Discussion of "Uncertainty and Business Cycles"

Ian Dew-Becker

July 14, 2016

- ▶ Recent explosion of work on uncertainty
    - ▶ Aggregate, idiosyncratic, macro, financial, household, firm, policy, etc.
- ▶ This paper: two forms of aggregate uncertainty – macro and financial
- ▶ Uncertainty is countercyclical. *Is it a cause or consequence?*
- ▶ Theory ambiguous on this point

This paper

- Two important contributions:

1. Novel identification scheme
2. Empirical VAR results

Identification scheme

- Consider endogenous y_t, x_t

$$\begin{bmatrix} y_t \\ x_t \end{bmatrix} = \begin{bmatrix} B_{yy} & B_{yx} \\ B_{xy} & B_{xx} \end{bmatrix} \begin{bmatrix} e_{y,t} \\ e_{x,t} \end{bmatrix} + \text{lags}$$

  want to know matrix B – tells us effects of structural shocks
  - Could be wages and education; interest rates and inflation
- Need one assumption. Cholesky: set either $B_{yx} = 0$ or $B_{xy} = 0$

Instrumental variable

- This paper's idea:

$$
\left[\begin{array}{c} y_t \\ x_t \\ z_t \end{array} \right] = \left[\begin{array}{ccc} B_{yy} & B_{yx} & 0 \\ B_{xy} & B_{xx} & 0 \\ B_{zy} & B_{zx} & B_{zz} \end{array} \right] \left[\begin{array}{c} e_{y,t} \\ e_{x,t} \\ e_{z,t} \end{array} \right]
$$

$$
\max \bar{C} \equiv \frac{|B_{zx}|}{\sqrt{B_{zx}^2 + B_{zz}^2}}
$$

- Need two timing restrictions
- If $B_{zy} = 0$, z valid instrument; so think of $\tilde{z}_t \equiv B_{zx} e_{x,t} + B_{zz} e_{z,t}$ as an instrument
- *Instrument relevance* $(\tilde{z})$: maximize $\bar{C}$
- Key question: what economic theory/assumption implies that $\bar{C}$ is maximized (or has known lower bound)?

Identifiction through numerical initialization

- ▶ If we observed a $\tilde{z}_t = B_{zx}e_{x,t} + B_{zz}e_{z,t}$, would be a classic instrument
- ▶ Paper constructs a $\tilde{z}_t$ by regressing z_t on a guess for $e_{y,t}$
- ▶ Iterate to convergence
    - ▶ I.e. guess $e_{y,t}^{(0)} \rightarrow$ identifies $B^{(0)} \rightarrow$ gives new $e_{y,t}^{(1)}$; iterate to convergence
- ▶ **Iteration alone does not constraint B at all**
- ▶ *Identification comes from the initial guess for $e_{y,t}$* (1st PC from macro variables)

This is a big deal

- Any time there is an endogeneity problem, IPIV procedure can in principle eliminate it
- E.g. what is the effect of education on income?
- Exogeneity restriction is unnecessary (though still need exclusion)
- Replace exogeneity with instrument relevance condition and iteration initialization

What this paper actually does (almost)

This paper

- Actual implementation (with single instrument)

$$
\begin{bmatrix} U_{M,t} \\ Y_t \\ U_{F,t} \\ S_t \end{bmatrix} = \begin{bmatrix} B_{MM} & B_{MY} & B_{MF} & 0 \\ B_{YM} & B_{YY} & B_{YF} & 0 \\ B_{FM} & B_{FY} & B_{FF} & 0 \\ B_{SM} & B_{SY} & B_{SF} & B_{SS} \end{bmatrix} \begin{bmatrix} e_{M,t} \\ e_{Y,t} \\ e_{F,t} \\ e_{S,t} \end{bmatrix} + \text{lags}
$$

- Four variable system: need 6 constraints
- Identified up to a three-dimensional rotation
- Can do a direct search over possible B – *exactly equivalent to trying different starting points for iteration*

The paper's result

- Impact matrix:

	Shocks:	e_M	e_Y	e_F
Responses (%):	Macro U.	0.04	**-0.95**	0.33
	Output	**0.62**	0.07	**-0.17**
	Finan. U.	0.81	0.25	2.57

Instrument relevance $=0.1267$

- Macro uncertainty responds negatively to output shock
- Macro uncertainty shock has initial *positive* effect on output
- Financial uncertainty shock reduces output

