

**Lecture on**

**Deep Habits**

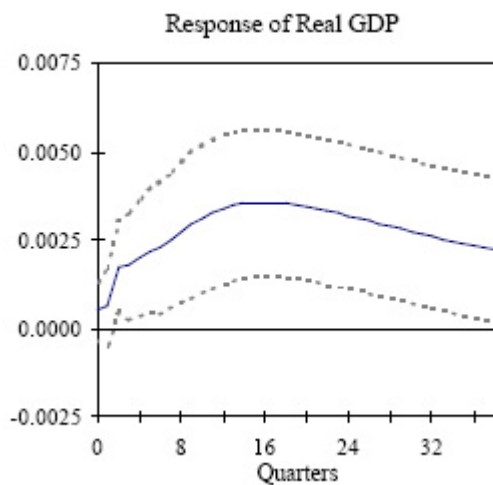
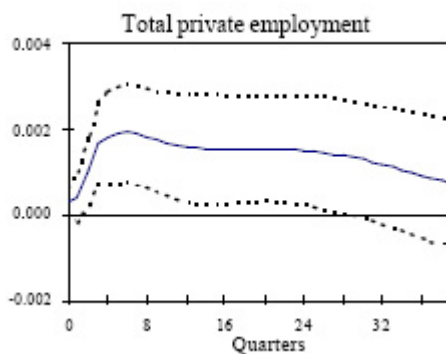
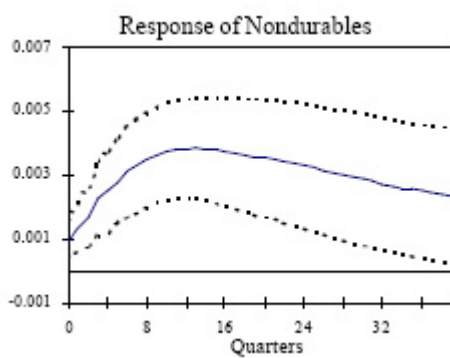
**by Martín Uribe**

## SVAR Evidence on Effects of Government Spending

- A positive innovation in Government Spending causes:
  1. An increase in private consumption
  2. An increase in wages
  3. An expansion in GDP
  4. An expansion in private employment
- References: Fatás and Mihov (2001), Blanchard and Perotti (2002), Perotti (2007)← this is an excellent recent survey.

# Empirical Impulse Response Functions to an Increase in Government Spending

(Quarterly VAR. USA, 1960:1-1996:3)



Source: Fatás and Mihov (2001)

The SVAR evidence represents a problem for the Neoclassical Model. In this model, an increase in government spending causes:

1. A contraction in private consumption (because of a negative wealth effect)
2. An expansion in labor supply (driven by the same negative wealth effect)
3. A decrease in wages
4. An expansion in GDP

## Existing Literature on Habit Formation

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

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

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

- In this lecture: Habits are formed at the level of individual goods. (Deep Habits)

$$U(x_t)$$

with

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

## Aggregate Implications of 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:

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

Isoelastic demand function  $\Rightarrow$  markups are constant over time.

## Aggregate Implications of Deep Habits

- Demand side: The consumption Euler equation) is identical to the one associated with superficial external habits.

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

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

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

- Deep Habits give rise to a theory of countercyclical markups.
- The price elasticity of demand becomes procyclical: [Price-elasticity effect of deep habits.]
- the firm's pricing problem becomes dynamic: [Intertemporal effect of deep habits.]

## **Three Variations**

1. Good-Specific Subsistence Points
2. Relative Deep Habits
3. Internal Deep Habits

## Good-Specific Subsistence Points

Aggregator Function

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

Implied demand function for good  $i$

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

- The price-elasticity effect remains
- The intertemporal effect vanishes

## Relative Deep Habits

Aggregator Function

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

Demand Function for Good  $i$

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

- The price-elasticity effect vanishes
- The intertemporal effect remains

## Internal Deep Habits

Aggregator Function

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

Implied Demand Function for Good  $i$

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

- Current demand for good  $i$  depends on current and future expected prices.
- The firm's (Ramsey) optimal pricing policy becomes time inconsistent.

