Internal and external habits and news-driven business cycles

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Abstract

In many applications of habit persistence to macroeconomics, it is of little significance whether habits are internal or external. In this paper, it is shown that the distinction between internal and external habits is important in a situation wherein a shock is news about the future. An internal habit can be a source of news-driven business cycles, positive comovement in consumption, labor, investment, and output from the news about the future, whereas an external habit cannot.

Keywords: Habit persistence; internal habit; external habit; news-driven business cycles

JEL Classification: E32, E21

1 Introduction

Habit persistence is often employed to account for the observed facts of business cycles in modern macroeconomics. Boldrin, Christiano, and Fisher (2001) show that a model with habit formation and inflexibilities in factor markets can help explain the salient aspects of asset prices and business cycles. Medium-scale DSGE models that are widely used for policy analysis by central banks, à la Christiano, Eichenbaum, and Evans (2005) and

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Smets and Wouters (2007), possess habit persistence as an important friction to generate hump-shaped responses of consumption to shocks. In a recent paper by Christiano, Ilut, Motto, and Rostagno (2007), they show that a model with habit persistence and adjustment costs of investment can generate a positive comovement between consumption, labor, investment, and output from the news on future productivity that refers to the "news-driven business cycle" (hereafter NDBC).

There are two major types of habit persistence. The first one is that a habit is internal in the sense where the consumer's habit is directly affected by her past consumption. In this case, the preference is non-separable over time. The other one is that a habit is external or exogenous for each consumer. Preferences with external habits are referred to as "catching up with the Jones." The external habit simplifies the optimization problem of the consumer because it is considered as exogenous for the individual. In many applications of habit persistence, it is of little significance whether habits are internal or external. [1]

In this paper, it is shown that an internal habit can be a source of news-driven business cycles whereas an external habit cannot. Therefore, the distinction between internal and external habits is important in a situation wherein a shock is news about the future. This result implies that it is important to distinguish between internal and external habits if the effects of news shocks are large in business cycles, as emphasized by Fujiwara, Hirose, and Shintani (2008) and Schmitt-Grohé and Uribe (2008).

This paper is closely related to the paper by Uribe (2002), who also points out that the distinction of habits is important in a situation wherein consumers expect a regime shift in the future. Uribe (2002) shows that the observed contraction in consumption before the collapse of the currency peg can be accounted for by a model with an internal habit but not with an external habit.

The rest of this paper is organized as follows. Section 2 introduces our model. In Section 3, it is shown that an internal habit can be a source of NDBCs whereas an

[1] For example, Christiano, Eichenbaum, and Evans (2005) employ a utility with an internal habit while Smets and Wouters (2007) employ a utility with an external habit.

external one cannot. Section 4 draws the main conclusions.

2 Model

The model is a simple one-sector neoclassical growth model with habit persistence and adjustment costs of investment à la Christiano, Ilut, Motto, and Rostagno (2007).

The utility function with an internal habit is

$$U^I = E_0 \sum_{t=0}^{\infty} \beta^t \left[\log\left(c_t - b c_{t-1}\right) - \psi \frac{\ell_t^{1+\sigma_\ell}}{1+\sigma_\ell} \right], \tag{1}$$

where c_t and ℓ_t denote consumption and labor, respectively. An internal habit is implied by $b > 0$, and $\sigma_\ell > 0$ denotes the Frisch elasticity. The analogue of (1) with an external habit is

$$U^E = E_0 \sum_{t=0}^{\infty} \beta^t \left[\log\left(c_t - b \bar{c}_{t-1}\right) - \psi \frac{\ell_t^{1+\sigma_\ell}}{1+\sigma_\ell} \right], \tag{2}$$

where $\bar{c}_{t-1}$ denotes the average consumption level in the economy at period $t-1$.

The production function is the standard Cobb-Douglas form:

$$y_t = A_t k_t^{\alpha} \ell_t^{1-\alpha}, \tag{3}$$

where y_t, A_t and k_t denote output, productivity and capital stock, respectively.

The flow specification of adjustment costs of investment is introduced as

$$k_{t+1} = (1-\delta) k_t + \left[1 - \frac{\sigma_G}{2} \left(\frac{i_t}{i_{t-1}} - 1 \right)^2 \right] i_t, \tag{4}$$

where i_t denotes investment.

