Discussion of “Uncertainty and Business Cycles”

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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:

\[
\begin{bmatrix}
  y_t \\
  x_t \\
  z_t
\end{bmatrix}
= \begin{bmatrix}
  B_{yy} & B_{yx} & 0 \\
  B_{xy} & B_{xx} & 0 \\
  B_{zy} & B_{zx} & B_{zz}
\end{bmatrix}
\begin{bmatrix}
  e_{y,t} \\
  e_{x,t} \\
  e_{z,t}
\end{bmatrix}
\]

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

- 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
- \textit{Instrument relevance} (\( \tilde{z} \)): maximize \( \bar{C} \)
- Key question: what economic theory/assumption implies that \( \bar{C} \) is maximized (or has known lower bound)?
Identifiﬁcation through numerical initialization

- If we observed a \( \tilde{z}_t = B_{xz} e_{x,t} + B_{zz} e_{z,t} \), 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 \( e_{y,t}^{(0)} \) → identiﬁes \( B^{(0)} \) → 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)**
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:

<table>
<thead>
<tr>
<th>Shocks:</th>
<th>$e_M$</th>
<th>$e_Y$</th>
<th>$e_F$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Macro U.</td>
<td>0.04</td>
<td>-0.95</td>
<td>0.33</td>
</tr>
<tr>
<td>Output</td>
<td>0.62</td>
<td>0.07</td>
<td>-0.17</td>
</tr>
<tr>
<td>Finan. U.</td>
<td>0.81</td>
<td>0.25</td>
<td>2.57</td>
</tr>
</tbody>
</table>

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:**

<table>
<thead>
<tr>
<th></th>
<th>$e_M$</th>
<th>$e_Y$</th>
<th>$e_F$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Macro U.</td>
<td>0.90</td>
<td>0.44</td>
<td>-0.08</td>
</tr>
<tr>
<td>Output</td>
<td>-0.32</td>
<td>0.47</td>
<td>0.31</td>
</tr>
<tr>
<td>Finan. U.</td>
<td>1.18</td>
<td>-0.55</td>
<td>2.37</td>
</tr>
</tbody>
</table>

*Instrument relevance = 0.1281*

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

- Impact matrix $B$:

<table>
<thead>
<tr>
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<th>$e_Y$</th>
<th>$e_F$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Macro U.</td>
<td>0.29</td>
<td>-0.93</td>
<td>0.24</td>
</tr>
<tr>
<td>Output</td>
<td>0.58</td>
<td>0.25</td>
<td>-0.14</td>
</tr>
<tr>
<td>Finan. U.</td>
<td>0.70</td>
<td>0.20</td>
<td>2.61</td>
</tr>
</tbody>
</table>

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 $E[U_t|\text{full sample}]$
- Not optimal for estimating shocks to $U_t$

In a VAR, potentially problematic – includes forward-looking information
- 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