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An Intertemporal Benchmark Model for Turkey's Current Account

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Abstract

In this paper, we analyze the Turkish current account between 1992 and 2004 within an intertemporal benchmark model. Increasingly larger current account deficits in the Turkish economy have caused a great level of discussion of the current account but it has mainly focused on the real exchange rate and short-term international competitiveness. However, changes in the fundamentals of the Turkish economy warrant a longer term approach in the analysis. This paper computes the optimal consumption smoothing current account using the intertemporal benchmark model (IBM) and tests for intertemporal solvency of the current account. We find consumption tilting dynamics are in effect. As expected of borrowing developing countries, Turkey tilts consumption to the present. We find support for one of the implications of the IBM, that the current account Granger-causes future changes in national cash flow as implied by the intertemporal benchmark model. However, we also find that the actual consumption smoothing current account is considerably more volatile than the optimal consumption smoothing current account suggesting that speculative forces have driven capital movements during the sample period. From the trends in data and the model and testable implications we believe that although Turkey breached the intertemporal solvency condition in the 1990s, this is not true for Turkey in the period following the 2001 crisis. Therefore, we conclude that changed fundamentals in Turkey have made the high current account deficits sustainable.

Keywords: Current account sustainability, intertemporal benchmark model, Turkey
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I. INTRODUCTION

Although Turkey has suffered from current account deficits earlier, the last two years have seen ever increasing current account deficits. These large deficits have caused a great level of discussion of the current account which has mainly focused on the real exchange rate and short-term international competitiveness. However, changes in the fundamentals of the Turkish economy warrant a longer term approach in the analysis. This paper addresses this issue by computing Turkey's optimal consumption smoothing current account for the sample period using an intertemporal benchmark model (IBM) and tests for solvency of the current account.

High levels of current account deficits which become unsustainable could precipitate a sudden reversal in capital flows or might necessitate adjustments in interest rates or exchange rates. This was seen in Mexico prior to the 1994 peso crisis and occurred in countries in East Asia prior to the East Asian financial crisis. In previous periods when the current account deficit increased significantly, Turkey suffered a crisis as was seen in 1994 and 2001. The deficits today are higher than those experienced prior to the crises. Since Turkey has not witnessed a crisis this might indicate that even though the deficit is very high, it may still be sustainable. We examine this issue of sustainability in the paper.

Our analysis of current account sustainability in Turkey is based on the intertemporal benchmark (IBM) model used by Ghosh and Ostry (1995).[1] This model which builds on the work done by Sachs (1982), Campbell and Shiller (1987) determines current account sustainability based on intertemporal solvency. The intertemporal approach to assessing current account sustainability allows us to compute the optimal or benchmark current account and compare the actual with the optimal current account. If the actual current account deficit is *significantly* higher than the optimal it sheds light on the unsustainability of the current account deficit.

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[1] There have been other models to determine current account deficit sustainability. Hudson and Stennett (2003) highlight that the GS-SCAD model and Deutsche Bank model also shed light on current account deficit sustainability. We focus on the intertemporal approach only.

Ghosh (1995) tested the IBM for 5 developed countries including the Canada, Germany, Japan, UK and US and concluded that the model is able to characterize the direction of the current account well for the countries in the sample. Ghosh and Ostry (1995) analyzed the IBM for developing countries. Evidence from 45 countries in their paper shows support for the IBM for developing countries as well. The IBM has also been used by others to assess current account sustainability in individual countries. Using the IBM, Hudson and Stennett (2003) conclude that the current account did not breach the solvency condition for Jamaica. Adedeji (2001) uses both the model and examines macroeconomic indicators from 1960 to 1997 to conclude that Nigeria's current account was unsustainable during that time. We add to this literature by analyzing the current account sustainability of Turkey. To our knowledge, this is the first time that the intertemporal approach has been used to model the Turkish current account. From the model and testable implications we conclude that although Turkey breached the intertemporal solvency condition in the 1990s, this is not true for Turkey in the period following the 2001 crisis.

The paper is organized as follows: the following section provides background on the Turkish current account. Section III provides the analytical framework for the intertemporal approach to studying the current account. This is followed by the empirical analysis in section IV. Section V summarizes and concludes.

II. BACKGROUND

In this section we discuss Turkey's current account and components. The Turkish current account is highly volatile with a strong seasonal component. In figures 1 and 2 we have graphed the current account and its components for Turkey using quarterly data from 1992 to 2005. Figure 1 maps Turkey's current account balance and the trade balance[2] in that period and figure 2 shows the trend in net investment income and unilateral transfers.

2 For the graphs we have combined the balance of trade of goods and services.

The seasonal component of both the current account and the trade balance is apparent from figure 1. It is also evident that deficit periods outweigh surpluses. The graph reveals the high current account and trade deficits facing Turkey prior to the crises of 1994 and 2001. The crises periods (1994 and 2001) which resulted in capital outflows led to current account surpluses which are visible from the graph. We also observe a current account surplus in 1998 which may be a contagion effect related to the East Asian financial crisis and the Russian ruble crisis.

