# Random walk, excess smoothness or excess sensitivity? Evidence from literature and an application for Turkish economy

Bilgili, Faik

Erciyes University

02. June 2006

# Random Walk, Excess Smoothness or Excess Sensitivity?
# Evidence from Literature and an Application for Turkish Economy

Faik Bilgili
fbilgili@erciyes.edu.tr,
Erciyes University, Faculty of Economics and Administrative Sciences, 38039, Kayseri

**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

Faik Bilgili**,** Random Walk, Excess Smoothness or Excess Sensitivity? Evidence from Literature and an Application for Turkish Economy, TEA, International Conference on Economics, "Session: Consumption in Turkey" Ankara, Turkey, September 11, 2006.

1/20

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.

$$C_t = E_{t-1}[C_t] + e_t \tag{1}$$

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

$$C_t = C_{t-1} + e_t \tag{2}$$

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,

$$C_t = b_0 + b_1 C_{t-1} + b_2 C_{t-2} + b_3 C_{t-3} + b_4 C_{t-4} + e_t \tag{3}$$

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.

$$C_t = b_0 + b_1 C_{t-1} + b_2 Y_{t-1} + b_3 Y_{t-2} + b_4 Y_{t-3} + b_5 Y_{t-4} + e_t \tag{4}$$

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.

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

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

Faik Bilgili, Random Walk, Excess Smoothness or Excess Sensitivity? Evidence from Literature and an Application for Turkish Economy, TEA, International Conference on Economics, "Session: Consumption in Turkey" Ankara, Turkey, September 11, 2006.

2/20

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-λ) fraction of the consumers follows Equation (2) as suggested by Hall's random walk or Permanent Income Hypothesis.

$$\Delta C_t = \lambda(\Delta Y_t) + (1-\lambda)e_t \tag{7}$$

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-λ) 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

Faik Bilgili, Random Walk, Excess Smoothness or Excess Sensitivity? Evidence from Literature and an Application for Turkish Economy, TEA, International Conference on Economics, "Session: Consumption in Turkey" Ankara, Turkey, September 11, 2006.

3/20

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

Faik Bilgili, Random Walk, Excess Smoothness or Excess Sensitivity? Evidence from Literature and an Application for Turkish Economy, TEA, International Conference on Economics, "Session: Consumption in Turkey" Ankara, Turkey, September 11, 2006.

4/20

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; Jørgansen *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.

Faik Bilgili, Random Walk, Excess Smoothness or Excess Sensitivity? Evidence from Literature and an Application for Turkish Economy, TEA, International Conference on Economics, "Session: Consumption in Turkey" Ankara, Turkey, September 11, 2006.

6/20

**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

Faik Bilgili, Random Walk, Excess Smoothness or Excess Sensitivity? Evidence from Literature and an Application for Turkish Economy, TEA, International Conference on Economics, "Session: Consumption in Turkey" Ankara, Turkey, September 11, 2006.

7/20

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:**

$$LNCONS_t = a_0 + a_1 LNCONS_{t-1} + a_2 LNCONS_{t-2} + a_3 LNGDP_{t-1} + a_4 LNGDP_{t-2}$$
$$+ a_5 LNGOV_{t-1} + a_6 LNGOV_{t-2} + a_7 LNTAX_{t-1} + a_8 LNTAX_{t-2}$$
$$+ a_9 LNTR_{t-1} + a_{10} LNTR_{t-2} + a_{11} DS_t + a_{12} D94_t + a_{13} D01_t + e_{1,t} \tag{9}$$

$$LNGDP_t = b_0 + b_1 LNCONS_{t-1} + b_2 LNCONS_{t-2} + b_3 LNGDP_{t-1} + b_4 LNGDP_{t-2}$$
$$+ b_5 LNGOV_{t-1} + b_6 LNGOV_{t-2} + b_7 LNTAX_{t-1} + b_8 LNTAX_{t-2}$$
$$+ b_9 LNTR_{t-1} + b_{10} LNTR_{t-2} + b_{11} DS_t + b_{12} D94_t + b_{13} D01_t + e_{2,t} \tag{10}$$

$$LNGOV_t = c_0 + c_1 LNCONS_{t-1} + c_2 LNCONS_{t-2} + c_3 LNGDP_{t-1} + c_4 LNGDP_{t-2}$$
$$+ c_5 LNGOV_{t-1} + c_6 LNGOV_{t-2} + c_7 LNTAX_{t-1} + c_8 LNTAX_{t-2}$$

