Sticky Information

Sang Seok Lee

Department of Economics, Bilkent University

Fall Semester 2016

Readings

- Chapter 5, Walsh (2010) “Monetary Theory and Policy,” MIT Press
- Mankiw and Reis (2002) “Sticky Information versus Sticky Prices: A Proposal to Replace the New Keynesian Phillips Curve,” QJE

Sticky Information

- The slow dispersal of information about macroeconomic conditions
- Can help account for the sluggish adjustment of prices and the delayed responses of real variables to monetary shocks
- Mixed evidence:
  - Coibion (2010) "Testing the Sticky Information Phillips Curve," RESTAT
    - The estimated structural parameters are inconsistent with an underlying sticky information model and the sticky information Phillips curve is statistically dominated by the new Keynesian Phillips curve
  - Andrade and Le Bihan (2013) "Inattentive Professional Forecasters," JME
    - Data: ECB Survey of Professional Forecasters
    - Empirical facts are qualitatively supportive of sticky information à la Mankiw–Reis, but it cannot quantitatively replicate the error and disagreement observed in the data

Model

- A continuum of firms of unit measure
- Each firm adjusts its price in every period but its decision may be based on outdated information
- In every period, a fraction λ of firms are randomly selected and update their information
- Eventually new information reaches all firms but in a delayed manner
- Suppose firm j's optimal (log) price $p_t^*(j)$ is

$$p_t^*(j) = p_t + \alpha x_t$$

  where p is the log aggregate price level and x is an output gap
- If all firms were identical, $p_t^*(j) = p_t^*$ for all j and

$$p_t^* = p_t + \alpha x_t$$

  - Because $p_t^* = p_t$, it follows that $x_t = 0$ (output is at its natural level)
- With sticky information, firms will set different prices

Aggregate Price under Sticky Information

- $p_t^i = E_{t-i}p_t^*$ is the price set by firms which updated their information i periods in the past from period t
- A fraction λ of firms which update their information sets in t set their prices at p_t^* because their (identical) information sets are fully updated
- Of the remaining $1-\lambda$ fraction of firms that do not update information in t, λ of them would have updated information in $t-1$. These $\lambda(1-\lambda)$ firms set their prices at $E_{t-1}p_t^*$
- It follows that the fraction $(1-\lambda) - \lambda(1-\lambda) = (1-\lambda)^2$ firms would not have updated information in t and $t-1$. Of these firms, λ firms would have updated their information in $t-2$. These $\lambda(1-\lambda)^2$ firms set their prices at $E_{t-2}p_t^*$
- If you keep going, you will see that for any period i in the past, $(1-\lambda)^i\lambda$ firms would not have updated their information since $t-i$ and set their prices at $E_{t-i}p_t^*$
- Aggregating over all firms,

$$p_t = \sum_{i=0}^{\infty}(1-\lambda)^i\lambda E_{t-i}p_t^* = \lambda\sum_{i=0}^{\infty}(1-\lambda)^i E_{t-i}(p_t + \alpha x_t)$$

- λ is a measure of the degree of information stickiness. Small λ implies that firms update information sluggishly

Inflation under Sticky Information

- Let $z_t = p_t + \alpha x_t$
- The formula above becomes

$$p_t = \lambda z_t + \lambda(1-\lambda)E_{t-1}z_t + \lambda(1-\lambda)^2 E_{t-2}z_t + \lambda(1-\lambda)^3 E_{t-3}z_t + ...$$

and lagging in by one period

$$p_{t-1} = \lambda E_{t-1}z_{t-1} + \lambda(1-\lambda)E_{t-2}z_{t-1} + \lambda(1-\lambda)^2 E_{t-3}z_{t-1} + ...$$

- Rewrite the first equation as

$$p_t = \lambda z_t + \lambda E_{t-1}z_t - \lambda^2 E_{t-1}z_t + \lambda(1-\lambda)E_{t-2}z_t - \lambda^2(1-\lambda)E_{t-2}z_t$$
$$+\lambda(1-\lambda)^2 E_{t-3}z_t - \lambda^2(1-\lambda)^2 E_{t-3}z_t + ...$$

