

Lecture 3

Pricing to Habits and Incomplete Pass-Through

Habit Formation

Preferences:

$$U(x_t)$$

- **Existing Literature on Habit Formation**

- Habits are formed at the level of a composite good (Superficial Habits)

$$x_t = \frac{c_t}{c_{t-1}^\theta} \quad \text{with } c_t = \left[\int_0^1 c_{it}^{1-\frac{1}{\eta}} di \right]^{\frac{1}{1-\frac{1}{\eta}}}$$

- **This paper**

- Habits are formed at the level of individual goods. (Deep Habits) Ravn, Schmitt-Grohé, and Uribe, (RES 2006)

$$x_t = \left[\int_0^1 \left(\frac{c_{it}}{c_{it-1}^\theta} \right)^{1-\frac{1}{\eta}} di \right]^{\frac{1}{1-\frac{1}{\eta}}}$$

A Model of Incomplete Pass-Through

Household j minimizes $\int_0^1 P_{it} c_{it}^j di$ subject to

$$\left[\int_0^1 \left(\frac{c_{it}^j}{c_{it-1}^\theta} \right)^{1-1/\eta} di \right]^{1/(1-1/\eta)} \geq x_t^j$$

$\theta =$ deep-habit parameter

External habit Stock, c_{it-1} , taken as given

Demand for good i by household j

$$c_{it}^j = \left(\frac{P_{it}}{P_t} \right)^{-\eta} c_{it-1}^{\theta(1-\eta)} x_t^j,$$

- Short-Run Price Elasticity = η
- Long-Run Price Elasticity = $\frac{\eta}{1-\theta(1-\eta)}$
- Habit elasticity $\theta(1 - \eta)$

The firm

- Each variety i is produced by a monopolistically competitive firm
- Demand faced by producer of good i

$$c_{it} = \left(\frac{P_{it}}{P_t} \right)^{-\eta} c_{it-1}^{\theta(1-\eta)} x_t,$$

- Because the firm takes as given the aggregate state variables P_t and x_t , demand can be simplified to

$$c_{it} = A_t P_{it}^{-\eta} c_{it-1}^{\theta(1-\eta)} \quad A_t > 0$$

- Marginal cost of producing good i , MC_{it} , exogenous and independent of scale
- Period profits:

$$(P_{it} - MC_{it})c_{it}$$

- Firms maximize present value of expected profits

$$\sum_{t=0}^{\infty} \beta^t E_0 (P_{it} - MC_{it}) c_{it},$$

subject to

$$c_{it} = A_t P_{it}^{-\eta} c_{it-1}^{\theta(1-\eta)}$$

- pricing problem of the firm becomes dynamic
- First-order conditions:

$$c_{it} = A_t P_{it}^{-\eta} c_{it-1}^{\theta(1-\eta)}$$

$$P_{it} \left(1 - \frac{1}{\eta} \right) + \beta \theta \frac{1-\eta}{\eta} E_t P_{it+1} \frac{c_{it+1}}{c_{it}} = MC_{it}$$

- Markups are time varying

$$\frac{P_{it}}{MC_{it}} = \frac{1}{\left(1 - \frac{1}{\eta}\right) + \beta\theta\frac{1-\eta}{\eta} E_t \frac{P_{it+1}c_{it+1}}{P_{it}c_{it}}}$$

- deep habits provide microfoundations to existing models of:
 - Brand-switching costs (Klemperer, RES 1995; Kleshchelski and Vincent, 2007)
 - Customer-market pricing (Phelps and Winter, 1970)
- advantage of Deep Habit formulation over those theoretical approaches. Easy to incorporate into a GE model

- Key Stylized Facts

- Incomplete (exchange rate) pass-through
- Conditional on marginal cost shocks, prices are less volatile than marginal costs

- Key References

- Giovannini, *JIE*, 1988
- Froot and Klemperer, *AER* 1989
- Kadiyali (*JIE* 1997)
- Hellerstein (2004)
- Goldberg and Campa, 2006.
- Nakamura, 2006.

- Steady state markup

$$\mu = \left(\frac{\eta}{\eta - 1} \right) \left(\frac{1}{1 - \beta\theta} \right) < \frac{\eta}{(\eta - 1)}.$$

- **Parameter Constraint:** The markup is non-negative and firm's policy rule is locally unique iff

$$\theta > \frac{1}{(1 - \eta)}.$$

Temporary Marginal-Cost Shocks

- E_t

$$\widehat{MC}_{it+1} = \lambda \widehat{MC}_{it} + \epsilon_t$$

- Calibration:

Parameter	Value
β	0.99
η	6
λ	0
θ	-0.1

(Recall Parameter Restriction: Steady-state markup non-negative and firm's decision locally unique iff $\theta > -0.2$)

Impulse Response to a One-Percent Increase in Marginal Cost

period	price	marg.costs	markup
0	0.81	1	-0.19
1	-0.11	0	-0.11
2	-0.04	0	-0.04
3	-0.01	0	-0.01
4	-0.01	0	-0.01

Units: percent deviations from the steady state.