Faik Bilgili, Random Walk, Excess Smoothness or Excess Sensitivity? Evidence from Literature and an Application for Turkish Economy, TEA, International Conference on Economics, "Session: Consumption in Turkey" Ankara, Turkey, September 11, 2006.

8/20

$$+ c_9LNTR_{t-1} + c_{10}LNTR_{t-2} + c_{11}DS_t + c_{12}D94_t + c_{13}D01_t + e_{3,t} \qquad (11)$$

$$LNTAX_t = d_0 + d_1LNCONS_{t-1} + d_2LNCONS_{t-2} + d_3LNGDP_{t-1} + d_4LNGDP_{t-2}$$
$$+ d_5LNGOV_{t-1} + d_6LNGOV_{t-2} + d_7LNTAX_{t-1} + d_8LNTAX_{t-2}$$
$$+ d_9LNTR_{t-1} + d_{10}LNTR_{t-2} + d_{11}DS_t + d_{12}D94_t + d_{13}D01_t + e_{4,t} \qquad (12)$$

$$LNTR_t = g_0 + g_1LNCONS_{t-1} + g_2LNCONS_{t-2} + g_3LNGDP_{t-1} + g_4LNGDP_{t-2}$$
$$+ g_5LNGOV_{t-1} + g_6LNGOV_{t-2} + g_7LNTAX_{t-1} + g_8LNTAX_{t-2}$$
$$+ g_9LNTR_{t-1} + g_{10}LNTR_{t-2} + g_{11}DS_t + g_{12}D94_t + g_{13}D01_t + e_{5,t} \qquad (13)$$

**VAR in differences :**

$$\Delta(LNCONS)_t = h_0 + h_1\Delta(LNCONS)_{t-1} + h_2\Delta(LNGDP)_{t-1}$$
$$+ h_3\Delta(LNGOV)_{t-1} + h_4\Delta(LNTAX)_{t-1}$$
$$+ h_5\Delta(LNTR)_{t-1}$$
$$+ h_6DS_t + h_7D94_t + h_8D01_t + e_{6,t} \qquad (14)$$

$$\Delta(LNGDP)_t = j_0 + j_1\Delta(LNCONS)_{t-1} + j_2\Delta(LNGDP)_{t-1}$$
$$+ j_3\Delta(LNGOV)_{t-1} + j_4\Delta(LNTAX)_{t-1}$$
$$+ j_5\Delta(LNTR)_{t-1}$$
$$+ j_6DS_t + j_7D94_t + j_8D01_t + e_{7,t} \qquad (15)$$

$$\Delta(LNGOV)_t = k_0 + k_1\Delta(LNCONS)_{t-1} + k_2\Delta(LNGDP)_{t-1}$$
$$+ k_3\Delta(LNGOV)_{t-1} + k_4\Delta(LNTAX)_{t-1}$$
$$+ k_5\Delta(LNTR)_{t-1}$$
$$+ k_6DS_t + k_7D94_t + k_8D01_t + e_{8,t} \qquad (16)$$

$$\Delta(LNTAX)_t = m_0 + m_1\Delta(LNCONS)_{t-1} + m_2\Delta(LNGDP)_{t-1}$$
$$+ m_3\Delta(LNGOV)_{t-1} + m_4\Delta(LNTAX)_{t-1}$$
$$+ m_5\Delta(LNTR)_{t-1}$$
$$+ m_6DS_t + m_7D94_t + m_8D01_t + e_{9,t} \qquad (17)$$

$$\Delta(LNTR)_t = n_0 + n_1\Delta(LNCONS)_{t-1} + n_2\Delta(LNGDP)_{t-1}$$
$$+ n_3\Delta(LNGOV)_{t-1} + n_4\Delta(LNTAX)_{t-1}$$
$$+ n_5\Delta(LNTR)_{t-1}$$
$$+ n_6DS_t + n_7D94_t + n_8D01_t + e_{10,t} \qquad (18)$$

