# 1 News about the future and fluctuations

- old idea: expectations drive business cycle
- uncertainty about the economy's fundamentals, which will determine the long run equilibrium
- partial equilibrium ideas:
  - consumption: permanent income hypothesis future income expectations matter for consumption decisions
  - investment: high expected returns
- problem: how to fit these ideas in general equilibrium setup

## 1.1 Evidence

- basic fundamental for long-run growth: TFP
- can expectations about long-run TFP drive cycle?
- how to measure expectations?
- Beaudry and Portier (2006): use the stock-market

$$\begin{bmatrix} \Delta TFP_t \\ \Delta S_t \end{bmatrix} = \begin{bmatrix} a_{11}(L) & a_{12}(L) \\ a_{21}(L) & a_{22}(L) \end{bmatrix} \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix}$$

Two identification approaches:

1. Short run:

$$a_{12,0} = 0.$$

2. Long run:

$$a_{12}(1) = 0.$$

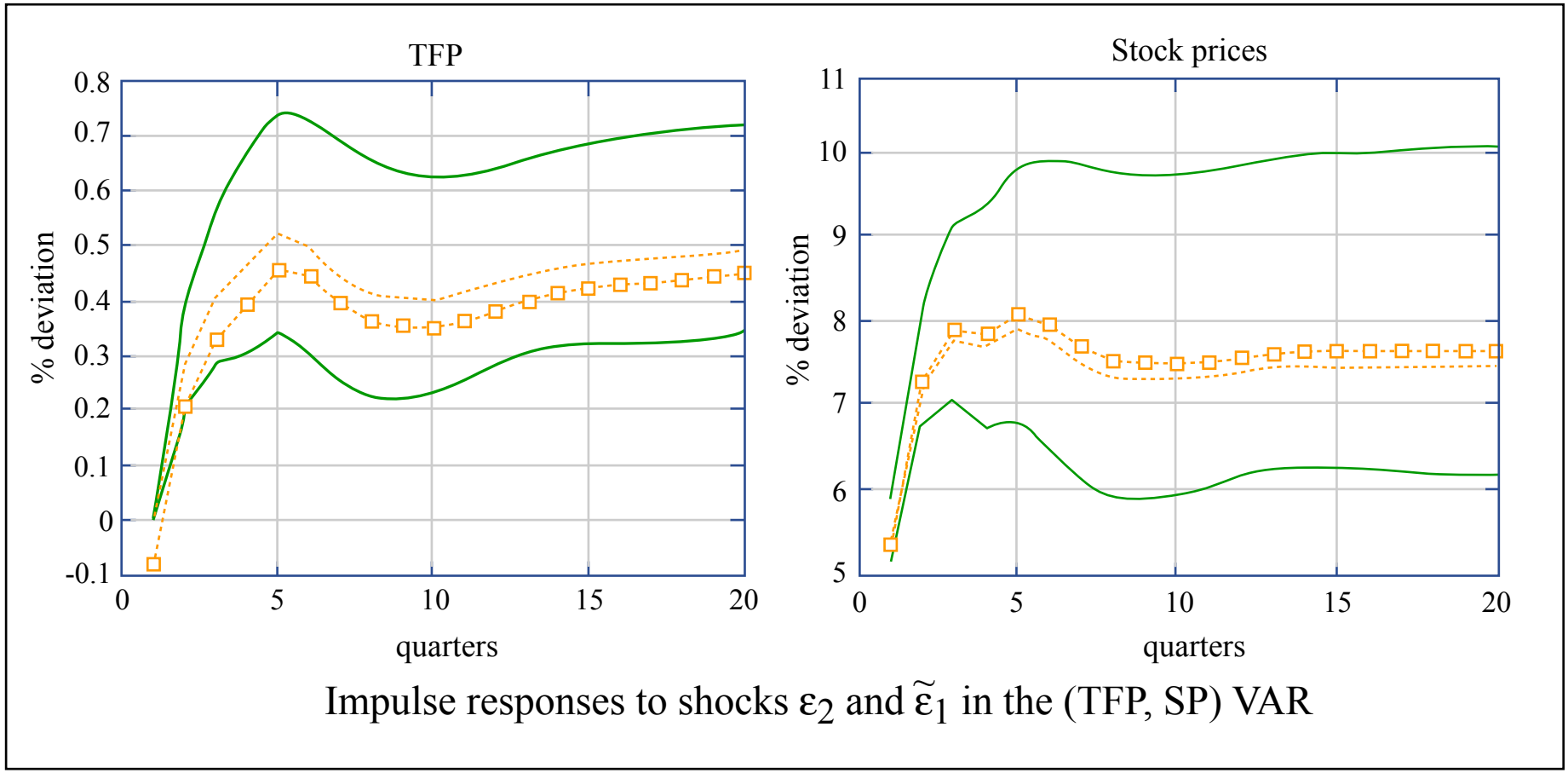
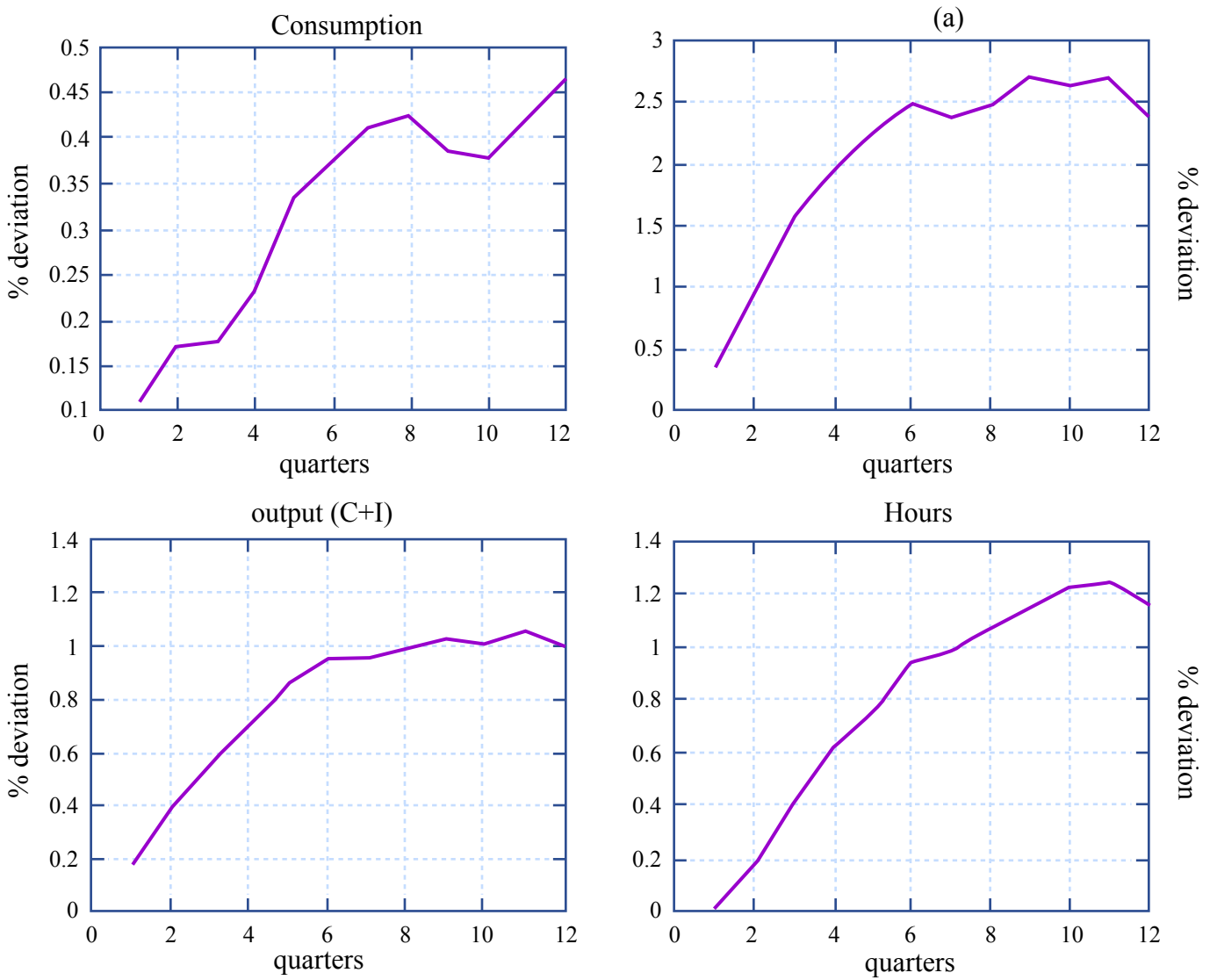
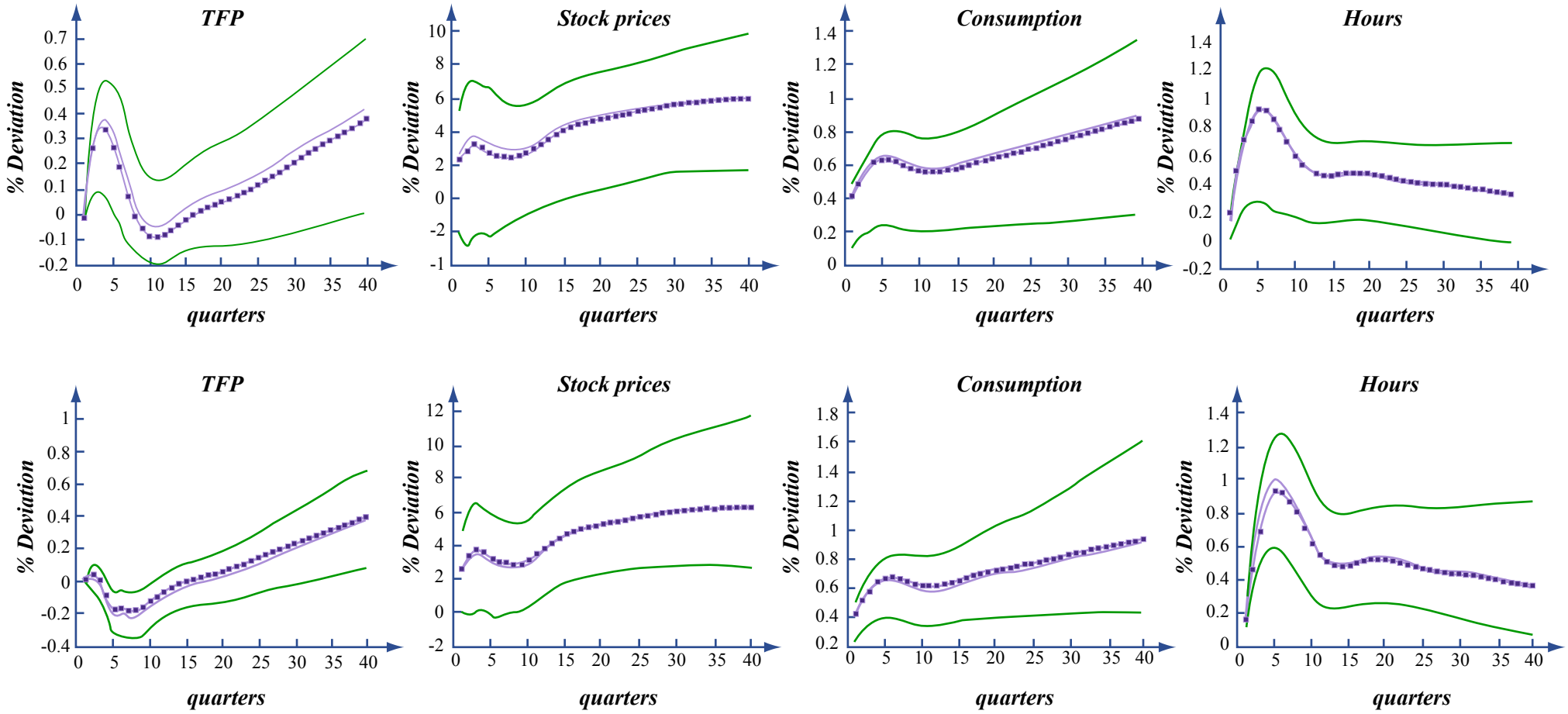


