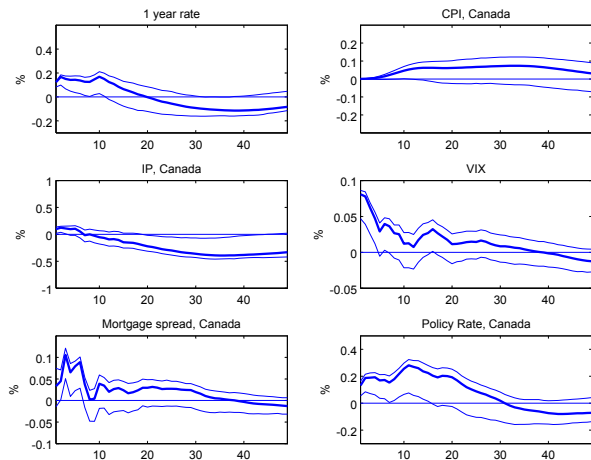


Figure: Response of Canada (% points) to a 20bp increase in the US one year rate (HF instruments of Gertler and Karadi, monthly)

What is the effect of a US monetary policy shock on ... the United Kingdom?

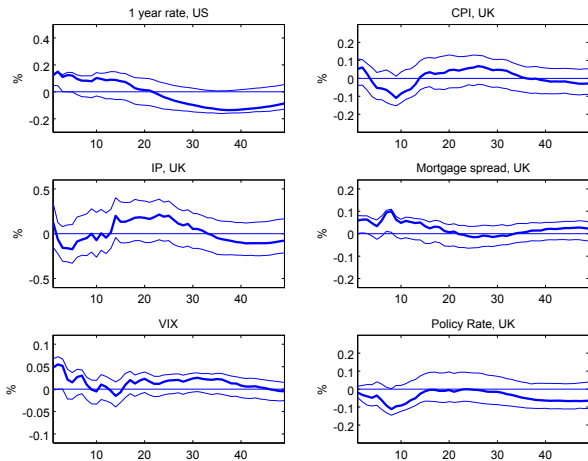


Figure: Response of the UK (% points) to a 20bp increase in the US one year rate
(HF instruments of Gertler and Karadi)

What is the effect of a US monetary policy shock on ... Sweden?

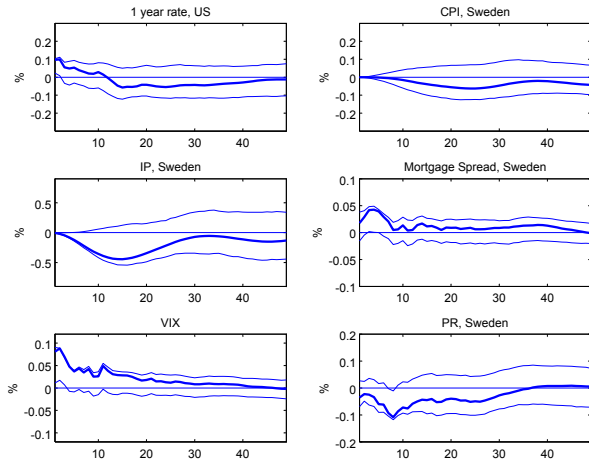


Figure: Response of Sweden (% points) to a 20bp increase in the US one year rate (HF instruments of Gertler and Karadi)

What is the effect of a US monetary policy shock on ... New Zealand?

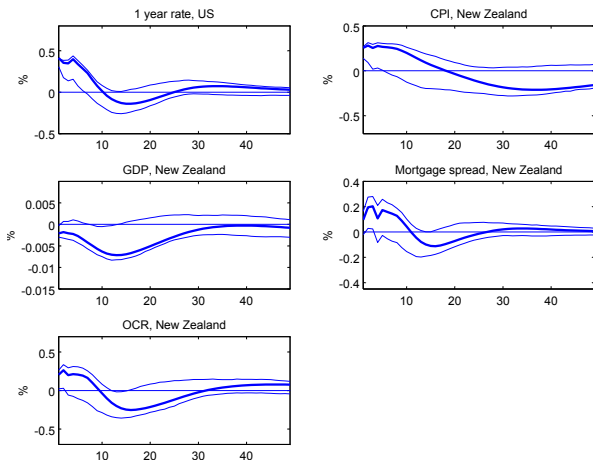


Figure: Response of New Zealand (% points) to a 40bp increase in the US one year rate (Miranda -Agrippino Rey narrative instruments, quarterly)

What is the effect of a US monetary policy shock on ... Australia?