**Consumption equation to be tested:**

$$\Delta(LNCONS)_t = p_0 + p_1\Delta(LNGDP)_t + p_2\Delta(LNGOV)_t + p_3\Delta(LNTAX)_t +$$
$$+ p_4\Delta(LNTR)_t + p_5DS_t + e_{11,t} \qquad (19)$$

**Anticipated and unanticipated parts of (19):**

$$\Delta(LNCONS)_t = r_0 + \mathbf{r_1} [b_0 + b_1LNCONS_{t-1} + b_2LNCONS_{t-2} + \mathbf{(b_3\text{-}1)}LNGDP_{t-1}$$
$$+ b_4LNGDP_{t-2} + b_5LNGOV_{t-1} + b_6LNGOV_{t-2} + b_7LNTAX_{t-1}$$

Faik Bilgili, Random Walk, Excess Smoothness or Excess Sensitivity? Evidence from Literature and an Application for Turkish Economy, TEA, International Conference on Economics, "Session: Consumption in Turkey" Ankara, Turkey, September 11, 2006.

9/20

$$+ b_8 LNTAX_{t-2} + b_9 LNTR_{t-1} + b_{10} LNTR_{t-2}$$
$$+ b_{11} DS_t + b_{12} D94_t + b_{13} D01_t]$$

$$+ \mathbf{r_2} [c_0 + c_1 LNCONS_{t-1} + c_2 LNCONS_{t-2} + c_3 LNGDP_{t-1}$$
$$+ c_4 LNGDP_{t-2} + (\mathbf{c_5-1}) LNGOV_{t-1} + c_6 LNGOV_{t-2} + c_7 LNTAX_{t-1}$$
$$+ c_8 LNTAX_{t-2} + c_9 LNTR_{t-1} + c_{10} LNTR_{t-2}$$
$$+ c_{11} DS_t + c_{12} D94_t + c_{13} D01_t ]$$

$$+ \mathbf{r_3} [d_0 + d_1 LNCONS_{t-1} + d_2 LNCONS_{t-2} + d_3 LNGDP_{t-1}$$
$$+ d_4 LNGDP_{t-2} + d_5 LNGOV_{t-1} + d_6 LNGOV_{t-2} + (\mathbf{d_7-1}) LNTAX_{t-1}$$
$$+ d_8 LNTAX_{t-2} + d_9 LNTR_{t-1} + d_{10} LNTR_{t-2}$$
$$+ d_{11} DS_t + d_{12} D94_t + d_{13} D01_t ]$$

$$+ \mathbf{r_4} [g_0 + g_1 LNCONS_{t-1} + g_2 LNCONS_{t-2} + g_3 LNGDP_{t-1}$$
$$+ g_4 LNGDP_{t-2} + g_5 LNGOV_{t-1} + g_6 LNGOV_{t-2} + g_7 LNTAX_{t-1}$$
$$+ g_8 LNTAX_{t-2} + (\mathbf{g_9-1}) LNTR_{t-1} + g_{10} LNTR_{t-2}$$
$$+ g_{11} DS_t + g_{12} D94_t + g_{13} D01_t ]$$

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

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.

Faik Bilgili, Random Walk, Excess Smoothness or Excess Sensitivity? Evidence from Literature and an Application for Turkish Economy, TEA, International Conference on Economics, "Session: Consumption in Turkey" Ankara, Turkey, September 11, 2006.

