Expectation Driven Business Cycles with Limited Enforcement

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Background

- Recent interest in **expectation shocks** following Beaudry and Portier (2004,2006)
- Hard to set up model in line with B&P's SVAR evidence: positive response of:
  - investment
  - consumption
  - employment
  - **stock prices**

The Game

Existing literature aim to generate news shock IRFs in line with SVAR evidence using various frictions/mechanisms:

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- (Variable capital utilization)

Existing models' stock price implications

- Beaudry and Portier (2004)
  - positive response of stock prices, but particular 3 sector model
- Jaimovich and Rebelo (2006)
  - negative
- Christiano, Motto and Rostagno (2006)
  - negative

CMR solves above issues by introducing nominal rigidities

My contribution

Construct a real one-sector model that delivers a positive response of the four key variables to expectation shocks.

Key mechanism

Limited enforcement creates a "collateral constraint" on a firm's external financing - can only borrow a fraction of firm's liquidation value

1. Price effect: *Wedge* between cost of capital (marginal q) and stock price (average q)
2. Quantity effect: Feedback channel from future expected profits to:
   - today's availability of funds,
   - and thereby today's investment

My contribution - alternative interpretation

- The idea that optimistic expectations create additional collateral that entrepreneurs can borrow against is **old**
  - Minsky
  - (Keynes)
- I merely formalize this old idea in a modern modelling framework

What I do

- Stay close to one-sector models of CMR and Jaimovich and Rebelo
- Key difference is financial dimension
- Use financial modelling from Lorenzoni and Walentin (2007)
  - Optimal state contingent contracts under limited enforcement
- This yields an increase in stock prices to good news. (price effect)
- Explore an alternative setup: risk-neutrality and capital adjustment costs ($f\left(\frac{I}{K}\right)$) instead of investment adjustment costs ($f\left(\frac{I_t}{I_{t-1}}\right)$)
  - Strong quantity effect

Consumers

Life-time utility described by

$$\mathbb{E}\left[\sum_{t=0}^{\infty}\beta^{t}u_{t}\left(c_{t},l_{t};c_{t-1}\right)\right]$$

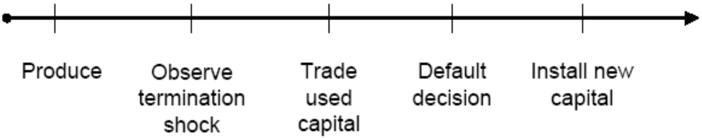
$$u_{t}\left(c_{t},l_{t};c_{t-1}\right) = \frac{\left(c_{t}-bc_{t-1}\right)^{1-\sigma_{C}}}{1-\sigma_{C}}-\frac{\varphi_{L}}{1+\sigma_{L}}l_{t}^{1+\sigma_{L}}$$

- Receive wage income $l_t w_t$
- Can trade in state contingent securities
- State-dependent discount factor $m_{t+1} = \beta\frac{u'(c_{t+1})}{u'(c_t)}$

Entrepreneurs

- Risk-neutral
- Impatient, discount factor $\beta_E < \beta$
- Exit with probability γ
- First period of life labor endowment of l_E
- Own all capital and operate production

Timeline for entrepreneurs



Technology

- Production function:

$$A_t F(k_t, l_t)$$

$$\log A_t = a_t = \rho a_{t-1} + \varepsilon_t + \eta_{t-p}$$

- Investment adjustment costs:

$$K_{t+1} = (1-\delta) K_t + \left(1 - S\left(\frac{I_t}{I_{t-1}}\right)\right) I_t$$

$$\text{where } S(x) = \frac{g}{2}(x-1)^2$$

Financial markets

- **Financial contract** (entrepreneur at t): sequence of state contingent transfers

$$\{d_\tau\}_{\tau=t}^{\infty}$$

- **Limited Enforcement**
  - Entrepreneur can default and divert a fraction $(1-\theta)$ of liquidation value v
  - After default the firm is liquidated, and the entrepreneur can start anew

Some results/definitions

- The **liquidation value** of a firm is

$$\begin{aligned} v_t &= R_t k_t \\ &= \max_l (A_t F(k_t, l) - w_t l) + q_t^m k_t (1-\delta) \end{aligned}$$