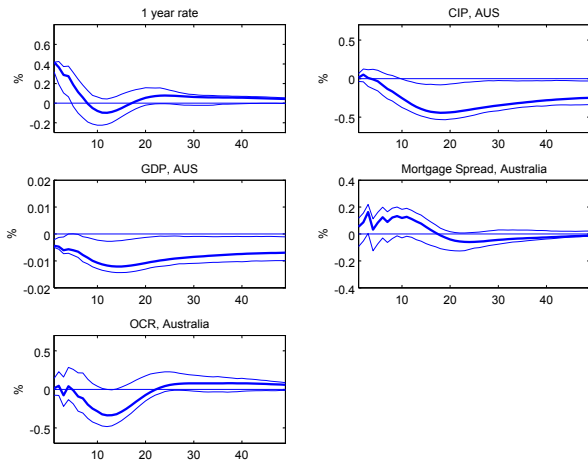


Figure: Response of Australia (% points) to a 40bp increase in the US one year rate (Miranda- Agrippino Rey narrative instruments, quarterly)

Results: the international credit channel

- In a Domestic US context: a 20bp increase in the US one year rate leads to about 8bp increase in mortgage spread
- In Canada: about 10 bp
- In UK: about 6-10 bp
- In Sweden: about 4 bp
- In New Zealand: about 10 bp
- In Australia: about 9 bp
- These international responses are smaller but of the same order of magnitude as the domestic US one
- A subset only of the countries adjusted their policy rate. In that case the domestic and the international credit channel interact
- Running regressions on correlations of short rates across countries is not appropriate to test for monetary independence

Conclusion: the Dilemma

- US monetary policy is a driver of credit growth in the US and... **abroad**, of **cross-border** credit flows, of leverage of ... **European banks**.
- No doubt more VARs should be run but: US monetary policy seems to be a driver of the **global factor** in asset prices, of the risk premium, of mortgage spreads including in ... **Canada, Sweden, UK, Australia, New Zealand**.
- The international credit channel can operate even if policy rates do not react. When there is "fear of floating" (Calvo and Reinhart), international credit and domestic credit channel can reinforce each other.

Conclusion: the Dilemma

- This evidence reinforces dilemma view
- Now the task is to build analytical foundations. Heterogeneity of agents managing and holding assets is a key building block
- This needs to be integrated with what we know from international macro on exchange rate and capital flows
- Finally, if the international credit channel is potent, more tools, such as macroprudential ones, are needed to restore some monetary autonomy

Countries in Global Data

Table: List of Countries Included

North America	Latin America	Central and Eastern Europe	Western Europe	Emerging Asia	Asia Pacific	Africa and Middle East
Canada	Argentina	Belarus	Austria	China	Australia	Israel
US	Bolivia	Bulgaria	Belgium	Indonesia	Japan	South Africa
	Brazil	Croatia	Cyprus	Malaysia	Korea	
	Chile	Czech Republic	Denmark	Singapore	New Zealand	
	Colombia	Hungary	Finland	Thailand		
	Costa Rica	Latvia	France			
	Ecuador	Lithuania	Germany			
	Mexico	Poland	Greece*			
		Romania	Iceland			
		Russian Federation	Ireland			
		Slovak Republic	Italy			
		Slovenia	Luxembourg			
		Turkey	Malta			
			Netherlands			
			Norway			
			Portugal			
			Spain			
			Sweden			
			Switzerland			
			UK			

Notes: The table lists the countries included in the construction of the Domestic Credit and Cross-Border Credit variables used throughout the paper. Greece is not included in the computation of Global Domestic Credit due to poor quality of original national data.

