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2 June 2006

Turkish Economic Association (TEA), International Conference on Economics, "Session: Consumption in Turkey" Ankara, Turkey, September 11, 2006.

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Abstract

This paper observes the Turkish household' consumption data to see whether it follows random walk or not. The quarterly data covers the period from 1987:1 to 2003:4. By employing the direct tests for random walk, excess smoothness or excess sensitivity, this study results in both excess sensitivity and excess smoothness and rejects random walk hypothesis for the Turkish consumption pattern.

Keywords: consumption, fiscal policies, seasonality, stationarity, random walk, excess smoothness, excess sensitivity

JEL classification codes: C32, E20

I. Introduction

There has been wide dispute on consumption models of Absolute Income, Life Cycle and Permanent Income Models in the literature analyzing the consumption behavior, mostly employing the data for US, UK and other developed countries. The purpose of this study is to search the pattern of private consumption in Turkish economy using several time series analyses.

After presenting the evidence from the literature, this study runs consumption models in which private consumption, GDP, government spending, taxes, transfers and the dummies for financial crises (centered seasonal, April 1994 and February 2001) are included as variables, by using the data of Turkish Central Bank, National Accounts. Within this framework, first several stationarity tests are conducted for the data by employing related statistics. Later, the VAR model, fitting the Turkish data best, is used through the tests of LR, FPE, AIC, SC and HQ. The final consumption model output, then, is decomposed into anticipated and unanticipated parts. To reach some fiscal policy conclusions, this study, by running exogeneity and/or weak exogeneity tests, observes if the Turkish private consumption data follows random walk or excess smoothness or excess sensitivity.

II. Literature Evidence

The Hall's Euler equation model (1978) produced many works on consumption behavior. The model states that the conditional expectation of future marginal utility is a function of today's level of consumption alone; all other information is irrelevant (Hall, 1978:972). This statement follows the argument that consumption is random walk and therefore changes in income cannot be anticipated.

$$C_t = E_{t-1}[C_t] + e_t \qquad (1)$$

Where C_t is per capita consumption and e_t is innovation error. Since $E_{t-1}[C_t] = C_{t-1}$,

$$C_t = C_{t-1} + e_t \qquad (2)$$

Therefore consumption at time t is predictable through only one lagged consumption alone. Hall tests this implication of Equation (2), by the Equation (3) below,

$$C_t = b_0 + b_1C_{t-1} + b_2C_{t-2} + b_3C_{t-3} + b_4C_{t-4} + e_t \qquad (3)$$

and is not able to reject the hypothesis H_0: $b_2= b_3=b_4=0$ at the %5 level. He also employs Equation (4) as below.

$$C_t = b_0 + b_1C_{t-1} + b_2Y_{t-1} + b_3Y_{t-2} + b_4Y_{t-3} + b_5Y_{t-4} + e_t \qquad (4)$$

Where Y is per capita disposable income. Testing the hypothesis H_0:$b_2=b_3=b_4= b_5=0$ yields not rejection at %5 but rejection at %10 level. Equation (4) gives statistically marginal and numerically small relation between C and very recent levels of Y (Hall, 1978:984).

Flavin (1981) tests the excess sensitivity by running Equation (5) with the eight order of specification.

$$Y_t = a_0 + a_i\sum_{i=1}^{8} Y_{t-i} + e_{t,1} \qquad (5)$$

$$\Delta C_t = m + B_i\sum_{i=0}^{7} \Delta Y_{t-i} + k\Phi e_{t,1} + e_{t,2} \qquad (6)$$

Where Ct is per capita consumption on non-durables and Y_t is per capita labor income. The hypothesis of all B parameters are jointly equal to zero is rejected and she concludes that US consumption follows excess sensitivity (Flavin, 1981:999).

Seator and Mariona (1985), run a regression in which per capita consumption is regressed on permanent (the stochastic steady state values of the series) and transitory parts (difference between permanent and real values of series) of real per capita variables of income, government expenditures, tax revenue, transfers, debt, social security wealth, average marginal tax rate and short and long run real interest rate after tax. They find that consumption shows sensitivity to transitory income due to liquidity constraints.

In considering Euler Equation (2), without transitory consumption shocks, unanticipated part of consumption is equal to unanticipated part of income. Thus the variance of unanticipated part of consumption (innovation) should be at least equal and greater than the variance of unanticipated part of current income, if income has a persistent unit root process. I fact, in the US and other countries seasonally adjusted consumption growth has a variance of one-half or less of income variance. This imply that consumption acts excessively smooth (Muellbauer, 1996: 103).

Campbell and Mankiw (1989) suggests by Equation (7) that a fraction λ of consumers takes into account their current income as suggested by Keynesian Absolute Income Hypothesis and $(1-\lambda)$ fraction of the consumers follows Equation (2) as suggested by Hall's random walk or Permanent Income Hypothesis.

$$\Delta C_t = \lambda(\Delta Y_t) + (1-\lambda)e_t \qquad (7)$$

In testing the significance and value of λ by using US data, they find that consumers increase their consumption by 0.40 to 0.50 units as anticipated current income increases by one unit. This result is obviously against random walk hypothesis but support of the excess sensitivity results.

