Nominal Rigidities, News-Driven Business Cycles, and Monetary Policy

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DECEMBER 19TH, 2008 @ CEPR-RIETI WORKSHOP

News-Driven Business Cycle

- Pigou (1927): If agents receive positive news (or have optimistic expectations) about the future, booms occur at current period.

- **News-Driven Business Cycles (NDBC)**
  - ▸ Definition: **Positive comovements in output, consumption, investment, and labor** when positive news about the future arrives.

- Why do we care?
  - ▸ Japan's late 1980s, US's late 1990s (Internet bubble), and the Subprime housing boom
  - ▸ Standard RBC models **cannot** generate NDBCs!

What is news?

- Evolution of technology:

$$\log(A_t) = \rho_A \log(A_{t-1}) + u_t^A.$$

- Technology shock u_t^A consists of two components:

$$u_t^A = \underbrace{\varepsilon_t^A}_{\text{observed at } t} + \underbrace{v_{t-p}^A}_{\text{observed at } t-p}.$$

- v_{t-p}^A: news shock.

Why Do RBCs Fail? (1/2)

- Standard RBC with
  - ▸ Utility:

$$u(c_t, n_t) = \log(c_t) - \gamma \frac{n_t^{1+\sigma_n}}{1 + \sigma_n}.$$

  - ▸ Production technology:

$$y_t = A_t \cdot k_{t-1}^{\alpha} \cdot \left[\zeta_t n_t \right]^{1-\alpha},$$

    and

$$\log(A_t) = \rho_A \log(A_{t-1}) + \varepsilon_t^A + v_{t-p}^A,$$
$$\log(g_t) = \rho_g \log(g_{t-1}) + \varepsilon_t^g + v_{t-p}^g,$$

    where $g_t \equiv \frac{\zeta_t}{\zeta_{t-1}}$.

Why Do RBCs Fail? (2/2)

- Effects of the news about positive future productivity shocks (v_t^A or v_t^g):
    - Consumption ↑ (wealth effect & consumption smoothing)
    - Labor, output, and investment ↓

$$\gamma c_t n_t^{\sigma_n} = (1 - \alpha) \left[\frac{k_{t-1}}{n_t} \right]^{\alpha} A_t \zeta_t^{1-\alpha},$$

$$c_t + i_t = A_t k_{t-1}^{\alpha} \left[\zeta_t n_t \right]^{1-\alpha}.$$

- To generate NDBC, we have to violate the intratemporal condition!

Related Literature (1/2)

Strategy (1): **NDBC w/o market failure**: Change production technology or preference

- Beaudry and Portier (2004, 2007)
    - Multi-sector production technology (change of technology)
    - Complementarity btw consumption and investment goods

- Jaimovich and Rebelo (2006, 2008)
    - Preferences without income effect on labor supply
    - Capital utilization
    - Adjustment costs of investment (flow specification)

- Christiano, Ilut, Motto, and Rostagno (2007, 2008) (CIMR)
    - Habit persistence
    - Adjustment costs of investment (flow specification)
    - (+ sticky price-wage, and Taylor rule)

Related Literature (2/2)

Strategy (2): **NDBC w/ market failure**: **Labor wedge** ($\equiv$ MRS/MPL)

- Den Haan and Kaltenbrunner (2006)
    - Matching friction in the labor market
    - Complementarity btw consumption and investment goods

- Kobayashi, Nakajima and Inaba (2007) / Kobayashi and Nutahara (2007)
    - Collateral constraints on working capital
    - Adjustment costs of investment (level specification)

What We Do

- New mechanism of NDBC: **Nominal rigidities**
  (sticky prices) + (adjustment costs of investment)

- Our models can generate
  1. NDBCs due to news about both technology growth and level
  2. Procyclical movements of Tobin's q
  3. Recessions if the news turns out to be false (growth)

- Mechanism:

$$\gamma c_t n_t^{\sigma_n} = \frac{1-\alpha}{x_t} \cdot \left[\frac{k_{t-1}}{n_t}\right]^\alpha A_t \zeta_t^{1-\alpha},$$

$$c_t + i_t = A_t k_{t-1}^\alpha \left[\zeta_t n_t\right]^{1-\alpha}.$$

Decrease of markup x_t causes comovements of consumption, labor, investment, and output.

Our Model (1/3)

Standard New Keynesian sticky-price model

1. Household:
   - Utility: $u(c_t, n_t) = \log(c_t) - \gamma \frac{1}{1+\sigma_n} n_t^{1+\sigma_n}$.
   - Adjustment costs of investment (level: i_t/k_{t-1})

   $$k_t = (1 - \delta)k_{t-1} + \Phi\left(\frac{i_t}{k_{t-1}}\right)k_{t-1},$$

   where $\Phi(0) = 0$, $\Phi'(\cdot) > 0$ and $\Phi''(\cdot) < 0$.