Global Domestic Credit Data

- Global Domestic Credit is constructed as the cross-sectional sum of National Domestic Credit data.
- National Domestic Credit is calculated as the difference between Domestic Claims to All Sectors and Net Claims to Central Government [Gourinchas and Obstfeld (2012)]:
 - Claims to All Sectors are calculated as the sum of Claims On Private Sector, Claims on Public Non Financial Corporations, Claims on Other Financial Corporations and Claims on State And Local Government.
 - Net Claims to Central Government are calculated as the difference between Claims on and Liabilities to Central Government
- Raw data in national currency.
- *Source:* IFS, Other Depository Corporation Survey and Deposit Money Banks Survey (prior to 2001).

Global Cross Border Credit Data

- Global Inflows are calculated as the cross-sectional sum of national Cross Border Credit data.
- Data refer to the outstanding amount of Claims to All Sectors and Claims to Non-Bank Sector in all currencies, all instruments, declared by all BIS reporting countries with counterparty location in a selection of countries. [Avdjiev, McCauley and McGuire (2012)]
- Raw data in Million USD.
- *Source*: BIS, Locational Banking Statistics Database, External Positions of Reporting Banks vis-à-vis Individual Countries (Table 6).

▶ [BackToIntro](#)

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Global Banks Leverage

- Leverage Ratios for the Global Systemic Important Banks in the Euro-Area and United-Kingdom are constructed as weighted averages of individual banks data.
- Individual banks leverage ratios are computed as the ratio between aggregate Balance sheet Total Assets (DWTA) and Shareholders' Equity (DWSE).
- Weights are proportional to Market Capitalization (WC08001).
- *Source:* Thomson Reuter Worldscope Datastream.

▶ [BackToIntro](#)

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Aggregate Banking Sector Leverage

- We construct the European Banking Sector Leverage variable as the median leverage ratio among Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain and United Kingdom.
- Aggregate country-level measures of banking sector leverage are built as the ratio between Claims on Private Sector and Transferable plus Other Deposits included in Broad Money of depository corporations excluding central banks. [Kalemli-Ozcan et al. (2012)]
- Raw data in local currency.
- *Source:* IFS, Other Depository Corporation Survey and Deposit Money Banks Survey (prior to 2001).

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The NIW prior (1)

- It is a modification of the Minnesota prior [Litterman (1986)] which allows for cross-correlation in the VAR residuals, crucial for structural analysis. [Kadyiala and Karlsson (1997)]
- Given a VAR(p) for the n endogenous variables in $Y_t = [y_{1t}, \dots, y_{Nt}]'$ of the form:

$$Y_t = C + A_1 Y_{t-1} + \dots + A_p Y_{t-p} + u_t,$$

the Minnesota prior assumes

$$Y_t = C + Y_{t-1} + u_t.$$

- This requires shrinking A_1 towards $eye(n)$ and all other A_i matrices ($i = 2, \dots, p$) towards zero.
- Problem: $\mathbb{E}(u_t u_t') = diag(Q)$!

The NIW prior (2)

- The NIW solution:

$$\Sigma \sim \mathcal{W}^{-1}(\Psi, \nu) \quad \beta|\Sigma \sim \mathcal{N}(b, \Sigma \otimes \Omega),$$

where β is a vector collecting *all* VAR parameters.

- $\nu = n + 2$ ensures the mean of \mathcal{W}^{-1} exists.
- $\Psi = \text{diag}(\psi_i)$ is a function of the residual variance of $AR(p)$ $\forall y_i \in Y_t$.
- Other parameters are chosen to match:

$$\mathbb{E}[(A_i)_{jk}] = \begin{cases} \delta_j & i = 1, j = k \\ 0 & \text{otherwise} \end{cases} \quad \text{Var}[(A_i)_{jk}] = \begin{cases} \frac{\lambda^2}{i^2} & j = k \\ \frac{\lambda^2}{i^2} \frac{\sigma_k^2}{\sigma_j^2} & \text{otherwise.} \end{cases}$$

- $\lambda = 0$ maximum shrinkage; posterior equals prior.

