Credit and Crises: Being Careful about Inference

June 13, 2016

Aim of the talk

To get you interested, by exploring an issue of current policy interest, in learning how to do, and criticize time series inference that is

- multiple-equation,
- Bayesian,
- and weakly structural.

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- Over long spans of time, credit grows relative to gdp as gdp increases.
- Countries with high gdp per capita tend to have high credit/gdp.

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- When the borrower can't repay, they throw ownership of assets into an uncertain state, to be resolved by an expensive and slow process, which hurts economic efficiency.
- Credit expansion might be associated with increased gross exposures, so that the risk of chains of loan contracts defaulting at once is increased.

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The need for a multiple equation approach

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- We got this correctly sorted out only by recognizing the endogeneity of M and the need to separate policy-generated changes in r from other sources of variation in r.

Why "semi-structural"

- DSGE's are story-telling devices, not science.
- They're better than RBC or old Keynesian models, because they are formulated as explicit multivariate time series models that can be compared in fit to structural VAR's.
- SVAR's came first: DSGE's were built to match SVAR results.

DSGE limitations

- But they don't fit as well as SVAR's.
- We don't really believe the stories they tell. (e.g., K, I, C, L, W and P are fictions)
- They are awkward tools when, as now, we are uncertain as to whether and how we should be expanding the list of variables that enter our macro models.

Why Bayesian?

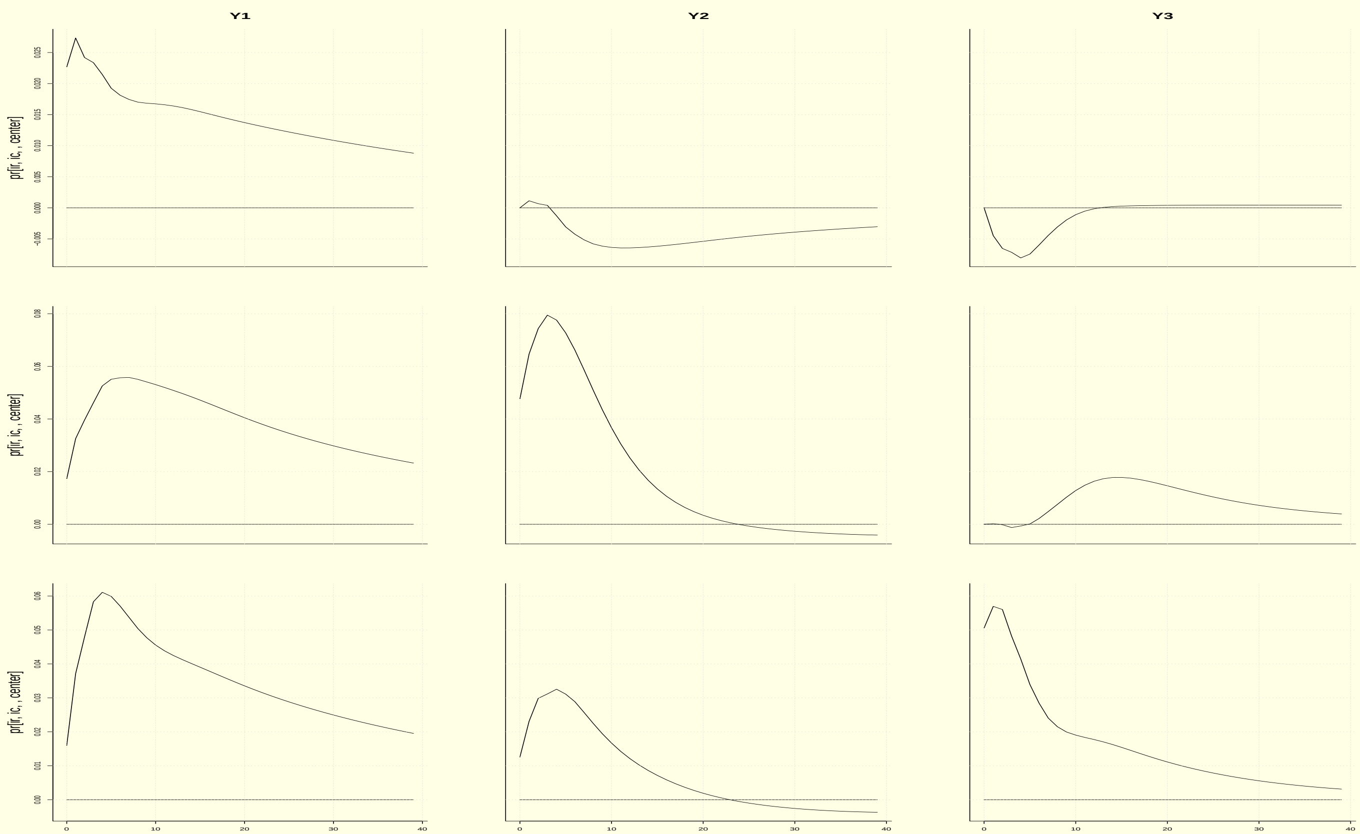
- Honest macro models have more free parameters than the data can give us firm answers about.

