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Investigation on Habit Formation, Risk Aversion and Intertemporal Substitution in Consumption of Iranian Households by GMM Approach

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Abstract
Consumption is the principal feature of Iran's Gross National Production. Therefore, recognizing of factors that influence it is quite crucial. This article, investigates habit formation, durability, relative risk aversion and intertemporal substitution in consumption expenditures of Iranian households. For empirical study, at first, we constructed two weighted portfolio of the main assets return that households hold them. Then, by using generalized method of moments, we examined some models with the mentioned factors in pattern of households' consumption for 1979-2012 periods. Our Empirical findings indicated that for durable goods, the effect of habit persistence dominated the effect of durability in consumption expenditures and for semi durable goods vice versa. Also, for semi-durable and durable goods the effect of durability dominated the effect of habit formation. Furthermore, the results indicate that coefficients of relative risk aversion and elasticity of intertemporal substitution are between 0.25 to 0.95 and 1.05 to 4, respectively.

Keywords: Consumption, Habit Formation, Risk Aversion, Elasticity of Intertemporal Substitution, GMM

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1. Introduction

Habit formation, durability, relative risk aversion and elasticity of intertemporal substitution have long history in researches of consumer behavior. In fact, one time that consumer gains to the specific level of consumption, that level becomes also among his habits and it to be very difficult that reduces his consumption expenditures in future. For one level of the current expenditure, past purchases participate in constitution his habits accumulation and only one increasing in his current consumption over his habits accumulation causes increasing his current utility.

In this article, we examine intertemporal consumption by using of time-non-separable preferences of a representative consumer that cancels standard time-separable assumption and we give permission that durability of durables enters into utility function of consumer. Past consumption of own his consumer, habit persistence and durability of durable goods affect his subsistence level and his current consumption. So, past patterns of consumption constitute a threshold level that current consumption should compare with it.

We examine habit formation and durability on data of Iran's consumption and calculate coefficients of relative risk aversion and elasticity of intertemporal substitution by using of generalized moment method (GMM) presented by Hansen (1982). Estimated parameters that determine consumer behavior are consist of coefficient of durable goods or habit formation, relative risk aversion and elasticity of intertemporal substitution.

The paper is organized as follows: In section 2, we review theoretical bases of habit formation, durability of durable goods, relative risk aversion and elasticity of intertemporal substitution through a framework. In section 3, by using of annual data for the period 1979-2012, we estimate mentioned coefficients. Finally, section 4 concludes.

2. The model

In this paper, we want to expand standard Von Neumann-Morgenstern utility of consumption in order that by using of time-nonseparable preferences can analyze effects of habits formation and durability of consumption goods on the consumer's utility. Furthermore, we want to estimate relative risk aversion and elasticity of intertemporal substitution.

Under the durability, expenditures of past consumption accumulate in the argument of utility function. So, more durability in the durable goods causes that less necessity to the current expenditures. But, under the habit formation, more expenditure of past periods causes more habits and higher subsistence level. So, in this state, consumer needs more consumption in order to have the same utility in various times. Base on the studies of Ferson and Constantinides (1991) and another researchers, habit persistence implying that coefficient of the lagged consumption expenditures to be negative, but coefficient of durability is positive. Furthermore, if there are both effects, which of them that dominate, it determines final sign.

In 1990s, we can see many improvements about specification of habit formation and durability of durable goods. Although, these effects can model by several ways, but there are two competitor specifications in relevant literature including: ratio models and difference models. In ratio models, utility is based on power function of $\frac{c_t}{S_t}$ (for example: Abel (1990), Harbaugh (1996), Carroll et a.l (1997) and Fuhrer (1998)), that S_t is subsistence or reference consumption. In the difference models, utility is based on power function of $(c_t - S_t)$ (for example see: Boldrin et al. (1995), Alesie and Lusardi (1997)).

The foundation of this paper is on the basis of surveys of Abel (1990), Ferson and Constantinides (1991), Braun et al. (1993), Gali (1994), Carroll et al. (1997), Campbell and Cochrane (1999a,b). In fact, origin of studies relevant to habit formation models is based on studies of Sundaresan (1989) and Constantinides (1990). These researchers presented a model for continuous habit formation that was generalized previous models in consumption literature. Foundation of these studies is ignored time-separable suppose in Von Neumann-Morgenstern preferences of consumption and also permit that utility of consumer relevant to his own past consumption.

