Macroeconomics 2 Presentation

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Gabaix, Xavier. 2020. "A Behavioral New Keynesian Model." American Economic Review, 110(8): 2271-2327

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Sciences Po

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6. Behavioral Enrichments of the Model

6.1 Term Structure of Consumer Attention

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Term Structure of Consumer Attention

It is plausible that consumers **do not equally pay attention to all economic variables**, even in the present. We could therefore introduce attention discount factors that are variable specific, yielding **perceived variables** under Bounded Rationality :

- $\hat{r}^{BR}$ the perceived interest rate under bounded rationality
- $\hat{y}^{BR}$ the perceived income under bounded rationality

Prior to this, consumers perceived perfectly variables at the current period, now, they do not anymore.

Directly affects the consumer maximisation program.

Term Structure of Consumer Attention

The law of motion of the personal wealth of the consumer becomes thus a **perceived law of motion**

$$\begin{aligned} k_{t+1} &= G^k(c_t, N_t, k_t, \boldsymbol{X}_t) \\ &:= (1 + \bar{r} + \hat{r}(\boldsymbol{X}_t))(k_t + \bar{y} + \hat{y}(N_t, \boldsymbol{X}t) - c_t) \end{aligned} \tag{6}$$

Turns into :

$$\begin{aligned} k_{t+1} &= \mathbf{G}^{k,BR}(c_t, N_t, k_t, \mathbf{X}_t) \\ &:= (1 + \bar{r} + \hat{r}^{BR}(\mathbf{X}_t))(k_t + \bar{y} + \hat{y}^{BR}(N_t, \mathbf{X}_t) - c_t) \end{aligned} \tag{49}$$

What could be functional forms of $\hat{r}^{BR}$ and $\hat{y}^{BR}$?

Term Structure of Consumer Attention

The perceived values of interest rate and income are defined such that :

$$\begin{cases} \hat{r}^{BR} = m_r \cdot \hat{r}(\mathbf{X}_t) \\ \hat{y}^{BR}(N_t, \mathbf{X}_t) = m_y \cdot \hat{y}(\mathbf{X}_t) + \omega(\mathbf{X}_t)(N_t - N_t(\mathbf{X}_t)) \end{cases} \tag{50}$$

Equation (50) is a possible functional form. The main changes are the attention discount factor.

Now, what would be the expectation under behavioral expectation of those perceived values ?

Term Structure of Consumer Attention

Consumers already have a general attention discount factor $\bar{m}$, from Lemma 1 in equation (11) :

$$\mathbb{E}_t^{BR}\left[z\left(\boldsymbol{X}_{t+k}\right)\right] = \bar{m}^k \cdot \mathbb{E}_t\left[z\left(\boldsymbol{X}_{t+k}\right)\right] \tag{11}$$

Applied to the perceived interest rate and perceived income, we thus get the **Lemma 5 (Term Structure of Attention)**:

$$\begin{cases} \mathbb{E}_t^{BR}\left[\hat{r}^{BR}(\mathbf{X}_{t+k})\right] = m_r \cdot \bar{m}^k \cdot \mathbb{E}_t\left[\hat{r}(\mathbf{X}_{t+k})\right] \\ \mathbb{E}_t^{BR}\left[\hat{y}^{BR}(\mathbf{X}_{t+k})\right] = m_y \cdot \bar{m}^k \cdot \mathbb{E}_t\left[\hat{y}(\mathbf{X}_{t+k})\right] \end{cases} \tag{51}$$

Term Structure of Consumer Attention

What are consequences of this enriched attention structure term ?

When we solve for consumption, we get **Proposition 8** (Behavioral Consumption Function) :

$$\hat{c}_t = \mathbb{E}_t \left[\sum_{\tau \geq t} \frac{\bar{m}^{\tau - t}}{R^{\tau - t}} \Big(b_r m_r \hat{r}(\mathbf{X}_\tau) + m_Y \frac{\bar{r}}{R} \hat{y}(\mathbf{X}_\tau) \Big) \right] \tag{52}$$

With :

$$\begin{cases} c_t = c_t^d + \hat{c}_t \\ c_t^d = \bar{y} + b_k \cdot k_t \\ b_k := \frac{\bar{r}}{R} \cdot \frac{\phi}{\phi + \gamma} \end{cases} \qquad \begin{cases} m_Y = \frac{\phi \cdot m_y + \gamma}{\phi + \gamma} \\ b_r := -\frac{1}{\gamma \cdot R^2} \end{cases}$$

Term Structure of Consumer Attention

Interest rate has **direct** and **indirect** effects on consumption.

