Extensions/Applications of the CSV Framework

ECON 70428: Advanced Macro: Financial Frictions

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Extensions

The Bernanke and Gertler (1989), Carlstrom and Fuerst (1997), and Bernanke, Gertler, and Gilchrist (1999) papers are based on the CSV framework of Townsend (1979)

Idiosyncratic returns to entrepreneurs and the possibility of default give rise to an **external finance premium**

More net worth an entrepreneur has, the better access to credit it has

This can generate both **persistence** (BG 1989 and CF 1997) as well as **amplification** (BGG 1999) depending on the environment and the underlying shocks

We will focus on two extensions of this framework:

1. Christiano, Motto, and Rostagno (2014): "Risk Shocks"
2. Carlstrom, Fuerst, and Paustian (2016): "Optimal Contracts, Aggregate Risk, and the Financial Accelerator"

Non-Financial Components of the CMR (2014) Model

The CMR (2014) paper is basically BGG (1999) with a shock to the variance from which ω is drawn

But it has lots of other bells and whistles that BGG (1999) don't necessarily include

- Sticky wages (in addition to sticky prices)
- Backward price and wage indexation
- Variable capital utilization
- "I-dot" adjustment costs (as in Christiano, Eichenbaum, and Evans 2005)
- Habit formation in consumption
- Long-term bonds
- Many more types of shocks (preference, investment-specific technology)

Risk Shocks

The key thing in the model is time-varying cross-sectional risk facing entrepreneurs

Entrepreneur borrows funds from intermediary to finance purchase of new capital, K_{t+1}

i.e. it borrows $Q_t K_{t+1} - N_t$ at some gross loan rate (the loan is intertemporal)

It draws a value of ω_t. Across entrepreneurs, $\mathbb{E}[\omega_t] = 1$

This gives it capital $\omega_t K_{t+1}$

Enjoys entrepreneur-specific return $\omega_t R^k_{t+1}$ in $t+1$, where R^k_{t+1} is the aggregate return to physical capital

Distribution on ω_t

As in CF (1997) and BGG (1999), let:

$$\ln(\omega_t) \sim N(\mu, \sigma_t^2)$$

The difference is that σ_t is time-varying, e.g.:

$$\sigma_t = (1 - \rho_\sigma)\sigma + \rho_\sigma \sigma_{t-1} + s_\sigma \varepsilon_{\sigma,t}$$

The shock to σ_t, $\varepsilon_{\sigma,t}$, is called the risk shock

- Note this is not aggregate risk, which wouldn't have first-order effects
- It is a shock to the **cross-sectional variance of** ω

Basic Intuition

An increase in cross-sectional risk increases probability of an entrepreneur drawing a low ω

Low ωs drive entrepreneurs to default

Default is costly for lenders

Hence, lenders demand a higher interest rate on these loans

But this reduces the overall demand for capital and hence investment

Triggering a recession

Anticipated vs. Unanticipated Risk

CMR (2014) include both a "conventional" surprise risk shock but also an anticipated risk shock, i.e. a "news shock":

