Consumption–leisure choice with habit formation

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Abstract

In an intertemporal consumption–leisure choice model with wage uncertainty, and habit-forming consumption, we have shown that, consumption and leisure do move in opposite directions, consistent with the observed pro-cyclic of aggregate hours worked. © 2001 Elsevier Science B.V. All rights reserved.

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1. Introduction

Intertemporal substitution of consumption and leisure is an important topic in the modern macroeconomic theory. In a perfect certainty model with permanent productivity shocks, Barro and King (1984) argued that, with time-non-separable preferences consumption and leisure may move in opposite directions, consistent with the observed pro-cyclic of aggregate hours worked. Several authors then have argued that temporal non-separabilities in preferences may be introduced to explain fluctuations to be characterized by a negative covariation of consumption and unemployment. Kydland and Prescott (1982); Eichenbaum et al. (1988); Kennan (1988); Hotz et al. (1988); incorporate an intertemporally non-separable utility function in their model to explain the observed behavior of consumption and labor during the business cycle.

In this paper, we will allow non-separability in preferences by assuming habit formation in consumption. The motivation behind this setting is to examine the implications of habit-forming preferences in consumption to current and future consumption and leisure choices. We want to investigate, in particular, whether only habit formation in consumption is capable of generating intertemporal substitution effects.

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Habit formation has been used in several contexts in economics. The implications of habit formation were first discussed in Duesenberry’s work (1949). His proposition was that families are willing to sacrifice saving in order to protect their living standards. In the event of a fall in income, consumption will not fall proportionately, producing a ratchet effect.

Whereas time-separable preferences imply that current utility depends only on current consumption, time-non-separable preferences with habit formation imply that past real consumption patterns and levels form consumer habits which persist long enough to slow down the effects of current income changes on current consumption. For a given level of current expenditures, past purchases contribute to a habit stock. Hence, it is an increase of current consumption over and above the habit stock which raises current utility.

Recent empirical papers in the consumption literature have argued for the role of habits in determining consumption. Constantinides (1990); Ferson and Constantinides (1991); Dynan (1993); Carroll et al. (1995); Heaton (1995); Garcia et al. (1997); Fuhrer and Klein (1998); are among others. In this work, with an example of multiplicative utility function, we have shown that the intratemporal marginal rate of substitution between consumption and leisure, as well as the intertemporal marginal rate of substitution of leisure are higher with the habit-forming consumption behavior. The main conclusion of the paper is that consumption and leisure do move in opposite directions, consistent with the observed pro-cyclic of aggregate hours worked.

This paper is organized as follows: Section 2 describes the dynamic optimization model of consumption–leisure with habit formation and discusses the results obtained. Section 3 concludes the paper.

2. The model

In this section, we introduce our model of consumption–leisure with non-separable preferences in consumption. Suppose that a representative consumer maximizes the lifetime utility subject to the budget constraint.

$$\text{Max}_{t=0}^{\infty} \mathbb{E} \sum_{t=0}^{\infty} \beta^t U(c_t, x_t, l_t)$$

$$\text{s.t.} \quad A_{t+1} = (1 + r_t) \left[ A_t + w_t(1 - l_t) - c_t \right]$$

where \( E(.) \) denotes expectations conditional on the information available at time \( t \). Since the preferences are time-non-separable in consumption, the current utility will depend not only on current leisure and current consumption but also on the habit stock, \( x_t \). The utility function is assumed to be a Cobb-Douglas utility function,

$$U(c_t, x_t, l_t) = \frac{1}{\theta} [c_t^{\eta} x_t^{-\theta \alpha}] \frac{1}{\eta} \eta$$

where \( \theta \) and \( \eta \) are preference parameters between zero and one. The habit formation parameter \( \alpha \) measures the effect of habit stock on current utility and it is between zero and one. Habit stock \( x_t \) is a weighted average of all past consumptions and can be defined as:
\[ x_t = (1 - \zeta) \sum_{j=0}^{\infty} \zeta^j c_{t-1-j} \]  

(4)

where weights add to one with \((1 - \zeta)\) being the depreciation parameter of habits, \(0 < \zeta \leqslant 1\). When the depreciation of habits is equal to one, \((\zeta = 0)\), i.e., the case where past values of consumption before \(c_{t-1}\) do not affect the habit stock, we have the model which reflects one-period habit formation, i.e., \(x_t = c_{t-1}\). For simplicity, we will assume this specification for habit stock.