There are some statistical or theoretical doubts on above seminal works of consumption. For instance, the most common criticism to Campbell and Mankiw's study is why US households behave so differently that they follow λ or $(1-\lambda)$ probabilities without common rational considerations. Flavin's study might not be applicable if her ARMA model is not stable, in other words, if income is not stationary. Hall's Equation (4) brings about some doubts on the random walk since one cannot reject the joint null hypothesis of zero at %10 level of confidence. Throughout last two decades, some other consumption models include alternative potential variables or consider the weaknesses of the models above discussed.

Madsen and McAleer (2000) run a study about consumption model using the expectations (Michigan Surveys of Consumers Data) and they conclude that when uncertainty and inflationary expectations are included in the model, consumption is not sensitive to current income. Their important finding is that credit constraints or limited access to available information are not important in excess sensitivity explanations.

Souleles (2002) employs micro data from the Consumer Expenditure Survey to test the effects of tax-cuts on consumption. He finds that consumption is excessively sensitive to tax-cuts. In his model, credit constraints or other widely accepted factors such as; limited access to available information, myopia are not the relevant variables to explain excess sensitivity as Madsen and McAleer (2000) conclude.

Pistoresi (1996) employs a vector error correction model to decompose the transitory and permanent (cycle and trend) components of US disposable income and consumption. Their results are the permanent component in consumption explains %93 of total volatility whereas permanent component in income explains %34 of all variance of the variables. A permanent shock has greater effect on income than consumption. The transitory shock has no effect on consumption but has long term effect on income. Therefore their work indicates that consumption is not random walk but follows both excess sensitivity and excess smoothness.

Can consumption be both excess smooth and excess sensitive? Or is there a puzzle to be solved in the literature? Excess sensitivity deals with anticipated changes and excess smooth is due to unanticipated changes, then, it is possible that consumption may follow both (Romer, 1996: 319). In other words, consumption may be smoothed to current income, which has surprise part, and also sensitive to lagged income, which is known by consumer. There are many works giving puzzle results and/or having puzzle explanations (i.e. Campbell and Deaton, 1989, Pesaran, 2003; Ludvigson and Michaelides, 2001, Berument and Froyen, 2006) which are not included in this paper due to the fact that such a study of theoretical and empirical explanations on puzzle is another topic to be worked in the future, which is currently beyond of the scope of this study. Other possible related woks for consumption with rational expectations or with permanent income hypothesis through rational expectations or with the perspective of Ricardian Equivalence with rational expectations can be found in Bilgili (1997, 2001, 2003). This paper involves mostly the dynamic behavior of consumption and direct tests to see if Turkish consumption data follows random walk, excess sensitivity or excess smoothness. The next section analyses the data first and runs the relevant tests of the consumption model.

III. Empirical Evidence with Turkish Data

Here, in this section of the study, I employ vector auto regression (VAR), cointegration, impulse response and several parameter restrictions analysis to define the consumption behavior for the Turkish Economy. The aim of this part of study is basically to understand if consumption is defined by random walk, excess sensitivity or excess smoothness.

The variables employed in analyses are private final consumption (CONS), gross domestic product (GDP), government final consumption (GOV), total taxes (TAX), and total transfer (TR) respectively. All variables are real with 1987 prices. The quarterly Turkish data covers the period of 1987:1 – 2003:4. The data can be reached through The Central Bank of Turkey, Electronic Data Distribution System.

In econometrical perspective, it is a basic necessity to run unit root and rank (cointegrating relation) tests. In the case of existence of unit root, one would get biased results from the regression output. Although the variables might be individually nonstationary, $I(1)$, one or more linear combinations of those might be stationary, $I(0)$. In existence of such linear combination(s), the variables are said to be cointegrated and, therefore, there is one or more long-run relationship (equilibrium) among them (Granger, 1991). In literature, it is underlined that prerequisite for cointegration is to obtain $I(1)$ variables. Then, either naturally or due to this prerequisite, almost all cointegration applications refer to the $I(1)$ series, hence a cointegration relation is denoted as $CI(1,1)$. Before proceeding the analysis, it should be noted that the set of $I(2)$ variables, on the other hand, might be candidates of cointegration relationship of order $CI(2,1)$, so that there exist a linear combination that is $I(1)$ (Enders, 1995:359-361; J∅rgansen *et al.,* 1996).

III.1 Stationarity Tests

Dickey Fuller/Augmented Dickey Fuller (DF/ADF) unit root test results of the natural log (ln) of variables are given in Table 1. All variables are found $I(1)$ in their levels and $I(0)$ in their differences, hence they are difference stationary. The next step is to search if any linear combination(s) of them is stationary. I run a VAR system in which lnCONS, lnGDP, lnGOV, lnTAX, and lnTR are employed as endogenous variables and constant, centered seasonal dummy (DS), April 1994 dummy (D94) and February 2001 dummy (D01) are included as exogenous variables. In the system, DS is used to capture the seasonal effects in data, and D94 and D01 are included to catch up the possible effects of financial crises; 5 April of 1994 and 22 February of 2001 in the data, respectively. In determining the lag numbers of the VAR systems, considering over-parameterization, the maximum lag number is chosen as 6. In lag order selection, Schwarz information criteria (SC), likelihood ratio (LR), final prediction error (FPE), Akaike information criteria (AIC) and Hannan-Quinn criteria (HQ) are used together with the main concern of choosing the relatively smaller lag. In testing the Johansen's deterministic trend assumptions, the SC and AIC are observed.