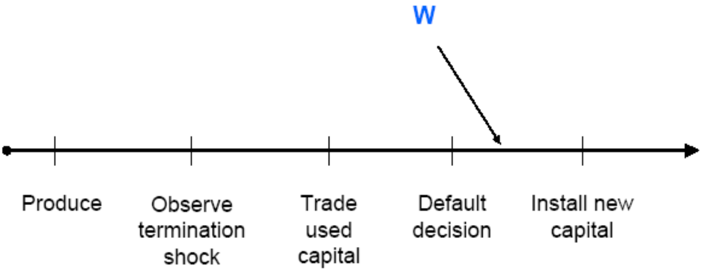
- R_t gross return on invested capital
- q^m equal across entrepreneurs because of trade

$$q_t^m = \frac{1 - \beta_E E_t \left[\frac{\phi_{t+1}}{\phi_t} q_{t+1}^m\right] \left[S'\left(\frac{I_{t+1}}{I_t}\right)\left(\frac{I_{t+1}}{I_t}\right)^2\right]}{1 - S\left(\frac{I_t}{I_{t-1}}\right) - S'\left(\frac{I_t}{I_{t-1}}\right)\left(\frac{I_t}{I_{t-1}}\right)}$$

- With alternative, capital adjustment cost definition:

$$q_t^m = \frac{\partial G\left(k_{t+1}, k_t^o\right)}{\partial k_{t+1}}$$

Value function **W** for entrepreneurs



Entrepreneur problem - recursive characterization

- $W_t(v, b)$ value function
- b present (market) value of liabilities
- Choose c^E, d, k' and b' subject to:
  1. Promise keeping constraint

$$b = d + E\left[m' b'\right]$$

  2. No-default constraint (next period)
  3. Resource constraint

$$c^E + d + q^m k' \leq v$$

No-default constraint

- W_t is linear
$$W_t\left(v,b\right)=\phi_t\left(v-b\right)$$
- No-default constraint
$$W_{t+1}\left(v',b'\right)\geq W_{t+1}\left(\left(1-\theta\right)v',0\right)$$
equivalent to:
$$b'\leq\theta v'$$
- Work with parameters such that this constraint is always binding, yields $\phi>1$
- Implies that entrepreneurs always use all available funds to buy capital

L.O.M. for capital

Define $n \equiv v - b$
Individual capital:

$$k' = \frac{1}{q_t^m - \theta \mathbb{E}\left[m_{t+1} R_{t+1}\right]} n.$$

Aggregate entrepreneurial net worth:

$$N_t = (1-\gamma)(1-\theta) R_t K_t + \gamma w_t l_E,$$

Combining yields L.O.M.

$$K_{t+1} = \frac{(1-\gamma)(1-\theta) R_t K_t + \gamma w_t l_E}{q_t^m - \theta \mathbb{E}_t\left[m_{t+1} R_{t+1}\right]}.$$

Definition of q

Value of the firm

sum of **future claims** by insiders and outsiders:

$$p_t = W_t(v, b) + b - d - c^E$$

Average q

$$q_t \equiv \frac{p}{k'}$$

Result on q

Given that $\phi_t > 1$ we have, using the resource constraint,

$$p_t = \phi_t(v - b) + b - d - c^E > v - d - c^E = q^m k'$$

and,

$$\begin{aligned} p_t &> q^m k' \\ \text{average } q &> \text{marginal } q \end{aligned}$$

Denote difference as **wedge**

ϕ - a forward looking measure

Average future tightness of the financial constraint

$$\phi_t = \frac{\beta_E \mathbb{E}_t\left[\left(\gamma + (1-\gamma)\,\phi_{t+1}\right)(1-\theta)\,R_{t+1}\right]}{q_t^m - \theta \mathbb{E}_t\left[m_{t+1} R_{t+1}\right]}$$