One of the main problem is how should determine history or his own past consumption for consumer. One way is that we suppose process of habit accumulation S_t grows up follow on:

$$S_t = (1-\psi)S_{t-1} + c_t \qquad (1)$$

where ψ is depreciation rate.

We consider economy that expenditures on the goods in t period is $c_t = \sum_{i=1}^{N} d_{i,t}$. If $d_{i,t}$ to be a durable good, its durability implying that consumer consumes a flow of services that it has created by this good. Whereas goods are depreciating, a current flow of services provides by past and now expenditures. We show this flow by:

$$S_t = \sum_{\tau=0}^{\infty} \delta_\tau c_{t-\tau} \qquad (2)$$

where S_t is amount of provided services by all of consumption expenditures and $c_{t-\tau}, \tau > 0$. Parameter δ_τ is durability rate of consumption good and $\sum_{\tau=0}^{\infty} \delta_\tau = 1, 0 \le \delta_\tau < 1$

By using this parameter can measure depreciation rate of purchased goods in $t-\tau$ period that is still use in *t* period as $\delta_\tau = (1-\psi_\tau)$, $0 \le \psi_\tau < 1$.

We suppose that utility of consumer indicates time non-separable preferences as:

$$U(c_t) = \frac{1}{(1-\gamma)} [X_t]^{1-\gamma}, \quad \forall t \in [0,\infty), 0 < \gamma \ne 1 \qquad (3)$$

γ is parameter of concavity of utility function or relative risk aversion. In order to enter habit formation and durability of consumption goods into the preference or utility function of consumer, we modeled the term X_t as:

$$X_t = S_t - h\sum_{s=1}^{\infty} a_s S_{t-s} \qquad (4)$$

This internal effect shows distance between past and now of flow of services. Habits formation implies that instantaneously utility relates to difference flow of current service S_t of accumulation of past patterns of consumption that formed into the consumption habits. So, $h\sum_{s=1}^{\infty} a_s S_{t-s}$ reflects a subsistence level or bliss that $h \ge 0$ presents fraction of weighted sum of the lagged consumption flows. Likewise, a_s (that $0 \le a_s < 1$) measure durability of lagged flow of consumption in the subsistence level that $\sum_{s=1}^{\infty} a_s = 1$. In sum, we can say this utility function is time non-separable because selection of consumption for each period reflects in future subsistence level and also reflects into utility of future periods. By attention to appropriate selection of parameter, explained model has several important applications such as:

1) If $h \ne 0$, utility function (3) includes habit persistent and durability of consumption goods. Therefore, model is time non-separable.
2) If $h = 0$, utility function (3) reduces to standard Von Neumann-Morgenstern separable utility function with γ which is parameter of concavity of utility function that indicates relative tendency to risk.
3) If $\tau \ge 1$, $\delta_\tau = 0$, $\delta_0 = 1$, $h = 0$, so, model is time separable. For appropriate notation between existence flow of services and subsistence level, we can write:

$$X_t = S_t - h\sum_{s=1}^{\infty} a_s S_{t-s} = \sum_{\tau=0}^{\infty} b_\tau c_{t-\tau} \qquad (5)$$

where, $b_\tau = \delta_\tau - h\sum_{i=1}^{\tau} a_i \delta_{\tau-i} \qquad (b_0 = 1)$

is time varying and it is including δ_τ , h and a_s .