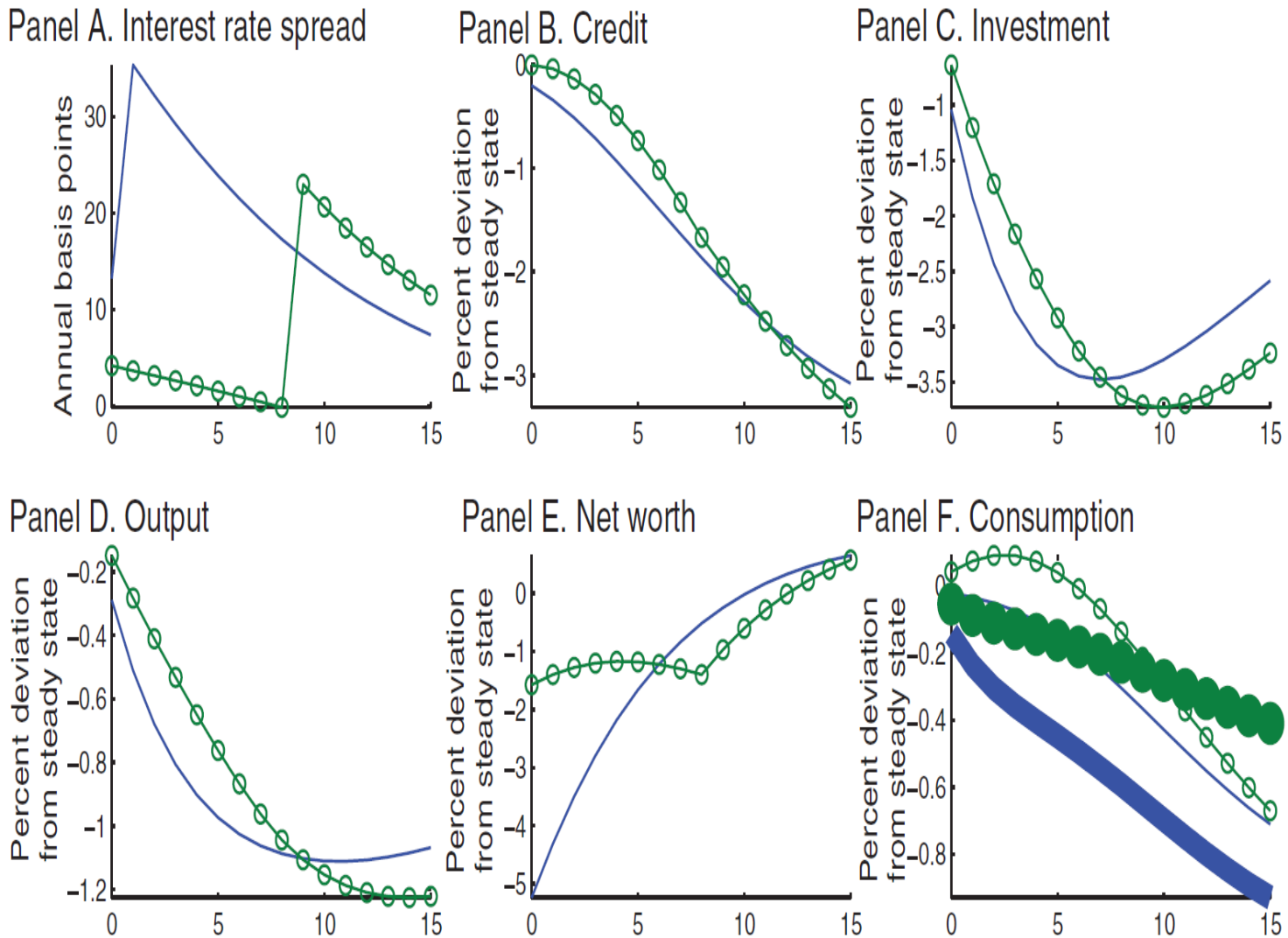
$$\sigma_t = (1-\rho_\sigma)\sigma + \rho_\sigma \sigma_{t-1} + s_\sigma \varepsilon_{\sigma,t} + s_{\sigma'} \varepsilon_{\sigma',t-l}$$

Here, $l > 0$ is the anticipation horizon

They estimate model and find that risk shocks are important, and drive out importance of marginal efficiency of investment shocks (Justiniano, Primiceri, and Tambalotti 2010, 2011)

Why? Risk shock does better job matching business cycle statistics related to financial variables – in particular credit flows and stock prices (think of Q_t as proxying for stock prices)

IRFs to Risk Shock: Unanticipated vs. Anticipated



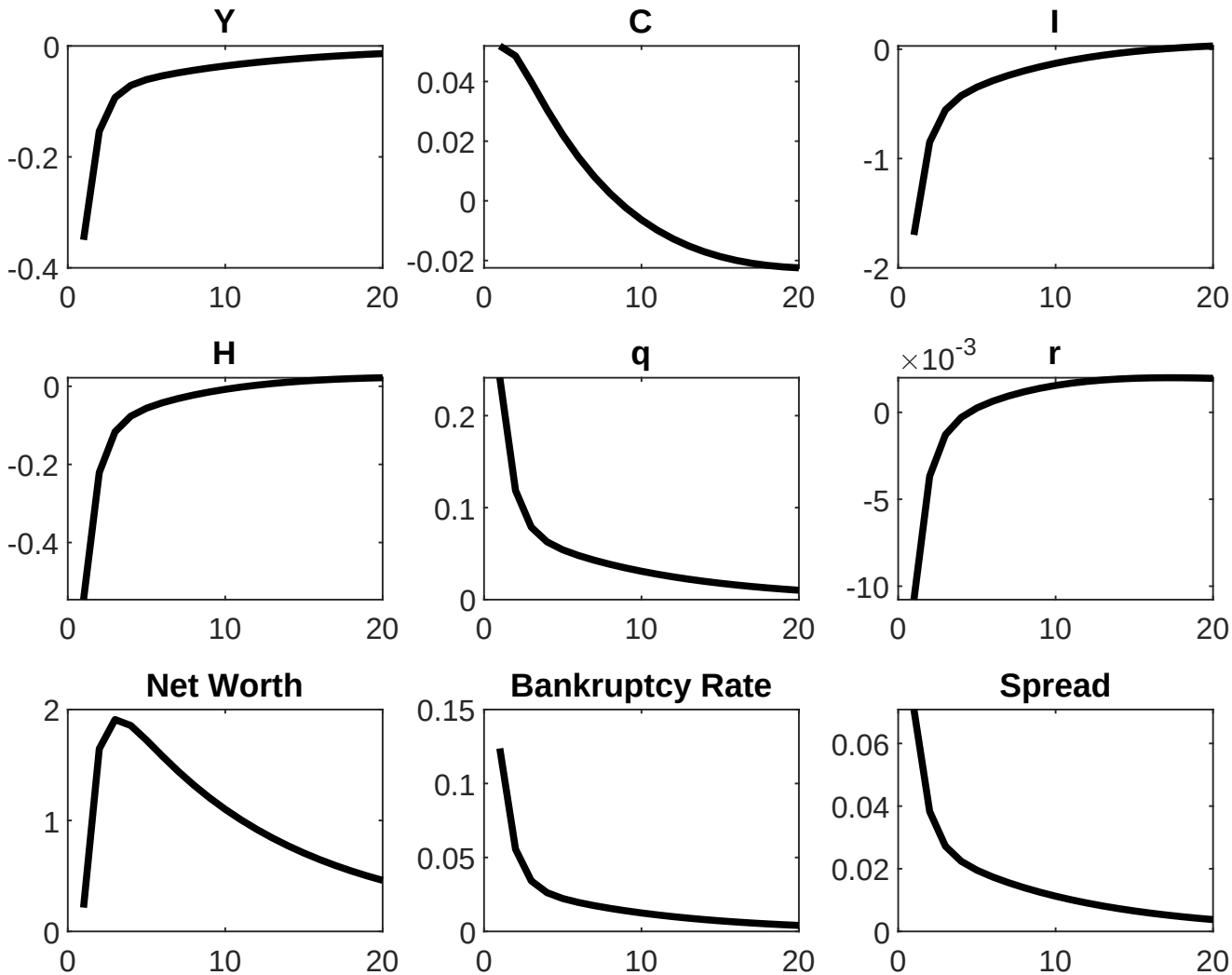
Risk Shocks in the Carlstrom and Fuerst (1997) Model

