Schumpeter meets Beaudry and Portier
Innovation, business cycles and news shocks

Filip Rozsypal

February 28, 2012

Business cycle theory

- Internal propagation not strong enough
- Christiano and Fitzgerald (1998): overview of various mechanisms used in the literature to fix propagation
  - variable capital utilization, various changes in preferences including habit persistence, different models of labour market
  - . . . and news shocks

News shocks
overview I

- <u>Motivation</u>: Cochrane (1994), Beaudry and Portier (2004)
- <u>Empirical evidence</u>: Beaudry and Portier (2006), Schmitt-Grohe and Uribe (2008), Jaimovich and Rebelo (2009), Barsky and Sims (2011), Blanchard et al. (2011)
- <u>Asset pricing implications</u>: Christiano et al. (2008), Matsumoto et al. (2011), Malkhozov and Shamloo (2011)
- <u>Interplay with financial frictions</u>: Kobayashi et al. (2007), Jermann and Quadrini (2007), Danthine et al. (1998)

News shocks
overview II

- Dynamics of News (Pigou) cycles
  - boom in Y, C, L after getting the news
  - recession if the news does not materialize
- Beaudry and Portier (2004): impossible in standard RBC setting
  - in RBC, good news⇒recession
    positive wealth effect without higher productivity⇒ agents slack off and start consuming capital: $C \uparrow$, $L \downarrow$, $K \downarrow \Rightarrow Y \downarrow$
  - more sectors needed (capital production sector + adjustment costs)
- Schumpeterian model is a natural setting!
  - more sectors by definition
  - growth caused by research→ news shock can be interpreted as a signal about quality of current research

Schumpeterian business cycles
overview

- Basic idea
  - productivity not exogenous process, but a result of research
  - spending on research is endogenously determined
  - finite and small number of industries $\rightarrow$ no LLN
- Implementation
  - at given time only one research firm in each industry
    - simplification: no competition between different research firms
  - if research is successful, it replaces the existing production firm
  - if research is unsuccessful, it is replaced by a new firm next period
- Related literature:
  - endogenous growth:
    Grossman and Helpman (1991), Aghion and Howitt (1992)
  - ... in business cycle setting:
    Ozlu (1996), Andolfatto and MacDonald (1998), Wälde (2005),
    Phillips and Wrase (2006), Lambson and Phillips (2007), Maliar
    and Maliar (2004)

Business cycle with news shocks
amplification mechanism

- Good news = good news *relative* to the average tech growth
- Zoom out $\Rightarrow$ products of different industries are complements
  - Higher productivity in one industry increases demand for the products of all the others industries

The core mechanism of amplification:

1. good news increase the value of firms in other industries
2. additional incentive to do research in all sectors
3. higher chances of innovation
4. ...

Business cycle with news shocks
research questions

1. Is the propagation strong enough?
   * complementarity of output should amplify the productivity shocks
2. Is the co-movement correct?
   * good news should lead to higher demand of labour from the research sector, bidding up the wages which might overcome the wealth effect so *L* and *Y* does not fall
3. Is this setting able to generate Pigou cycles?
   * feature of Schumpeterian models, if good news do not materialize, then by definition, the economy is below trend
4. What about behaviour of asset prices over the business cycle?
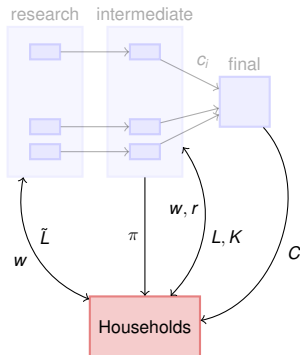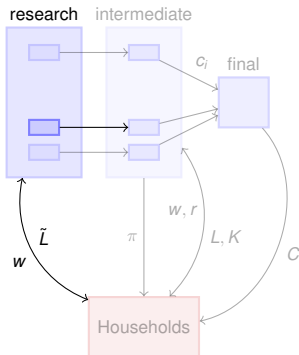   * research firms have to sell its stocks in order to finance research
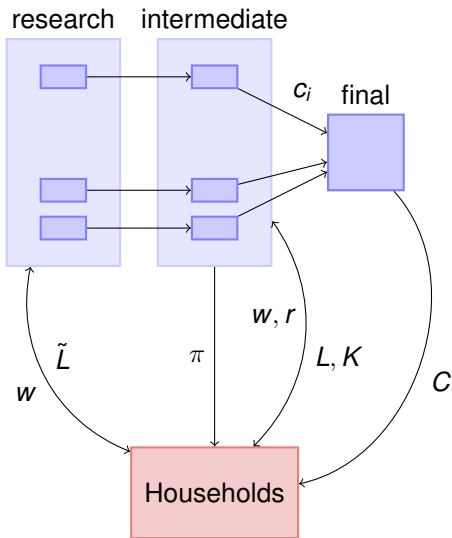
Households