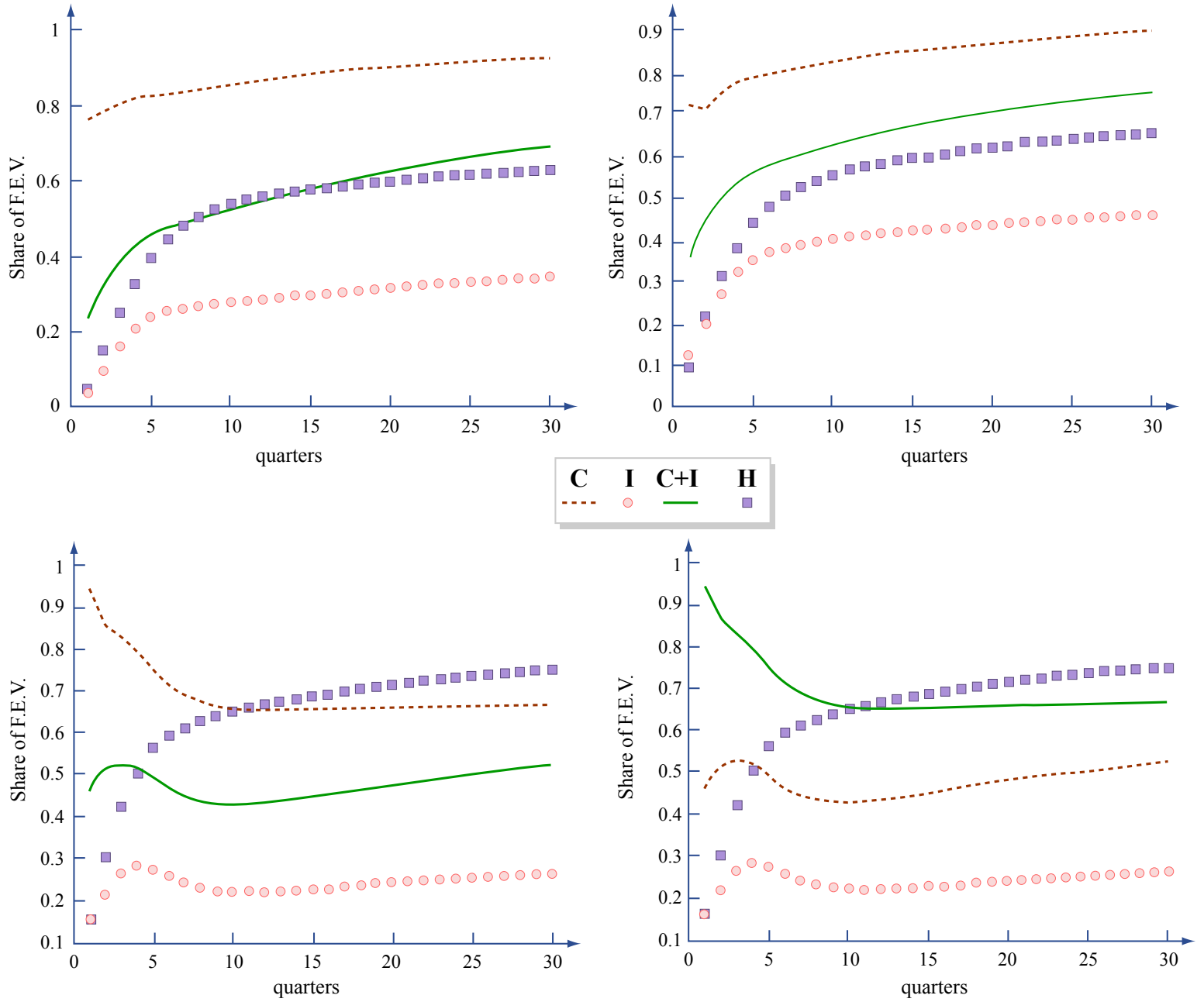

Image by MIT OpenCourseWare. Adapted from Figure 2 in Beaudry, Paul, and Franck Portier. "Stock Prices, News, and Economic Fluctuations." National Bureau of Economic Research Working Paper No. 10548, June 2004.




The figure displays the response of consumption, investment, output (measured as C + I) and hours to a unit $\varepsilon_2$ shock (the shock that does not have instantaneous impact on TFP in the short run identification). The unit of the vertical axis is percentage deviation from the situation without shock. (See the main text for more details)




Impulse responses to $\varepsilon_2$ and $\tilde{\varepsilon}_1$ in the (TFP, SP, H) VAR, without (upper panels) or with (lower panels) Adjusting TFP for capacity utilization.




Share of the forecast error variance of consumption (C), Investment I, Output (C+I) and hours (H) attribute to $\varepsilon_2$ (left panel) and $\tilde{\varepsilon}_1$ (right panel) in 4-variables VARs, with non adjusted TFP (top panels) or adjusted TFP (bottom panels)

Main conclusions:

- both identifications give similar shocks
- response of C and Y builds up, then permanent
- response of H has hump then dies out slowly

## 1.2 Neoclassical growth model

Preferences

$$\mathsf{E}\sum_{t=0}^{\infty}\beta^{t}U\left(C_{t},N_{t}\right)$$

Technology

$$C_{t}+K_{t}-\left(1-\delta\right)K_{t-1}\leq A_{t}F\left(K_{t-1},N_{t}\right)$$

- what happens when agents receive news about future $A_{t+s}$?

- what type of cycles does this generate?

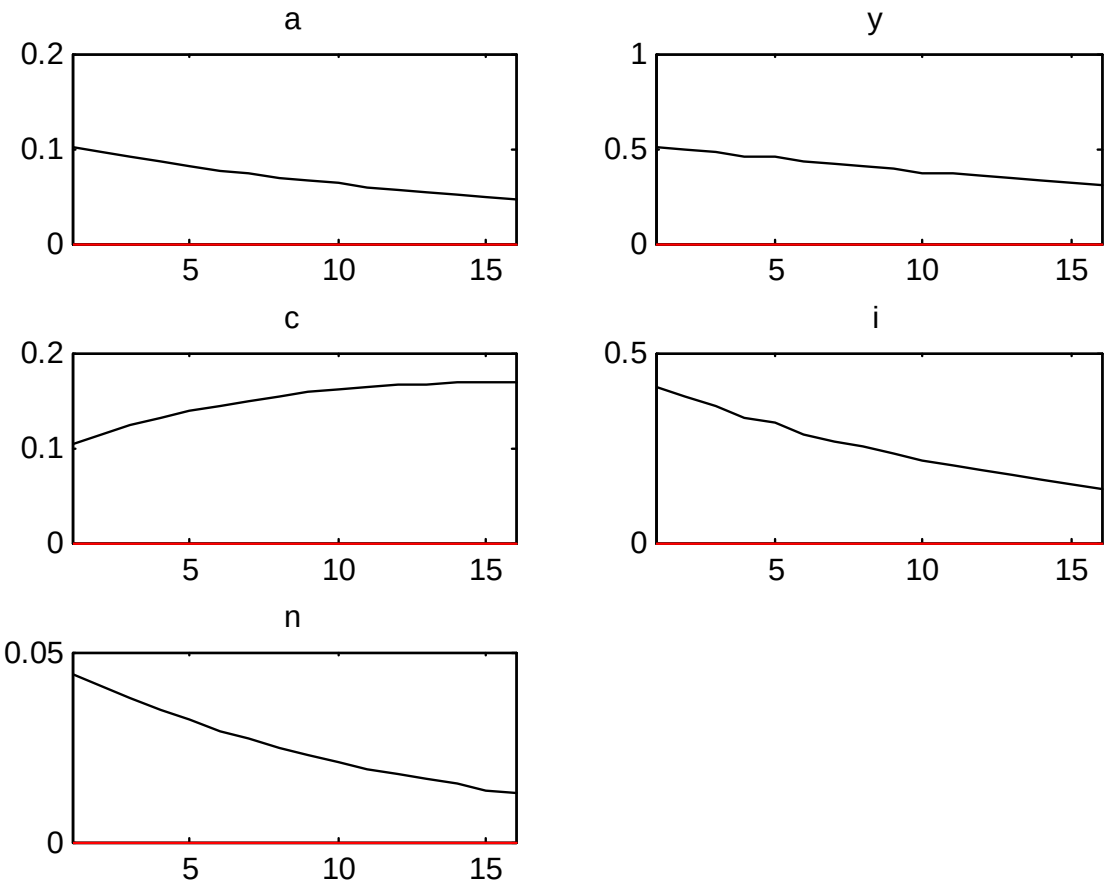
Basic parametrization

$$\begin{aligned} U\left(C_t, N_t\right) &= \log C_t - \frac{1}{1+\eta} N_t^{1+\eta} \\ A_t F\left(K_{t-1}, N_t\right) &= A_t K_{t-1}^{\alpha} N_t^{1-\alpha} \end{aligned}$$

$$A_t = e^{a_t}$$

$$a_t = \rho a_{t-1} + \epsilon_t$$

$$\begin{aligned} \beta &= 0.99 \\ \eta &= 1 \\ \alpha &= 0.36 \\ \rho &= 0.95 \\ \delta &= 0.025 \end{aligned}$$




