Empirical Macroeconomic Modelling: 5. Default Risk, Collateral and the Financial Accelerator

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Moving Beyond Risk-Free Interest Rates

- Up to now, we have been discussing how monetary policy sets something called "the interest rate."
- However, in reality, monetary policy sets a very particular targeted short-term risk-free interest rate, usually the overnight interest rate that banks charge each other for very short-term loans.
- But these interest rates are not very important for the economy. Most of the important borrowing that takes place involved some element of risk.
- This risk, and how it operates and how it changes over time, is very important for understanding the way the financial sector interacts with modern economies.
- A lot of borrowing also operates via financial intermediaries such as banks and these are very special institutions worth examining closely.

Part I

Default Risk and Collateral

Default Risk, Collateral and Borrowing Rates

- An alternative to investing in (essentially) risk-free government bonds is to lend to households and businesses.
- Because there is some risk that these loans will be defaulted on, these types of loans need to have higher interest rates.
- Suppose the interest rate on risk-free bonds is r percent. Now consider a loan with interest rate R but a probability of default of p.
- This loan has
  1. A probability $1 - p$ of a return of R.
  2. A probability p of a return of -1: Losing all your money.
  3. So, the expected return is $R - Rp - p$. Rp will be small so the expected return is approximately $R - p$.
- To deliver the same expected return as the risk-free bond, this loan has to have $R - p = r$, so its interest rate needs to be $R = r + p$.
- If the loan has some collateral, so default implies a return of $c - 1 < 0$, then the loan needs to have a return of approximately $R = r + (1 - c)p$, so collateralized loans have lower interest rates.

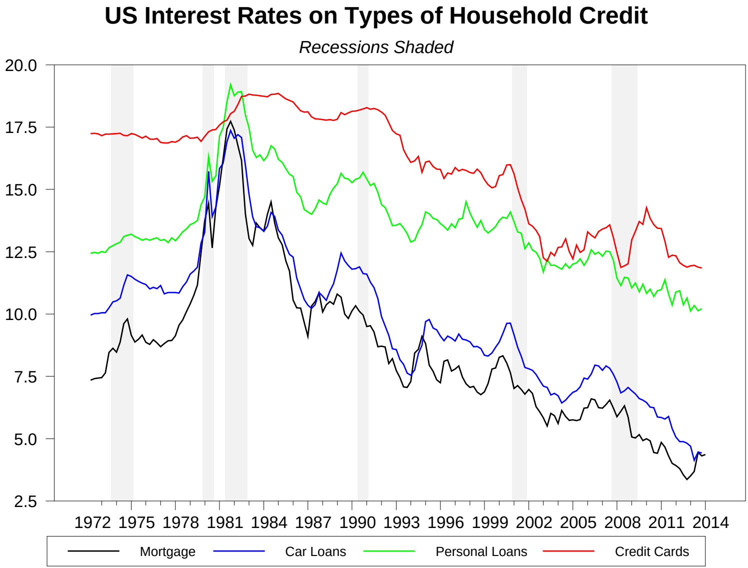
Four Types of Household Borrowing

- To assess whether this framework helps to explain interest rates, consider four different types of loans to households:

  1. **Credit Cards**: No collateral. Can be used for any purpose (e.g. shopping for clothes). No set schedule for repayments apart from a small minimum monthly payment. Attractive to irresponsible borrowers who may not pay back.
  2. **Personal Loans**: No collateral. Usually screened by a bank manager as being for a particular purpose. Generally, a set schedule for repayments.
  3. **Car Loans**: The car can be used as collateral. But it's not great collateral: Cars lose value quickly. Set schedule for repayments.
  4. **Mortgages**: House used as collateral and usually it's pretty good collateral. Set schedule for repayments and people are generally very reluctant to default and lose their house.

- This suggests interest rates on credit cards should be the highest, then personal loans, then car loans, then mortgages.
- The chart on the next page confirms that this is indeed the case.