10/20

**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

Faik Bilgili, Random Walk, Excess Smoothness or Excess Sensitivity? Evidence from Literature and an Application for Turkish Economy, TEA, International Conference on Economics, "Session: Consumption in Turkey" Ankara, Turkey, September 11, 2006.

11/20

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.

Faik Bilgili, Random Walk, Excess Smoothness or Excess Sensitivity? Evidence from Literature and an Application for Turkish Economy, TEA, International Conference on Economics, "Session: Consumption in Turkey" Ankara, Turkey, September 11, 2006.

12/20

## Unit Root Tests in Levels

| Table:1.1<br>**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<br>**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<br>**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)<br>0.145(15) | -3.481 |

| Table:1.4<br>**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<br>**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<br>**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<br>**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<br>**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)<br>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<br>**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<br>**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.

Faik Bilgili, Random Walk, Excess Smoothness or Excess Sensitivity? Evidence from Literature and an Application for Turkish Economy, TEA, International Conference on Economics, "Session: Consumption in Turkey" Ankara, Turkey, September 11, 2006.

14/20

## 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 |

Faik Bilgili, Random Walk, Excess Smoothness or Excess Sensitivity? Evidence from Literature and an Application for Turkish Economy, TEA, International Conference on Economics, "Session: Consumption in Turkey" Ankara, Turkey, September 11, 2006.

15/20

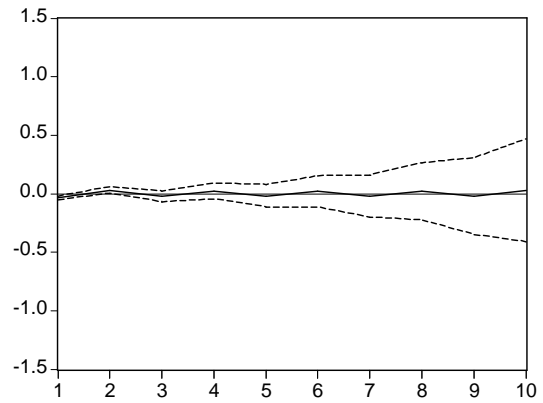# Figure 1: Responses of D(LCONS) to All Variables in VAR

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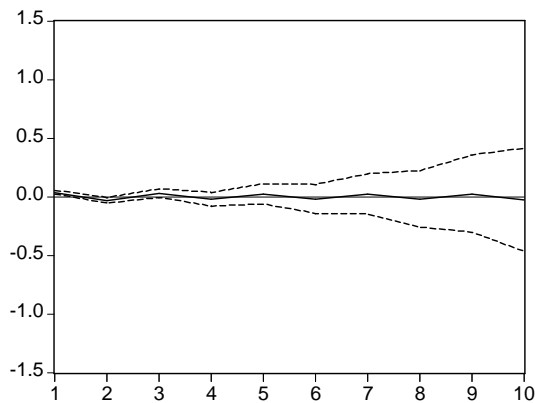