- Any conclusions we get therefore depend on priors, either formally via Bayesian inference, or informally, and usually only implicitly, via “calibrating” some subset of parameters and fiddling with model specification.

- These models are complicated, so non-Bayesian approaches to inference rely on asymptotic results, and in honestly specified models the ratio of parameter count to data points makes the reliability of asymptotic theory dubious.

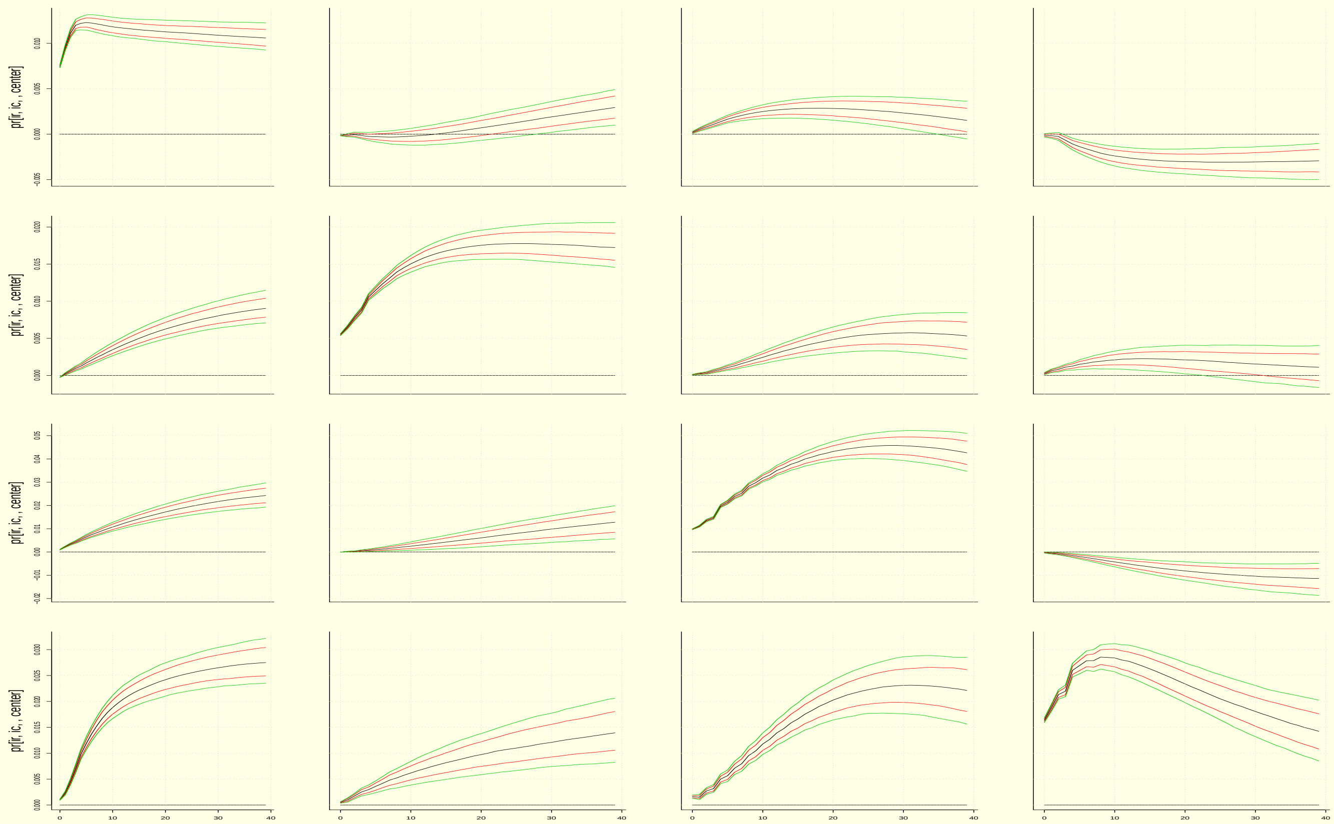
A puzzle: Mian-Sufi-Verner results

Kit for Chris Sims/Replication Kit for Chris Sims/irplot.pdf irf's with logs of rgdp, aha, ana, no Turkey



CAS semi-replication with prior, quarterly data, ID through heteroskedasticity

irf for 4v model with bands



A bigger model

- A panel data structural VAR for 13 countries.
- Country-specific constant terms, but the rest of the VAR constant across countries.
- Identification through heteroskedasticity, with the variances of structural shocks allowed to vary across countries.

Equations

$$A(L)y_i(t) = c_i + \Lambda_i^{-1}\varepsilon_i(t)$$

$y_i(t)$ $n \times 1$; $\varepsilon_i(t) \sim N(0, I)$, i.i.d.; Λ_i diagonal; sum of diagonal elements of Λ over i is a vector of 1's.

$A^{-1}(L)\Lambda_i$ represents impulse responses for country i, while $A^{-1}(L)$ by itself is a kind of harmonic average impulse response.

Identification through heteroskedasticity

Under the (strong) assumption that all differences across countries are captured in the c_i and Λ_i parameters, so long as there are even as many as two countries across which the ratios of the diagonals of Λ_i are all different, the system — and hence the responses to the structural shocks $\varepsilon_i(t)$, are identified.

We have to supply the names of the responses ourselves, but the quantitative decomposition of disturbances into independent sources of variation is unique.

We are relying on the idea that different countries have different relative sizes of disturbances to monetary policy, financial stability, productivity, fiscal disturbances, etc.

Data

13 countries: Austria, Belgium, Canada, Denmark, France, Italy, Japan, Netherlands, Norway, Sweden, United Kingdom, US, and Switzerland.

Sample periods differ across countries, based on data availability.

6 variables: real property prices (rp), real gdp (rgdp), short interest rate (usually 1-month t-bill or something similar), commodity prices (pc), gdp deflator (defl), and BIS "aha" credit (credit).