For a consumer, a decrease in future interest rate :

- increases their present consumption, because it is more profitable to consume right now (direct effect)
- increases other consumers future consumption, increasing their future income, increasing their current consumption (indirect effect)

Therefore, the aggregate consumption multiplies the positive effect on consumption of a decrease in future interest rate.

What does this behavioral model imply for this multiplicator ?

In the **rational consumer** case :

If we derive from equation (52), we get the direct effect :

$$\Delta^{\text{direct}} := \left.\frac{\partial \hat{c}_0}{\partial \hat{r}_\tau}\right|_{(y_t)_{t\geq 0} \text{ held constant}} = -\alpha \cdot \frac{1}{R^\tau}$$

If we derive from equation (26), we get the indirect effect :

$$\Delta^{GE} := \frac{\partial \hat{c}_0}{\partial \hat{r}_\tau} = -\alpha R$$

Put together :

$$\frac{\Delta^{GE}}{\Delta^{\text{direct}}} = R^{\tau+1} \tag{53}$$

In the **behavioral consumer** case :

If we derive from equation (52), we get the direct effect :

$$\Delta^{\text{direct}} := \left.\frac{\partial \hat{c}_0}{\partial \hat{r}_\tau}\right|_{(y_t)_{t\geq 0}\text{ held constant}} = -\alpha \cdot m_r \cdot \bar{m}^\tau \frac{1}{R^\tau}$$

If we derive from equation (26), we get the indirect effect :

$$\Delta^{GE} := \frac{\partial \hat{c}_0}{\partial \hat{r}_\tau} = -\alpha m_r \cdot M^\tau \frac{R}{R - r \cdot m_Y} R$$

Put together :

$$\frac{\Delta^{GE}}{\Delta^{\text{direct}}} = \left(\frac{R}{R - r m_Y}\right)^{\tau+1} \in \left[1, R^{\tau+1}\right] \tag{54}$$

Term Structure of Consumer Attention

In a behavioral framework, the multiplicative effect is dampened by bounded rationality.
An attention discount factor that is variable specific allows to explain why forward guidance is not as strong as what theory predicts.
What about variable specific attention deficiency for firms now ?

Flattening of the Phillips Curve via Imperfect Firm Attention

If we introduce variable specific inattention for firms, equation (15), defining the real profit of the firm :

$$v\left(q_{it}, \boldsymbol{X}\tau\right) := v^{0}\left(q_{it} - \Pi(\boldsymbol{X}\tau), \mu(\boldsymbol{X}\tau), c(\boldsymbol{X}_{\tau})\right) \tag{15}$$

Turns into a perceived real profit of the firm :

$$v^{BR}(q_{it}, (\mathbf{X}_{\tau})) := v^{0}\left(q_{it} - m_{\pi}^{f} \cdot \Pi(\mathbf{X}_{\tau}), m_{x}^{f} \cdot \mu(\mathbf{X}_{\tau}), c(\mathbf{X}_{\tau})\right) \tag{55}$$

Where :

- m_{π}^{f} is the attention deficit to inflation
- m_{x}^{f} is the attention deficit to marginal cost

Flattening of the Phillips Curve via Imperfect Firm Attention

The maximisation program of equation (16) :

$$\max_{q_{it}} \mathbb{E}_t \left[\sum_{\tau=t}^{\infty} (\beta\theta)^{\tau-t} \frac{c\left(\boldsymbol{X_\tau}\right)^{-\gamma}}{\left(\boldsymbol{X_t}\right)^{-\gamma}} v\left(q_{it}, \boldsymbol{X}\tau\right) \right] \tag{16}$$

turns into :

$$\max_{q_{it}} \mathbb{E}_t^{BR} \left[\sum_{\tau=t}^{\infty} (\beta\theta)^{\tau-t} \frac{c(\mathbf{X}_\tau)^{-\gamma}}{c(\mathbf{X}_t)^{-\gamma}} v^{BR}(q_{it}, \mathbf{X}_\tau) \right] \tag{56}$$