The resource constraint is

$$c_t + i_t = y_t. \tag{5}$$

The evolution of A_t is specified as follows:

$$\log(A_t) = \rho_A \log(A_{t-1}) + \varepsilon_t + \nu_{1,t-1} + \nu_{2,t-2} + \cdots \nu_{p,t-p}, \tag{6}$$

where ε_t denotes an unanticipated technology shock, and $\nu_{n,t-n}$ denotes the news shock observed at period $t-n$ for $n = 1, 2, \cdots, p$.

3 Main result

3.1 Responses to news shocks

The model period is one quarter. Parameter values are as follows. The discount factor of household, β, is $1.01358^{-.25}$. The weight of leisure, ψ, is set to be 109.82 and the Frisch elasticity, σ_n, is 1. The share of capital in the production, α, is .4, and the depreciation rate of capital, δ, is .025. The adjustment costs of investment $\sigma_G = 15.1$. The persistence of technology shock ρ_A is .83. These are taken from Christiano, Ilut, Motto, and Rostagno (2007). The steady-state value of A is normalized to be one.

To calculate the policy functions of our economy, the equilibrium system is approximated using the log-linearization technique, and the method of Uhlig (1999) is employed.

In this experiment, the following impulse is considered. Up until period $t = 0$, the economy is at the steady state. At period $t = 0$, a news shock hits the economy, which suggests that productivity will increase by one percent in period $t = 4(= p)$: $\nu_{4,0} = .01$. However, when period $t = p$, the expected rise in productivity in fact does not occur: $\varepsilon_4 + \nu_{4,0} = 0$. This is interpreted as the news turning out to be false.

Figure 1 shows the responses of the model with internal and external habits. In the case of an internal habit, consumption, labor, investment, and output increase at $t = 0$ when the news shock hits the economy. At $t = 4$, these variables drop since the news turns out to be false. Therefore, NDBCs are generated in this model. In the case of an external habit, consumption drops when the news shock hits the economy and NDBCs are not generated.

3.2 Why an external habit cannot generate NDBCs?

Under the utility function with an internal habit, the intratemporal equilibrium condition is

$$\psi \ell_t^{\sigma_\ell} \Big/ \left\{ \frac{1}{c_t - bc_{t-1}} - b\beta \left[\frac{1}{E_t[c_{t+1}] - bc_t} \right] \right\} = (1-\alpha) A_t \left[\frac{k_t}{\ell_t} \right]^{\alpha}. \tag{7}$$

The point is that the term of the expectation of future consumption $E_t[c_{t+1}]$ affects this intratemporal condition. The comovement of consumption and labor from the news

about future productivity is compatible if the expectation of future consumption increases sufficiently.

The analogue of (7) is

$$\psi\left[c_t - bc_{t-1}\right]\ell_t^{\sigma_\ell} = (1-\alpha)A_t\left[\frac{k_t}{\ell_t}\right]^{\alpha}, \tag{8}$$

since $c_t = \bar{c}_t$ in an equilibrium.

Generally, (8) is captured by using the following form:

$$MRS^E(\underset{\oplus}{c_t}, \underset{\ominus}{c_{t-1}}, \underset{\oplus}{\ell_t}) = MPL(\underset{\ominus}{\ell_t}, \underset{\oplus}{k_t}, \underset{\oplus}{A_t}), \tag{9}$$

where MRS denotes the marginal rate of substitution between labor and consumption, and MPL denotes the marginal product of labor. MRS is increasing in current consumption and labor, while MPL is decreasing in labor. Because of this relationship, comovement between consumption and labor is incompatible.

The internal habit analogue of (10) is

$$MRS^I(\underset{\ominus}{E_t[c_{t+1}]}, \underset{\oplus}{c_t}, \underset{\ominus}{c_{t-1}}, \underset{\oplus}{\ell_t}) = MPL(\underset{\ominus}{\ell_t}, \underset{\oplus}{k_t}, \underset{\oplus}{A_t}). \tag{10}$$

In the case of an internal habit, the increase in the expectation of future consumption reduces the current MRS, and it enables comovement between consumption and labor.