According to the studies of Dunn and Singleton (1986), Eichenbaum and Hansen (1990) and Ferson and Constantinides (1991), we also suppose that coefficients of habit persistence or durability reduces with exponential rate. That is $\delta_\tau = (1-\delta)\delta^\tau$ and $a_s = (1-\phi)\phi^{s-1}$ which $\delta = (1-\psi)$ and $0 \le \delta <$, $\phi \le 1$. Therefore, by substituting equivalents of δ_τ , a_s and δ , we get for b_τ :

$$b_\tau = (1-(1-\psi))(1-\psi)^\tau - h\sum_{i=1}^{\tau}(1-\phi)\phi^{i-1}(1-(1-\psi))(1-$$

$$= \psi(1-\psi)^\tau - h(1-\phi)\sum_{i=1}^{\tau}\phi^{i-1}\psi(1-\psi)^{\tau-i}$$

$$= \psi(1-\psi)^\tau\left\{1-h(1-\phi)\frac{1}{\phi}\left(\frac{\phi}{1-\psi}+(\frac{\phi}{1-\psi})^2+(\frac{\phi}{1-\psi}\right.\right. \quad (6)$$

$$\left.\left.+....+(\frac{\phi}{1-\psi})^{\tau-2}+(\frac{\phi}{1-\psi})^{\tau-1}+(\frac{\phi}{1-\psi})^{\tau}\right)\right\}$$

Bracket in Equation (6) can devede to two geometric series that we can calculate them separately. After some calculation, we get:

$$b_\tau = \psi(1-\psi)^\tau\left\{1-h(1-\phi)\frac{1}{\phi}\left(\frac{\phi}{1-\psi-\phi}\right.\right.$$

$$\left.\left.+\left(\frac{\phi}{1-\psi}\right)^\tau\left(\frac{\phi}{\phi-1+\psi}\right)\right)\right\} \quad (7)$$

$$= \psi(1-\psi)^\tau\left\{1-h\left(\frac{1-\phi}{1-\psi-\phi}\right)\right\}+h\phi^\tau\psi\left(\frac{1-\phi}{1-\psi-\phi}\right)$$

This coefficient is including below states:

a) If there isn't habit persistence in function $(h=0)$ but there is durability of consumption, this coefficient reduces to $b_\tau = \psi(1-\psi)^\tau = (1-\delta)\delta^\tau > 0, \quad \tau \geq 1$ and it is positive all the time.

b) If there isn't durability of consumption in function $(\delta=0)$ but there is habit persistence, this coefficient reduces to $b_\tau = -h(1-\phi)\phi^{\tau-1} < 0, \quad \tau \geq 1$ and it is negative all the time.

c) When there are habit persistence and durability of consumption in function, b_τ depending on measure of preference parameters such as: h, ϕ and δ may be negative or positive. If $(1-\psi) > \phi + h(1-\phi)$, so, this coefficient is positive for all $\tau \geq 0$. If $(1-\psi) \leq h(1-\phi)$.

d) Thus, b_τ is negative for all $\tau \geq 1$. Finally, If $h(1-\phi) < \delta < \phi + h(1-\phi)$, so, b_τ is positive for recent lags and it is negative for lags with more distance. Therefore, in this case, If durability dominates habit persistence, b_τ will be positive and if habit persistence dominates durability of goods, it will be negative.

According to the above parameters, problem of maximizing the utility of consumer that we encounter with it is:

$$\underset{d_t,\lambda_{i,t}}{Max}[E_t\sum_{t=0}^{\infty}\beta U(c_t)\,|\,I_t]$$

$$subject \quad to: W_{t+1} = (w_t + Y_t\Delta t - c_t\Delta t)R^p_{t+1}$$

$$,\quad R^p_{t+1} = \sum_{i=1}^{k}\lambda_{i,t}R^p_{t+1}$$

$$,\quad c_t = \sum_{i=1}^{N}d_{i,t}$$

$$with \quad utility \quad function: \; U(c_t) = \frac{1}{(1-\gamma)}[\alpha X_t]^{1-\gamma} \quad (8)$$

Y_t and W_t are income of labor and wealth in t period. $R^p_{t+1} = (1+r^p_{t+1}\Delta t)$ is return of each asset and r^p_{t+1} is real return rate of portfolio between t and $t+1$ periods. $\beta = (1+\rho\Delta t)^{-1}$ is discount factor and ρ indicates subjective rate of time preferences. After this, we suppose that periods of time have the same long and Δt equals to one $\Delta t = (t+1) - t = 1$. $\lambda_{i,t}$ is optimum weights that selected in t time in order that $\sum_{i=1}^{k}\lambda_{i,t} = 1$. Some of assets may be riskless that their returns are independent of realization of $t+1$ period. E_t Shows mathematical operator of conditional expectation to set of available information for consumer at t time that is I_t. Now, we extract the first order conditions for set of (8):