In VAR, the lag length choice is determined as 2 by SC. It is found as 5 by LR, FPE, and HQ and 6 by AIC. SC selection is preferred to avoid over-parameterization problem. Some evidence from Monte Carlo studies also shows that SC dominates all other criteria named above in VAR process (Köse and Uçar, 1994). Table 2 gives the Wald statistics of lag exclusion tests of the variables in the system. Result indicates that all variables' first and second, lags both separately and jointly, should be included in the system with %1 percent confidence level. Dummies of DS, D4 and D01 are found significant by Wald test at 1% critical value. To be more specific; the exclusion test of DS from all equations in VAR gave chi-square of 180.694 with the probability value of 0.000. The exclusion test of D01 from all equations in VAR resulted in chi-square of 16.205 with the probability value of 0.006. Finally the exclusion test of D94 from all equations in VAR provided a chi square of 28.211 with the probability value of 0.000. After determining the optimal VAR lag length, the next is to test the deterministic trend assumptions. By SC criteria, it is concluded that, CE specification is defined as, within linear deterministic trend, no trend in VAR and trend and intercept in cointegrating equation (CE). Table 3 provides the result of one rank by both trace and max-eigenvalue statistics at both 5% and 1% levels. It indicates that there is a cointegrating equation including VAR variables, hence although VAR variables are $I(1)$ in levels, their linear combination provides an $I(0)$. At this very initial construing stage, one can conclude that there is a long run relationship between consumption and other variables; income, government expenditures, tax and transfers. A deviation from long run equilibrium is adjusted by short run behaviors of the variables.

III.2 Impulse-Response Analysis

Impulse response functions expose the dynamic response of each endogenous variable to a shock in the other variables. This dynamic tracing enables us to observe the effect of a unit shock in one variable on current and future values of itself and another variable(s). Hence all variables in VAR system are all affected through one standard deviation shock occurred in innovations of any variable in the system. In impulse-response analysis, ordering the variables in VAR system is important and analysis is subject to change under different ordering, if we work with Choleski factorization. Then one should make decision on which variable behaves more exogenously, then that variable can come first (Doan, 1992: 8.14). One may follow this suggestion. I, however, use the generalized impulse responses that appear recently in the literature since this method does not impose a priori restrictions to the ordering of the variables (Pesaran and Shin, 1998; Ewing, 2003). Another issue of impulse response from VAR is that unrestricted nonstationaries VAR may not result in converge to optimal predictors and hence impulse response and forecast error variance matrix estimates are not consistent at least long horizons (Phillips, 1998). By considering this statistical evidence, I run impulse response through a VAR in first differences with the dummies DS, D94 and D01. Table 4 indicates that all variables' first differenced lags both separately and jointly are statistically significant at %1 level. Dummies of DS, D4 and D01 are found significant by Wald test at 1% critical value. The exclusion test of DS from all equations in VAR gave chi-square of 1278.578 with the probability of 0.000. The exclusion test of D01 from all equations in VAR resulted in chi-square of 14.225 with the probability of 0.0142. And the exclusion test of D94 from all equations in VAR provided a chi square of 38.831 with the probability of 0.000.

Figure 1 exhibits the responses of D(LNCONS) to the impulses of all individual variables in the VAR system. With one unit shock occurred in D(LNGDP), D(LNCONS) shows movements up and down for ten quarters. Although the degree of these movements appear to be low in comparison with the graph scale of impulse responses, one can claim that growth in consumption is sensitive to unexpected changes in growth in total income. In other words, there is no consumption smoothness to income. As for the impacts of D(LNGOV), D(LNTAX) and D(LNTR) on D(LNCONS), related figures show consumption smoothness to the growth in government expenditures, taxes and transfer payments. Last graph in Figure 1 represents the response of D(LNCONS) to its own shock. Again up and down movements in consumption after unexpected change in consumption. Consumption shock and income shock have similar impacts on consumption. These shocks lead consumption to down by second quarter, increase at third quarter, decrease at fourth quarter and increase at fifth period and so on. An innovation (unexpected change) in income and consumption equations brings about change in consumption in the future, whereas innovations of government expenditures, tax and transfers are negligible at all periods. To make sure this result, this study will carry direct tests to see if consumption changes due to anticipated and/or unanticipated changes in variables of the system.

III.3 Direct tests on Random Walk, Excess Sensitivity and Excess Smoothness

Random walk implies that the change in series of interest cannot be forecast. Therefore if consumption (LNCONS here) follows random walk, then consumption changes through only unexpected changes represented by innovations or error terms in the VAR system. If there is excess sensitivity of consumption to variables in the VAR, it implies that consumption responds even to predictable changes in LNGDP, LNGOV, LNTAX and LNTR whose innovations are zero. On other hand, if consumption does not change even at the existence of unexpected changes (innovations), then one can argue that consumption is smoothed excessively. By the introduction of the actual (fitted) changes in variables that represent predictable changes in the VAR system given by equation (8) through equation (18) below, the "random walk", "excess sensitivity" and "excess smoothness" can be tested with the following equation of (19').

$$\mathbf{X}_t = \prod_0 + \prod_1 \mathbf{X}_{t-1} + \mathbf{e}_t \tag{8}$$

Where, $\mathbf{X}_t$ is n×1 vector of endogenous variables included in the system, $\prod_0$ is n×1 vector of intercept terms, $\prod_1$ is n×n matrices of coefficients and e_t is n×1 vector of errors (innovations).