3.3 Medium-scale DSGE models and external habits

Medium-scale DSGE models à la Smets and Wouters (2007) that employ preferences with external habits are widely used by central banks and political institutions for empirical policy analysis. This type of models have many frictions and shocks.

Are NDBCs generated in medium-scale DSGE models? The answer is yes.[2] However, an external habit is not the key for NDBCs. Kobayashi and Nutahara (2008) show that a model with nominal rigidities can generate NDBCs, and the countercyclicity of markup

[2]Fujiwara, Hirose, and Shintani (2008) estimate a medium-scale DSGE model with external habits and news shocks using data of the U.S. and Japanese economies. NDBCs are generated in their estimated model.

through nominal rigidities is the key for NDBCs. If there are no nominal rigidities, no NDBCs are generated in medium-scale DSGE models with external habits.

This difference of mechanism of NDBCs might lead us to different policy implications. NDBCs by nominal rigidities are results of market failures while NDBCs based on internal habits represent the nature of the economy. In the latter case, NDBCs are generated even if the economy is Pareto optimal. Therefore, optimal monetary policies might differ.

4 Conclusion

In modern macroeconomics, habit persistence is often employed to account for the observed facts of business cycles. In many applications of habit persistence, it is of little significance whether habits are internal or external.

In this paper, it was shown that an internal habit can be a source of NDBCs whereas an external habit cannot. Therefore, the distinction between internal and external habits is important in a situation wherein a shock is news about the future. Recent papers by Fujiwara, Hirose, and Shintani (2008) and Schmitt-Grohé and Uribe (2008) emphasize on the role of news shocks as a source of business cycle fluctuations. Thus, it would be important to distinguish between internal and external habits.

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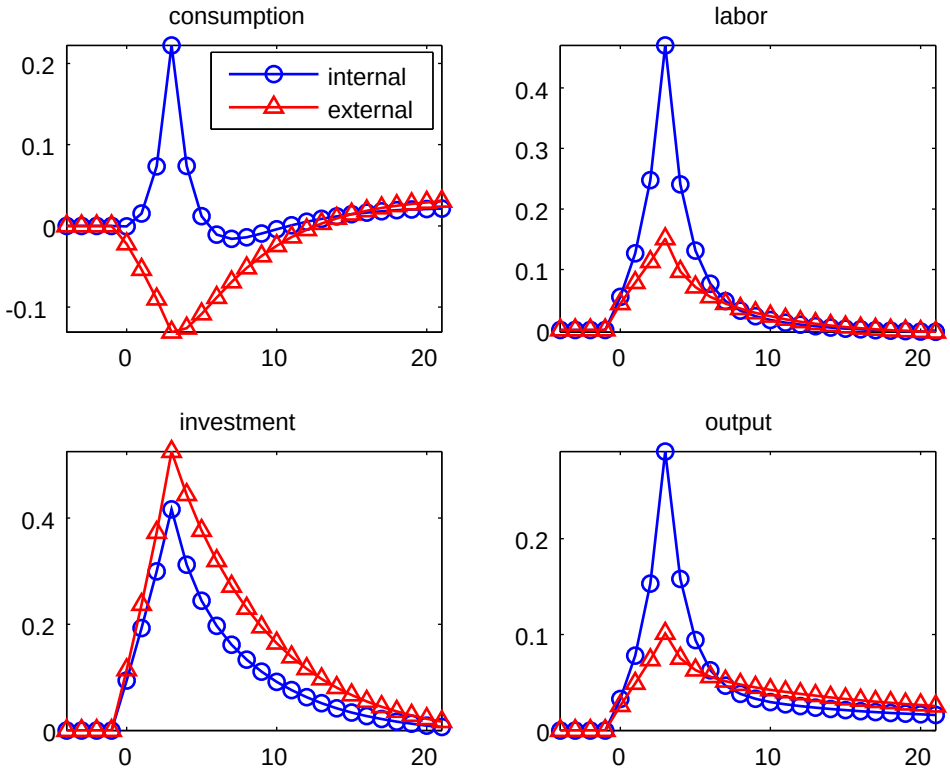
Figure 1: Responses to news shock



Notes: The news occurs at $t = 0$ and turns out to be false at $t = 4$. The vertical axes are percentage deviations from the steady-state values , and the horizontal ones are quarters.