Case 1) If $\tau \geq 1$, $\delta_\tau = 0$, $\delta_0 = 1$, $h = 0$. So, model is time separable and results are similar to standard Von Neumann-Morgenstern model. The first order conditions for two adjustment periods give familiar form of Euler equation, that is:

$$E_t\beta\left\{\left(\frac{c_{t+\tau}}{c_t}\right)^{-\gamma} R^i_{t+1}\right\}=1 \qquad (9)$$

Case 2) If $\tau\geq 1,\ \delta_\tau\neq 0,\ \delta_0=1,\ h\neq 0$ ' there are habit persistence and durability of consumption in utility function. Consider one consumer that his consumption expenditures decrease from c_t to $c_{t-\varepsilon}$ in t period. Amount of ε Investment in a asset market with R^i_{t+1} return increases consumption expenditure of consumer from c_{t+1} to $c_{t+1}+\varepsilon R^i_{t+1}$ in future period. But, because of habit formation and durability of durable goods, this decreasing of consumption in t period, will have an long effect on all of periods in future via Equation (5). Therefore, in this case, problem of maximizing the utility of consumer is:

$$\max_{d_{i,t}} E_t\sum_{t=0}^{\infty}\beta^t U(X_t)$$
$$subject\quad to: W_{t+1}=(W_t+Y_t-c_t)R^i_{t+1} \qquad (10)$$
$$,\quad c_t=\sum_{i=1}^{N} d_{i,t}$$

In order to solve the above problem, we rewrite discounted utility for whole periods of life such as:

$$U(X_t)+\beta U(X_{t+1})+$$
$$(X_{t+2})+\beta^3 U(X_{t+3})+....$$
$$=U(b_0c_t+b_1c_{t-1}+b_2c_{t-2}+b_3c_{t-3}+...)$$
$$J(b_0c_{t+1}+b_1c_t+b_2c_{t-1}+b_3c_{t-2}+...) \qquad (11)$$
$$+\beta^2 U(b_0c_{t+2}+b_1c_{t+1}+b_2c_t+b_3c_{t-1}+...)$$
$$U(b_0c_{t+3}+b_1c_{t+2}+b_2c_{t+1}+b_3c_t+b_4c_{t-1}+...)+...$$

Marginal utilities for consumption t and $t+1$ periods are:

$$\frac{\partial U}{\partial c_t}=U'(X_t)b_0+\beta U'(X_{t+1})b_1+$$
$$\beta^2U'(X_{t+2})b_2+\beta^3U'(X_{t+3})b_3+...$$
$$=U'(X_t)b_0+\sum_{\tau=1}^{\infty}\beta^\tau b_\tau U'(X_{t+\tau})$$
$$\frac{\partial U}{\partial c_{t+1}}=\beta U'(X_{t+1})b_0+\beta^2U'(X_{t+2})b_1 \qquad (12)$$
$$+\beta^3U'(X_{t+3})b_2+\beta^4U'(X_{t+4})b_3+...$$
$$=\sum_{\tau=1}^{\infty}\beta^\tau b_{\tau-1}U'(X_{t+\tau})$$

Through substituting the above phrases into standard Euler equation and considering $b_0=1$, we will get:

$$U'(X_t)+E_t\sum_{\tau=1}^{\infty}\beta^\tau b_\tau U'(X_{t+1})=E_t\sum_{\tau=1}^{\infty}\beta^\tau b_{\tau-1}U'(X_{t+1})R^i_{t+1}$$
$$\Rightarrow U'(X_t)=E_t\sum_{\tau=1}^{\infty}\beta^\tau U'(X_{t+1})\left[b_{\tau-1}R^i_{t+1}-b_\tau\right] \qquad (13)$$
$$1=\ E_t\sum_{\tau=1}^{\infty}\beta^\tau\left[\frac{U'(X_{t+\tau})}{U'(X_t)}\left(b_{\tau-1}R^i_{t+1}-b_\tau\right)\right]$$