It is possible to study risk shocks in the CF (1997) model

This helps elucidate the core mechanism in CMR (2014), but also better highlights some of the differences between CF (1997) and the BGG (1999)

- In particular, in CF (1997) the agency friction applies to the **supply curve** for capital (because it applies to entrepreneurs who do investment)
- In BGG (1999) and related approaches the friction applies to the **demand curve** for capital
  - The capital supply curve is upward-sloping because of adjustment costs, not the agency friction per se as in CF (1997)
  - Entrepreneurs demand capital (from separate capital goods producers) to in turn lease to production firms
  - Their net worth and the riskiness of their idiosyncratic returns influences how much of a loan they can get, and hence influences how much capital they can purchase

CF (1997) IRFs to a Risk Shock



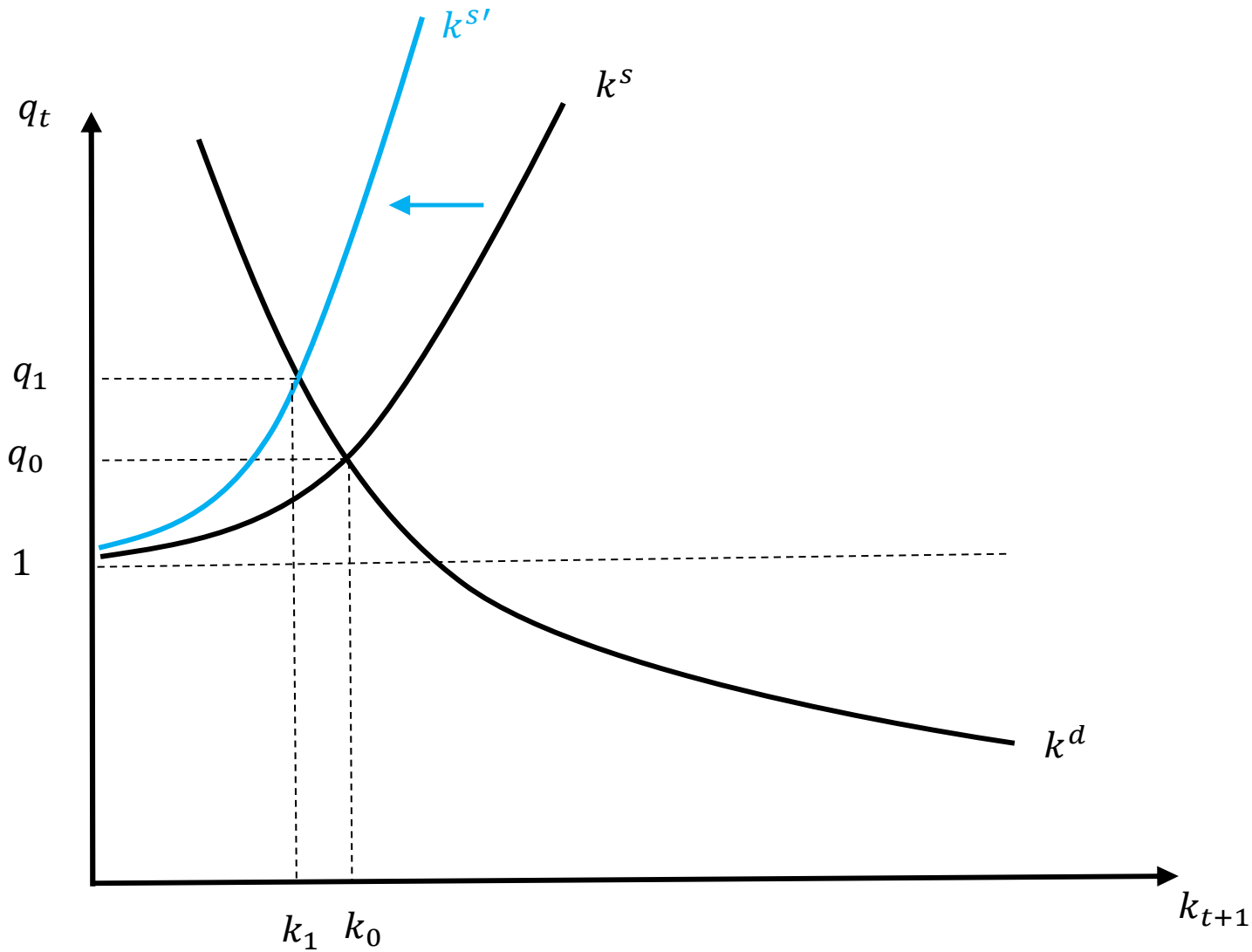
Mechanism of Risk in CF (1997) Model

An increase in risk:

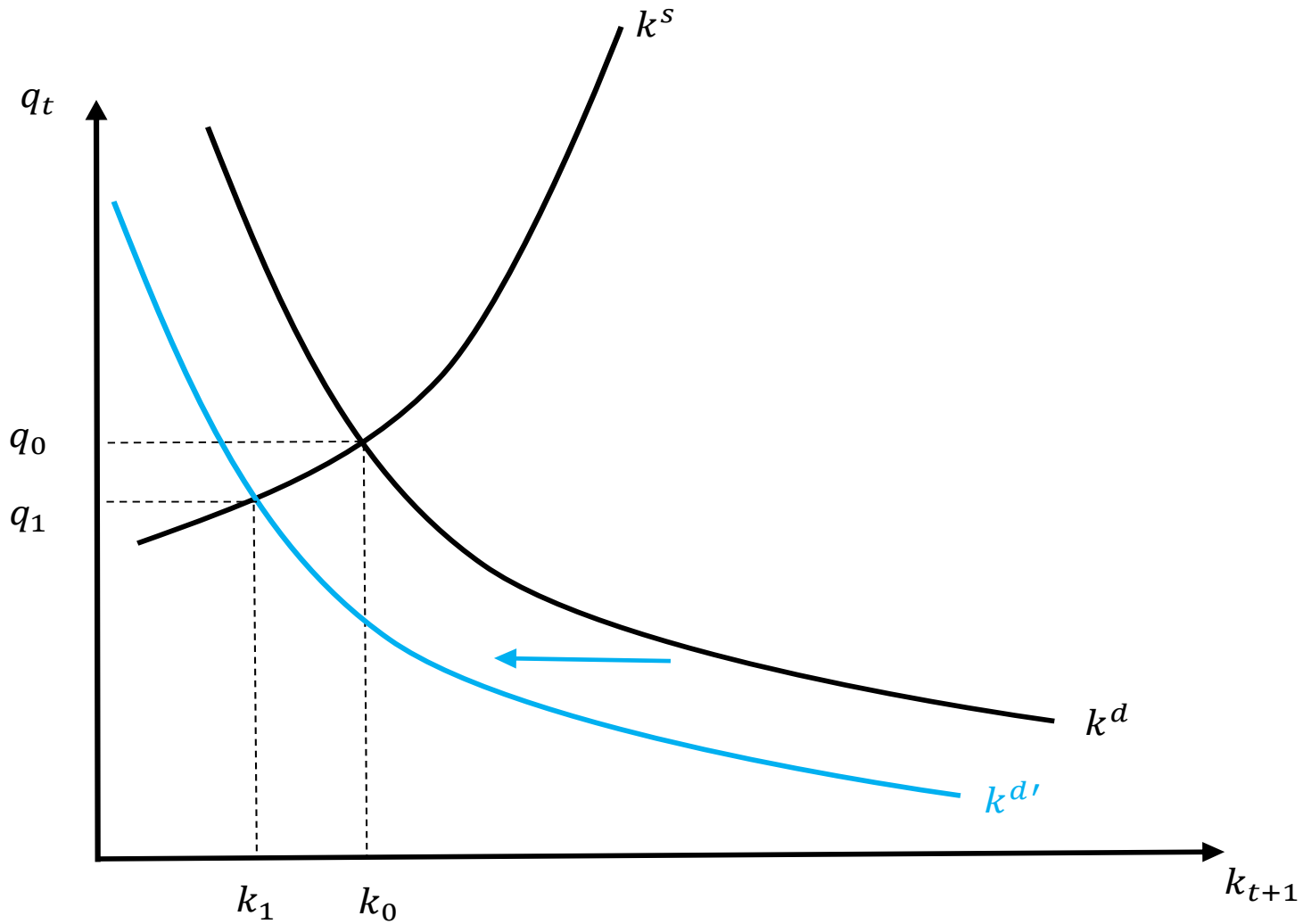
- Increases probability of a low ω draw
- Results in tightening credit and less investment
- Higher risk spread and higher bankruptcy rate
- But **higher price of capital,** q_t**,** and hence net worth