Estimation methods

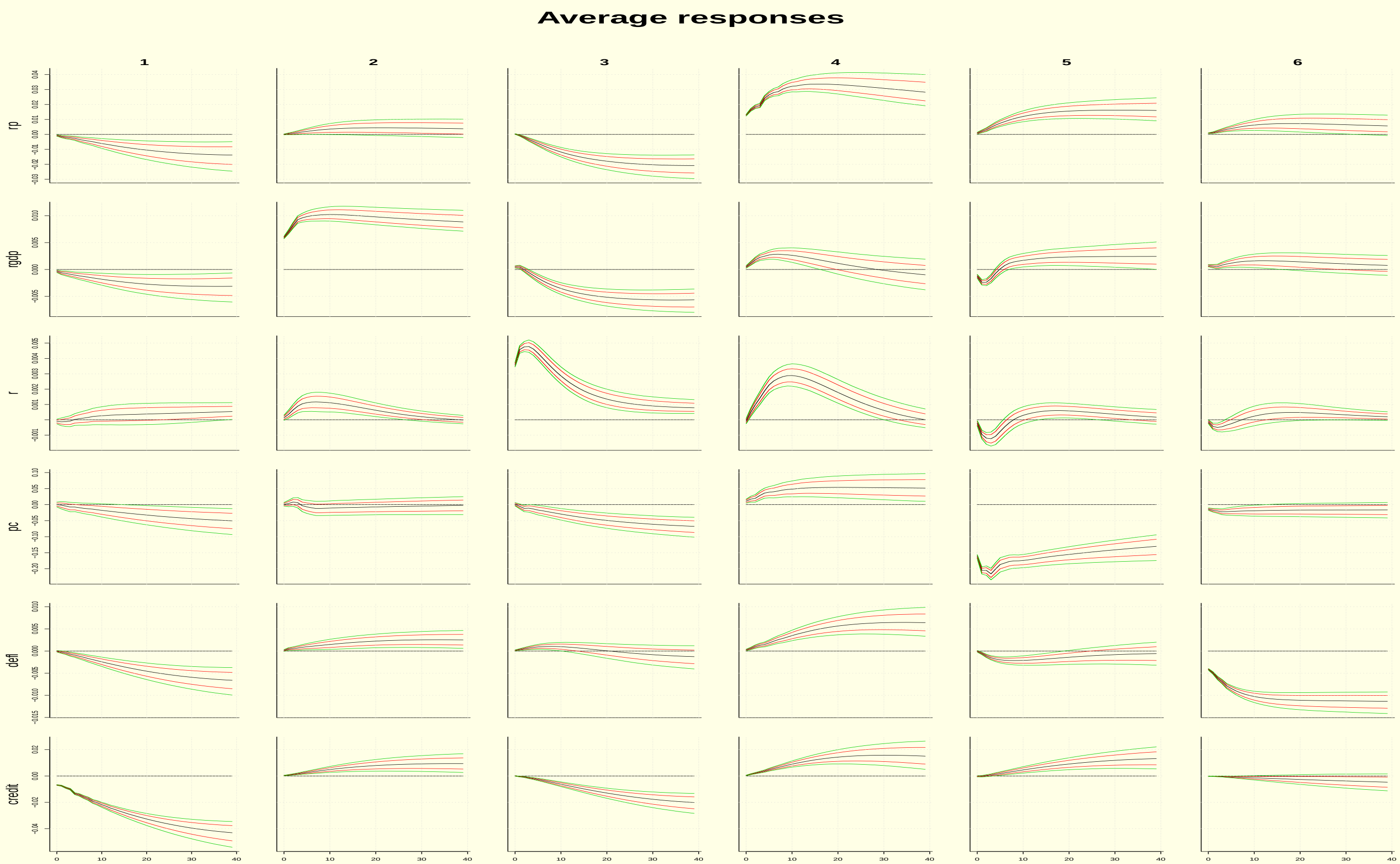
- 108 free parameters in A_0, Λ, 180 more in $A^+(L)$.

- A Bayesian approach is essential. A pure dummy-observation Minnesota prior (including pulling toward unit roots and toward cointegration) was used conditional on A_0, Λ.

- A_0 elements had mean 100 on the diagonal, 0 off diagonal, standard error 200. Rows of Λ independent Dirichlet, multiplied by number of countries (so average is about 1).

- The marginal distribution of $A^+ \mid A_0, \Lambda$ is available analytically, so the model is estimated via maximization, then MCMC posterior sampling, over the distribution of A_0, Λ. This is quite fast on a laptop.

Results



Worth noting

- The identification approach seems to have thrown up one shock that behaves like a usual SVAR monetary policy shock (number 3)
- There is no shock that produces an increase in credit followed by below-trend gdp.
- There is one shock (number 4) that produces steady exapansion of credit, followed by expansion of real gdp for about three years, then a decline back to, or slightly below, steady state. (The 10-year response is negative, but 0 is within the 68% error band.)

Why so different?

- No accounting for cross-country shock correlations in the same year, and these are high.
- 2008-9 is an outlier in nearly every country: mean shock is -9 standard deviations.
- MSV cluster by year, use no prior. Clustering on a highly unbalanced panel with 30 clusters is quite unreliable, tends to estimate too-small standard errors.
- Unit roots / initial conditions. The strongest priors toward unit roots were on the biggest model, and this should thus have the least problem of this sort. But requires further exploration.

- Country lists and data spans don't match.
- Symmetric models don't make sense: US r should probably enter everywhere else.
- Surely there is big time-varying heterosckasticity, and we've allowed only across countries.