in frictionless case

$$\beta_E \frac{E_t[R]}{q^m} = 1 \implies \phi_t = 1$$

ϕ_t, and therefore the wedge, reflects the tension between

1. **Future profitability** of investment
2. **Today's availability** of funds

Finance Premium

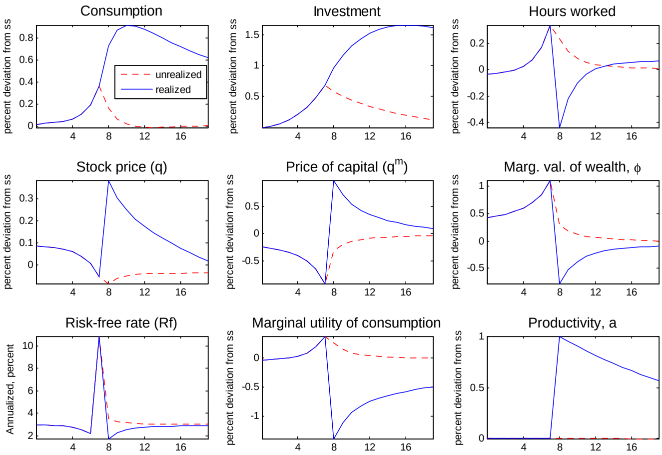
Premium outsiders would pay to invest in physical capital of firms

$$f = \frac{E_t[\beta \frac{u'_{c,t+1}}{u'_{c,t}} R_{t+1}]}{q_t^m} - 1 > 0$$

Calibration

β	0.9925	3% annual r^f
β_E	0.99	just below β
α	0.33	capital share
δ	0.0125	depreciation
ρ	0.95	tech shock persistence
b	0.63	habit
g	15.1	inv. adjustment cost
ξ	5	cap. adjustment cost
σ_C	1	log utility
σ_L	1	elasticity of labor
φ_L	10	matching $\bar{L} = 0.30$
θ	0.3	30% of manuf. investm. financed ext.
γ	0.05	2% annual finance premium
I_E	0.015	2% annual finance premium

IRF to news shock (p=8)



The quantity propagation mechanism of limited enforcement

Consider L.O.M.

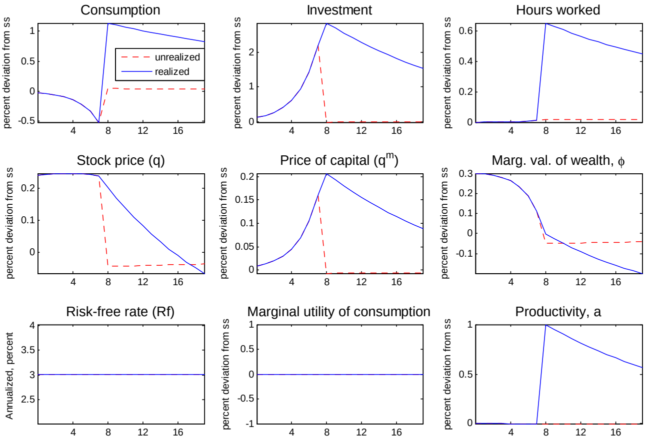
$$K_{t+1} = \frac{(1-\gamma)(1-\theta) R_t K_t + \gamma w_t l_E}{q_t^m - \theta \mathbb{E}_t \left[m_{t+1} R_{t+1} \right]}$$

and the definition

$$R_t = \alpha A_t K_t^{\alpha-1} L_t^{1-\alpha} + q_t^m (1-\delta)$$

$E_t \{a_{t+p}\} \uparrow \Rightarrow R_{t+p} \uparrow$
$\Rightarrow K_{t+p} \uparrow \Leftrightarrow I_{t+p-1} \uparrow$
$\Rightarrow q^m_{t+p-1} \uparrow$
$\Rightarrow R_{t+p-1} \ldots$

IRF with risk-neutrality and "level" capital adj costs



Conclusion

- The contribution is to set up a real one-sector model that delivers a positive response of stock prices to an expectation shock.
- The key mechanism is limited enforcement that creates a "collateral constraint" on firms' external financing:
  - price effect on stock prices through time-varying *wedge*
  - quantity effect on current investment from relaxed "collateral constraint" if expected future returns increase

Future research

- Use permanent technology shocks instead of stationary
- Explore small open economy dimension
- (Maybe) Take model to data
  - Estimate model - get time series for expectation shocks
  - ...

Appendix - entrepreneur's problem fully specified

$$W(v, b; X) = \max_{\substack{c^E, d \\ k', b'(.)}} c^E + \beta_E \mathbb{E}[W(v', b'; X') | X]$$

s.t.

$$c^E + d + q^m(X) k' \leq v,$$

$$b = d + \mathbb{E}[m'(X') b'(X') | X],$$

$$v'(X') = R(X') k' \quad \forall X',$$

$$W(v'(X'), b'(X'); X') \geq W((1-\theta) v'(X'), 0; X') \quad \forall X',$$