- The difference between the two gives ($\triangle z_t = z_t - z_{t-1}$)

$$\pi_t = p_t - p_{t-1} = \lambda z_t + \lambda E_{t-1}\triangle z_t + \lambda(1-\lambda)E_{t-2}\triangle z_t + \lambda(1-\lambda)^2 E_{t-3}\triangle z_t + ...$$
$$+(-\lambda^2 E_{t-1}z_t) + (-\lambda^2(1-\lambda)E_{t-2}z_t) + (-\lambda^2(1-\lambda)^2 E_{t-3}z_t) + ...$$

so that

$$\pi_t = \lambda z_t + \lambda \sum_{i=0}^{\infty}(1-\lambda)^i E_{t-1-i}\triangle z_t - \lambda^2 \sum_{i=0}^{\infty}(1-\lambda)^i E_{t-1-i}z_t$$

Inflation under Sticky Information

- Rewriting

$$p_t = \lambda \sum_{i=0}^{\infty} (1-\lambda)^i E_{t-i}(p_t + \alpha x_t)$$

as

$$p_t = \lambda(p_t + \alpha x_t) + \lambda \sum_{i=1}^{\infty} (1-\lambda)^i E_{t-i} z_t$$

and solving for p_t gives

$$p_t = \left(\frac{\lambda}{1-\lambda}\right) \alpha x_t + \left(\frac{\lambda}{1-\lambda}\right) \sum_{i=1}^{\infty} (1-\lambda)^i E_{t-i} z_t$$

$$= \left(\frac{\lambda}{1-\lambda}\right) \alpha x_t + \lambda \sum_{i=0}^{\infty} (1-\lambda)^i E_{t-1-i} z_t$$

Inflation under Sticky Information

$$\pi_t = \lambda z_t + \lambda \sum_{i=0}^{\infty} (1-\lambda)^i E_{t-1-i} \triangle z_t - \lambda^2 \sum_{i=0}^{\infty} (1-\lambda)^i E_{t-1-i} z_t$$

$$p_t = \left(\frac{\lambda}{1-\lambda}\right) \alpha x_t + \lambda \sum_{i=0}^{\infty} (1-\lambda)^i E_{t-1-i} z_t$$

- The last term in the first equation is equivalent to

$$\lambda p_t - \left(\frac{\lambda^2}{1-\lambda}\right) \alpha x_t$$

- So,

$$\pi_t = \lambda z_t + \lambda \sum_{i=0}^{\infty} (1-\lambda)^i E_{t-1-i} \triangle z_t - \lambda p_t + \left(\frac{\lambda^2}{1-\lambda}\right) \alpha x_t$$

- With $\triangle z_t = \pi_t + \alpha \triangle x_t$ and $\lambda z_t - \lambda p_t = \lambda \alpha x_t$,

$$\pi_t = \lambda \alpha x_t + \left(\frac{\lambda^2}{1-\lambda}\right) \alpha x_t + \lambda \sum_{i=0}^{\infty} (1-\lambda)^i E_{t-1-i} (\pi_t + \alpha \triangle x_t)$$

$$= \left(\frac{\lambda}{1-\lambda}\right) \alpha x_t + \lambda \sum_{i=0}^{\infty} (1-\lambda)^i E_{t-1-i} (\pi_t + \alpha \triangle x_t)$$

Sticky Information Phillips Curve

- The Sticky Information Phillips Curve is

$$\pi_t = \left(\frac{\lambda}{1-\lambda}\right)\alpha x_t + \lambda \sum_{i=0}^{\infty}(1-\lambda)^i E_{t-1-i}(\pi_t + \alpha \triangle x_t)$$

  - The coefficient on the output gap is increasing in λ
  - The expectations are based on the lagged information sets
  - Hence, shocks occurring in t will only gradually affect inflation: It takes time for information to be dispersed across the economy

Further Readings

- Mankiw and Reis (2010) "Sticky Information in General Equilibrium," JEEA
- Mankiw and Reis (2010) "Imperfect Information and Aggregate Supply," Handbook of Monetary Econ