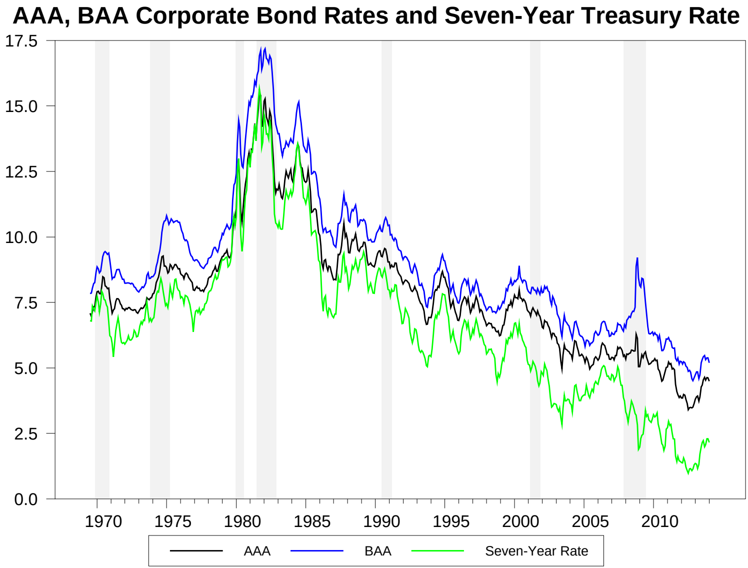
Default Risk and Collateral Affect Borrowing Rates



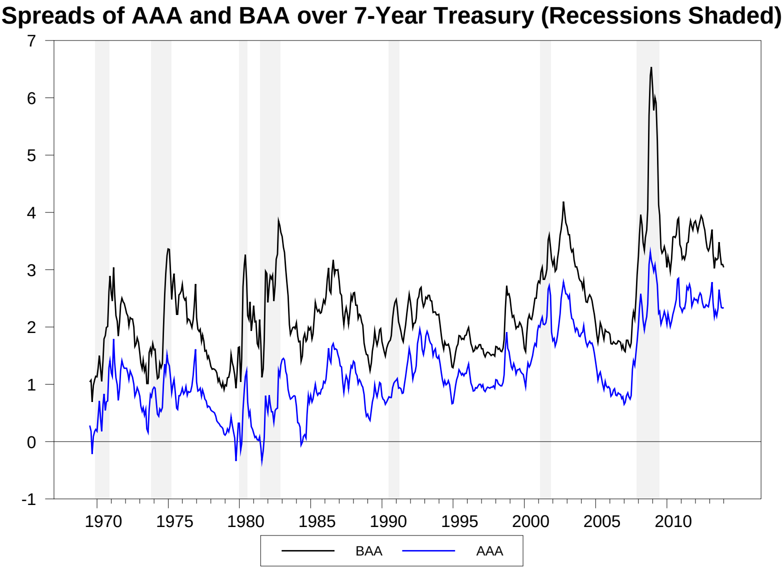
Corporate Bond Rates

- Large public corporations have their credit-worthiness rated by independent ratings agencies such as Moody's and S&P.
- The highest-rated firms get an AAA rating.
- Firms with that are an "adequate" credit risk are given a BAA rating by Moody's.
- Corporate bonds tend to move in line with rates on Treasuries of similar maturities, usually around seven years.
- But BAA bond rates are higher than AAA rates. This reflects higher perceived default rates.
- Because default risk goes up and down over the cycle, the "risk spreads" associated with these bonds tend to display a cyclical pattern, rising during and after recessions, when corporate default risks are high.
- These risk spreads spiked upwards to all-time highs during the period after the Lehmans bankruptcy. They have come back down now but are still high by historical standards.

Relationship Between Treasury and Corporate Bonds



Risk Spreads are Cyclical



Part II

The Financial Accelerator

Collateral Feedback Effects: The Financial Accelerator

- We have seen how the value of collateral pledged by a borrower can affect the interest rate at which they borrow.
- Because assets values go up and down with the state of the economy, this suggests that a mechanism by which the financial sector can propagate business cycle shocks: A shock that produces a recession leads to higher interest rate spreads for borrowers and thus a deeper recession.
- There are a number of ways to model the link between interest rates and collateral formally. Bernanke and Gertler (1989) was a famous paper that introduced collateral-based risk spreads into an otherwise-standard real business cycle model and showed how it produced more substantial impulse responses to shocks. This mechanism became known as the *financial accelerator*.
- Bernanke, Gertler and Gilchrist (1999) adds the financial accelerator to a fairly standard New Keynesian model.
- The next few slides are borrowed from lecture notes in which Mark Gertler explains the log-linearised version of the model.