The current account and trade deficit increased significantly in 1993 and again in 2000 (period prior to the crises). The annual current account deficits in these periods were approximately $ 6.4 billion and $ 9.8 billion while the annual trade deficits exceeded the current account deficits at $ 7.3 billion and $ 10.6 billion for 1993 and 2000 respectively. From the graph it is obvious that the trade balance mimics the current account balance and indicates that the trade balance is the most important component and the driving force of the current account balance.

It is noteworthy to mention that even though deficits (both current account deficit and trade deficit) prior to the crises were high, they were not nearly as high as the deficits in 2004 and have continued to increase in 2005. Since Turkey did not suffer a financial crisis in 2005 despite an annual current account deficit of over $ 15 billion, it may be indicative of changed fundamentals in Turkey which can sustain such a high deficit. We explore this issue in the paper.

What is particularly interesting about the trend in figure 1 is that the trade deficit was either equal to the current account deficit or exceeded it prior to 2001. Also, in surplus periods, we can see that the trade surplus was lower than the current account surplus. Since 2001 we are seeing a reversal of this trend. Trade surpluses now exceed the current account surplus and the trade deficit is lower than the current account deficit. This indicates a changing impact of the different components of the current account. Figure 2 graphs the other components of the current account namely investment income and unilateral transfer accounts.

As seen from figure 2, net investment income for Turkey is consistently negative. This means that the returns on investment received by Turkish residents from their investments abroad are lower than those earned by foreigners for their investment in Turkey. Not only is net investment income negative, but it is also increasingly negative over the period under study. Since 2000, Turkey's net investment income has been declining from approximately $ – 4 billion to $ – 5.6 billion. This component is a major contributor to the current account deficit. Net investment income sheds light on the profitability of investment in Turkey. While higher returns are leaving the country for foreign investors, the returns are being earned due to investment in Turkey. Higher returns indicate profitability and competitiveness of a country, which has implications for the future potential of Turkey.

The only component which has been consistently positive in Turkey for the entire period is the unilateral transfers account. While the account appears to be declining, this is not due change in the economy, but rather due to a change in accounting. Remittances that were earlier counted in this account are now no longer a part of it.

From the two graphs we see a worsening position for all components[3] and therefore the current account in Turkey from 1992 to 2005. This raises concerns about the sustainability of the current account. Conventional wisdom suggests that a current account deficit to GDP ratio of 4 – 5% or higher implies that the current account is unsustainable. Figure 3 maps the current account to GDP ratio for Turkey. As can be seen from the graph, Turkey breached this threshold prior to both previous crises.[4] Figure 3 reveals that this ratio is worsening from 2003 onwards. At the current rate of over 5%, Turkey should be suffering from a financial crisis. However, as Hudson and Stennett (2003) show Ireland, Australia and Israel had current account deficits that were above this threshold for several years. In fact, the US has been experiencing current account

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[3] As mentioned earlier, the change in unilateral transfers may be due to a change in accounting, rather than changed fundamentals.

[4] Turkey also crossed this threshold in 1995. Turkey was recovering from its crisis in 1995 and this would have been a setback. However, Turkey was able to withstand this problem.

deficits of these levels for a few years. All these countries are in a far more stable economic climate than Turkey and therefore even though they have high current account deficits and are not facing crises, it is insufficient to conclude that Turkey will not suffer a crisis. Nevertheless, the evidence of other countries does cast doubt on the arbitrary threshold to determine current account sustainability.

In addition, this definition of sustainability does not shed light on the future potential of a country. If Turkey can repay current deficits by generating trade surpluses in the future, then the high current account deficit is not problematic. There is reason to be hopeful in Turkey. Earlier we noted that net investment income (one of the components of the current account) is negative for the entire period. This implies that the returns on investment in Turkey owned by foreigners are greater than returns earned by Turkish residents from their investments abroad. Essentially this means that investment in Turkey is profitable, which indicates the potential for future growth.

In our paper we use an intertemporal model to address the issue of Turkey's current account sustainability. The following section discusses the analytical framework of the intertemporal approach to current account modeling.

III. INTERTEMPORAL MODEL OF CURRENT ACCOUNT SUSTAINABILITY

The Theoretical Model

We use the intertemporal model of current account determination by Ghosh and Ostry (1995). According to this framework when national cash flow increases there will be a current account deficit where national cash flow is computed as the difference between GDP and investment and government spending $(q_t - i_t - g_t)$. Ghosh and Ostry (1995) argue that a country is more likely to borrow if they are growing.

The model assumes a small open economy that has a single infinitely lived representative agent. The agent's utility function is given by

$$\sum_{t=0}^{\infty} \beta^t \, \mathrm{E}[u(c_t)] \tag{1}$$

where β is the discount rate $[0 < \beta < 1]$, u is the utility function $[u'(c_t) > 0 \text{ and } u''(c_t) < 0]$, and c is consumption of a single traded good. Utility is maximized subject to a dynamic budget constraint given by

$$b_{t+1} = (1+r)b_t + q_t - c_t - i_t - g_t \tag{2}$$

where b is the level of foreign bonds held by the economy, r is the world rate of interest, q_t is GDP, i_t is the level of investment, and g_t is government expenditure.