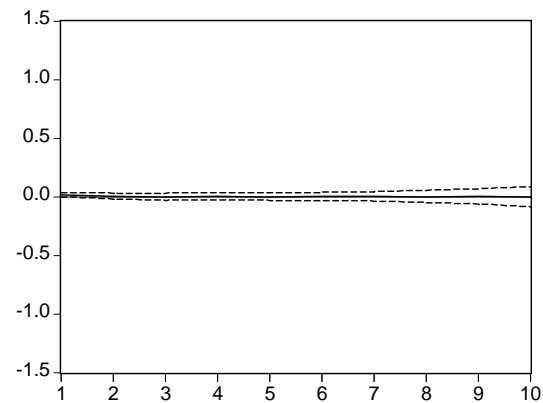Response of D(LNCONS) to D(LNGDP)
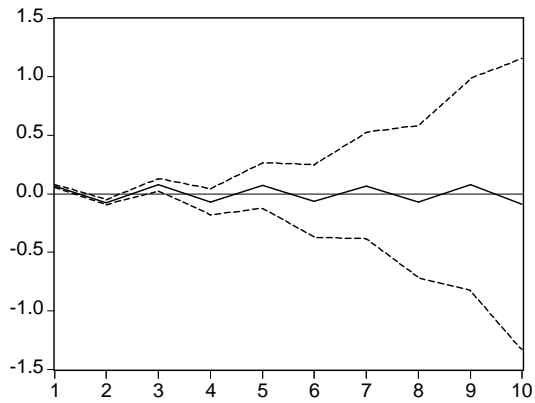
Response of D(LNCONS) to D(LNGOV)
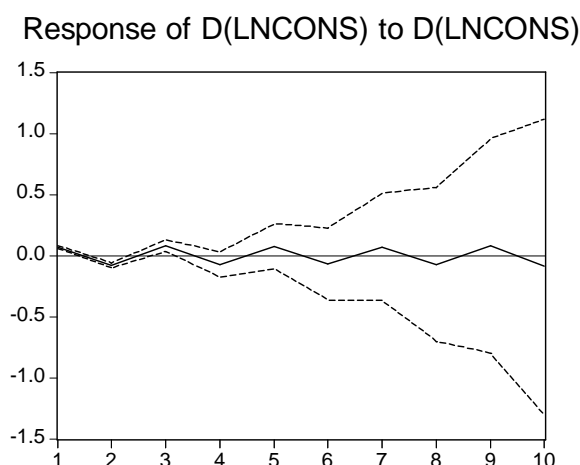
## Response to Generalized One S.D. Innovations ± 2 S.E.



Response of D(LNCONS) to D(LNTAX)

Response of D(LNCONS) to D(LNTR)

Faik Bilgili, Random Walk, Excess Smoothness or Excess Sensitivity? Evidence from Literature and an
Application for Turkish Economy, TEA, International Conference on Economics, "Session: Consumption in Turkey"
Ankara, Turkey, September 11, 2006.

16/20

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

### Response of D(LNCONS) to D(LNCONS)

**Bibliography**

Alessie, Rob and Annamaria Lusardi, "Saving and income smoothing: Evidence from panel data", **European Economic Review**, Volume 41, Issue 7, July 1997, Pages 1251-1279.

Antzoulatos, Angelos A.**,** "On the Excess Sensitivity of Consumption to Information about Income", **Journal of Macroeconomics**, Volume 19, Issue 3, July 1997, Pages 539-553.

Attfield, C. L. F., D. Demery and N. W. Duck**,** "Partial adjustment and the permanent income hypothesis", **European Economic Review**, Volume 36, Issue 6, August 1992, Pages 1205-1222.

Berument, Hakan and Richard Froyen, "Monetary Policy and U.S. Long-term Interest Rates: Is there and Excess Sensitivity Puzzle?", **Bilkent University and University of North Carolina**, January, 2006.

Bilgili, Faik, **"**Dynamic implications of fiscal policy: Crowding out or crowding in?", **METU-ERC, International Conference in Economics VII**, "F5 Fiscal Policy, Public and Private Expenditures" METU, September 8, 2003.

Bilgili, Faik, "Testing the Ricardian equivalence theorem in the framework of the permanent income hypothesis", **METU- ERC, International Conference in Economics I**, "F27 Macroeconometric Studies I" METU, September 19, 1997.

Bilgili, Faik, "The Unbiasedness and efficiency tests of the rational expectations hypothesis", **METU-ERC, International Conference in Economics V**, "F7 Adjustment Dynamics in Open Economies" METU, September 12, 2001.

Caballero, Ricardo J., "Consumption puzzles and precautionary savings", **Journal of Monetary Economics**, Volume 25, Issue 1, January 1990, Pages 113-136.

Faik Bilgili**,** Random Walk, Excess Smoothness or Excess Sensitivity? Evidence from Literature and an Application for Turkish Economy, TEA, International Conference on Economics, "Session: Consumption in Turkey" Ankara, Turkey, September 11, 2006.