Mark Gertler's Description of the BGG Model

Aggregate demand

$$y_t = \frac{C}{Y}c_t + \frac{I}{Y}inv_t + \frac{G}{Y}g_t + \frac{C^e}{Y}c_t^e + ...$$

$$c_t = -\sigma r_{t+1} + E_t c_{t+1}$$

$$c_t^e = \frac{1-\phi}{\phi}n_{t+1}$$

Mark Gertler's Description of the BGG Model

$$(inv_t - k_t) = \varphi q_t$$

$$E_t r_{kt+1} = (1-\vartheta) E_t (p_{wt+1} - p_{t+1} + y_{t+1} - k_{t+1}) + \vartheta E_t q_{t+1} - q_t$$

$$E_t r_{kt+1} - r_{t+1} = -v(n_t - q_t - k_{t+1})$$

Mark Gertler's Description of the BGG Model

Aggregate supply

$$y_t = a_t + \alpha k_t + (1-\alpha) l_t$$

$$y_t - l_t = \mu_t + \gamma_l l_t + c_t$$

$$\pi_t = \kappa(p_{wt} - p_t) + \beta E_t \pi_{t+1}$$

Mark Gertler's Description of the BGG Model

Evolution of state variables

$$k_{t+1} = \delta inv_t + (1 - \delta)k_t$$

$$n_t = \frac{\theta RK}{N}[r_t^k - r_t] + \theta R(r_t + n_{t-1})$$

with

$$r_r = i_{t-1} - \pi_{t-1}$$

Mark Gertler's Description of the BGG Model

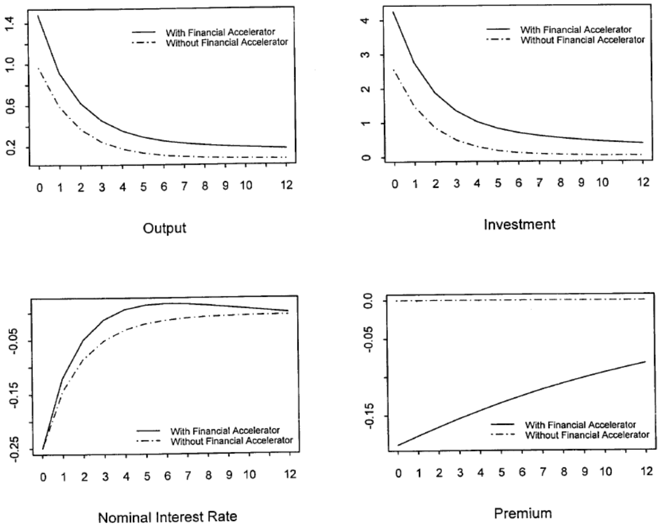
Monetary Policy Rule

$$i_t = \rho i_{t-1} + (1-\rho)[\gamma_\pi \pi_t + \gamma_y (y_t - y_t^n)] + \varepsilon_t^{rn}$$