Effectively, an increase in risk reduces the **supply of new capital goods**

CF (1997) and Risk: Demand-Supply Interpretation



CMR (2014) and Risk: Demand-Supply Interpretation



Discussion

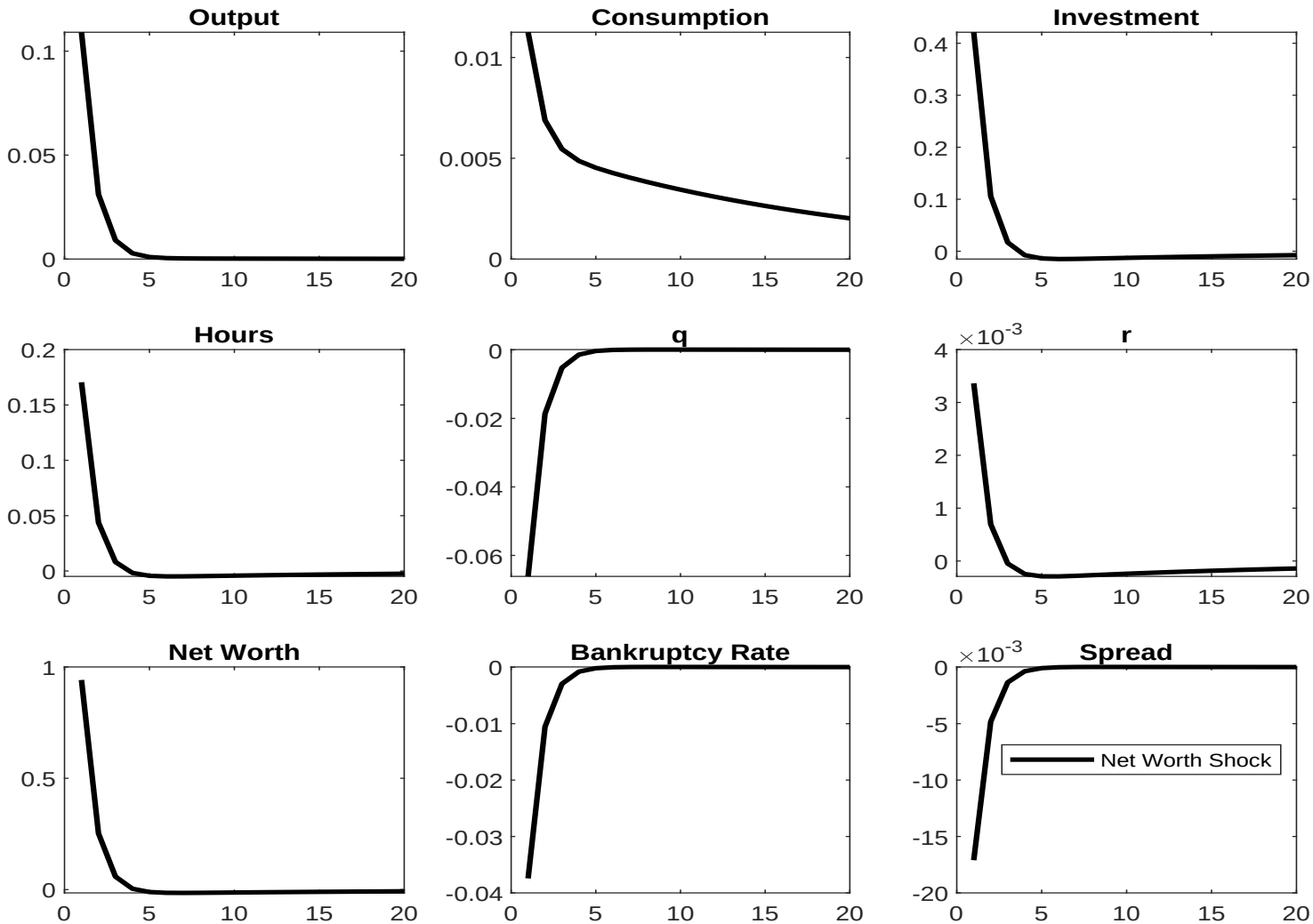
An increase in risk causes capital supply to contract in CF (1997), resulting in an increase in q_t (i.e. countercyclical stock prices)