2. Final goods firms: Competitive

   $$y_t = \left[\int_0^1 Y_t(z)^{\theta/(\theta-1)} dz \right]^{(\theta-1)/\theta}.$$

Our Model (2/3)

3. Intermediate goods firms: Monopolistically competitive
   - Production technology:

   $$Y_t(z) = A_t\Big[K_t(z)\Big]^{\alpha}\Big[\zeta_t N_t(z)\Big]^{1-\alpha},$$

   and

   $$\log(A_t) = \rho_A \log(A_{t-1}) + \varepsilon_t^A + \nu_{t-p}^A,$$
   $$\log(g_t) = \rho_g \log(g_{t-1}) + \varepsilon_t^g + \nu_{t-p}^g,$$

   where $g_t \equiv \zeta_t/\zeta_{t-1}$.

   - Calvo-pricing with price indexation:
     - Probability of price re-optimization: $1 - \kappa$
     - Backward-pricing firms: η

     $$\hat{\pi}_t = \frac{\beta}{1 + \eta\beta}E_t\hat{\pi}_{t+1} + \frac{\eta}{1 + \eta\beta}\hat{\pi}_{t-1} - \frac{(1 - \kappa\beta)(1 - \kappa)}{\kappa(1 + \eta\beta)}\hat{x}_t.$$

Our Model (3/3)

4. Monetary Authority: Forward-looking Taylor rule

$$\hat{R}_t = \rho_R \hat{R}_{t-1} + (1 - \rho_R) \left[\rho_\pi E_t \hat{\pi}_{t+1} + \rho_y \hat{y}_t \right].$$

5. Specification of adjustment costs of investment:

$$\Phi \left(\frac{i_t}{k_{t-1}} \right) \equiv \frac{\delta \sigma_\Phi}{q} \log \left(\frac{i_t}{k_{t-1}} + \bar{a} \right) + \bar{b},$$

where $\Phi(0) = 0$, $\Phi(\delta) = \delta$, and σ_Φ is the elasticity of investment w.r.t. Tobin's q:

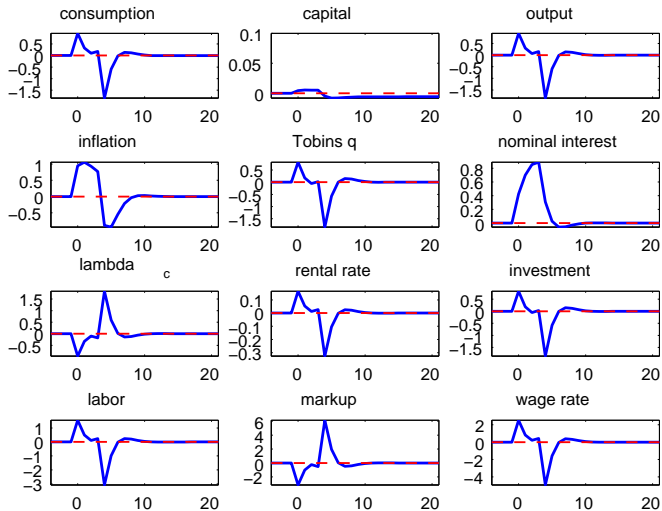$$\hat{i}_t = \sigma_\Phi \hat{q}_t + \hat{k}_{t-1} + \hat{g}_t.$$

News-Shock Experiments

- We try Christiano, Ilut, Motto, and Rostagno (2007) type experiment:

  1. At $t < 0$, the economy is at the steady state.
  2. At $t = 0$, news arrives; positive technology growth or level shock, $v_0^j = .01$ for $j = A$ or g.
  3. At $t = 4$, agents know that **the news turns out to be false**: $\varepsilon_4^j + v_0^j = 0$.

- Parameters;

β	σ_n	γ	α	δ	ρ_g	ρ_A
$1.01358^{-.25}$	1	109.82	.4	.025	.83	.83
$1 - \kappa$	η	σ_Φ	θ	ρ_R	ρ_π	ρ_y
.37	.84	1.01	6	.81	1.95	.18

(same as CIMR except for σ_Φ & ρ_g)

NDBC (1): Growth

Mechanism of NDBC: Growth

- Why do booms occur?
  - ▸ Positive news arrives...
    - $\implies$ Future $c_t\uparrow$ and future $n_t\downarrow$ (future wealth effect)
    - $\implies$ For $n_t\uparrow$, future $w_t\uparrow$ and future markup $\downarrow$ (competitivness $\uparrow$)
    - $\implies$ Future price $\uparrow$ (NKPC)
    - $\implies$ Current optimal price $\uparrow$
    - $\implies$ **Markup**$\downarrow$ (sticky-price)
    - $\implies$ Aggregate demand, output, labor input $\uparrow$
    - $\implies$ Investment, consumption $\uparrow$ (loosened household's budget)
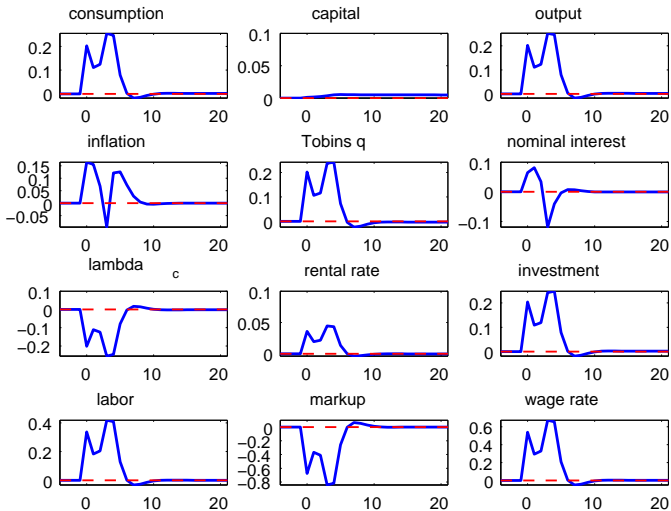
- Why do recessions occur?
  - ▸ If news turns out to be false
    - $\implies$ **Markup**$\uparrow$ (more than level of s.s.) (sticky-price)
    - $\implies$ Aggregate demand, output, and labor input $\downarrow$
    - $\implies$ Investment, consumption $\downarrow$ (similar to that of boom)