VAR in levels:

$$\begin{aligned} LNCONS_t = {} & a_0 + a_1LNCONS_{t-1} + a_2LNCONS_{t-2} + a_3LNGDP_{t-1} + a_4LNGDP_{t-2} \\ & + a_5LNGOV_{t-1} + a_6LNGOV_{t-2} + a_7LNTAX_{t-1} + a_8LNTAX_{t-2} \\ & + a_9LNTR_{t-1} + a_{10}LNTR_{t-2} + a_{11}DS_t + a_{12}D94_t + a_{13}D01_t + e_{1,t} \end{aligned} \tag{9}$$

$$\begin{aligned} LNGDP_t = {} & b_0 + b_1LNCONS_{t-1} + b_2LNCONS_{t-2} + b_3LNGDP_{t-1} + b_4LNGDP_{t-2} \\ & + b_5LNGOV_{t-1} + b_6LNGOV_{t-2} + b_7LNTAX_{t-1} + b_8LNTAX_{t-2} \\ & + b_9LNTR_{t-1} + b_{10}LNTR_{t-2} + b_{11}DS_t + b_{12}D94_t + b_{13}D01_t + e_{2,t} \end{aligned} \tag{10}$$

$$\begin{aligned} LNGOV_t = {} & c_0 + c_1LNCONS_{t-1} + c_2LNCONS_{t-2} + c_3LNGDP_{t-1} + c_4LNGDP_{t-2} \\ & + c_5LNGOV_{t-1} + c_6LNGOV_{t-2} + c_7LNTAX_{t-1} + c_8LNTAX_{t-2} \end{aligned}$$

$$+ c_9 LNTR_{t-1} + c_{10} LNTR_{t-2} + c_{11} DS_t + c_{12} D94_t + c_{13} D01_t + e_{3,t} \quad (11)$$

$$LNTAX_t = d_0 + d_1 LNCONS_{t-1} + d_2 LNCONS_{t-2} + d_3 LNGDP_{t-1} + d_4 LNGDP_{t-2} + d_5 LNGOV_{t-1} + d_6 LNGOV_{t-2} + d_7 LNTAX_{t-1} + d_8 LNTAX_{t-2} + d_9 LNTR_{t-1} + d_{10} LNTR_{t-2} + d_{11} DS_t + d_{12} D94_t + d_{13} D01_t + e_{4,t} \quad (12)$$

$$LNTR_t = g_0 + g_1 LNCONS_{t-1} + g_2 LNCONS_{t-2} + g_3 LNGDP_{t-1} + g_4 LNGDP_{t-2} + g_5 LNGOV_{t-1} + g_6 LNGOV_{t-2} + g_7 LNTAX_{t-1} + g_8 LNTAX_{t-2} + g_9 LNTR_{t-1} + g_{10} LNTR_{t-2} + g_{11} DS_t + g_{12} D94_t + g_{13} D01_t + e_{5,t} \quad (13)$$

VAR in differences :

$$\Delta(LNCONS)_t = h_0 + h_1 \Delta(LNCONS)_{t-1} + h_2 \Delta(LNGDP)_{t-1} + h_3 \Delta(LNGOV)_{t-1} + h_4 \Delta(LNTAX)_{t-1} + h_5 \Delta(LNTR)_{t-1} + h_6 DS_t + h_7 D94_t + h_8 D01_t + e_{6,t} \quad (14)$$

$$\Delta(LNGDP)_t = j_0 + j_1 \Delta(LNCONS)_{t-1} + j_2 \Delta(LNGDP)_{t-1} + j_3 \Delta(LNGOV)_{t-1} + j_4 \Delta(LNTAX)_{t-1} + j_5 \Delta(LNTR)_{t-1} + j_6 DS_t + j_7 D94_t + j_8 D01_t + e_{7,t} \quad (15)$$

$$\Delta(LNGOV)_t = k_0 + k_1 \Delta(LNCONS)_{t-1} + k_2 \Delta(LNGDP)_{t-1} + k_3 \Delta(LNGOV)_{t-1} + k_4 \Delta(LNTAX)_{t-1} + k_5 \Delta(LNTR)_{t-1} + k_6 DS_t + k_7 D94_t + k_8 D01_t + e_{8,t} \quad (16)$$

$$\Delta(LNTAX)_t = m_0 + m_1 \Delta(LNCONS)_{t-1} + m_2 \Delta(LNGDP)_{t-1} + m_3 \Delta(LNGOV)_{t-1} + m_4 \Delta(LNTAX)_{t-1} + m_5 \Delta(LNTR)_{t-1} + m_6 DS_t + m_7 D94_t + m_8 D01_t + e_{9,t} \quad (17)$$

$$\Delta(LNTR)_t = n_0 + n_1 \Delta(LNCONS)_{t-1} + n_2 \Delta(LNGDP)_{t-1} + n_3 \Delta(LNGOV)_{t-1} + n_4 \Delta(LNTAX)_{t-1} + n_5 \Delta(LNTR)_{t-1} + n_6 DS_t + n_7 D94_t + n_8 D01_t + e_{10,t} \quad (18)$$