17/20

Campbell, John Y. and Mankiw N. G., "Consumption, Income, and Interest Rates: Reinterpreting the Time Series Evidence", **NBER, Macroeconomics Annual** 1989, 185-216.

Chow, Gregory C. and Lihui Zheng, "Equity premium and consumption sensitivity when the consumer–investor allows for unfavorable circumstances", **Journal of Economic Dynamics and Control**, Volume 26, Issues 9-10, August 2002, Pages 1417-1429.

Doan, Thomas, **Rats User's Manual**, *4.0*, Estima, Evanston, IL, 1992.

Enders, Walter, **Applied Econometric Time Series**, John Wiley & Sons, Inc., 1995, Canada.

Evans, Paul and Georgios Karras, "Private and government consumption with liquidity constraints", **Journal of International Money and Finance**, Volume 15, Issue 2, April 1996, Pages 255-266.

Flavin, M., "The Adjustment of Consumption to Changing Expectations about Future Income", **Journal of Political Economy**, 89 (1981), Pages 974-1009.

Forni, Mario, "Consumption volatility and income persistence in the permanent income model", **Ricerche Economiche**, Volume 50, Issue 3, September 1996, Pages 223-234.

Gali, Jordi, "Finite horizons, life-cycle savings, and time-series evidence on consumption", **Journal of Monetary Economics**, Volume 26, Issue 3, December 1990, Pages 433-452.

Granger, C., "Developments in the Study of Cointegrated Economic Variables", (in) **Long-Run Economic Relationships**, ed. by R., F., Engle and C., W., J., Granger, 1991, Oxford University Press., U.S.

Hall, Robert, "Stochastic Implications of the Life Cycle-Permanent Income Hypothesis: Theory and Evidence", **Journal of Political Economy**, December 78, Vol. 86, Pages 971-987.

Ho, Tsung-wu, "The government spending and private consumption: a panel cointegration analysis", **International Review of Economics & Finance**, Volume 10, Issue 1, Winter 2001, Pages 95-108.

Issler, João Victor and Farshid Vahid, "Common cycles and the importance of transitory shocks to macroeconomic aggregates", **Journal of Monetary Economics**, Volume 47, Issue 3, June 2001, Pages 449-475.

Jappelli, Tullio and Luigi Pistaferri, "Using subjective income expectations to test for excess sensitivity of consumption to predicted income growth", **European Economic Review**, Volume 44, Issue 2, February 2000, Pages 337-358.

Johansen, S., **Statistical Analysis of Cointegration Vectors,** In Engle and Granger (eds), Long Run Economic Relationships. Readings in Cointegration, Oxford University Press, New York, 1992, Pages 131-152.

Jorgensen, Clara, Hans C. Kongsted and Anders Rahbek, "Trend-Stationarity in the I(2) Cointegration Model", **Institute of Economics, University of Copenhagen**, Vol. 26, 1996,

Faik Bilgili, Random Walk, Excess Smoothness or Excess Sensitivity? Evidence from Literature and an Application for Turkish Economy, TEA, International Conference on Economics, "Session: Consumption in Turkey" Ankara, Turkey, September 11, 2006.

18/20

Köse, Nezir ve Nuri Uçar, "Durağan Vektör Otoregresif Süreçlerde Gecikme Uzunluğunu Belirleyen Kriterlerin Karşılaştırılması: Hata Terimleri Arasındaki Çapraz Korelasyon Derecesi ve Parametre Matrisi Özdeğerlerinin Sıfıra Yakınlığının Etkileri", **IV. Ulusal Ekonometri ve İstatistik Sempozyumu Bildirileri**, Antalya, 1999, Pages 619-632.

Ludvigson, Sydney C. and Alexander Michalides, "Does Buffer- Stock Explain the Smoothness and Excess sensitivity of Consumption?", **The American Economic Review**, June 2001, Pages 631-647.