Alternative econometric optimum

- Impact matrix:

Shocks:	e_M	e_Y	e_F	
Responses (%):	Macro U.	0.90	**0.44**	-0.08
	Output	**-0.32**	0.47	**0.31**
	Finan. U.	1.18	-0.55	2.37

Instrument relevance $=0.1281$

- Opposite results, higher instrument relevance
- Equivalent to alternative starting point for iteration

Another optimum

- Impact matrix B:

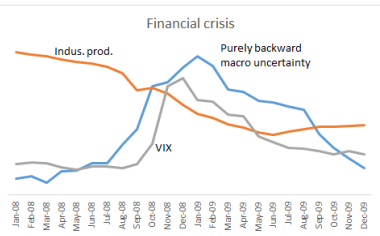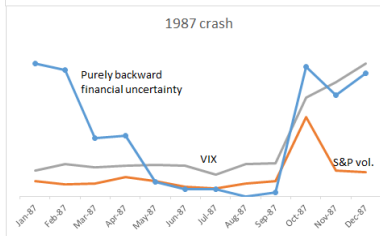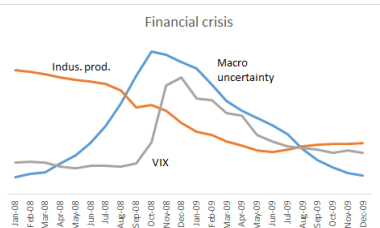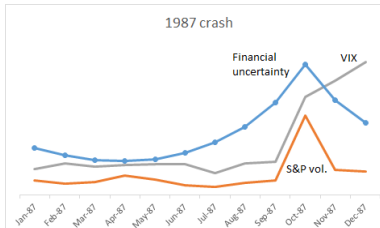|	Shocks:	e_M	e_Y	e_F
Responses (%):	Macro U.	0.29	**-0.93**	0.24
	Output	**0.58**	0.25	**-0.14**
	Finan. U.	0.70	0.20	2.61

Instrument relevance $=0.1281$

- Same instrument relevance, now match paper's results
- Illustrates degrees of freedom in B
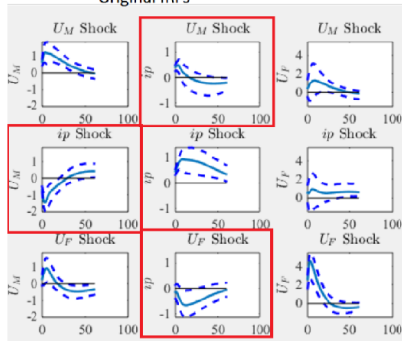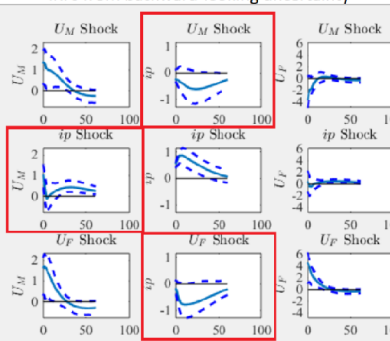- Key input is economic intuition to eliminate certain B's

The uncertainty series

- Goal: estimate uncertainty at a point in time
  - Uses large panel, Bayesian methods; big improvement on past work (e.g. just VIX)
- Estimate is a two-sided filter
  - Optimal for estimating $E\left[U_t | \text{full sample}\right]$
  - Not optimal for estimating *shocks* to U_t
- In a VAR, potentially problematic – includes forward-looking information

1987 crash

Financial uncertainty · VIX · S&P vol.

Financial crisis

Indus. prod. · Macro uncertainty · VIX

1987 crash

Purely backward financial uncertainty · VIX · S&P vol.

Financial crisis

Indus. prod. · Purely backward macro uncertainty · VIX

Original IRFs — IRFs from backward-looking uncertainty

- ▶ Macro uncertainty less endogenous to output; more negative effect on output
- ▶ Financial uncertainty shock unchanged
- ▶ **Not claiming that right-hand panel is correct** – just that including forward-looking information can matter in a VAR

Summary

- Novel identification method; power from numerical initialization and looking at estimated shocks
- Implies that macro U. mostly endogenous, financial U. major driver of output
- Suggestions:
  - More on economic motivation of identification
  - Make sure uncertainty measures are purely backward-looking