Consumption equation to be tested:

$$\Delta(LNCONS)_t = p_0 + p_1 \Delta(LNGDP)_t + p_2 \Delta(LNGOV)_t + p_3 \Delta(LNTAX)_t + + p_4 \Delta(LNTR)_t + p_5 DS_t + e_{11,t} \quad (19)$$

Anticipated and unanticipated parts of (19):

$$\Delta(LNCONS)_t = r_0 + \mathbf{r_1} [b_0 + b_1 LNCONS_{t-1} + b_2 LNCONS_{t-2} + \mathbf{(b_3\text{-}1)} LNGDP_{t-1} + b_4 LNGDP_{t-2} + b_5 LNGOV_{t-1} + b_6 LNGOV_{t-2} + b_7 LNTAX_{t-1}$$

$$
\begin{aligned}
&+ b_8LNTAX_{t-2} + b_9LNTR_{t-1} + b_{10}LNTR_{t-2} \\
&+ b_{11}DS_t + b_{12}D94_t + b_{13}D01_t]
\end{aligned}
$$

$$
\begin{aligned}
+ \mathbf{r_2}\,[&c_0 + c_1LNCONS_{t-1} + c_2LNCONS_{t-2} + c_3LNGDP_{t-1} \\
&+ c_4LNGDP_{t-2} + \mathbf{(c_5\text{-}1)}LNGOV_{t-1} + c_6LNGOV_{t-2} + c_7LNTAX_{t-1} \\
&+ c_8LNTAX_{t-2} + c_9LNTR_{t-1} + c_{10}LNTR_{t-2} \\
&+ c_{11}DS_t + c_{12}D94_t + c_{13}D01_t\,]
\end{aligned}
$$

$$
\begin{aligned}
+ \mathbf{r_3}\,[&d_0 + d_1LNCONS_{t-1} + d_2LNCONS_{t-2} + d_3LNGDP_{t-1} \\
&+ d_4LNGDP_{t-2} + d_5LNGOV_{t-1} + d_6LNGOV_{t-2} + \mathbf{(d_7\text{-}1)}LNTAX_{t-1} \\
&+ d_8LNTAX_{t-2} + d_9LNTR_{t-1} + d_{10}LNTR_{t-2} \\
&+ d_{11}DS_t + d_{12}D94_t + d_{13}D01_t\,]
\end{aligned}
$$

$$
\begin{aligned}
+ \mathbf{r_4}\,[&g_0 + g_1LNCONS_{t-1} + g_2LNCONS_{t-2} + g_3LNGDP_{t-1} \\
&+ g_4LNGDP_{t-2} + g_5LNGOV_{t-1} + g_6LNGOV_{t-2} + g_7LNTAX_{t-1} \\
&+ g_8LNTAX_{t-2} + \mathbf{(g_9\text{-}1)}LNTR_{t-1} + g_{10}LNTR_{t-2} \\
&+ g_{11}DS_t + g_{12}D94_t + g_{13}D01_t\,]
\end{aligned}
$$

$$
+ \mathbf{r_5}DS_t + \mathbf{r_6}(e_{7,t}) + \mathbf{r_7}(e_{8,t}) + \mathbf{r_8}(e_{9,t}) + \mathbf{r_9}(e_{10,t}) + e_{12,t} \qquad (19')
$$

In the Equation (19'), r_1, r_2, r_3 and r_4 are the parameters of expected (anticipated) changes in explanatory variables, whereas r_6, r_7, r_8, and r_9 represent unanticipated parts of the changes in variables and DS and $e_{12,t}$ are seasonal dummy and the error term of the consumption equation, respectively. DS is to capture the seasonal effects of the consumption behavior apart from the contribution of government expenditures, tax and transfers in explanation of consumption equation. It would be otherwise accommodated in error term. DS is found significant at %1 level of confidence. Since D94 and D01 individually are not statistically significant at %1 level and the null hypothesis that D94 and D01 are jointly equal zero is not able rejected at %1 level, Equation (19') do not include these dummies. Table 5 reveals the results of tests for sensitivity, smoothness and random walk. As Table 5 states, consumption is excessively sensitive to income and government expenditures at %5 and %1, respectively, and excessively sensitive to taxes and transfers at only %10 level in terms of growth. Consumption's excessive sensitiveness to taxes and transfers can be rejected at %5 level. On the other hand, consumption is affected by unanticipated changes occurred in income at %1 level, whereas it is not affected by unanticipated changes of government expenditures, taxes and transfer payments even at %50 level, again in terms of growth level. This means that consumption is excessively smoothed for government expenditures, taxes and transfers and does not experience excessive smoothness for income. The later result is consistent with impulse response analyses.

