Deep Habits

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Existing Literature on Habit Formation

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

$$U(c_t - \theta c_{t-1})$$

$$c_t = \left[\int_0^1 c_{it}^{1-\frac{1}{\eta}} di\right]^{\frac{1}{1-\frac{1}{\eta}}}$$

- This paper: Habits are formed at the level of individual goods. (Deep Habits)

$$U(x_t)$$

with

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

Superficial Habits

Demand side effect: Euler equation with external superficial habit

$$U'(c_t - \theta c_{t-1}) = \beta E_t U'(c_{t+1} - \theta c_t) R_{t+1}$$

No supply side effects: Demand function for good i as in a model without habits:

$$c_{it} = \left(\frac{P_{it}}{P_t}\right)^{-\eta} c_t$$

Aggregate Implications of Deep Habits

- The economys demand side (particularly the consumption Euler equation) is identical under deep and superficial external habits.

- Under deep habit formation, the supply side of the economy changes in fundamental ways.

Demand Function for Good i Under External Deep Habit Formation

$$c_{it} = p_{it}^{-\eta}(c_t - \theta c_{t-1}) + \theta c_{it-1}$$

- Deep Habits give rise to a theory of countercyclical markups. the price elasticity of demand becomes countercyclical: [Price-elasticity effect of deep habits]

- the pricing problem becomes dynamic: [Intertemporal effect of deep habits]

Three Variations

1. Good Specific Subsistence Points

$$c_{it} = p_{it}^{-\eta} x_t + \theta c^*$$

2. Relative Deep Habits

$$c_{it} = p_{it}^{-\eta} x_t c_{it-1}^{\theta(1-\eta)}$$

3. Internal Deep Habits

$$c_{it} = \left[\sum_{k=0}^{\infty} \theta^k r_{t,t+k} p_{it+k} \right]^{-\eta} X_t + \theta c_{it-1}$$

Equilibrium Under Deep Habits

$$U_x(x_t, h_t) = \beta R_t E_t U_x(x_{t+1}, h_{t+1})$$

$$x_t = c_t - \theta c_{t-1}$$

$$w_t = -\frac{U_h(x_t, h_t)}{U_x(x_t, h_t)}$$

$$c_t = A_t h_t$$

$$\mu_t = \frac{A_t}{w_t}$$

$$\nu_t = \frac{\mu_t - 1}{\mu_t} + \theta E_t r_{t,t+1} \nu_{t+1}$$

$$c_t = \eta(c_t - \theta c_{t-1})\nu_t$$

$$\mu_t = \left[1 - \frac{1}{\eta\left(1 - \frac{\theta c_{t-1}}{c_t}\right)} + \theta E_t r_{t,t+1} v_{t+1}\right]^{-1}$$

Deep Habits and Markups Dynamics in a Fully Fledged RBC Model

- Slow decay in habits:

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

$$s_{it} = \rho s_{it-1} + (1-\rho) c_{it}.$$

- Elastic labor supply and Capital accumulation

- Three shocks:

  - Productivity Shocks

  - Preference Shocks

  - Government Spending Shocks

- Government consumption is subject to deep habit formation

Estimating Deep Habits

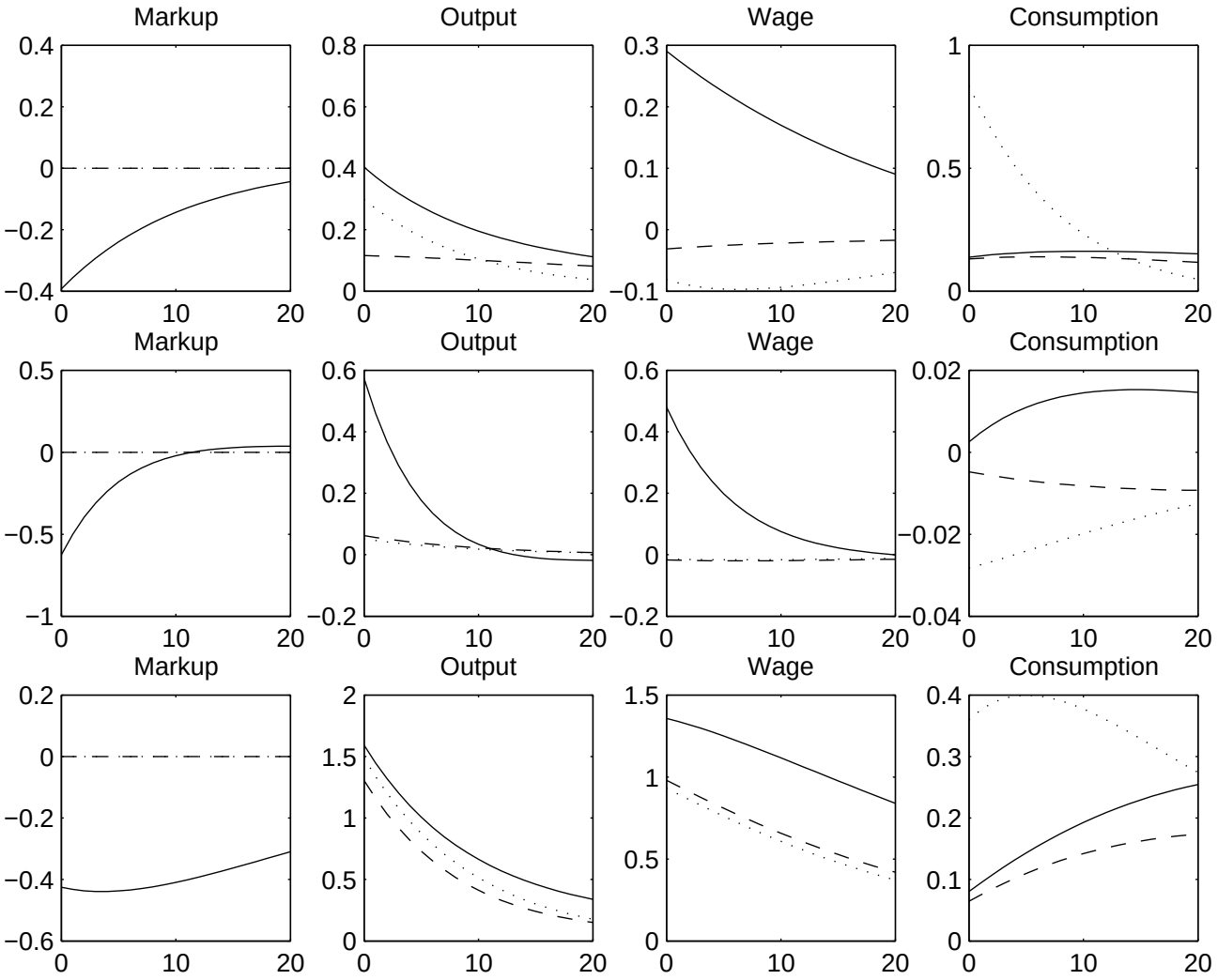
Fully Fledged Deep-Habit Model: GMM Estimates of Structural Parameters,

U.S. data from 1967-2003 (Quarterly).

Measurement		Joint System Based Estimates				
C	R	σ	θ	η	ρ	J-test
C^{tot}	R^{FFR}	1.854	0.861	5.261	0.848	54.22
		(0.583)	(0.039)	(1.062)	(0.027)	[0.749]

Notes: Numbers in parentheses are heteroscedasticity consistent standard errors. Numbers in square brackets are P-values.

Impulse Responses to Positive Preference, Government Spending, and Productivity Shocks Under Deep Habit, Superficial Habit, and No Habit



___ Deep Habit _ _ _ Superficial Habit ..... No habit

Row 1: Preference Shock. Row 2: Government Spending Shock. Row 3: Technology shock.

Conclusion

- Deep habit formation implies that producers face demand functions that depend on past sales.

- Thus, the deep-habit model provides microfoundations to customer market (Phelps-Winter, 1970) and brand-switching-cost (Klemperer, 1995) models.

- Deep habits induce a theory of endogenous markup determination.

- Under deep habits markups are countercyclical, which is in line with empirical evidence.