Shock to current productivity

- Now introduce news about the future

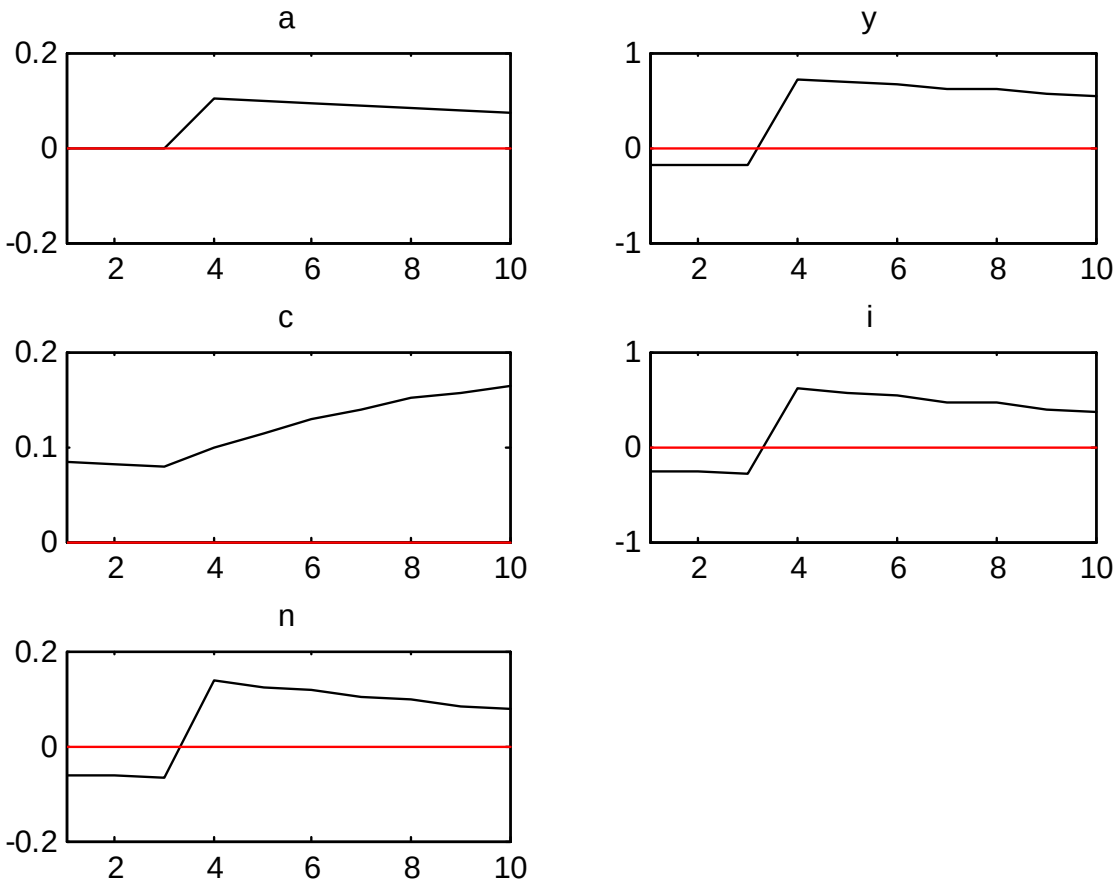
- Simplest way: agents observe shock realization $T$ *periods in advance*

$$a_t = \rho a_{t-1} + \epsilon_{t-T}$$

- What happens at the time of the announcement?

- Consumption increases, investment and hours fall!

- Danthine, Donaldson and Johnsen (1997), Beaudry and Portier (2005): nothing that looks like business cycles.


a
0.2
0
-0.2
2
4
6
8
10
y
1
0
-1
2
4
6
8
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c
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0.1
0
2
4
6
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i
1
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n
0.2
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### 1.2.1 Mechanism

Basic mechanism driven by intra-temporal optimality condition

$$(1-\alpha)\frac{1}{C_t}A_t K_{t-1}^{\alpha} N_t^{-\alpha} = N_t^{\eta}$$

or (in terms of real wages)

$$\frac{1}{C_t} W_t = N_t^{\eta}$$

together with the resource constraint

$$I_t + C_t = A_t K_{t-1}^{\alpha-1} N_t^{1-\alpha}$$

- If $A_t$ unchanged cannot have $I_t \uparrow$,$C_t \uparrow$

- Changing intertemporal elasticity and elasticity of labor supply can change response of $C_t$ and $I_t$, but cannot give right combination

- Adjustment costs in $K_t$ can give $I_t \uparrow$ but then $C_t \downarrow$

- No hope for neoclassical model with news about the future?

- Several attempts

- Jaimovich and Rebelo (2006): three ingredients
  - adjustment costs in *investment*
  - variable capacity utilization
  - preferences with "weak wealth effects on labor supply"