In this case, the specific form of utility function is: $U=\frac{1}{(1-\gamma)}X^{1-\gamma}_{t+\tau}\quad\forall\tau\geq 0$, and marginal utility with respect to $X_{t+\tau}$ is equal to : $X^{-\gamma}_{t+\tau}\quad\forall\tau\geq 0$. If we substitute this phrase in the previous equation, we will obtain a recursive Euler equation for quantity of optimum, that is:

$$E_t\sum\beta^\tau\left[\left(\frac{X_{t+\tau}}{X_t}\right)^{-\gamma}(b_{\tau-1}R^i_{t+1}-b_\tau)\right]=1 \qquad (14)$$

The above nonlinear equation is very complex to empirical estimation. So, the following up studies of Eichenbaum and Hansen (1990), Ferson and Constantinides (1991) and some more researchers, in this study, we calculate this model for only one lag, in other words, $b_\tau=0,\quad \tau\geq 2$. In this case, Equations (11) and (12) become:

$$U = \frac{1}{(1-\gamma)}(X_t^{1-\gamma} + \beta X_{t+1}^{1-\gamma} + \beta^2 X_{t+2}^{1-\gamma})$$

$$= \frac{1}{(1-\gamma)}\begin{pmatrix} (c_t + b_1 c_{t-1})^{1-\gamma} + \beta (c_{t+1} + b_1 c_t)^{1-\gamma} \\ +\beta^2 (c_{t+2} + b_1 c_{t+1})^{1-\gamma} \end{pmatrix} \quad (15)$$

$$\frac{\partial U}{\partial c_t} = X_t^{-\gamma} + \beta b_1 X_{t+1}^{-\gamma}$$

$$,\frac{\partial U}{\partial c_{t+1}} = \beta\left(X_{t+1}^{-\gamma} + \beta b_1 X_{t+2}^{-\gamma}\right) \quad (16)$$

Thus, in this case, Euler equation is:

$$X_t^{-\gamma} + \beta b_1 X_{t+1}^{-\gamma} = E_t\left[\beta\left(X_{t+1}^{-\gamma} + \beta b_1 X_{t+2}^{-\gamma}\right)R_{t+1}^i\right] \quad (17)$$

We can rewrite the above phrase with respect to u_{t+2}, as:

$$u_{t+2} = E_t\left[\beta\left(X_{t+1}^{-\gamma} + \beta b_1 X_{t+2}^{-\gamma}\right)R_{t+1}^i\right] - E_t(X_t^{-\gamma} + \beta b_1 X_{t+1}^{-\gamma}) \quad (18)$$

If the model is correct, we will have $E_t\left[u_{t+2} \mid I_t\right] = 0$. If we consider $X_t = c_t + b_1 c_{t-1}$ and standardize disturbance term with $c_t^{-\gamma}$, after slightly calculation, we can write:

$$u_{t+2}^* = E_t\left\{\beta\left(\frac{c_{t+1}}{c_t} + b_1\right)^{-\gamma}(R_{t+1}^i - b_1)\right.$$
$$\left\{+\beta^2 b_1\left(\frac{c_{t+2}}{c_t} + b_1\frac{c_{t+1}}{c_t}\right)^{-\gamma} R_{t+1}^i\right\} \quad (19)$$
$$-\left[1 + b_1\left(\frac{c_{t-1}}{c_t}\right)\right]^{-\gamma}$$

Thus, u_{t+2}^* establishes orthogonality conditions in generalized moment method meaning $E_t\left[u_{t+2}^* \mid I_t\right] = 0$.

Case 3), $\alpha = 1, h = 0, \delta_0 = 1, \delta_\tau = 0$, if $\tau \geq 0$.