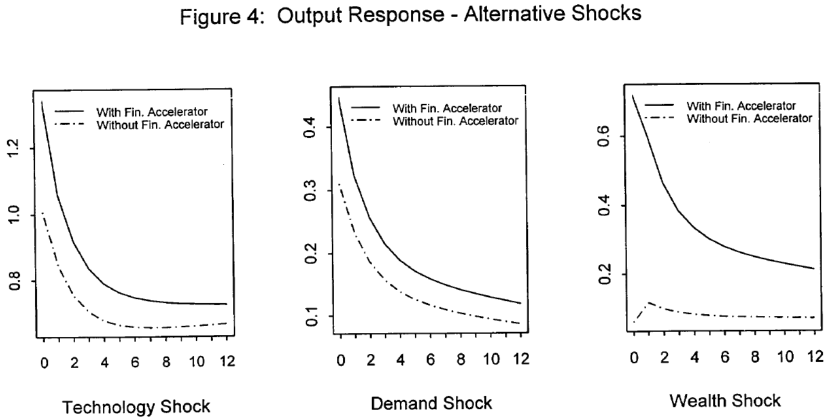
$$i_t = r_{t+1} - E_t \pi_{t+1}$$

Impulse Responses with the Financial Accelerator

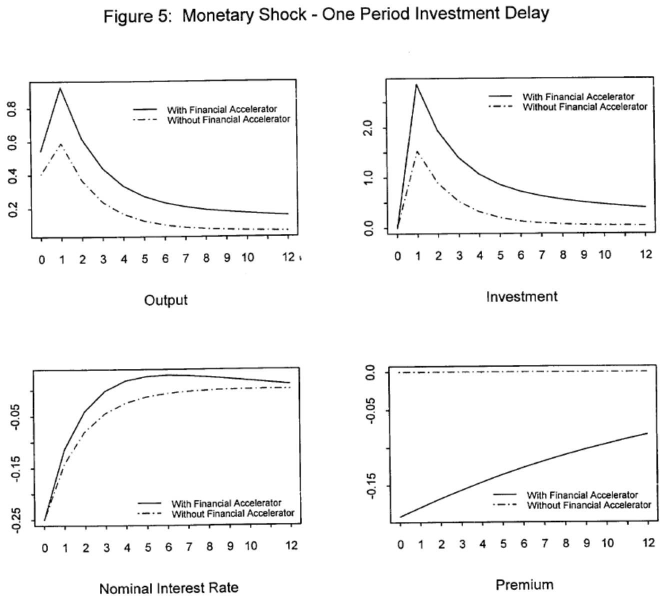
Figure 3: Monetary Shock - No Investment Delay



Impulse Responses with the Financial Accelerator



Impulse Responses with the Financial Accelerator



Limits to DSGE Modelling of Financial Factors

- After the global financial crisis, DSGE models were correctly criticised for generally having a very limited role for the financial system. The BGG model was a partial exception but this modelled only a very limited aspect of financial transmission mechanisms.
- There is more work underway now to add financial factors to DSGE models.
- There may be limits to how far you can get with modelling financial factors with DSGE models.
- In the log-linearised forms in which they are simulated and estimated DSGE models can capture simple linear interactions between variables but they cannot capture highly nonlinear events. So, for example, they generally cannot capture the complete closure of a sovereign bond market or the sudden onset of a bank run. Credit rationing is another type of behaviour that linearised DSGE models would have great trouble capturing.
- So while DSGE models should be enchanced to incorporate how the financial system amplifies shocks in normal booms and recessions, it is probably too much to ask them to be useful tools to forecast or understand serious crises.

Blanchard on Modelling Financial Factors

- IMF chief economist, Olivier Blanchard, has a new article discussing the idea that often the dangers for the global economy "lurk in dark corners" that the economics profession does not understand well.
- *"How should we modify our benchmark models—the so-called dynamic stochastic general equilibrium (DSGE) models that we use, for example, at the IMF to think about alternative scenarios and to quantify the effects of policy decisions? The easy and uncontroversial part of the answer is that the DSGE models should be expanded to better recognize the role of the financial system—and this is happening. But should these models be able to describe how the economy behaves in the dark corners?*
- *Let me offer a pragmatic answer. If macroeconomic policy and financial regulation are set in such a way as to maintain a healthy distance from dark corners, then our models that portray normal times may still be largely appropriate. Another class of economic models, aimed at measuring systemic risk, can be used to give warning signals that we are getting too close to dark corners, and that steps must be taken to reduce risk and increase distance. Trying to create a model that integrates normal times and systemic risks may be beyond the profession's conceptual and technical reach at this stage."*

Dynare Code for DSGE Models with Financial Factors

- Volker Wieland's Macro Models Database is a fantastic resource of Dynare code for macro models.
- It contains code for a number of DSGE-style models that incorporate financial factors.
- Three of these papers and their Dynare code are on the course website.
  1. "A Model of Unconventional Monetary Policy," Mark Gertler and Peter Karadi, *Journal of Monetary Economics*, 2011.
  2. "Credit and Banking in a DSGE Model of the Euro Area," Andrea Gerali, Stefano Neri, Luca Sessa and Federico Maria Signoretti, *Journal of Money, Credit and Banking*, 2010.
  3. "Monetary and Macroprudential Policy Rules in a Model with House Price Booms," Prakash Kannan, Pau Rabanal and Alasdair Scott, *The B.E. Journal of Macroeconomics*, 2012.