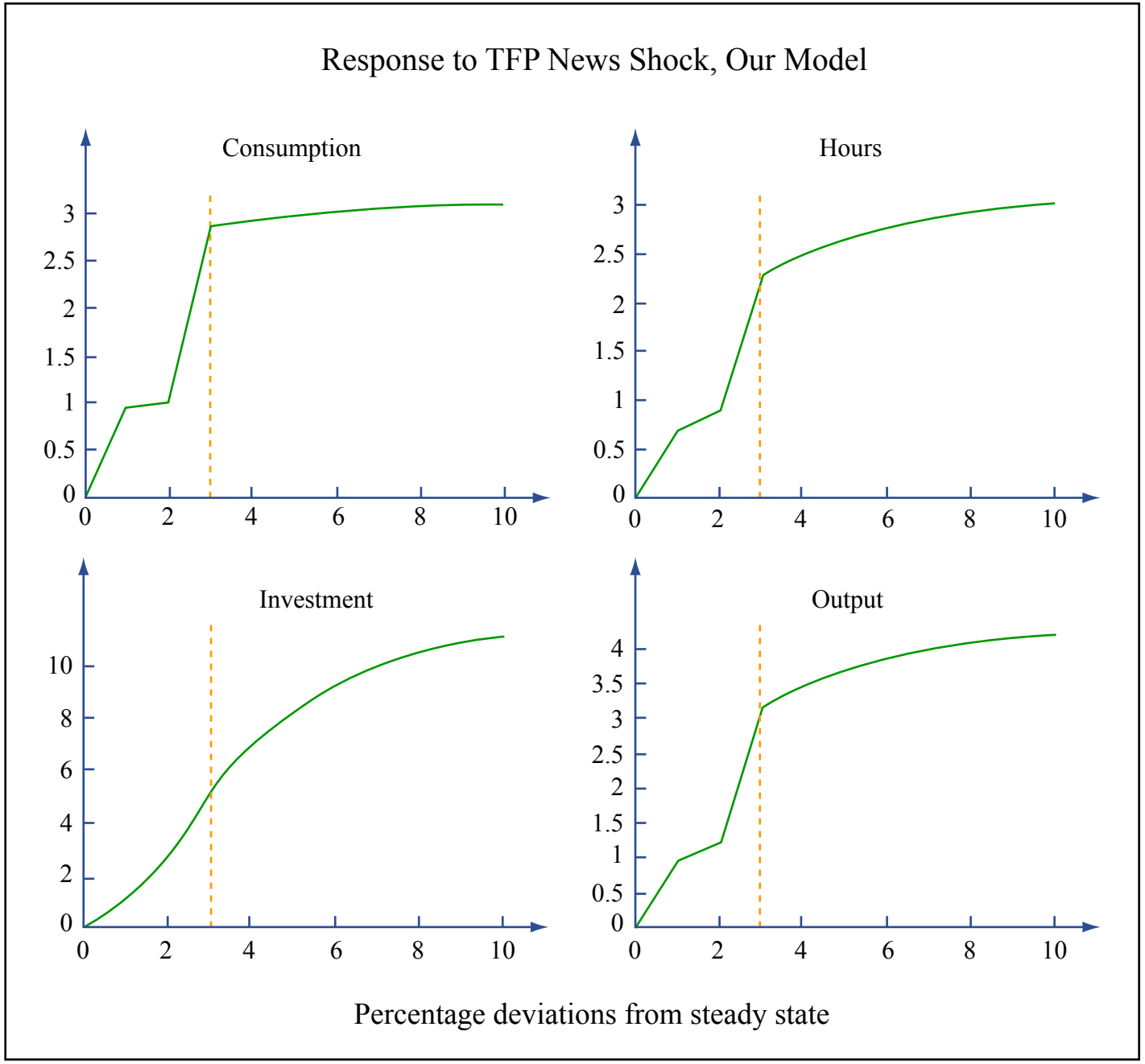



Image by MIT OpenCourseWare. Adapted from Figure 2 in Jaimovich, Nir, and Sergio Rebelo. "Can News about the Future Drive the Business Cycle?" National Bureau of Economic Research Working Paper No. 12537, September 2006.

*Preferences*

$$\sum \beta^t \frac{\left(C_t - N_t^\theta X_t\right)^{1-\sigma} - 1}{1-\sigma}$$

- $X_t$ is a geometric discounted average of past consumption levels

$$X_t = C_t^\gamma X_{t-1}^{1-\gamma}.$$

- The parameter $\gamma \in [0, 1]$: speed at which the wealth effect kicks in

- Suppose $X_t \equiv 1$ then quasi-linear (GHH)

$$W_t = \theta N_t^{\theta-1}$$

no income effect here. Inconsistent with LR growth

- Here income effect that phases in slowly

- In the long run

$$W_t = \theta N_t^{\theta-1} C_t$$

Simplistic interpretation:

1. quasi-linear in short run: no income effect

2. log in the long run: income and substitution cancel

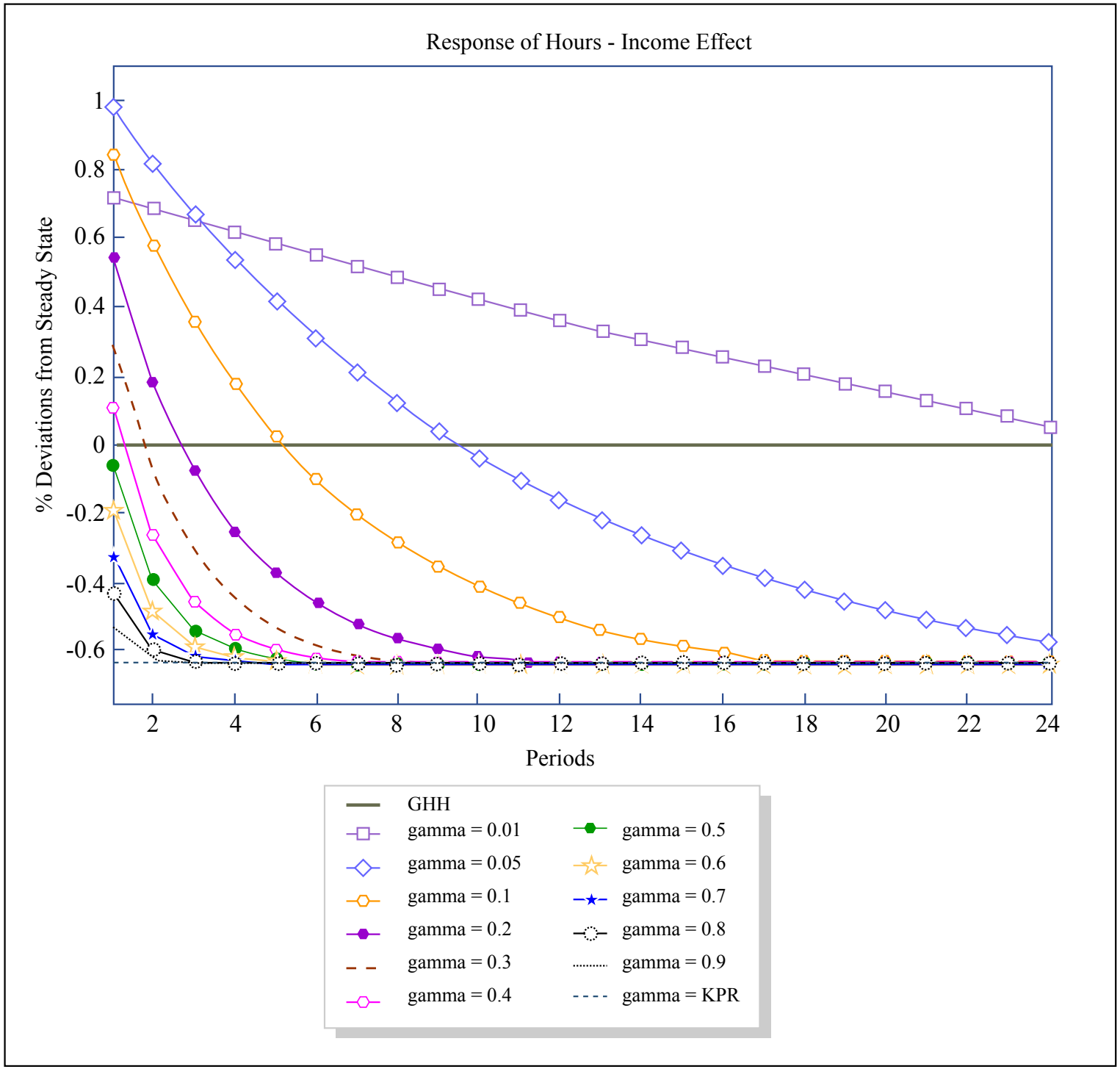
but 1 is wrong!

Decomposition: income effect

$$\sum \beta^t \frac{\left(C_t - N_t^{\theta} X_t\right)^{1-\sigma} - 1}{1-\sigma}$$

$$\sum R^{-t} \left(C_t - W N_t\right) = B_0$$

- Suppose real wage constant at $W$, interest rate constant at $R = 1/\beta$
- effects of an increase in $B_0$



Mechanism

first order condition for labor supply in the following form

$$\xi_t W_t = \theta X_t N_t^{\theta-1},$$

and

$$\xi_t = \frac{\left(C_t - N_t^{\theta} X_t\right)^{-\sigma} - \mu_t \gamma C_t^{\gamma-1} X_t^{1-\gamma}}{\left(C_t - N_t^{\theta} X_t\right)^{-\sigma}},$$

where $\mu_t$ is a complicated forward looking object.