The above parameters imply that flow of expenditures is only based on contemporaneous consumption expenditures; it means $S_t = c_t$ since there is not recursive structure; the first order condition reduces to the standard Euler equation that is time separable and additive. Thus, we will obtain:

$$E_t\beta\left[\left(\frac{c_{t+1}}{c_t}\right)^{-\gamma} R_{t+1}^i\right] = 1 \quad (20)$$

3. Empirical Results

In this paper, we will use two weighted portfolio returns that they have nominated portfo1 (consists of: bank deposits, stocks, gold, and housing) and portfo2(consists of: bank deposits, stocks, gold, housing and foreign exchange). In fact, these are most important and principal assets that Iranian households in their assets basket. In order to weight return of bank deposits have used “volume of long term deposits”, to return of stocks have used “value of stock exchange transaction”, to return of changes of gold price have used “household’s costs for purchasing gold”, to return of changes of housing price have used “investment of private sector in housing”, to return of foreign exchange have used “foreign assets of central bank”. All of the data have collected of central bank of Iran and statistics center of Iran.

We use the following formula for making portfolios:

$$portfo1(portfo2) = \sum_{i=1}^{k} W_i R_i$$

$$, \sum_{i=1}^{k} W_i = 1, \quad W_i = \frac{v_i}{V} \quad , \sum_{i=1}^{k} v_i = V \quad (21)$$

$$R = (exchange, stocks, long\_rate, gold, housing)$$

where,

R: vector of return of each asset in household’s portfolio consists of (*exchange*: return of foreign exchange, *stock*: return of total index of stock exchange; *long_rate*: return of long term deposits; *gold*: return of changes of gold price; *housing*: return of changes of housing price). v_i: volume of each asset in household’s portfolio; V: total volume of assets that have used in household’s portfolio; W_i: weight of each asset.

In this section, in order to compare habit persistence and durability of consumption goods, we use semi-durable goods (hereafter *SDG*), durable goods (hereafter *DG* and both of semi-durable and durable goods (hereafter *SDGDG*). In the following figure, we draw consumption costs of semi durable goods (*SDG*), durable goods (*DG*), semi durable and durable goods (*SDGDG*), services (*SE*), nondurable goods (*ND*),services & nondurable goods (*SEND*) of Iran.

Figure 1 illustrates the trends of these variables for the country during 1980-2010.

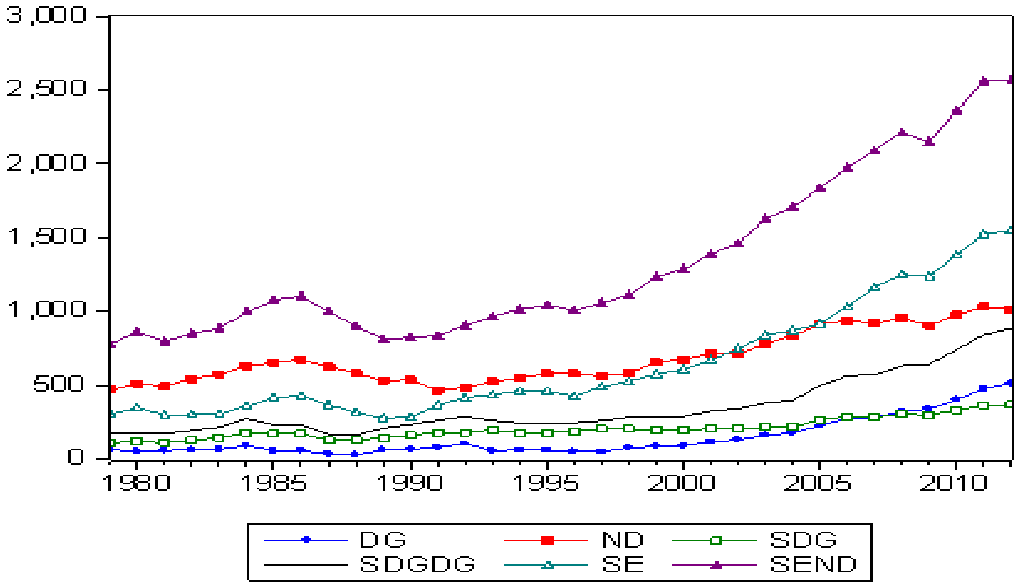

Figure 1: Consumption costs of *SDG, DG, SDGDG, SE, ND* and *SEND*

***Source*:** Authors

At first, in order to estimate the coefficient of habit formation and durability of goods (b_1) in Equation (22), we use *SDGDG*, portfo1 and portfo2. It is necessary that all of the used variables to be stationary. We have thus applied ADF test for them and have ensured that they are stationary. According to the Equation (22), we confront with some variables such as:

$xc1 = SDGDG(-1)/SDGDG(-2)$,
$xc2 = SDGDG/SDGDG(-2)$,
$xc3 = SDGDG(-3)/SDGDG(-2)$,
$portfo1$ and $portfo2$. Now, we present results of estimating coefficient of habit persistence and durability of goods in intertemporal consumption pattern of Iranian households (b_1) in Table 1.

$$E_{t-2}\begin{Bmatrix} \beta\left(xc1+b_1\right)^{-\gamma}(R^i_{t-1}-b_1)+ \\ \beta^2 b_1\left(xc2+b_1 xc1\right)^{-\gamma}R^i_{t-1} \end{Bmatrix} - [1+b_1(xc3)]^{-\gamma}=0 \quad (22)$$

, $R =$ portfo1,portfo2

Table1: Results of estimating b_1 for SDGDG by using of (22) and GMM approach

Portfolios	b_1	γ	β	J^*
Portfo1	-0.21(0.01)	0.40 (0.0001)	0.88(0.0)	1.65
Portfo2	-0.34(0.02)	0.25(0.03)	0.87(0.0)	1.12

***Source*:** Authors
Parentheses indicate p-value of t-statistic

Explanations of estimating (22) with *Portfo1*:
*Instrumental variables: xc1 (-1,-2), xc2 (-2,-3), Portfo1(-1); kernel: Quadratic; bandwidth: Fixed(NW).
**Hansen's J-statistic:
$J^* = N*J = 28*0.059 = 1.65 < \chi^2_{r-l} = \chi^2_{6-3,\%5} = 7.815$

That *N* is number of observations, *J* is J-statistic in GMM approach by Eviews, *r* is the number of instrumental variables, *l* is the number of parameters in model.
J shows that the model is valid.

***Sign of b_1 is negative. Hence, in this case, habits persistence dominates durability of goods.

Explanations of estimating (22) with *Portfo2*:
*Instrumental variables: xc1(-2), xc2(-2), xc3(-2,-3), portfo1(-2,-3); kernel: Quadratic; bandwidth: Fixed(NW).
Hansen's J-statistic (or *J):
$J^* = N * J = 28 * 0.04 = 1.12 < \chi^2_{r-l} = \chi^2_{7-3,\%5} = 9.488$

J^* shows that the model is valid.
***Sign of b_1 is negative, also. So, in this case, habits persistence dominates durability of goods.

Now, in order to estimate coefficient habit formation and durability of goods (b_1) in Equation (23), we use *DG*, portfo1 and portfo2. It is necessary that all of the used variables to be stationary. We applied ADF test for them and we ensured that they are stationary. According to Equation (23), we confront with some variables such as:

$k = DG(-1)/DG(-2)$,
$l = DG/DG(-2)$,
$m = DG(-3)/DG(-2)$,

$portfo1$ and $portfo2$. Now, we present results of estimating coefficient of habit persistence and durability of goods in intertemporal consumption pattern of Iranian households (b_1) in Table 2.

$$E_{t-2}\begin{Bmatrix} \beta\left(k + b_1\right)^{-\gamma}(R^i_{t-1} - b_1) \\ +\beta^2 b_1\left(l + b_1 k\right)^{-\gamma} R^i_{t-1} \end{Bmatrix} - \left[1 + b_1(m)\right]^{-\gamma} = 0 \quad , \quad R = \text{portfo1,portfo2} \tag{23}$$

Table 2: Results of estimating b_1 for *DG* by using of Equation (23) and GMM approach

Portfolio	b_1	γ	β	J^*
Portfo1	0.18	0.77 (0.01)	0.89 (0.0)	0.87
Portfo2	0.05	0.84 (0.003)	0.91 (0.0)	½.