Madsen, Jakob B. and Michael McAleer, "Direct tests of the permanent income hypothesis under uncertainty, inflationary expectations and liquidity constraints", **Journal of Macroeconomics**, Volume 22, Issue 2, Spring 2000, Pages 229-252.

Mankiw, N. Gregory and Matthew D. Shapiro, "Trends, random walks, and tests of the permanent income hypothesis", **Journal of Monetary Economics**, Volume 16, Issue 2, September 1985, Pages 165-174.

Michener, Ron**,** "Permanent income in general equilibrium", **Journal of Monetary Economics**, Volume 13, Issue 3, May 1984, Pages 297-305.

Muellbauer, John J., "Consumer Expenditure", In Tim Jeckinson (ed.), **Readings in Macroeconomics**, Oxford University Press, Pages 92-126.

Musila, Jacob Wanjala, "An econometric model of the Malawian economy", **Economic Modelling**, Volume 19, Issue 2, March 2002, Pages 295-330.

Peel, David and James Davidson, "A non-linear error correction mechanism based on the bilinear model", **Economics Letters**, Volume 58, Issue 2, 1 February 1998, Pages 165-170.

Perez, Stephen J., "Myopia, liquidity constraints, and aggregate consumption: what do the data say?", **Economics Letters**, Volume 67, Issue 1, April 2000, Pages 43-48.

Pesaran, M. Hashem and Shin Y., "Generalized Impulse Response Analysis in Linear Multivariate Models", **Economic Letters**, Vol. 58, January 1998, Pages 17-29.

Pesaran, M. Hashem, "Aggregation of linear dynamic models: an application to life-cycle consumption models under habit formation", **Economic Modelling**, Volume 20, Issue 2, March 2003, Pages 383-415.

Phillips, Peter C.B., "Impulse response and forecast error variance asymptotics in nonstationary VARs,", **Journal of Econometrics**, Volume 83, Issues 1-2, March-April 1998, Pages 21-56.

Pistoresi, Barbara, "Using a VECM to characterize the relative importance of permanent and transitory components of U.S. total disposable income and total consumption", **Research in Economics**, Volume 51, Issue 2, June 1997, Pages 131-155.

Faik Bilgili**,** Random Walk, Excess Smoothness or Excess Sensitivity? Evidence from Literature and an Application for Turkish Economy, TEA, International Conference on Economics, "Session: Consumption in Turkey" Ankara, Turkey, September 11, 2006.

19/20

Ploeg, Frederick van der, "Temporal risk aversion, intertemporal substitution and Keynesian propensities to consume", **Economics Letters**, Volume 39, Issue 4, August 1992, Pages 479-484.

Romer, David, **Advanced Macroeconomics**, The McGraw-Hill, New York, 1996.

Seater, John J. and Roberto S. Mariano, "New Tests of the Life Cycle and Tax Discounting Hypothesis", **Journal of Monetary Economics**, March 1985, Pages 195-215.

Shimizutani, Satoshi, "Consumer response to the 1998 tax cut: Is a temporary tax cut effective?", **Journal of the Japanese and International Economies**, Volume 20, Issue 2, June 2006, Pages 269-287.

Sims, Cristopher, "Macroeconomics and Reality", **Econometrica,** Volume 48, January 1980, Pages 1-49.

Souleles, Nicholas S., "Consumer response to the Reagan tax cuts", **Journal of Public Economics**, Volume 85, Issue 1, July 2002, Pages 99-120.

Vinod, H. D. and Parantap Basu, "Forecasting consumption, income and real interest rates from alternative state space models", **International Journal of Forecasting**, Volume 11, Issue 2, June 1995, Pages 217-231.

Faik Bilgili**,** Random Walk, Excess Smoothness or Excess Sensitivity? Evidence from Literature and an Application for Turkish Economy, TEA, International Conference on Economics, "Session: Consumption in Turkey" Ankara, Turkey, September 11, 2006.

20/20