Price-Cost Volatility Ratio

$$\frac{\text{var}(P_{it})}{\text{var}(MC_{it})} = 0.7$$

Results

- Imperfect Pass-Through of Marginal-Cost Shocks
- Prices are less volatile than marginal cost

Anticipated Marginal-Cost Shocks

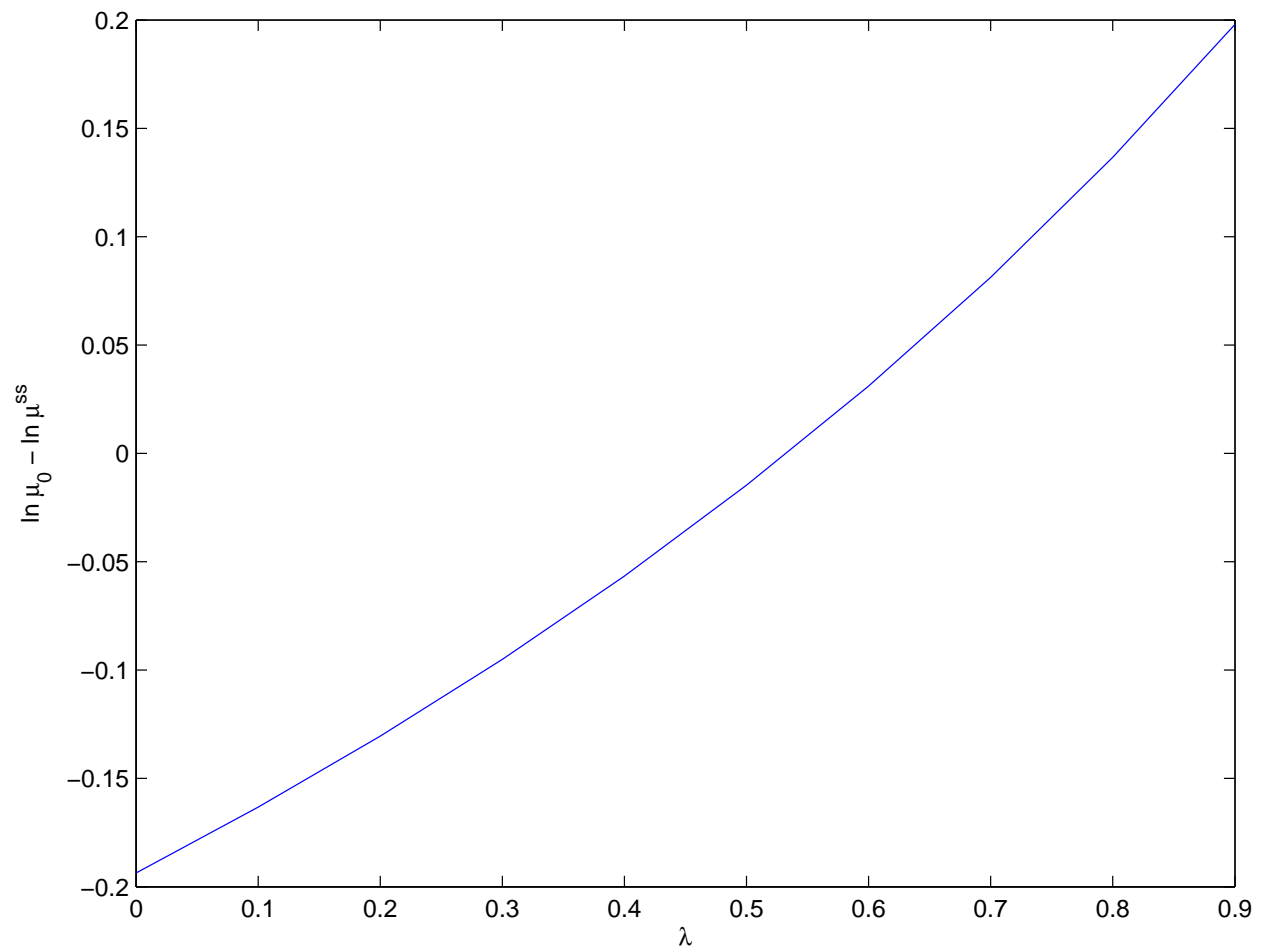
period	price	marg.costs	markup
0	0.29	0	0.29
1	0.77	1	-0.23
2	-0.12	0	-0.12
3	-0.05	0	-0.05
4	-0.02	0	-0.02

Units: percent deviations from the steady state.