- Research firms
  - buy stocks $s_i t$
  - supply $\tilde{l}_{it}$'s, get w_t
- Intermediate firm i
  - receive profits as a dividend
  - supply l_{it} and k_{it}
  - get paid w_t, r_t
- Consume C
  problem:
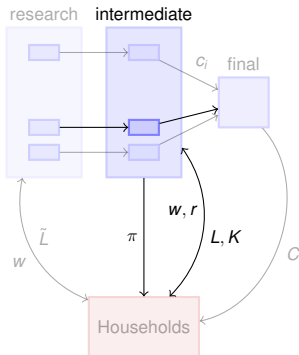 $\max E_0 \sum_{t=0}^{\infty} \beta^t u(C_t, L_t + \tilde{L}_t)$

Research sector, industry i

- Innovation
  - draws e_{it}
  - $\rho(l) : l \to (0, 1)$:
    ☺: $a_{i,t+1} = (1 + e_i)a_{i,t}$
    ☹: exit
- Households
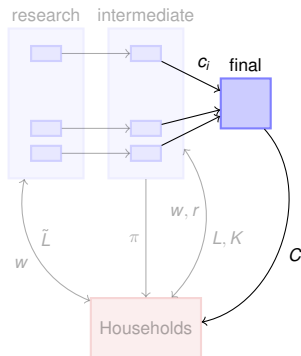 - sell equity
  - demand $\tilde{l}_{it}$'s, pay w_t

Intermediate sector, industry i

- Produce intermediate output
  - $y_{it} = k_{it}^{\alpha}(a_{it}l_{it})^{1-\alpha}$
  - $\pi_{it} = p_{it}y_{it} - w_t l_{it} - r_t k_{it}$:
  - $p_{it} = \mu(e_{it})MC_{it}$
- Households
  - demand l_{it}, k_{it}, pay w_t, r_t
  - give back π as dividends

Final goods production sector

$$C_t = \left(\sum_{i=1}^{N} c_{it}^{\frac{\theta-1}{\theta}}\right)^{\frac{\theta}{\theta-1}}$$

$$P_t = \left(\sum_{i=1}^{N} p_{it}^{1-\theta}\right)^{\frac{1}{1-\theta}}$$

$$c_{i,t} = C_t \left(\frac{p_{it}}{P_t}\right)^{-\theta}$$

- Households

$$P_t C_t + \sum_{i=1}^{N} s_{it} + K_{t+1} = (1 - \delta)K_t + \sum_{i=1}^{N} \left(\pi_{it} + w_t(l_{it} + \tilde{l}_{it}) + r_t k_{it} \right)$$

- Research firm i sells 100% of stocks valued at s_i

$$s_i = w_t \tilde{l}_{it}$$

- Intermediate firm i

$$\pi_{it} = p_{it} y_{it} - w_t l_{it} - r_t k_{it}$$

- Final goods

$$P_t C_t = \sum_{i=1}^{N} p_{it} y_{it}$$

1. Intermediate sector firm problem
   1. given p_{it}, w_t, r_t, solve for y_{it}, k_{it}, l_{it}
   2. given y_{it}, k_{it}, l_{it}, get π_{it}
   3. given π_{it}, form $E[\Pi_{it}]$, expected value of an *existing* firm in the intermediate production sector (make a guess of survival function and check later)

2. Research firm problem: given $E[\Pi_{i,t}]$, w_t and (observing) e_{it}, choose $\tilde{l}_{it}$, s.t. $s_{it} = w_t \tilde{l}_{it} = \frac{\rho(\tilde{l}_{it})}{1+r_t} E[\Pi_{it}]$

3. Household problem: given $E[\mathbf{\Pi}_t]$, $\mathbf{e}_t$, p_t, r_t, K_t, choose L_t, $\tilde{L}_t$, K_{t+1}

4. Impose market clearing and solve

Road plan

1. Solve the model in the basic setting
   - scaling to induce balanced growth path
   - State variables: $\boldsymbol{A}_t$, K_t
   - what is reasonable number of industries?

2. Introduce noise into information about $\boldsymbol{A}$
   - can get results like Lorenzoni (2009)?
   - but the number of state variables start growing

3. Introduce limited liability to the research sector
   - not to the intermediate, that has been done
   - research firms do not start with anything they could use to leverage
   - the issue: the leveraging would require some initial wealth $\rightarrow$ profits and ultimately consume some consumption... do I want this?

Thank you for your attention!

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