Agents forecast that work will be painful in the future, so they work more today

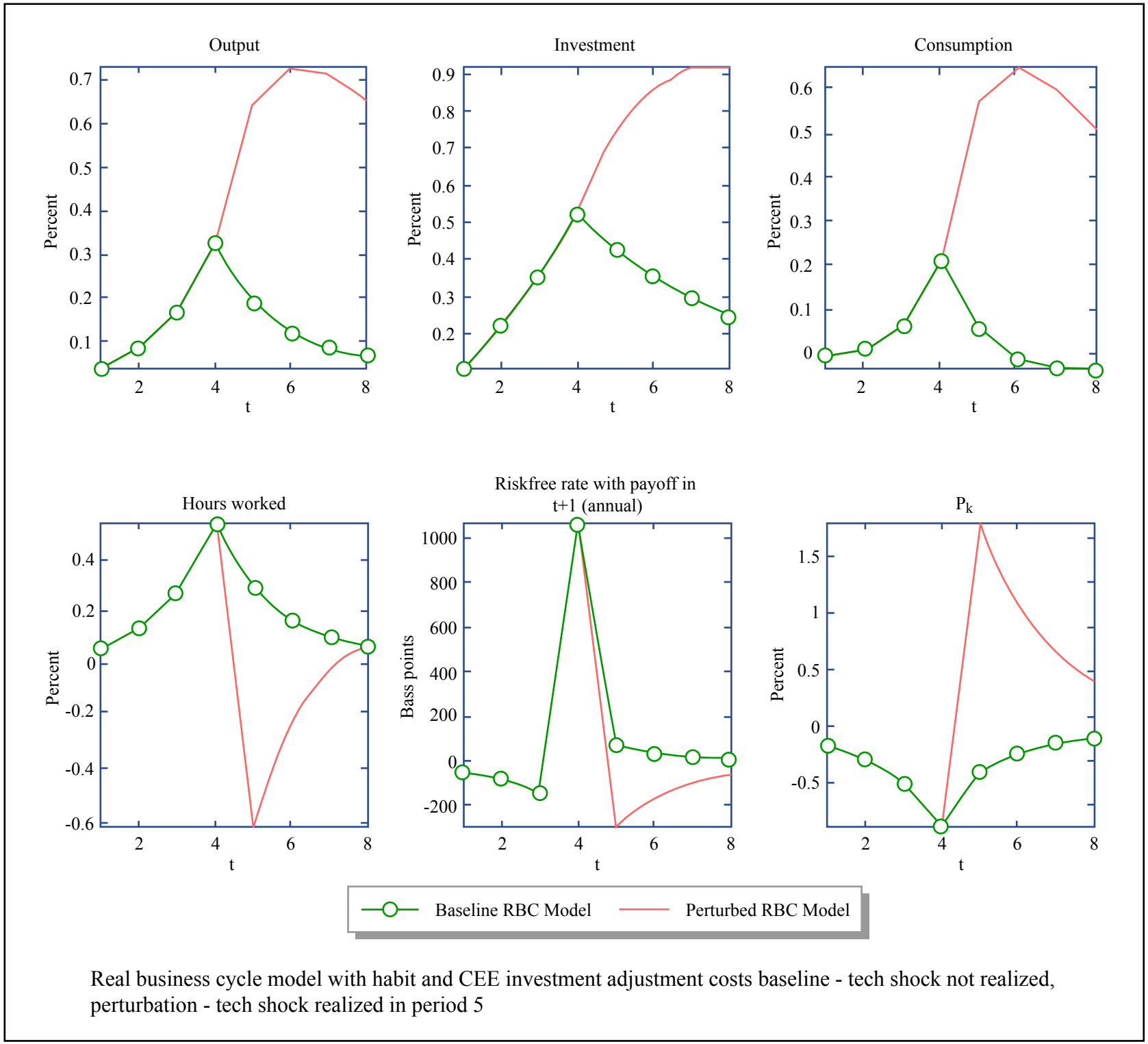
### 1.2.2 Habits and labor supply

Christiano, Ilut, Motto and Rostagno

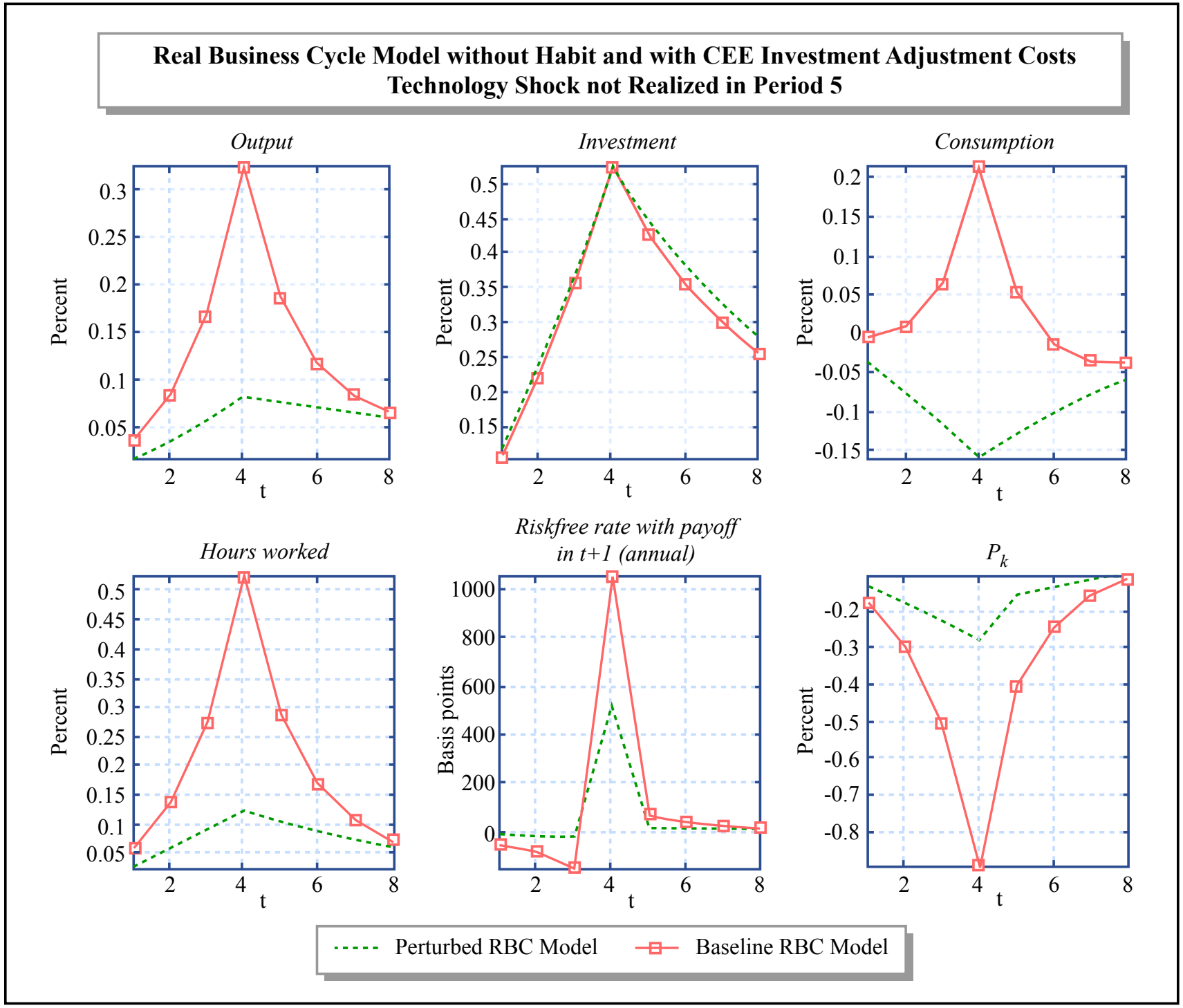
$$\mathsf{E}\sum_{t=0}^{\infty}\beta^t\left(\log\left(C_t-bC_{t-1}\right)-\frac{1}{1+\eta}N_t^{1+\eta}\right)\ \text{(habit)}$$