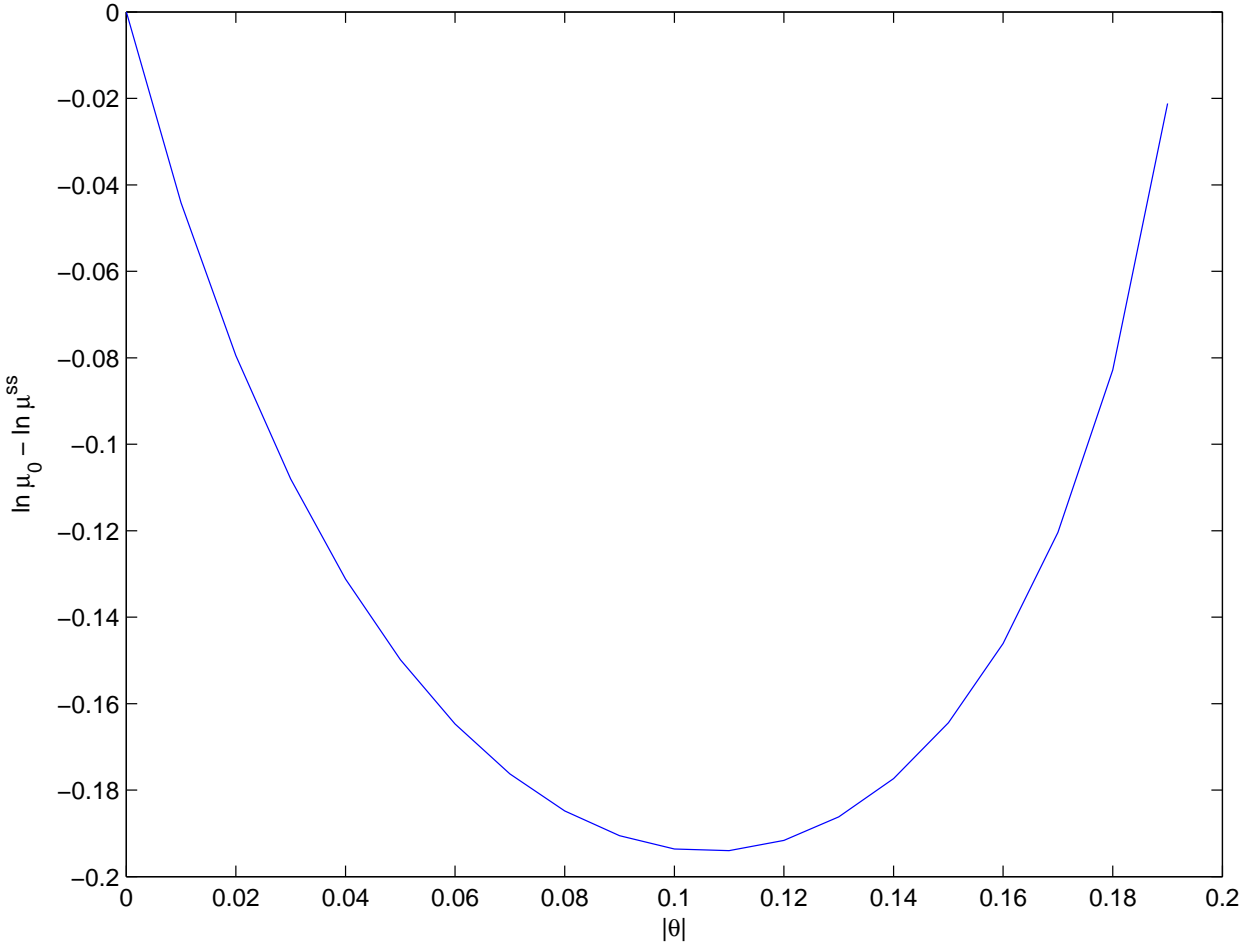
Result

About 1/3 of the future expected increase in costs is passed onto prices upon arrival of information. Consequently, a smaller fraction of the cost shock is passed onto prices upon realization of the shock \Rightarrow Measured pass-through is more imperfect.

Persistent Marginal-Cost Shocks



Pass-Through and the Strength of Habits



No Incomplete Pass-Through Under Additive Habits