Flattening of the Phillips Curve via Imperfect Firm Attention

Solving it yields :

$$p_t^* = p_t + (1 - \beta\theta) \cdot \sum_{k=0}^{\infty} (\beta\theta\bar{m})^k \, \mathbb{E}_t \left[m_\pi^f (\pi_{t+1} + ... + \pi_{t+k}) - m_x^f \mu_{t+k} \right] \tag{57}$$

In comparison, we had in the baseline model :

$$p_t^* = p_t + (1 - \beta\theta) \sum_{k=0}^{\infty} (\beta\theta\bar{m})^k \cdot \mathbb{E}_t \left[\pi_{t+1} + ... + \pi_{t+k} - \mu_{t+k} \right] \tag{27}$$

Flattening of the Phillips Curve via Imperfect Firm Attention

We also get :

$$M^f = \bar{m}\left(\theta + m_\pi^f \cdot (1-\theta) \cdot \frac{1-\beta\cdot\theta}{1-\beta\cdot\theta\cdot\bar{m}}\right) \in [0,1]$$

$$\kappa = m_x^f \bar{\kappa} \tag{58}$$

Where

- M^f is the general attention factor of the firm
- m_x^f is the attention deficiency to the output gap
- $\kappa = m_x^f \cdot \bar{\kappa}$, is the perceived value of the importance of outputgap on inflation

Flattening of the Phillips Curve via Imperfect Firm Attention

If we solve the Phillips curve, the equation (29) :

$$\pi_t = \beta \cdot M^f \cdot \mathbb{E}t\left[\pi_{t+1}\right] + \kappa \cdot x_t \tag{29}$$

Turns into a Phillips Curve with Behavioral Firms, allowing for imperfect attention to inflation and costs (**Proposition 10**) :

$$\pi_t = \beta \cdot \bar{m}\left(\theta + m_\pi^f \cdot (1-\theta) \cdot \frac{1-\beta \cdot \theta}{1-\beta \cdot \theta \cdot \bar{m}}\right) \cdot \mathbb{E}t\left[\pi_{t+1}\right] + m_x^f \cdot \bar{\kappa} \cdot x_t$$

Nonconstant Trend Inflation and Neo- Fisherian Paradoxes

Now, let's change the way we consider inflation. Instead of a steady state, agents perceive a default value. The article proposes the following functional form :

$$\pi_t^d = (1-\zeta)\bar{\pi}_t + \zeta\bar{\pi}_t^{CB} \tag{59}$$

The IS curve is unchanged, and is the same as equation (28) :

$$x_t = M\mathbb{E}_t\left[x_{t+1}\right] - \sigma\left(i_t - \mathbb{E}_t\left[\pi_{t+1}\right] - r_t^n\right) \tag{60}$$

Nonconstant Trend Inflation and Neo- Fisherian Paradoxes

The Phillips curve of equation (29) :

$$\pi_t = \beta \cdot M^f \mathbb{E}_t \left[\pi_{t+1}\right] + \kappa \cdot x_t \tag{29}$$

Turns into :

$$\hat{\pi}_t = \beta \cdot M^f \cdot \mathbb{E}_t \left[\hat{\pi}_{t+1}\right] + \kappa \cdot x_t \tag{61}$$

The only difference is through $\hat{\pi}_t$.

Nonconstant Trend Inflation and Neo- Fisherian Paradoxes

Finally, the equilbrium condition changes through ζ the weight given to the Central Bank declaration. Equation (34) in the Baseline model :

$$\phi_\pi + \frac{(1-\beta M^f)}{\kappa}\phi_x + \frac{(1-\beta M^f)(1-M)}{\kappa\sigma} > 1 \tag{34}$$

Turns into :

$$\phi_\pi + \zeta\frac{(1-\beta M^f)}{\kappa}\phi_x + \zeta\frac{(1-\beta M^f)(1-M)}{\kappa\sigma} > 1 \tag{62}$$

The term ζ can be considered as the weight of central bank guidance.

- What if it is 0 ?
- What are the consequences for Central Bankers ?

Discussion of the Behavioral Assumptions

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- Theoretical Microfoundation
- Lucas Critique
- Long-Run Learning
- Parsimony and New Degrees of Freedom
- Reasonable Variants

Conclusion

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Limits and Critics

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