The current account balance is given by

$$ca_t = b_{t+1} - b_t \tag{3}$$

Assuming a no-Ponzi game and the first order conditions with the dynamic budget constraint, the optimal consumption function is given by

$$c_t^* = \frac{r}{\theta}\left\{ b_t + \frac{1}{1+r} E_t \left[\sum_{j=0}^{\infty} \frac{1}{(1+r)^j} \Delta\left(q_{t+j} - i_{t+j} - g_{t+j}\right) \right] \right\} \tag{4}$$

where c_t^* is the optimal path of consumption and θ is the proportion that reflects consumption tilting which is given by the relation between rate of interest (r) and the rate of time preference (β).[5] If $\theta < 1$, then the country is consuming more than the national cash flow which means the country is tilting consumption to the present. If $\theta > 1$ then the country is consuming less than the national cash flow which implies that the country is tilting consumption to the future. If $\theta = 1$ then consumption equals the national cash flow. There is no consumption tilting in this case.

From optimal consumption c_t^* we can compute the optimal consumption smoothing current account ca_t^* as follows

$$ca_t^* = y_t - i_t - g_t - \theta c_t^* \tag{5}$$

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[5] For example, if we assume a quadratic utility function, $\theta = \beta r(1+r) / [\beta(1+r)^2 - 1]$.

where $y_t = q_t + r b_t$

If output rises relative to its permanent value, then there is a current account surplus implying that the country is lending. If output falls below its permanent value, there is a deficit reflecting borrowing. This is consumption smoothing behavior.

Ghosh (1995) argues that the focus on the consumption-smoothing current account[6] is valid for two reasons. Firstly, it is simpler to model borrowing or lending behavior for consumption smoothing rather than consumption tilting. Also, consumption smoothing is a stationary series which implies that standard econometric techniques may be used.

Combining equations (4) and (5) we get the optimal consumption smoothing current account

$$ca_t^* = -\sum_{j=1}^{\infty} \frac{1}{(1+r)^j} \left[\mathrm{E}_t \, \Delta \left(q_{t+j} - i_{t+j} - g_{t+j} \right) \right] \qquad (6)$$

where Δ is the backward difference operator such that $\Delta x_t = x_t - x_{t-1}$.

From equation (6) the optimal consumption smoothing current account is related to the present discounted value of the expected changes in the national cash flow. The focus here is on transitory shocks, because a permanent shock to national cash flow has no impact as the expected change is zero.

Econometric methodology

Our focus is on consumption smoothing current account. This means we need to eliminate the consumption tilting component from the current account. Consumption tilting as discussed earlier is given by the parameter θ which is related to the rate of interest and the discount rate. In addition, the optimal consumption smoothing current account requires the estimation of the present value of the expected changes in the national cash flow. Practically, the computation of the optimal consumption smoothing current account however does not require such an estimation

[6] As opposed to the current account which includes consumption tilting

because the information necessary is already reflected in the current account. This is based on Campbell and Shiller's (1987) work on savings and income.

We estimate unrestricted bivariate vector auto regression (VAR) of changes in national cash flow and the actual consumption smoothing current account given by the following

$$\begin{bmatrix} \Delta z_t \\ ca_t \end{bmatrix} = \begin{bmatrix} a(L) & b(L) \\ c(L) & d(L) \end{bmatrix} \begin{bmatrix} \Delta z_{t-1} \\ ca_{t-1} \end{bmatrix} + \begin{bmatrix} u_{1t} \\ u_{2t} \end{bmatrix} \tag{7}$$

where $\Delta z_t = \Delta(q_t - i_t - g_t)$ is the change in national cash flow, ca_t is the actual consumption smoothing current account which equals $y_t - i_t - g_t - \theta c_t$ (analogous to equation (5) of the optimal current account), $a(L), b(L), c(L)$ and $d(L)$ are polynomials in the lag operator of order *p*, and u_{1t} and u_{2t} are errors with a conditional mean of zero.

The VAR can be rewritten as follows

$$\begin{bmatrix} \Delta z_t \\ \vdots \\ \vdots \\ \Delta z_{t-p+1} \\ ca_t \\ \vdots \\ \vdots \\ ca_{t-p+1} \end{bmatrix} = \begin{bmatrix} a_1 \cdots a_p \; b_1 \cdots b_p \\ 1 \;\; 0 \;\; \cdots\cdots \;\; 0 \\ 0 \;\; 1 \;\; 0 \;\; \cdots\cdots 0 \\ \vdots \;\; 0 \;\; \ddots \; 0 \;\; \vdots \\ c_1 \cdots c_p \; d_1 \cdots d_p \\ 0 \cdots\cdots 0 \; 1 \;\; 0 \cdots \; 0 \\ 0 \;\cdots\cdots \;\; 0 \;\; 1 \cdots 0 \\ \vdots \;\; 0 \;\; \ddots \; 0 \;\; \vdots \end{bmatrix} \begin{bmatrix} \Delta z_{t-1} \\ \vdots \\ \vdots \\ \Delta z_{t-p} \\ ca_{t-1} \\ \vdots \\ \vdots \\ ca_{t-p} \end{bmatrix} + \begin{bmatrix} u_{1t} \\ 0 \\ \vdots \\ \vdots \\ u_{2t} \\ 0 \\ \vdots \\ \vdots \end{bmatrix} \tag{8}$$