Table 5: Random Walk Tests		
Hypothesis	**Chi-Square**	**Prob value**
H_0: $r_1 = 0$	5.443	0.019
H_0: $r_2 = 0$	8.081	0.004
H_0: $r_3 = 0$	2.810	0.093
H_0: $r_4 = 0$	2.716	0.099
H_0: $r_1 = r_2 = r_3 = r_4 = 0$	93.643	0.000
H_0: $r_6 = 0$	14.796	0.000
H_0: $r_7 = 0$	0.414	0.519
H_0: $r_8 = 0$	0.079	0.778
H_0: $r_9 = 0$	0.302	0.582
H_0: $r_6 = r_7 = r_8 = r_9 = 0$	21.118	0.000
H_0: $[r_1 = r_2 = r_3 = r_4 = r_6 = r_7 = r_8 = r_9] = 0$	119.541	0.000

IV. Summary and Conclusion

There has been a big debate on random walk approach since seminal work of Hall (1978) in the macroeconomics and/or microeconomics literature. This debate has been intensively accelerated by the seminal works of Flavin (1981), Seator and Mariona (1985) and Campbell and Mankiw (1989) and others. After Hall's paper, some researchers found consumption is not random walk but excessively smooth for unpredicted changes or excessively sensitive for predicted parts of the variables which are potential to explain the consumption. The preceding sections of this study launch empirical tests for consumption behavior using the Turkish data for total private consumption, GDP, government expenditures, tax, and transfer payments for the period of 1987:1-2003:4. The purpose of this work is, then, to expose an explanation for Turkish consumption to see whether it follows random walk, excessive sensitiveness and/or excessive smoothness. The cointegration analyses reveal that there is a long run relation between consumption and other variables. Impulse response analyses indicate that consumption is smoothed when unanticipated changes appear in government expenditures, taxes and transfers. On the other hand, it is found that consumption is not smoothed for the unexpected movements in income. Later in the study, using VAR in levels and differences, unanticipated and anticipated parts of the variables are obtained and these fractions of the variables are employed in a consumption equation fitted well among others. Upon carrying out related tests, it is concluded that consumption is excessively sensitive to income and government expenditures at %5 and %1 levels, respectively, and excessively sensitive to taxes and transfers at only %10 level. And, it is statistically revealed that consumption is excessively smoothed for government expenditures, taxes and transfers and not smoothed for the unanticipated changes in income at %1 level. Upon these findings, this paper may conclude that Turkish consumption data follows both excess sensitivity and excess smoothness but not random walk.

Unit Root Tests in Levels

Table:1.1 **DF/ADF tests for lnGDP**		DF/ADF	Lag(L)	Q prob.	5% critical value
1	$\Delta X_t = \alpha X_{t-1} + u_t$	4.062	7	0.171(15)	-1.945
2	$\Delta X_t = a + \alpha X_{t-1} + u_t$	-1.251	7	0.086(15)	-2.910
3	$\Delta X_t = a + bt + \alpha X_{t-1} + u_t$	-2.928	5	0.122(16)	-3.482

Table:1.2 **DF/ADF tests for lnCONS**		DF/ADF	Lag(L)	Q prob.	5% critical value
1	$\Delta X_t = \alpha X_{t-1} + u_t$	1.319	4	0.075(16)	-1.945
2	$\Delta X_t = a + \alpha X_{t-1} + u_t$	-1.051	4	0.072(16)	-2.907
3	$\Delta X_t = a + bt + \alpha X_{t-1} + u_t$	-2.965	4	0.211(16)	-3.481

Table:1.3 **DF/ADF tests for lnGOV**		DF/ADF	Lag(L)	Q prob.	5% critical value
1	$\Delta X_t = \alpha X_{t-1} + u_t$	1.960	4	0.128(16)	-1.945
2	$\Delta X_t = a + \alpha X_{t-1} + u_t$	-0.846	4	0.141(16)	-2.907
3	$\Delta X_t = a + bt + \alpha X_{t-1} + u_t$	-2.250	4	0.075(16) 0.145(15)	-3.481

Table:1.4 **DF/ADF tests for lnTAX**		DF/ADF	lag(L)	Q prob.	5% critical value
1	$\Delta X_t = \alpha X_{t-1} + u_t$	3.008	8	0.214(15)	-1.946
2	$\Delta X_t = a + \alpha X_{t-1} + u_t$	0.427	8	0.210(15)	-2.910
3	$\Delta X_t = a + bt + \alpha X_{t-1} + u_t$	-2.909	8	0.510(15)	-3.486

Table:1.5 **DF/ADF tests for lnTR**		DF/ADF	Lag(L)	Q prob.	5% critical value
1	$\Delta X_t = \alpha X_{t-1} + u_t$	1.288	4	0.184(16)	-1.945
2	$\Delta X_t = a + \alpha X_{t-1} + u_t$	-0.686	4	0.246(16)	-2.907
3	$\Delta X_t = a + bt + \alpha X_{t-1} + u_t$	-3.542	4	0.372(16)	-3.481

1: no constant, no trend; 2: constant, no trend; 3: constant and trend
In Q prob. columns, the number of lags in correlogram for residuals is given in parenthesis

Unit Root Tests in First Differences [*d*(1)]

Table:1.6 **DF/ADF tests for lnGDP**		DF/ADF	Lag(L)	Q prob.	5% critical value
1	$\Delta X_t = \alpha X_{t-1} + u_t$	-4.152(*)	6	0.079(15)	-1.945
2	$\Delta X_t = a + \alpha X_{t-1} + u_t$	-6.247(*)	6	0.163(15)	-2.910
3	$\Delta X_t = a + bt + \alpha X_{t-1} + u_t$	-6.317(*)	6	0.086(15)	-3.484

(*) hypothesis of unit root is rejected at 1% level as well as at 5%.