But in CMR (2014), based on BGG (1999), it is the capital demand curve that is shifting, so q_t falls (i.e. procyclical stock prices, consistent with data)

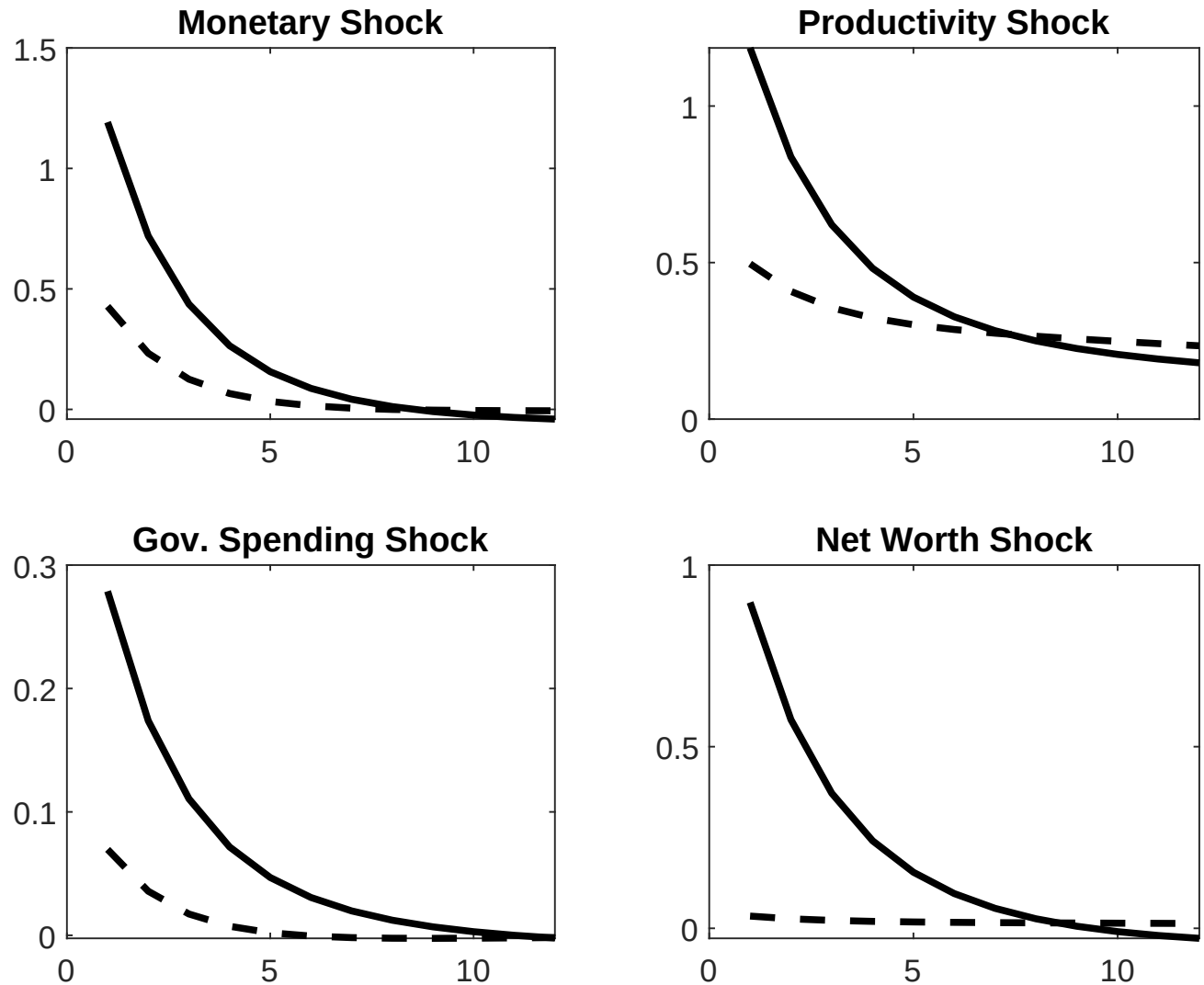
You see this same dynamic at work when looking at net worth shocks in CF (1997) compared to BGG (1999) – different implications for q_t – see next slides

CMR (2014) refer to the net worth shock as an equity shock. They show, because of general equilibrium considerations, the equity shock has counterfactual implications for the cyclicality of credit

Net Worth Shock: Countercyclical q_t in CF (1997)



Net Worth Shock: Procyclical Q_t in BGG (1999)