Equation (8) can be written compactly as $X_t = \Psi X_{t-1} + v_t$

where $X_t = \begin{bmatrix} \Delta z_t \\ \vdots \\ \vdots \\ \Delta z_{t-p+1} \\ ca_t \\ \vdots \\ \vdots \\ ca_{t-p+1} \end{bmatrix}$, $\psi = \begin{bmatrix} a_1 \cdots a_p \; b_1 \cdots b_p \\ 1 \;\; 0 \;\; \cdots\cdots \;\; 0 \\ 0 \;\; 1 \;\; 0 \;\; \cdots\cdots 0 \\ \vdots \;\; 0 \;\; \ddots \; 0 \;\; \vdots \\ c_1 \cdots c_p \; d_1 \cdots d_p \\ 0 \cdots\cdots 0 \; 1 \;\; 0 \cdots \; 0 \\ 0 \;\cdots\cdots \;\; 0 \;\; 1 \cdots 0 \\ \vdots \;\; 0 \;\; \ddots \; 0 \;\; \vdots \end{bmatrix}$ and $v_t = \begin{bmatrix} u_{1t} \\ 0 \\ \vdots \\ \vdots \\ u_{2t} \\ 0 \\ \vdots \\ \vdots \end{bmatrix}$

The k-step ahead expectation is therefore given as

$$\mathrm{E}_t\left[X_{t+k}\right]=\Psi^k X_t \tag{9}$$

Thus, $\mathrm{E}_t\left(\Delta z_{t+k}\right)=\begin{bmatrix}1 & 0 & \cdots & 0\end{bmatrix}\Psi^k X_t$ (10)

Combining equation (10) with equation (6) we can compute the optimal consumption smoothing current account as

$$\begin{aligned} ca_t^* &= -\sum_{j=1}^{\infty}\frac{1}{(1+r)^j}\begin{bmatrix}1 & 0 & \cdots & 0\end{bmatrix}\Psi^j X_t \\ &= -\begin{bmatrix}1 & 0 & \cdots & 0\end{bmatrix}\left(\Psi/1+r\right)\sum_{j=0}^{\infty}\frac{1}{(1+r)^j}\ \Psi^j X_t \\ &= -\begin{bmatrix}1 & 0 & \cdots & 0\end{bmatrix}\left[\Psi/(1+r)\right]\left[I-\Psi/(1+r)\right]^{-1} X_t \equiv \Gamma X_t \end{aligned} \tag{11}$$

The coefficients from the VAR will allow us to compute the optimal consumption smoothing current account. The optimal consumption smoothing current account equation given in equation (11) is valid if the infinite sum converges, which is dependent on stationarity of the variables in the VAR. The unit root tests to show evidence of stationarity of these variables will be presented in the following section.

There are a few testable implications of this model noted in Ghosh and Ostry (1995), Adedeji (2001) and others which we conduct as well. The first implication of the model is that the current account Granger-causes subsequent movements in national cash flow. As shown in Campbell (1987), an implication of the permanent income hypothesis is that savings increase when income declines and vice versa. In this context, there is a current account surplus when net output is expected to decline and a current account deficit when net output is expected to increase.

The second implication of the IBM is that the actual consumption smoothing current account ca_t will be equal to the optimal consumption smoothing current account ca_t^*. From equation (11), we note that the optimal consumption smoothing current account can be denoted as follows

$$ca_t^* = [\Gamma_{\Delta z} \quad \Gamma_{ca}]\begin{bmatrix}\Delta z_t \\ \vdots \\ \Delta z_{t-p} \\ ca_t \\ \vdots \\ ca_{t-p}\end{bmatrix} \tag{12}$$

The coefficients of $\Gamma_{\Delta z}$ and Γ_{ca} (which are both *1 x p* vectors) are computed using the VAR estimates as well as the world rate of interest according to the methodology described in equation (11). The implication of the model for a higher order VAR as noted in Ghosh (1995) is that the coefficients of national cash flow are zero, the coefficient of the contemporaneous current account is unity and the coefficients of the lagged current account are zero. Therefore, equation (12) can be rewritten as

$$ca_t^* = [0 \cdots 0 \quad 1\, 0 \cdots 0]\begin{bmatrix}\Delta z_t \\ \vdots \\ \Delta z_{t-p} \\ ca_t \\ \vdots \\ ca_{t-p}\end{bmatrix} \tag{13}$$

Equality of the actual and optimal consumption smoothing current account can also be visually depicted by graphing the two series. Both the visual and statistical tests of equality of the two accounts are discussed in the next section.

The third implication of the model is the equality of the variance of the actual and the optimal consumption smoothing current account. This can be tested with an F-test of equality of variance between the two series. Results of this test will be presented and discussed in the following section.