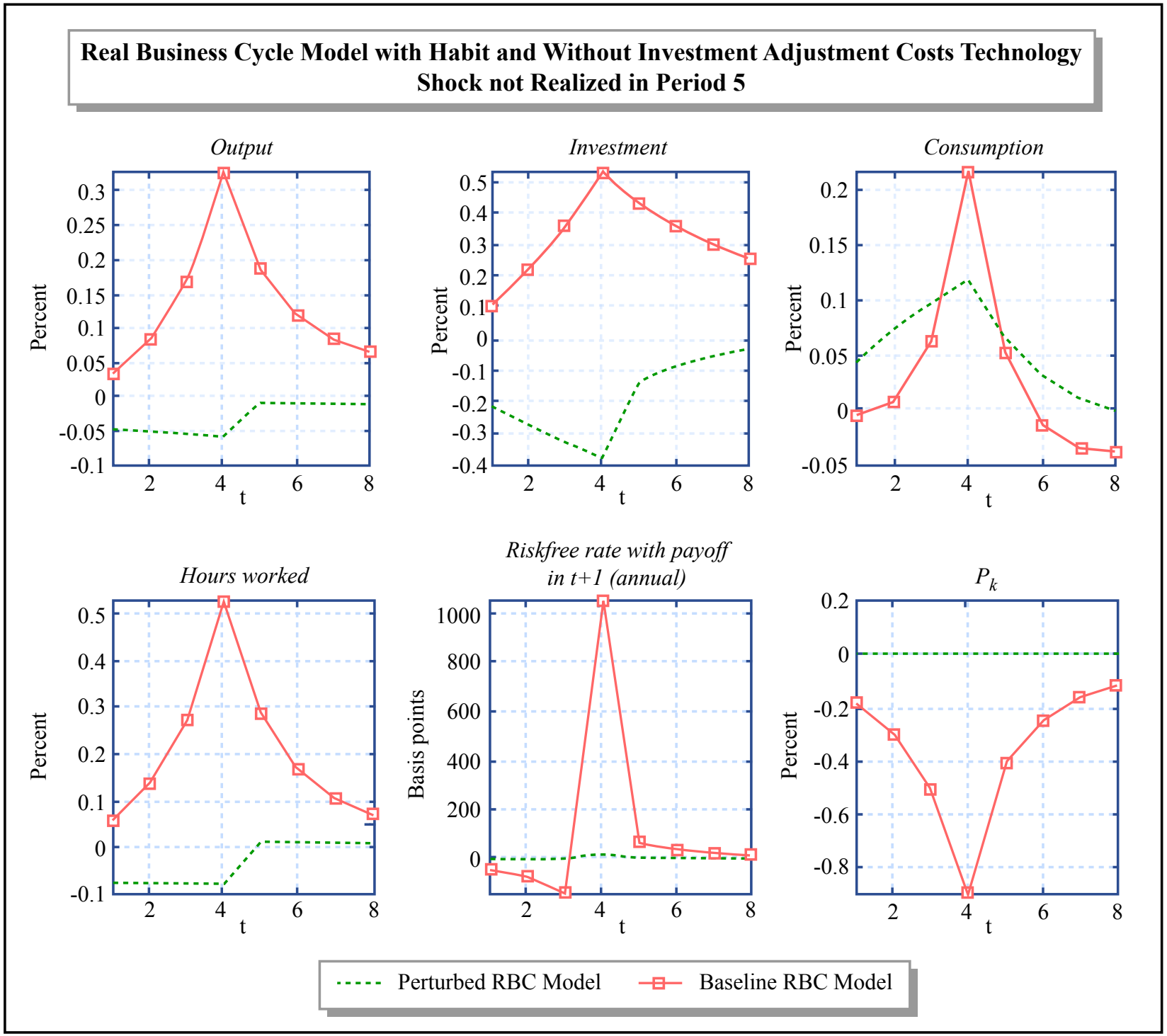
$$\begin{aligned}K_t &= \left(1-\delta\right)K_{t-1}+\left(1-\frac{a}{2}\left(\frac{I_t}{I_{t-1}}\right)^2\right)I_t\ \text{(CEE Adj. Costs)}\\ Y_t &= A_tK_t^{\alpha}N_t^{1-\alpha}=I_t+C_t\end{aligned}$$

$$\begin{aligned}A_t &= e^{a_t}\\ a_t &= \rho a_{t-1}+\epsilon_{t-T}\end{aligned}$$




Real business cycle model with habit and CEE investment adjustment costs baseline - tech shock not realized, perturbation - tech shock realized in period 5



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Conclusions:

- model with both habits and CEE adjustment costs produces right comovement of quantities
- but not of prices: interest rate and asset prices
- looking for real interest rate that responds less$\longrightarrow$models with nominal rigidities

Importance of habit formation

$$\lambda_t W_t = N_t^{\eta}$$

$$\lambda_t = \frac{1}{C_t - bC_{t-1}} - \beta b E_t \left[ \frac{1}{C_{t+1} - bC_t} \right]$$

- high consumption in the future increases incentive to work today.

- wealth effects here? See problem set

## 1.3 Nominal rigidities

- two period economy
- households of consumers-producers
- monopolistic competition, price-setting
- uncertainty about productivity

- preferences

$$\sum_{t=1}^{2} \beta^t \left( \log C_{it} - \frac{\kappa}{1+\eta} N_{it}^{1+\eta} \right),$$

$C_{it}$ is the CES aggregate

$$C_{it} = \left( \int_0^1 C_{ijt}^{\frac{\sigma-1}{\sigma}} di \right)^{\frac{\sigma}{\sigma-1}},$$

with $\sigma > 1$

- Technology

$$Y_{it} = A_t N_{it}.$$

- productivity shocks $A_t$

$$A_t = e^{a_t}$$

$$\begin{aligned} a_1 &= x + \epsilon_1, \\ a_2 &= x + \epsilon_2 \end{aligned}$$

- $x$ and $\epsilon_t$ mean-zero, i.i.d., normal

- A signal about long-run productivity

$$s = x + e$$

- nominal balances with central bank at nominal rate $R$

- household set $P_{it}$ then consumers buy

- intertemporal BC

$$(P_2 C_{i2} - P_{i2} Y_{i2}) + R \cdot (P_1 C_{i1} - P_{i1} Y_{i1}) \leq 0,$$

- $P_t$ is the price index

$$P_t = \left( \int P_{it}^{1-\sigma} di \right)^{\frac{1}{1-\sigma}}.$$

# Flexible price equilibrium

- optimality for price-setting

$$(1-\sigma)\frac{1}{P_t C_{it}}\frac{P_{it}Y_{it}}{P_{it}} + \kappa\sigma\frac{1}{A_t}\frac{Y_{it}}{P_{it}}N_{it}^{\eta} = 0.$$

- symmetric equilibrium, $Y_t = A_t N_t$, this condition gives

$$N_t = \left(\frac{\sigma-1}{\kappa\sigma}\right)^{\frac{1}{1+\eta}} = 1$$

(choosing $\kappa = (\sigma-1)/\sigma$).

