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with Habit Formation

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Consumption-Leisure Choice with Habit Formation[*]

Aylin Seckin[†]

Résumé / Abstract

Dans un modèle intertemporel de consommation et de loisir avec incertitude salariale et formation d'habitudes, nous avons démontré que la consommation et le loisir se déplacent vers des directions opposées, ce qui est consistant avec la procyclicité observée des heures travaillées.

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-cyclicy of aggregate hours worked.

Mots Clés :   Formation d'habitudes, choix de consommation/loisir

Keywords: Habit formation, consumption-leisure choice

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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-cyclicality 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, Hansen and Singleton (1988), Kennan (1988), Hotz, Kydland and Sedlacek (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.

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, Overland and Weil (1995), Heaton (1995), Garcia, Lusardi and Ng (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-cyclicality 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.

$$Max_{\{c_t\}_{t=0}^{\infty}, \{l_t\}_{t=0}^{\infty}, \{A_{t+1}\}_{t=0}^{\infty}} \quad E_0 \sum_{t=0}^{\infty} \beta^t U(c_t, x_t, l_t) \qquad (1)$$

$$s.t. \quad A_{t+1} \quad = \quad (1 + r_t)[A_t + w_t(1 - l_t) - c_t] \qquad (2)$$

where $E_t(.)$ 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

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function,

$$U(c_t, c_{t-1}, l_t) = \frac{1}{\theta} \left[c_t^\theta x_t^{-\theta\alpha} \right] \frac{1}{\eta} l_t^\eta \tag{3}$$

where θ and η are preference parameters between zero and one. The habit forma-
tion parameter α is the degree to which habit stock affects current utility and is
between zero and one. Habit stock x_t is a weighted average of all past consump-
tions and can be defined as:

$$x_t \equiv (1 - \zeta) \sum_{j=0}^{\infty} \zeta^j c_{t-1-j} \tag{4}$$

where weights add to one with $(1 - \zeta)$ being the depreciation parameter of habits,
$0 \leqslant \zeta \leqslant 1$. 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 simple model which reflects one-period habit formation, i.e. $x_t = c_{t-1}$.

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 a 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

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but future realizations are unknown and random.

We characterize the individual's maximization problem as a dynamic programming problem such as:

$$V(A_t, c_{t-1}, w_t) = Max \frac{1}{\theta} \left[c_t^\theta c_{t-1}^{-\theta\alpha} \right] \frac{1}{\eta} l_t^\eta + \beta E_t V(A_{t+1}, c_t, w_{t+1}) \qquad (5)$$

$$c_t, l_t, \ A_{t+1}$$

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

Then the Euler equation for consumption is as follows:

$$c_t^{\theta-1} c_{t-1}^{-\theta\alpha} \frac{1}{\eta} l_t^\eta - \alpha\beta^2 E_t \left[c_{t+1}^\theta c_t^{-\theta\alpha-1} \frac{1}{\eta} l_{t+1}^\eta \right] \qquad (6)$$

$$= \beta(1 + r_t) E_t \left[c_{t+1}^{\theta-1} c_t^{-\theta\alpha} \frac{1}{\eta} l_{t+1}^\eta - \alpha\beta c_{t+2}^\theta c_{t+1}^{-\theta\alpha-1} \frac{1}{\eta} l_{t+2}^\eta \right]$$

The Euler equation for leisure is:

$$c_t^\theta c_{t-1}^{-\theta\alpha} \frac{1}{\theta} l_t^{\eta-1} = \beta(1 + r_t) E_t \left[\frac{w_t}{w_{t+1}} c_{t+1}^\theta c_t^{-\theta\alpha} \frac{1}{\theta} l_{t+1}^{\eta-1} \right] \qquad (7)$$