The individual makes decision about next period assets \(A_{t+1}\), current leisure \(l_t\) and current consumption \(c_t\) subject to the budget constraint. In each period \(t\), total time available for leisure \(l_t\) and work \(h_t\) is assumed to be limited to one unit, that is a day. We assume time-varying interest rates, \(r_t\), with \(w_t\) is the real wage rate, and with the consumption good being numeraire. As of the beginning of period \(t\), the realizations of the real wage rate \(w_t\) are known to the individual but future realizations are unknown and random.

We characterize the individual’s maximization problem as a dynamic programming problem, and write the value function for this framework as:

\[ V(A_t, c_{t-1}, w_t) = \max \frac{1}{\theta} \left[ c_t^{\theta} c_{t-1}^{-\alpha} \frac{1}{\eta} l_t^\eta \right] + \beta E V(A_{t+1}, c_{t+1}, w_{t+1}) \]  

(5)

\[ c_t, l_t, A_{t+1} \]

s.t. \( A_{t+1} = (1 + r_t)[A_t + w_t(1 - l_t) - c_t] \)

Then the Euler equation for consumption is as follows:

\[ c_t^{\theta-1} c_{t-1}^{-\alpha} \frac{1}{\eta} l_t^\eta - \alpha \beta^2 E \left[ c_{t+1}^{\theta} c_t^{-\alpha-1} \frac{1}{\eta} l_{t+1}^\eta \right] \]

\[ = \beta(1 + r_t) E \left[ c_{t+1}^{\theta-1} c_t^{-\alpha} \frac{1}{\eta} l_{t+1}^\eta - \alpha \beta c_t^{\theta} c_{t+1}^{-\alpha-1} \frac{1}{\eta} l_{t+1}^\eta \right] \]  

(6)

The Euler equation for leisure is:

\[ c_t^{\theta-1} c_{t-1}^{-\alpha} \frac{1}{\theta} l_t^{\eta-1} = \beta(1 + r_t) E \left[ \frac{w_t}{w_{t+1}} c_t^{\theta} c_{t+1}^{-\alpha} \frac{1}{\eta} l_{t+1}^\eta \right] \]  

(7)

Now let us define:

\[ \frac{1}{\theta} c_t^{\theta-1} c_{t-1}^{-\alpha} l_t^\eta = U(\hat{c}_t, l_t) \]  

(8)

where \(\hat{c}_t\) is net current consumption. Then the marginal utility of leisure \(U(l_t)\), is:

\[ U_l(\hat{c}_t, l_t) = \frac{1}{\theta} c_t^{\theta-1} c_{t-1}^{-\alpha} l_t^{\eta-1} \]  

(9)

and \(MU(\hat{c}_t, l_t)\), the net marginal utility of consumption, is:
\[ \frac{dMRS_{\alpha=0}^{\text{inter}}}{d\alpha} = MRS_{\alpha=0}^{\text{inter}} \times \frac{d}{d\alpha} \left( \frac{c_t}{c_{t-1}} \right)^{\alpha} \] (14)

Since,
Therefore, $\frac{d}{d\alpha}(\frac{c_t}{c_{t-1}})^{\alpha\theta} = (\frac{c_t}{c_{t-1}})^{\alpha\theta} \ln(\frac{c_t}{c_{t-1}})^{\theta} > 0$

Thus, habit formation increases the intertemporal marginal rate of substitution between current and future leisure.

This implies that the individual would consume less leisure in the future and take more leisure today in the model with habit formation. In other words, the habit-forming consumer is someone who is less willing to intertemporally substitute between current and future leisure.

3. Conclusion

In an intertemporal consumption–leisure model with wage uncertainty, we have examined the implications of habit-forming consumption on the choices of consumption and leisure. When we consider a preference functional of a multiplicative form, we have obtained that habit formation increases both the intratemporal marginal rate of substitution between consumption and leisure and the intertemporal marginal rate of substitution between current and future leisure. The former basically implies that the individual is less willing to substitute between current leisure and current consumption. On the other hand, habit formation in consumption also increases the intertemporal marginal rate of substitution between current and future leisure, implying that the individual is less willing to intertemporally substitute between current and future leisure. Thus we have shown that, with habit formation in consumption, consumption and leisure do move in opposite directions, consistent with the observed pro-cyclicity of aggregate hours worked.

The model presented here suggests that recent attention in the literature concerning non-separable preferences is not unwarranted and empirical tests based on this work might give richer insights to better understand the behavior of consumption and leisure during the business cycle.

References