Implementation of NIW prior

- The NIW prior is implemented adding artificial observations [Theil (1963)] to the stacked version of the VAR:

$$Y = X\mathbf{B} + U,$$

where $Y \equiv [Y_1, \dots, Y_T]'$ is $[T \times n]$, $X = [X_1, \dots, X_T]'$ is $[T \times (np + 1)]$ and $X_t \equiv [Y'_{t-1}, \dots, Y'_{t-p}, 1]'$

- Dummy observations:

$$Y_{NIW} = \begin{pmatrix} \text{diag}(\delta_1\sigma_1, \dots, \delta_n\sigma_n)/\lambda \\ \mathbf{0}_{n(p-1) \times n} \\ \dots \\ \text{diag}(\sigma_1, \dots, \sigma_n) \\ \dots \\ \mathbf{0}_{1 \times n} \end{pmatrix} \quad X_{NIW} = \begin{pmatrix} J_p \otimes \text{diag}(\sigma_1, \dots, \sigma_n)/\lambda & \mathbf{0}_{np \times 1} \\ \dots & \dots \\ \mathbf{0}_{n \times np} & \mathbf{0}_{n \times n} \\ \dots & \dots \\ \mathbf{0}_{1 \times np} & \epsilon \end{pmatrix}.$$

- $J_p \equiv \text{diag}(1, \dots, p)$ and ϵ is a very small number.

Additional Priors (1)

- Sum-of-Coefficients prior (SoC) [Doan, Litterman and Sims (1984)]:
 - No-change forecast at the beginning of the sample is a good forecast;
 - Reduces importance of initial observations conditioning on which the estimation is conducted;
 - It is implemented adding n artificial observations:

$$Y_{SoC} = \text{diag} \left(\frac{\bar{Y}}{\mu} \right) \quad X_{SoC} = \left(\text{diag} \left(\frac{\bar{Y}}{\mu} \right) \quad \dots \quad \text{diag} \left(\frac{\bar{Y}}{\mu} \right) \quad \mathbf{0}_{n \times 1} \right)$$

- \bar{Y} denotes the sample average of the initial p observations per each variable and μ is the hyperparameter controlling for the tightness of this prior; with $\mu \rightarrow \infty$ the prior is uninformative.

Additional Priors (2)

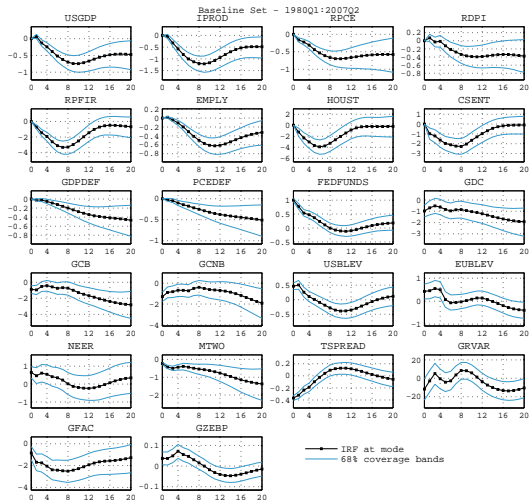
- Modification to sum-of-coefficients prior to allow for cointegration (Coin) [Sims (1993)]:
 - No-change forecast *for all variables* at the beginning of the sample is a good forecast;
 - It is implemented adding 1 artificial observation:

$$Y_{Coin} = \frac{\bar{Y}'}{\tau} \quad X_{Coin} = \frac{1}{\tau} \left(\bar{Y}' \quad \dots \quad \bar{Y}' \quad 1 \right)$$

- τ is the hyperparameter controlling for the tightness of this prior; with $\tau \rightarrow \infty$ the prior is uninformative.

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BVAR robustness (1): 1980:2007



BVAR robustness (1): EU cycle