Table:1.7 **DF/ADF tests for lnCONS**		DF/ADF	Lag(L)	Q prob.	5% critical value
1	$\Delta X_t = \alpha X_{t-1} + u_t$	-2.800(*)	3	0.070(16)	-1.945
2	$\Delta X_t = a + \alpha X_{t-1} + u_t$	-3.117	3	0.075(16)	-2.907
3	$\Delta X_t = a + bt + \alpha X_{t-1} + u_t$	-3.054(**)	3	0.073(16)	-3.481

(*) hypothesis of unit root is rejected at 1% level as well as well as at 5%.
(**) hypothesis of unit root is not rejected even at 10% level.

Table:1.8 **DF/ADF tests for lnGOV**		DF/ADF	Lag(L)	Q prob.	5% critical value
1	$\Delta X_t = \alpha X_{t-1} + u_t$	-3.986(*)	3	0.069(16) 0.103(15)	-1.945
2	$\Delta X_t = a + \alpha X_{t-1} + u_t$	-4.538(*)	3	0.128(16)	-2.907
3	$\Delta X_t = a + bt + \alpha X_{t-1} + u_t$	-4.523(*)	3	0.131(16)	-3.481

(*) hypothesis of unit root is rejected at 1% level as well as well as at 5%.

Table:1.9 **DF/ADF tests for lnTAX**		DF/ADF	lag(L)	Q prob.	5% critical value
1	$\Delta X_t = \alpha X_{t-1} + u_t$	-1.771(*)	7	0.197(15)	-1.946
2	$\Delta X_t = a + \alpha X_{t-1} + u_t$	-3.512	7	0.220(15)	-2.910
3	$\Delta X_t = a + bt + \alpha X_{t-1} + u_t$	-3.573	7	0.213(15)	-3.486

(*) hypothesis of unit root is rejected at 10% level (of -1.618)

Table:1.10 **DF/ADF tests for lnTR**		DF/ADF	Lag(L)	Q prob.	5% critical value
1	$\Delta X_t = \alpha X_{t-1} + u_t$	-3.707(*)	3	0.179(16)	-1.945
2	$\Delta X_t = a + \alpha X_{t-1} + u_t$	-3.941(*)	3	0.186(16)	-2.907
3	$\Delta X_t = a + bt + \alpha X_{t-1} + u_t$	-3.921	3	0.180(16)	-3.481

(*) hypothesis of unit root is rejected at 1% level as well as at 5% level.

Table 2: VAR Lag Exclusion Wald Tests

Included observations: 66

Chi-squared test statistics for lag exclusion: Numbers in [ ] are p-values

	LNCONS	LNGDP	LNGOV	LNTAX	LNTR	Joint
Lag 1	15.41007	18.99278	412.0745	618.2803	205.5867	1313.077
	[0.008747]	[0.001928]	[0.000000]	[0.000000]	[0.000000]	[0.000000]
Lag 2	59.09445	62.85069	48.17328	29.76233	15.17275	211.7092
	[1.87E-11]	[3.13E-12]	[3.27E-09]	[1.64E-05]	[0.009649]	[0.000000]
df	5	5	5	5	5	25

Table 3: Cointegration Test

Included observations: 66 after adjusting endpoints

Trend assumption: Linear deterministic trend (restricted)

Unrestricted Cointegration Rank Test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.673773	131.4413	87.31	96.58
At most 1	0.361224	57.51061	62.99	70.05
At most 2	0.179777	27.92935	42.44	48.45
At most 3	0.153427	14.84956	25.32	30.45
At most 4	0.056760	3.856658	12.25	16.26

*(**) denotes rejection of the hypothesis at the 5%(1%) level

Trace test indicates 1 cointegrating equation(s) at both 5% and 1% levels

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.673773	73.93069	37.52	42.36
At most 1	0.361224	29.58126	31.46	36.65
At most 2	0.179777	13.07979	25.54	30.34
At most 3	0.153427	10.99290	18.96	23.65
At most 4	0.056760	3.856658	12.25	16.26

*(**) denotes rejection of the hypothesis at the 5%(1%) level

Max-eigenvalue test indicates 1 cointegrating equation(s) at both 5% and 1% levels