All these implications rest on the estimation of the VAR for the change in national cash flow, $\Delta(q_t - i_t - g_t)$ and the actual consumption smoothing current account, $ca_t = y_t - i_t - g_t - \theta c_t$. The compute the latter, we require the consumption tilting parameter, θ. From the equation of the actual consumption smoothing current account, if the national cash flow inclusive of interest payments, $(y_t - i_t - g_t)$ and consumption c_t are I(1) processes and both are stationary in first differences and a cointegrating vector exists, then the consumption tilting parameter θ can be computed as the cointegrating vector between the two series (in levels). In the following section we test for stationarity and cointegration and provide results for θ.

IV. DATA AND RESULTS

Data

For the IBM we require the real world rate of interest and national cash flow and consumption data for Turkey. The world rate of interest (r_t) is computed by using 10-year US treasury nominal bond yields and converting them to real rates by inflation rates from US CPI. Data for the world rate of interest are available from the Bureau of Labor Statistics website.

National cash flow is made up of three components $(y_t - i_t - g_t)$. The first component y_t includes GDP (q_t) and net investment income $(r b_t)$. We do not need to compute net investment income as it is one of the components of the current account for which data is available directly. The other two components of national cash flow are investment (i_t) and government expenditure (g_t). In addition, we require consumption (c_t). Data for all these series are available from the Central Bank of Turkey website. All data is in constant Turkish liras.

We use quarterly data from 1992 to 2004. Our choice for the period is restricted to data availability. While annual data was available for a longer period, we wanted to focus on the current state of the Turkish economy. Therefore, we opted for quarterly data for a shorter period. All data for the econometric analysis is seasonally adjusted.

Tests of IBM for Turkey

The first task in modeling the optimal consumption smoothing current account for Turkey is to compute the actual consumption smoothing current account which requires the determination of the consumption tilting parameter θ. As noted in the previous section, θ can be computed as the cointegrating vector between the national cash flow inclusive of interest payments, $(y_t - i_t - g_t)$ and consumption, c_t assuming both are I(I) and a relation exists between them such that the residuals are stationary. Using the Augmented Dickey Fuller (ADF) test statistics on unit root tests for the two variables we find that both are I(1) as shown in table I. Following Ghosh (1995) we test for cointegration by using the Cointegrating Regression Dickey-Fuller (CRDF) test and the Cointegrating Regression Durbin Watson (CRDW) test. The first test requires the residuals be stationary which we find, also reported in table I. For the CRDW test we compute the DW statistic on the cointegrating relation and compare it to the critical value. If the DW statistic is greater than the critical we reject the null that there is no cointegration. We get DW = 1.94 which is higher than the critical of 0.38 (for a sample of 100)[7]. Thus, through both tests we reject the null of no cointegration and can compute θ as a cointegrating vector between national cash flow inclusive of interest payments and consumption.

The consumption tilting parameter for Turkey is estimated to be 0.93 with a long run standard error of 0.01. (See table II for details). Using this information, we can test if θ is different from unity. We conclude that the consumption tilting parameter is different from unity at 1% level of significance. This result is consistent with other work done on developing countries. Ghosh and Ostry (1996) find that most developing countries move consumption to the present. Out of 45 developing counties in their sample, 35 countries displayed consumption tilting from the future to the present. Their sample did not include Turkey. The following 13 countries in their sample produced a consumption tilting parameter in the range from 0.90 and 0.98: Ghana, Tunisia, India, Malaysia, Philippines, Thailand, Argentina, Brazil, Colombia, Guatemala, Mexico, Peru, and

[7] Although are sample is less than 100, given the high DW statistic, we can conclude that we will reject the null of no cointegration.

Uruguay. One can characterize these economies as emerging markets and we would expect to find Turkey's consumption tilting parameter to be close to these countries.

The next step is to estimate the optimal consumption smoothing current account for which we need to estimate the VAR of national cash flow, $\Delta(q_t - i_t - g_t)$ and consumption smoothing current account ca_t (which is computed using θ). To use standard econometric techniques we require stationarity of the two variables in the VAR. The unit root test results (also reported in table I) indicate that $\Delta(q_t - i_t - g_t)$ and ca_t are I(0) at 1% level of significance which means that they are both stationary variables.

From the estimation of the VAR of the national cash flow and actual consumption smoothing current account in equation (7) we can compute the optimal consumption smoothing current account. We use the θ above, to compute the actual consumption smoothing current account. Our next task is to determine the appropriate lag length, for which we use the Likelihood Ratio (LR) test. Two VARs with different lag lengths are estimated. The log likelihood ratio times $t-k$ is computed which has a χ^2 distribution with $n^2(p_1 - p_0)$ degrees of freedom, where t is the sample size, n is the number of variables in the system, p_1 and p_0 are lags in the two VARs $(p_0 < p_1)$ and k is the number of parameters estimated per equation given by np_1. If the computed χ^2 value is greater than the critical χ^2 value then the null hypothesis of p_0 being the appropriate number of lags is rejected in favor of the larger lag length. Our test shows that the appropriate lag length is five. For details, please see table III.[8]

As noted earlier, an implication of the IBM is that the current account should Granger-cause future changes in national cash flow. For this we use the F-statistics from the VAR results given in tables IV and V for the dependent variables, Δz_t and ca_t respectively. From table IV, the F-

[8] The table reports results for two cases, five lags compared with four and five lags compared with six. Tests were also conducted (not reported) comparing five lags with less than four lags and five lags with more than six lags and five lags was determined to be the appropriate lag length.

statistic for (ca_t) is 2.4443 and this variable is statistically significant at 10%. Therefore, we conclude that the current account Granger-causes future movements in national cash flow. We also test if national cash flow Granger-causes the current account. The F-statistic from table V is 0.5792 which implies that national cash flow is statistically not significant for future movements in the current account. Our result supports the first implication of the IBM that the current account Granger-causes future changes in the national cash flow.