Optimal Contracts, Aggregate Risk, and the Financial Accelerator

Carlstrom, Fuerst, and Paustian (2016, *AEJ: Macro*), throw some cold water on the celebrated financial accelerator mechanism of BGG (1999)

In BGG (1999), the lender's return on a loan to entrepreneurs is **predetermined** at the riskless, one-period (gross) rate, R_t

This predetermined return is what drives the financial accelerator

- Consider a shock that raises the aggregate return to capital (e.g. productivity)
- Because the lender's return is predetermined, this results in a large increase in entrepreneurial net worth
- But this increase in net worth lowers agency costs – this results in lower leverage, a lower risk spread, more investment, and the virtuous cycle of the financial accelerator

Privately Optimal Contract

CFP (2016) show that the BGG (1999) contract is not privately optimal

Basically, idea is that contract should be written to provide insurance to households for aggregate shocks

The privately optimal contract has debt repayment linked to innovations in the aggregate return to capital, the level of household consumption, and entrepreneur's valuation of net worth

Under the privately optimal contract, the gains from positive aggregate shocks to the return to capital are, in effect, shared by the lender and the entrepreneur

But this dampens the reallocation of net worth to entrepreneurs from these shocks, thus largely eliminating the financial accelerator

The Details

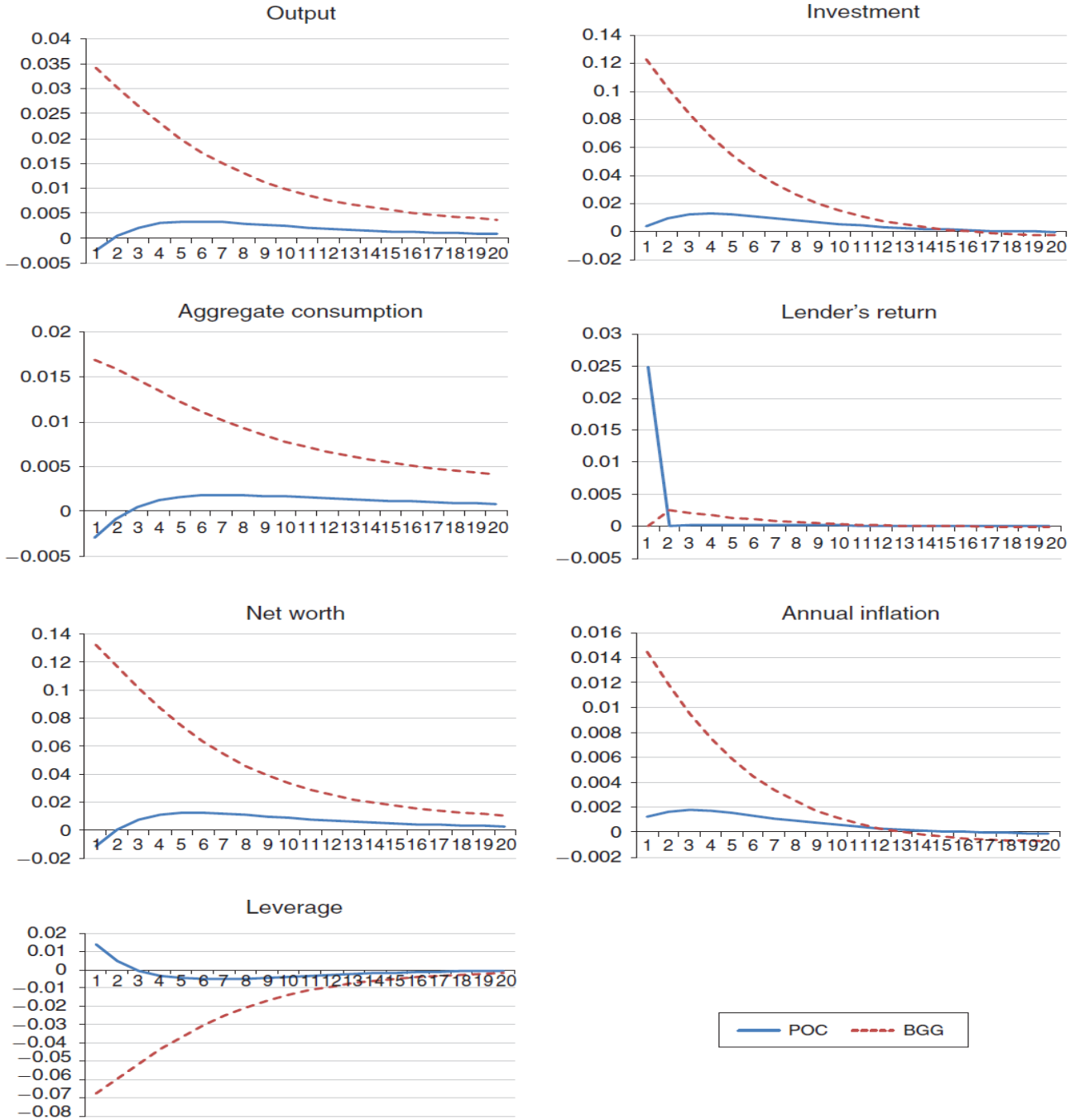
The details get rather messy, and I'm not going to go into them
The privately optimal contract and the BGG (1999) contract only differ in *innovations*