NDBC (2): Level

Mechanism of NDBC: Level

- Differences from the case of growth shock:
    1. Delay of responses
    2. No recessions even if the news turns out to be false

- Key: **Adjustment costs of investment**
    $\Longrightarrow$ investment $\uparrow$ (want to smooth by adjustment costs) &
    consumption $\uparrow$ (wealth effects)
    $\Longrightarrow$ **Increase in aggregate demand** causes both increase in
    labor input and decrease in markup.

$$\gamma \frac{c_t}{1 - n_t} = \frac{1 - \alpha}{x_t} \left[\frac{k_{t-1}}{n_t} \right]^\alpha A_t \zeta_t^{1-\alpha},$$

$$c_t + i_t = A_t k_{t-1}^\alpha \left[\zeta_t n_t \right]^{1-\alpha}.$$

NDBC (3): Level ($\rho_\pi = 1.5$)
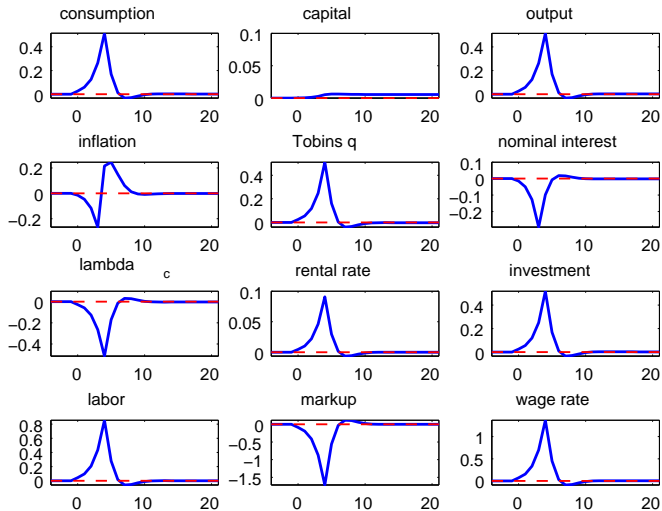
Comparison with CIMR (1/2)

- CIMR employ sticky prices!

- Difference btw our model and CIMR:
    - Remove (i) habit persistence and (ii) sticky wage from CIMR and
    - Change (iii) the adjustment costs of investment (flow $\Rightarrow$ level).

- CIMR:
    1. Find the role of (i) habit persistence and (ii) flow adjustment costs of investment for NDBC.
    2. Add (i) sticky price-wage and (ii) inflation targeting rule for procyclical movements of Tobin's q.
    3. Show the interaction btw sticky wage and monetary policy amplify NDBC. (CIMR, 2008)

Comparison with CIMR (2/2)

- They do not check whether nominal rigidities alone (w/o habit) can generate NDBC.

- We find that **nominal rigidities alone can generate NDBC**.
  - ▸ Nominal rigidities vs. Habit: Frictions to violate the intratemporal condition
  - ▸ Sticky wage is also mechanism of NDBCs. (see Appendix)

Summary

- New Mechanism of NDBCs: nominal rigidities

- Standard New Keynesian model
    1. sticky price
    2. adjustment costs of investment

        ⟹ **Key: Countercyclical markup**

- Our model generates
    1. NDBCs due to news about both technology growth and level
    2. Procyclical movements of Tobin's q
    3. Recessions if the news turns out to be false (growth)

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Appendix: Frictions and NDBCs

		Frictions				Results on NDBCs			
		habit	AC	SP	SW	Level	q(L)	Growth	q(G)
CIMR(a)	(1)	√	flow			√			
	(2)	√	level						
CIMR(b)	(3)	√	flow	√	√	√	√	√*	
	(4)	√	flow	√		√		√*	
	(5)		flow	√		√		√*	
	(6)	√	flow		√	√	√	√*	
	(7)		flow		√	√	√	√*	
	(8)		flow	√	√	√	√	√*	
KN	(9)		level	√		√	√	√	√
	(10)		level		√	√	√	√	√
	(11)		level	√	√	√	√		

Note: AC: adjustment costs, SP: sticky prices, SW: sticky wages, Results:
NDBC due to news about growth and level, q: procyclical Tobin's q

Appendix: Impulse Responses to Current Growth Shocks