From the VAR results reported in tables IV and V we can compute the optimal consumption smoothing current account series. Our estimated coefficients using the average world rate of interest in our sample are reported in table VI. To do a sensitivity analysis, we compare these coefficients to those computed over a range of rates of interest which are reported in table VI as well. The results suggest that the coefficients are robust because they do not change significantly when we compute them using higher and lower rates of interest.

Computation of the optimal current account allows us to test the second implication of the IBM of equality between the actual and the optimal consumption smoothing current account. We map the relation between actual and optimal consumption smoothing current accounts in figure (4). The graph shows that the actual consumption smoothing current account deficit exceeds the optimal consumption smoothing current account deficit. Visually, it does not seem that there is equality in the two accounts.

The formal test of equality of the two accounts for a higher order VAR are that the coefficient of the contemporaneous current account is unity and all other coefficients (for both the current account and the national cash flow) are zero. This places restrictions on the Γ matrix, implied in equation (11) and explained in equation (13) for the general case. Equation (13) can be rewritten for our VAR with five lags as follows

$$\Gamma = [\Gamma_{\Delta z} \quad \Gamma_{ca}] = [00000 \quad 10000] \tag{14}$$

Ghosh and Ostry (1995) show the method for computing restrictions when $p = 1$. We extend that method for the VAR with five lags. Using equations (11) and (14) we get the following

$$-[1\,0\,0\,0\,0\;\;0\,0\,0\,0\,0][\Psi/(1+r)][I-\Psi/(1+r)]^{-1} = [0\,0\,0\,0\,0\;\;1\,0\,0\,0\,0] \qquad (15)$$

Post-multiplying equation (15) with $[I-\Psi/(1+r)]$ and adding $[0\,0\,0\,0\,0\;\;1\,0\,0\,0\,0]\Psi/(1+r)$ we get the following

$$[-1\,0\,0\,0\,0\;\;1\,0\,0\,0\,0][\Psi/(1+r)] = [0\,0\,0\,0\,0\;\;1\,0\,0\,0\,0] \qquad (16)$$

For the VAR with five lags, the Ψ matrix can be written as follows

$$\Psi = \begin{bmatrix} a_1 & a_2 & a_3 & a_4 & a_5 & b_1 & b_2 & b_3 & b_4 & b_5 \\ 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ c_1 & c_2 & c_3 & c_4 & c_5 & d_1 & d_2 & d_3 & d_4 & d_5 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \end{bmatrix} \qquad (17)$$

Therefore, from equations (16) and (17) we get the following restrictions

$$\begin{aligned} &c_1 - a_1 = 0, \quad c_2 - a_2 = 0, \quad c_3 - a_3 = 0, \quad c_4 - a_4 = 0, \quad c_5 - a_5 = 0, \\ &d_1 - b_1 = 1 + r, \quad d_2 - b_2, \quad d_3 - b_3, \quad d_4 - b_4, \quad d_5 - b_5 \end{aligned} \qquad (18)$$

We test these restrictions using the VAR coefficients from tables IV and V. The standard errors for the tests are computed using the Variance-Covariance matrix from the VAR. Results for the test of equality of the two accounts are provided in table VII. From the results we see that all but two of the restrictions hold. We therefore weakly support the IBM based on the test of this implication.

The last implication of the model is the equality of variance of the actual and optimal consumption smoothing current account. Using the F-test for equality of variance, we find that the F-statistic was as 36.62 compared to the critical F, 1.69. Therefore, the null of equality of variance between the two accounts is rejected. From the test we conclude that volatility of the actual consumption smoothing current account[9] in Turkey is significantly higher than the optimal consumption smoothing current account.

Our econometric analysis shows support for the first implication of the IBM which is that the current account Granger-causes future changes in the national cash flow. We also weakly support the second implication of equality of the two accounts. We however reject the last implication of equality of variance in the two accounts. Therefore, we only find partial support for the IBM. To make sense of these mixed results we return to figure IV which shows interesting trends. From figure (4) we see that in the first period the actual consumption smoothing current account is below the optimal for most of the period. This implies that the actual current account deficit exceeded the optimal current account deficit in the first period. This suggests that Turkey breached the intertemporal solvency condition in that period which is consistent with the experience of two major financial crises in this period. However, this pattern does not hold for the current situation in Turkey. The graphical representation of the actual and optimal consumption smoothing current accounts in more recent years suggests that the Turkey's actual consumption smoothing current account outperforms that predicted by the model except for a brief period in 2004. It does not appear that the intertemporal solvency condition is currently breached.

