What causes banking crises? An empirical investigation

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Introduction

Much criticism of DSGE macroeconomics since the banking crisis: models could not analyse banking crisis because a) no banking element b) no mechanism (apart from stationary shock) to model crisis; yet crisis seems to produce permanent (’trend’) effects on GDP c) was unable to ‘predict’ events.
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Criticism ill-founded in some ways: a) banking models widely in use in which asymmetric information creates a risk premium; b) in macro models nonstationary shocks enter in principle even if ignored usually in practice; c) the models seem to be accurate in saying that ‘crisis’ cannot be predicted- noone predicted it except for ‘doomsayers’ who predicted crisis regularly years before it actually occurred. Yet basic point well taken: models being used for macro (such as Smets-Wouters) did not predict the possibility of banking crisis of sort we had.
Here we add the generic banking model of Bernanke et al to the Smets-Wouters model of the US, we test it against US data and find estimated parameters for which it fits, and add shocks derived from the unfiltered data (so some shocks nonstationary). Our claim is that it gives a coherent account of banking crises and of this crisis in particular.
The model we use

- We take Smets-Wouters model of US (2007) as modified by Le et al (2012) to have a competitive sector as well as an imperfectly competitive one: this heterogeneity allows the model to fit the data whereas imp. comp. with one homogeneous Calvo parameter does not, rather as found by Dixon and coauthors in recent work. The weight on the two sectors adjusts in different samples, mimicking the degree of price/wage rigidity which seems to vary with the environment- eg in Great Moderation rigidity is higher than before.
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- To this SW model we add the Bernanke, Gertler and Gilchrist (1999) ‘generic’ banking model, in which entrepreneurs borrow externally up to their net worth from the banks which charge a risk premium giving them an expected yield equal to their deposit rate. Net worth is accumulated through profits subject to a firms’ death rate with replacement by new firms entering.
We first test a calibrated version of this SWBGG (‘Synthesis’) model on stationary (HP-filtered) data; this fails on our main criterion, the joint behaviour of output, inflation and interest rates. The Wald test checks whether the model’s simulated behaviour statistically could e generating the actual behaviour as represented by a VAR- so-called Indirect Inference (or simulation-based testing method). Le et al (2012) show that the method has substantial power and is accurate in small samples.
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We re-estimate the model by Indirect Inference, using Simulated Annealing algorithm; we get parameters for which the model passes the test comfortably. We then extract the shocks implied by the raw data and this newly-parameterised model and apply these to the model to give an explanation of events during the crisis.
Figure: IRFs for a Monetary Shock
Figure: IRFs for a Productivity Shock
Testing the Synthesis Model

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Example below of an Impulse Response Function and its 95% bounds; the IRFs lie within the bounds because these come from the VAR coefficients which lie within the 95% bounds of their joint distribution according to the Wald test.
Figure: VAR IRFs for a Monetary Shock
Shocks during the crisis period

- Extract shocks from (unfiltered) data and model over 1984-2009. Of these productivity clearly non-stationary; external premium trend-stationary but has close to unit root. Other all stationary or trend-stationary.
Key shocks are: productivity, labour supply/competitive real wage ‘push’, external premium, Taylor Rule
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- Interpretation: Taylor Rule=zero bound; productivity continued to grow apart from the heart of crisis

Wage ‘push’ possible reasons: oil/commodity price rises reduce wages abnormally and produce intertemporal substitution; Obama programme boosting union power and health care reform causing uncertain higher costs for employees.

External premium: subprime loans unravelling. Role of government pressure in building up subprime loans exploiting rising house prices. Lehman collapse causes premium to peak as government is sucked into a ...al bail-out. Hence this shock includes government action both in building the subprime problem and in ultimately defusing it.
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Figure: US Real House Price Index (2000=100): 1975-2009 (Federal Housing Finance Agency)
Government intervention building up the subprime shock

Political and Legislative Targets

1) 1996 HUD target for F and F: 42% of mortgages to go to borrowers with income below area median (50% 2000; 52% 2005).
2) 1996 HUD target for ‘special affordable’ (borrowers with less than 60% of area median) was 12% (20% 2000; 22% 2005).
4) Taxpayer Relief Act increased CGT exclusion band on houses


Table: Evidence of Political Effect
Government intervention building up the subprime shock

Effects on Home Ownership

1) 1994-2006, US home ownership rate up 9.4% (to 70% of population). Hispanics up by 20.2%; Asians 17.2%; African Americans 14%; non-Hispanic Whites 8.2%.

2) Hispanic population 44% Pacific; 30% South; Asian population 49% Pacific. African; American 45% South.

3) Prices in these two regions both take off from 1992 but differentially due to extra supply response in South (less zoning tightness).


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<th>Table: Evidence of Political Effect</th>
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Variance decomposition of typical crisis episode

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<tr>
<th>SHOCK</th>
<th>Int. rate</th>
<th>Inflation</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investment</td>
<td>17.1</td>
<td>0.7</td>
<td>9.7</td>
</tr>
<tr>
<td>Taylor Rule</td>
<td>9.4</td>
<td>1.1</td>
<td>2.9</td>
</tr>
<tr>
<td>Productivity</td>
<td>4.5</td>
<td>3.1</td>
<td>24.0</td>
</tr>
<tr>
<td>Price Mark-up</td>
<td>15.9</td>
<td>85.4</td>
<td>1.0</td>
</tr>
<tr>
<td>Labour Supply</td>
<td>21.8</td>
<td>8.7</td>
<td>36.3</td>
</tr>
<tr>
<td>Premium</td>
<td>17.1</td>
<td>0.5</td>
<td>15.0</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
<td>100</td>
<td>100</td>
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<th></th>
<th>Int. rate</th>
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<tbody>
<tr>
<td>Banking Shocks</td>
<td>20.9</td>
<td>0.6</td>
<td>17.9</td>
</tr>
<tr>
<td>Non-Banking Shocks</td>
<td>79.1</td>
<td>99.4</td>
<td>82.1</td>
</tr>
</tbody>
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**Table:** Variance Decomposition for Crisis Period
What causes a typical crisis?

- Main cause is non-banking shocks: to output productivity/labour supply/investment; to inflation commodity prices/labour supply; to interest rates all of these and the Taylor Rule.
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- Inflation was not much affected by the banking shock.
Figure: Shock Decomposition for Output During the Banking Crisis Episode
Crisis period real time-line

Figure: Shock Decomposition for Interest Rate During the Banking Crisis Episode
Figure: Shock Decomposition for Inflation During the Banking Crisis Episode
Output: labour supply/investment/premium dominant negative shocks, offset by productivity. Taylor Rule minor.
Crisis period real time-line

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- **Inflation:** fluctuates + and - 0.5% (2% per annum) around target. By end is at bottom of this range as commodity price shock goes into reverse; productivity offsets labour supply; premium and Taylor Rule add to downward pressure.
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- Extreme financial shocks not required to generate financial crisis- see last set of charts which came from normal financial shocks.
- Extreme financial shocks do not on their own generate financial crises- see charts of bootstraps generated by financial shocks only 1984-2009 (including extreme values in crisis). Only get bad recessions (and premium rises); no crises.
Crisis Not Accompanied by Financial Crisis

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No Crises with only Financial Shocks

Figure: Simulation with only Financial Shocks
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- Experience of other countries (eg Australia, Spain) that prevented banking ‘special purpose vehicles’ suggests that limited prudential limits on banks helpful- prevented them buying toxic sub-prime package.
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Fiscal policy shows up in moderating the premium shock via bail-out (taxpayer credit provision) but not otherwise. QE effect may also be found from end-2008 in the moderating of the premium.