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Now let us define:

$$\frac{1}{\theta}c_t^\theta c_{t-1}^{-\theta\alpha}\frac{1}{\eta}l_t^\eta \equiv U(\widehat{c}_t, l_t) \tag{8}$$

so that the marginal utility of leisure, $U_l(\widehat{c}_t, l_t)$, is equal to:

$$U_l(\widehat{c}_t, l_t) = \frac{1}{\theta}c_t^\theta c_{t-1}^{-\theta\alpha}l_t^{\eta-1} \tag{9}$$

and $MU_c(\widehat{c}_t, l_t)$, the net marginal utility of consumption, is:

$$MU_c(\widehat{c}_t, l_t) = \left[c_t^{\theta-1}c_{t-1}^{-\theta\alpha}\frac{1}{\eta}l_t^\eta - \alpha\beta E_t\left\{c_{t+1}^\theta c_t^{-\theta\alpha-1}\frac{1}{\eta}l_{t+1}^\eta\right\}\right] \tag{10}$$

Then we can write the intratemporal marginal rate of substitution between consumption and leisure, $MRS_{|\alpha>0}^{intra}$, as:

$$
\begin{aligned}
MRS_{|\alpha>0}^{intra} &= \frac{U_l(\widehat{c}_t, l_t)}{MU_c(\widehat{c}_t, l_t)} = (\frac{\eta c_t}{\theta l_t})\frac{U(\widehat{c}_t, l_t)}{[U(\widehat{c}_t, l_t) - \alpha\beta E_t U(\widehat{c}_{t+1}, l_{t+1})]} \tag{11}\\
&= MRS_{|\alpha=0}^{intra} \times \frac{1}{\left[1 - \alpha\beta\frac{E_t U(\widehat{c}_{t+1}, l_{t+1})}{U(\widehat{c}_t, l_t)}\right]}
\end{aligned}
$$

Since the second term is greater than one, the intratemporal marginal rate of substitution between consumption and leisure when there is habit formation in consumption is higher than the case with no habit formation. This result

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implies that the intratemporal marginal rate of substitution between consumption

and leisure is higher when there is habit formation. The individual takes more

leisure today, i.e., he or she is less willing to intratemporally substitute between

consumption and leisure. Thus, with habit formation, the intratemporal elasticity

of substitution between current consumption and current leisure is lower, implying

that the individual will prefer to consume less of consumption goods and more of

leisure.

We can also calculate the intertemporal marginal rate of substitution between

current and future leisure as:

$$MRS^{inter}_{|\alpha>0} = \frac{U_l(\widehat{c}_t, l_t)}{E_t U_l(\widehat{c}_{t+1}, l_{t+1})} = \left[\frac{l_t^{\eta-1} \frac{1}{\theta} c_t^\theta c_{t-1}^{-\alpha\theta}}{E_t \left\{ l_{t+1}^{\eta-1} \frac{1}{\theta} c_{t+1}^\theta \right\} c_t^{-\alpha\theta}} \right] \tag{12}$$

Then, (9) can be divided into two terms:

$$MRS^{inter}_{|\alpha>0} = \underbrace{\left[\frac{l_t^{\eta-1} \frac{1}{\theta} c_t^\theta}{E_t \left\{ l_{t+1}^{\eta-1} \frac{1}{\theta} c_{t+1}^\theta \right\}} \right]}_{} \left(\frac{c_t}{c_{t-1}} \right)^{\alpha\theta} \tag{13}$$

where the first term is the intertemporal marginal rate of substitution between

current leisure and future leisure when there is no habit formation and the second

term is a function of the growth rate of consumption.

To find the effect of an increase in the strength of habit formation α on

the intertemporal marginal rate of substitution between leisure today and leisure tomorrow,

$$\frac{dMRS^{inter}_{|\alpha>0}}{d\alpha} = MRS^{inter}_{|\alpha=0} \times \frac{d\left(\frac{c_t}{c_{t-1}}\right)^{\alpha\theta}}{d\alpha} \tag{14}$$

Since,

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

Therefore, $MRS^{inter}_{|\alpha>0}$ is greater than $MRS^{inter}_{|\alpha=0}$. Thus, habit formation increases the intertemporal marginal rate of substitution between current and future leisure.

$$\frac{U_l(\widehat{c}_t, l_t)}{E_t U_l(\widehat{c}_{t+1}, l_{t+1})} > \frac{U_l(c_t, l_t)}{E_t U_l(c_{t+1}, l_{t+1})} \tag{15}$$

This implies that the individual would consume less leisure in the future and take more leisure today in the model with habit formation. In another 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 con-

sumption 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-cyclicality 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.

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