V. CONCLUSION

In this paper, we use the IBM framework to study the current account movements in Turkey from 1992 to the present. Within the IBM, we find that the consumption tilting parameter is less than one which means that consumption is tilted to the present in Turkey. This is consistent with the literature on consumption tilting dynamics in developing countries. Thus we contribute an

9 The F-statistic is the ratio of the variances of the actual to the optimal current account.

estimate of the consumption tilting parameter for Turkey to the IBM literature on developing countries, which although extensive, had thus far excluded Turkey.

The model has several implications that we test in our paper. The tests show mixed results for the IBM for Turkey. One of the implications of the model is that the current account Granger causes future changes in the national cash flow. Our results here show that the IBM proves to be a valid framework for Turkey when Granger causality tests are performed on the current account. We can only weakly support equality of the actual and optimal consumption smoothing current account in the formal test and the informal test of graphing the two accounts suggest that they are dissimilar. Finally, we reject the last implication of equality of variance in the two accounts. We find that actual consumption smoothing current account is significantly more volatile than the optimal consumption smoothing current account.

We believe that our mixed results are related to the changing fundamentals in Turkey. Our motivation in this paper was to shed light on the present sustainability of Turkey's current account. We therefore, compare Turkey's current account trends in the period prior to the two crises with the current situation in Turkey. To do this we divide the sample into two periods, the first period includes the major crises (prior to mid-2001) and the second beginning in the third quarter of 2001. As noted earlier, trends in the data in the two periods suggest that Turkey's actual current account underperforms compared with the optimal current account in the first period, but outperforms the optimal current account after 2001. In light of these trends, we argue that our partial support of the IBM may be linked to the current situation, while rejection of the intertemporal solvency condition is related to the early 1990s. Therefore, we conclude that Turkey's current account deficit while high is sustainable due to changed fundamentals.

Figure 1: Turkey's Current Account and Trade Balance (1992:Q1 to 2005:Q3)

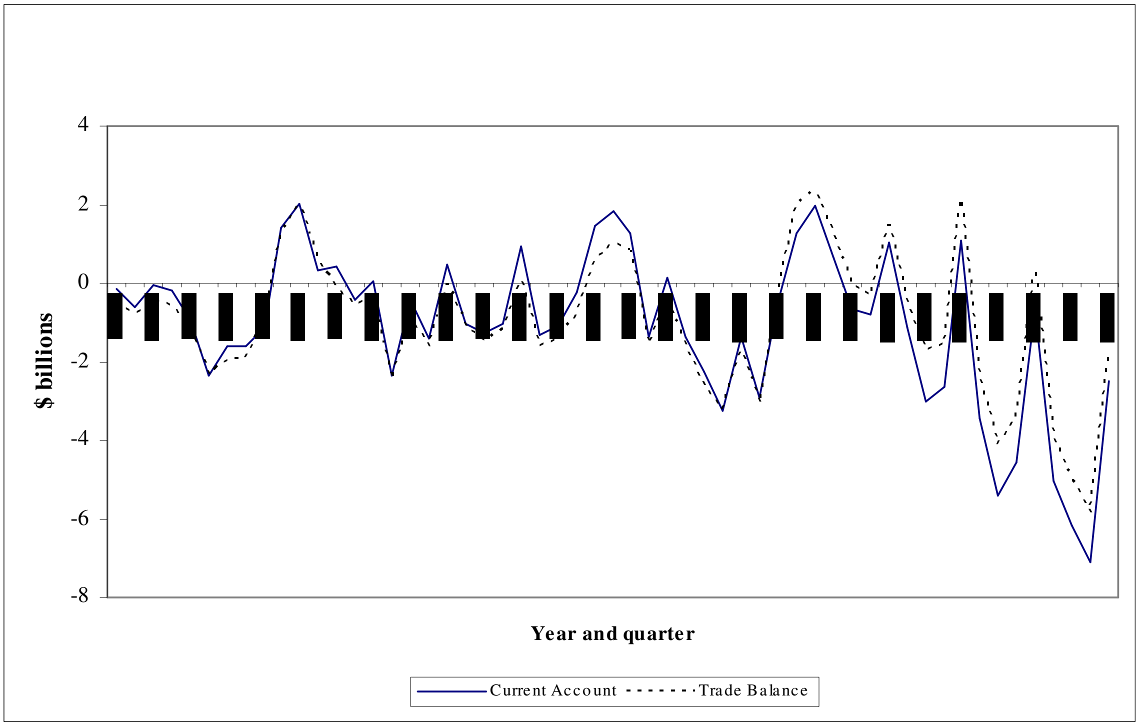

Figure 2: Turkey's Net Investment Income and Unilateral Transfers (1992:Q1 to 2005:Q3)