- The relationship between the risk spread and leverage is the same

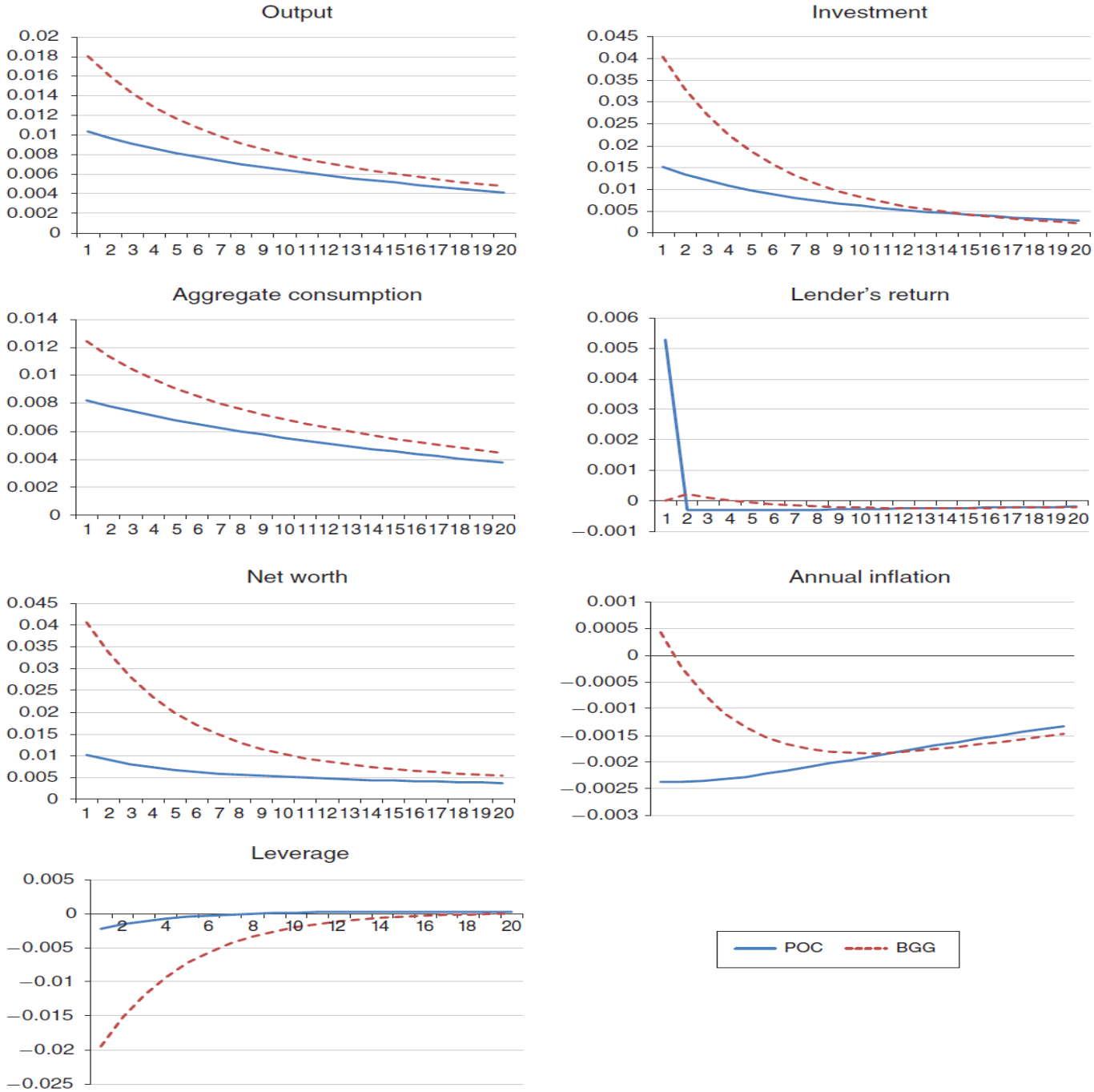
The difference is net worth

- With predetermined lender returns, aggregate shocks cause sharp movements in entrepreneurial net worth
- Which is what gives rise to the financial accelerator
- With the optimal contract, this doesn't happen, and the financial accelerator is largely eliminated

Net Worth Shock: Optimal Contract vs. BBG



Productivity Shock: Optimal Contract vs. BBG



Monetary Shock: Optimal Contract vs. BBG