- quantities

$$C_t = Y_t = A_t.$$

- what about consumers' decisions?

- consumer Euler equation

$$\frac{1}{C_1} = RE\left[\frac{P_1}{P_2}\frac{1}{C_2}|a_1, s\right]$$

- $C_t = A_t$ log-normal

$$r + p_1 - E\left[p_2|a_1, s\right] = E\left[a_2|a_1, s\right] - a_1 - \frac{1}{2}Var\left[a_2|a_1, s\right].$$

- all changes in $E\left[y_2\right]$ go to the real interest rate

- notice role of $p_1$: neutralizes $r$

# Fixed prices in period 1

- price-setting before any shock observed

$$E\left[(1-\sigma)\frac{1}{P_1 C_{i1}}\frac{P_{i1}Y_{i1}}{P_{i1}}+\kappa\sigma\frac{1}{A_2}N_{i1}^{\eta}\frac{Y_{i1}}{P_{i1}}\right]=0.$$

- rearranging this gives

$$E\left[N_1^{1+\eta}\right]=1$$

- this will pin down averages but not responses to shocks

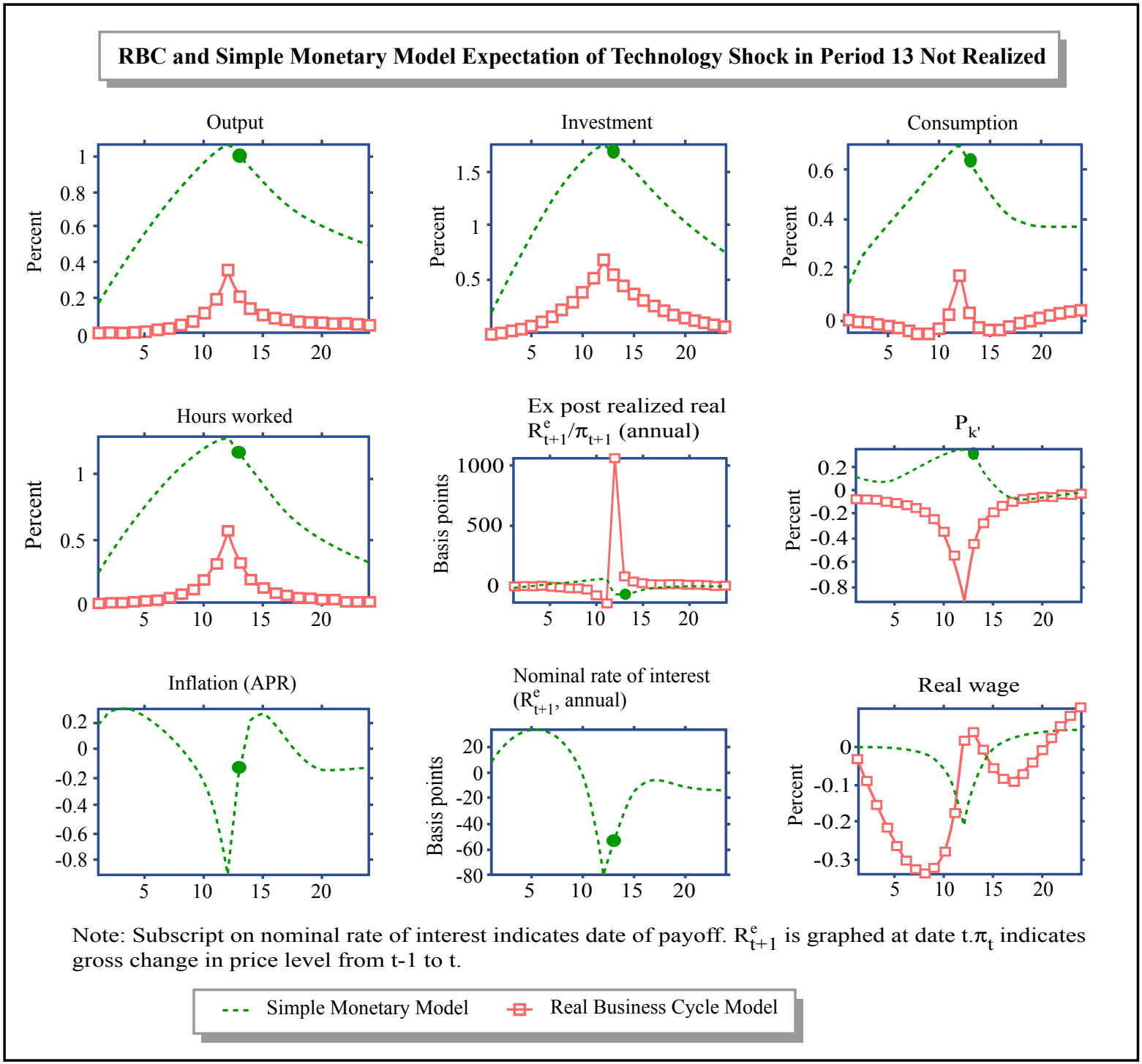
- quantities: equilibrium in period 2 identical

- in period 1 now Euler equation (set $p_2 = 0$)

$$c_1 = E\left[a_2|a_1, s\right] - \frac{1}{2}Var\left[a_2|a_1, s\right] - r - p_1.$$

- suppose $r$ fixed, $p_1$ fixed by assumption

- now "sentiment shocks" affect consumption

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- pin down $p_1$

$$E\left[N_1^{1+\eta}\right] = E\left[e^{(1+\eta)(y_1-a_1)}\right] = 1,$$

- thanks to log-normality this equation can be solved explicitly and gives

$$-r - p_1 - \frac{1}{2}Var\left[a_2|a_1, s\right] + \frac{1}{2}\left(1+\eta\right)\left(\beta+\delta-1\right)^2\sigma_x^2 + \\ + \frac{1}{2}\left(1+\eta\right)\left(\beta-1\right)^2\sigma_\epsilon^2 + \frac{1}{2}\left(1+\eta\right)\delta^2\sigma_e^2 = 0$$

- where

$$E\left[a_2|a_1, s\right] = \beta a_1 + \delta s$$

- simple implication anticipated changes in $r$ are neutral

- if instead we follow rule, e.g.

$$r = \alpha_0 + \alpha_1 y_1$$

  then economy response changes

- we'll go back to monetary policy

# 14.461 Advanced Macroeconomics I

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