Source: Authors
Parentheses indicate p-value of t-statistic

Explanations of estimating (23) with Portfo1:
*Instrumental variables: k(-1,-3), l(-2), m(-1), portfo1(-2) ; kernel: Quadratic; bandwidth: Fixed(NW).
**Hansen's J-statistic:
$J^* = N * J = 29 * 0.03 = 0.87 < \chi^2_{r-l} = \chi^2_{6-3,\%5} = 7.815$

J^* Shows that model is valid.

***Sign of b_1 is positive. So, in this case, habits persistence dominated durability of goods.

Explanations of estimating (23) with Portfo2:
*Instrumental variables: k(-2), l(-2), m(-1), portfo1(-1,-2); kernel: Quadratic; bandwidth: Fixed(NW).

**Hansen's J-statistic (or J^*):
$J^* = N * J = 30 * 0.04 = 1.2 < \chi^2_{r-l} = \chi^2_{6-3,\%5} = 7.815$

J^* Shows that model is valid.
***Sign of b_1 is positive, also. Hence, in this case, habits persistence dominated durability of goods.

Finally, in order to estimate coefficient habit formation and durability of goods (b_1) in Equation (24), we use *SDG*, portfo1 and portfo2. It is necessary that all of the used variables to be stationary. We applied ADF test for them and we ensured that they are stationary. According to the Equation (24), we confront with some variables such as:

$kn = SDG(-1)/SDG(-2)$,
$\ln = SDG/SDG(-2)$,
$mn = SDG(-3)/SDG(-2)$, $portfo1$ and $portfo2$. Now, we present results of estimating coefficient of habit persistence and durability of goods in intertemporal consumption pattern of Iranian households (b_1) in Table 3.

$$E_{t-2}\begin{Bmatrix} \beta\left(kn + b_1\right)^{-\gamma}(R^i_{t-1} - b_1) + \\ \beta^2 b_1\left(l + b_1 kn\right)^{-\gamma} R^i_{t-1} \end{Bmatrix} - \left[1n + b_1(mn)\right]^{-\gamma} = 0 \quad , \quad R = \text{portfo1,portfo2} \tag{24}$$

Table 3: Results of estimating b_1 for SDG by using of (24) and GMM approach

portfolios	b_1	γ	β	J^*
Portfo1	-0.20 (0.0)	0.95 (0.03)	0.89 (0.0)	1.1
Portfo2	-0.18 (0.002)	0.93 (0.02)	0.90 (0.0)	084

Source: Authors

Parentheses indicate p-value of t-statistic

Explanations of estimating Equation (24) with *Portfo1*:

*Instrumental variables: kn(-1), mn (-1), Portfo1(-1,-2); kernel: Quadratic ; bandwidth: Variable –Newey – West.

**Hansen's J-statistic:

$$J^* = N * J = 28 * 0.037 = 1.1 < \chi^2_{r-l} = \chi^2_{5-3,\%5} = 5.991$$

J^* Shows that model is valid.

***Sign of b_1 is negative. So, in this case, habits persistence dominates durability of goods.

Explanations of estimating Equation (24) with Portfo2:

*Instrumental variables kn(-1,-2), ln(-2), portfo1(-3); kernel: Quadratic; bandwidth: Fixed(NW).

Hansen's J-statistic (or *J):

$$J^* = N * J = 30 * 0.028 = 0.84 < \chi^2_{r-l} = \chi^2_{5-3,\%5} = 5.991$$

J^* shows that model is valid.

***Sign of b_1 is negative. So, in this case, habits persistence dominates durability of goods.

4. Conclusion

The aim of this paper was to survey the habit formation, durability of consumption goods and calculate coefficients of relative risk aversion and elasticity of intertemporal substitution in consumption behavior of Iranian households. In sum, according to the results of estimation various models for coefficient of habit formation and durability of consumption goods (or b1), the findings show that for semi durable goods, sign of this coefficient is negative. Thus, for this type of goods, habit persistence dominates durability of goods. But, about durable goods, this relationship is vice versa; because of sign of b1 for these goods is positive that means habit persistence dominated durability of goods. Finally, when we use both of semi durable goods and durable goods, habit persistence dominates durability of goods.

Results of our estimates for four models have shown that coefficient of relative risk aversion (γ) is between 0.25 and 0.95, and elasticity of intertemporal substitution is between 1.05 and 4.

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