## Equilibrium Under Deep Habits

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

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

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

$$c_t = A_t h_t$$

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

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

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

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

## 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

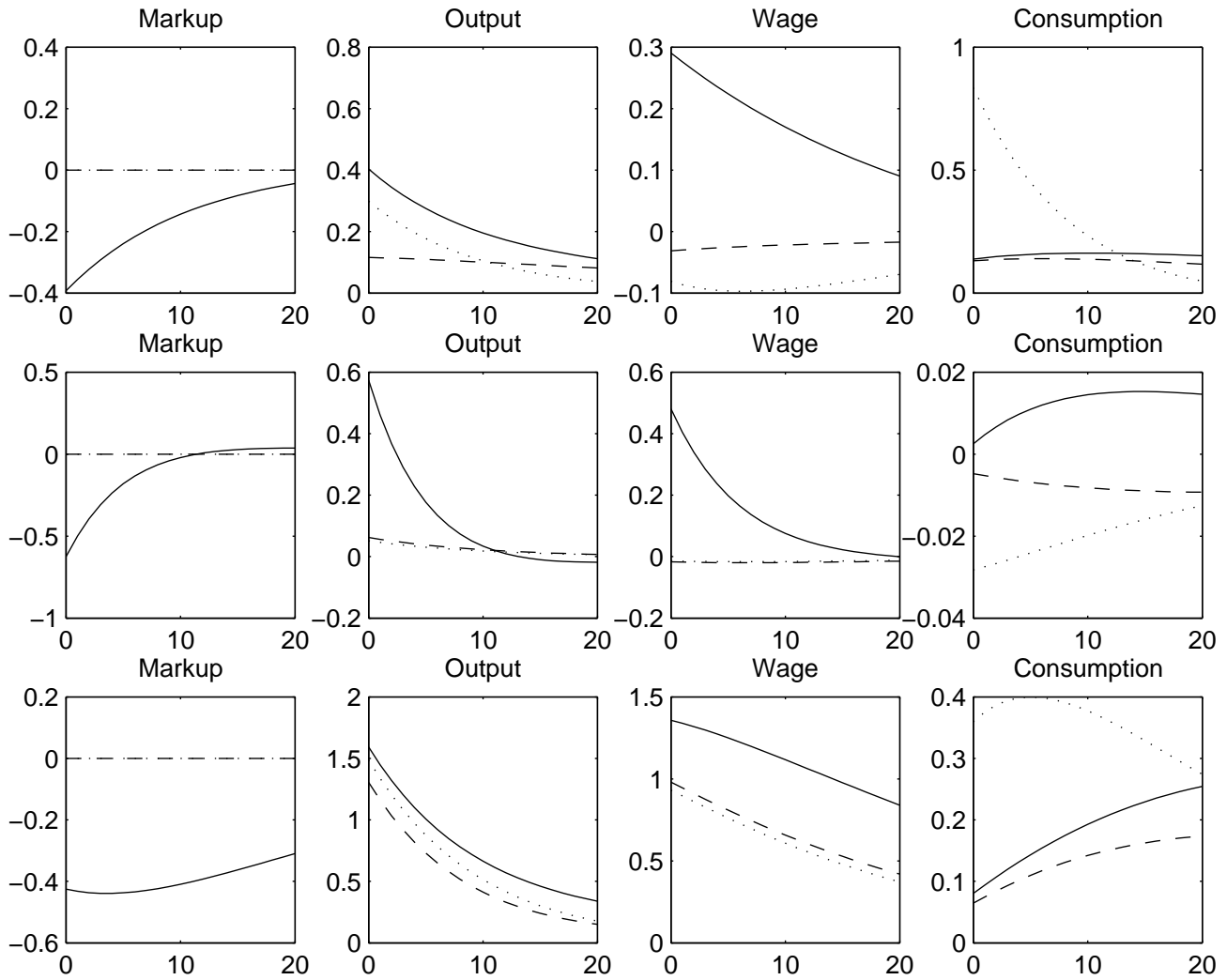
Fully Fledged Deep-Habit Model: GMM  
Estimates of Structural Parameters,

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

Measurement		Joint System Based Estimates				
C	R	$\sigma$	$\theta$	$\eta$	$\rho$	J-test
$C^{tot}$	$R^{FFR}$	1.854 (0.583)	0.861 (0.039)	5.261 (1.062)	0.848 (0.027)	54.22 [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 Spend-  
ing Shock. Row 3: Technology shock.

## Summary

- 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 counter-cyclical, which is in line with empirical evidence.
- Under deep habits a positive innovation in government spending raises private consumption and real wages.