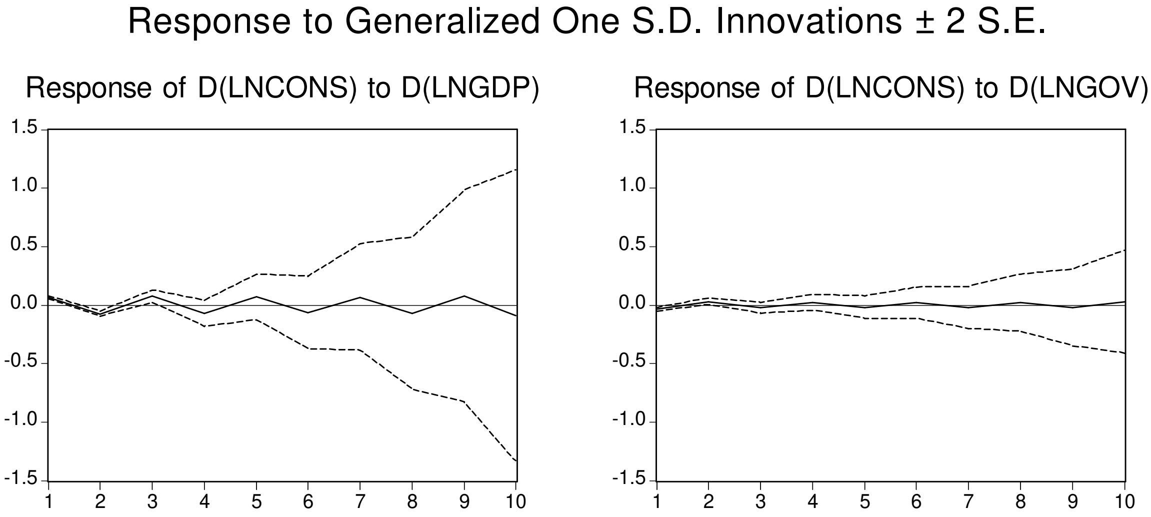
Table 4: VAR Lag Exclusion Wald Tests

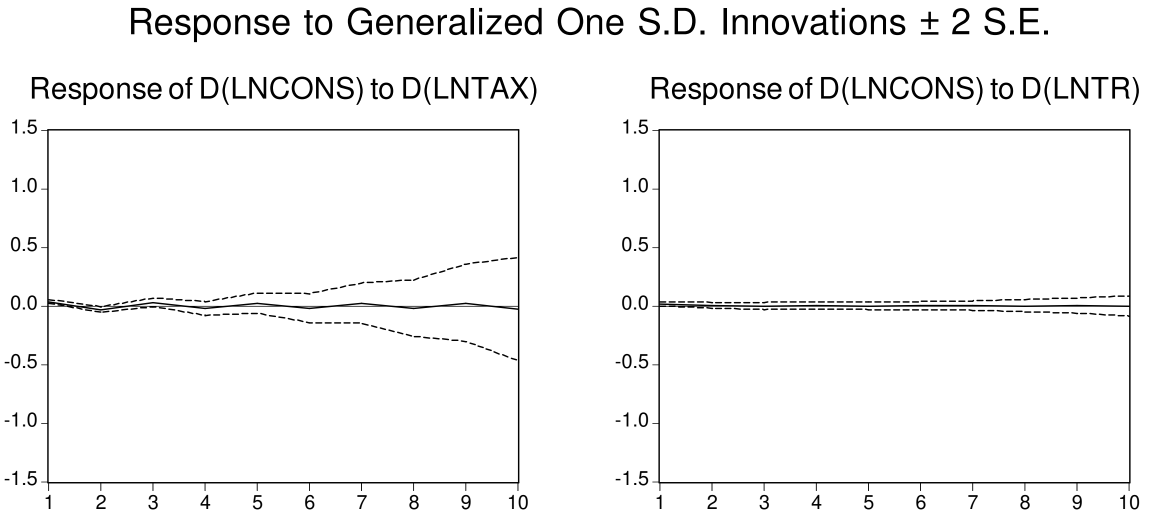
Included observations: 66

Chi-squared test statistics for lag exclusion: Numbers in [ ] are p-values

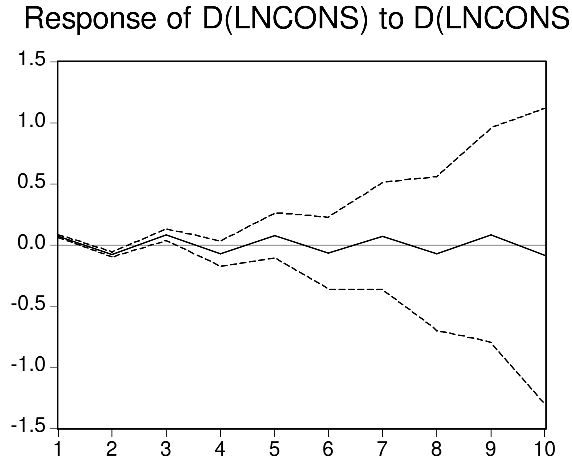
	D(LNCONS)	D(LNGDP)	D(LNGOV)	D(LNTAX)	D(LNTR)	Joint
Lag 1	273.5644	530.4394	215.9948	631.5357	172.3033	2055.760
	[0.000000]	[0.000000]	[0.000000]	[0.000000]	[0.000000]	[0.000000]
df	5	5	5	5	5	25

Figure 1: Responses of D(LCONS) to All Variables in VAR





Response to Generalized One S.D. Innovations ± 2 S.E.



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