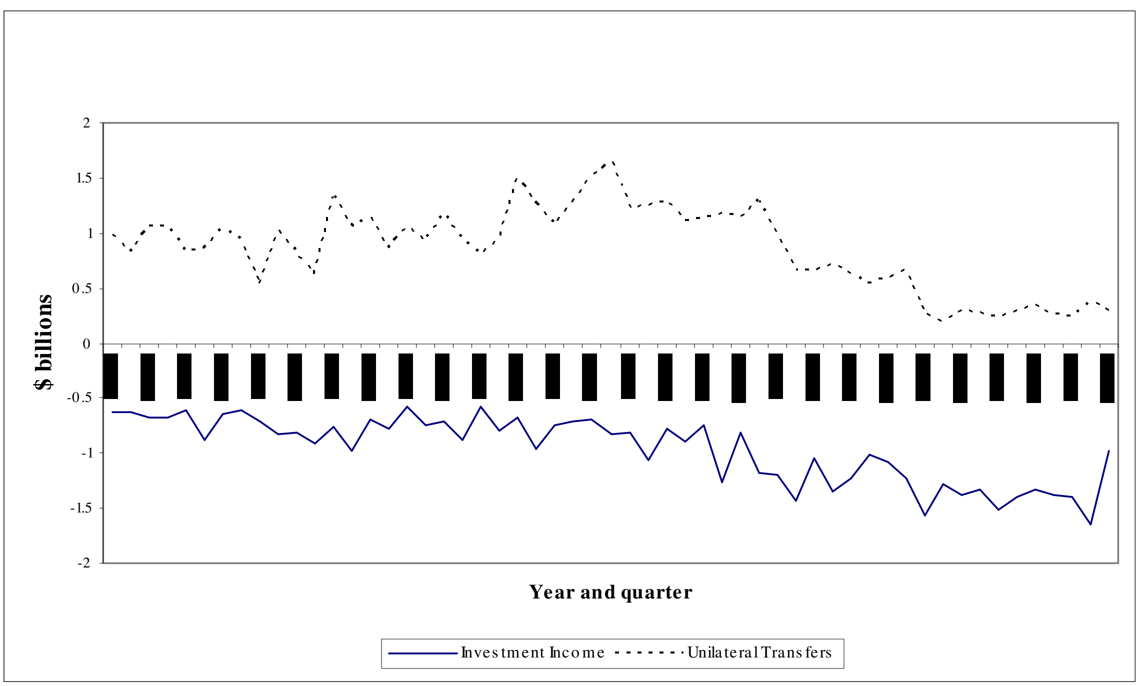

Figure 3: Turkey's Current Account to GDP Ratio (1992:Q1 to 2005:Q3)

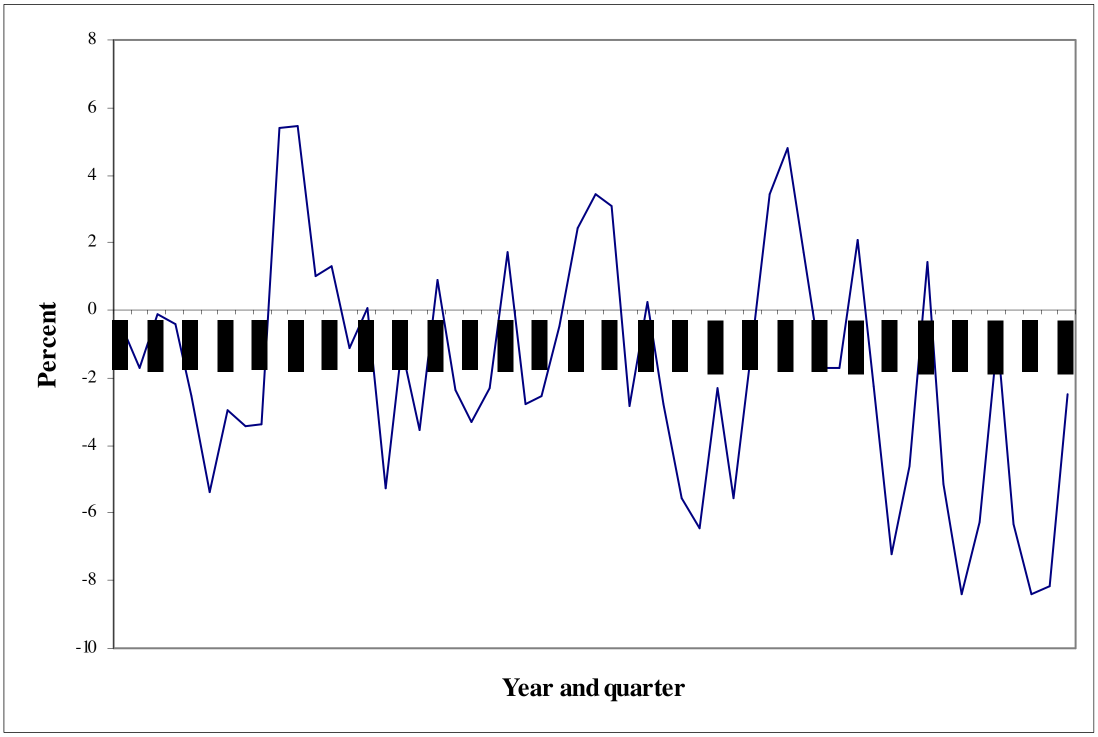

Figure 4: Actual and Optimal Current Account (1994:Q4 to 2004:Q4)

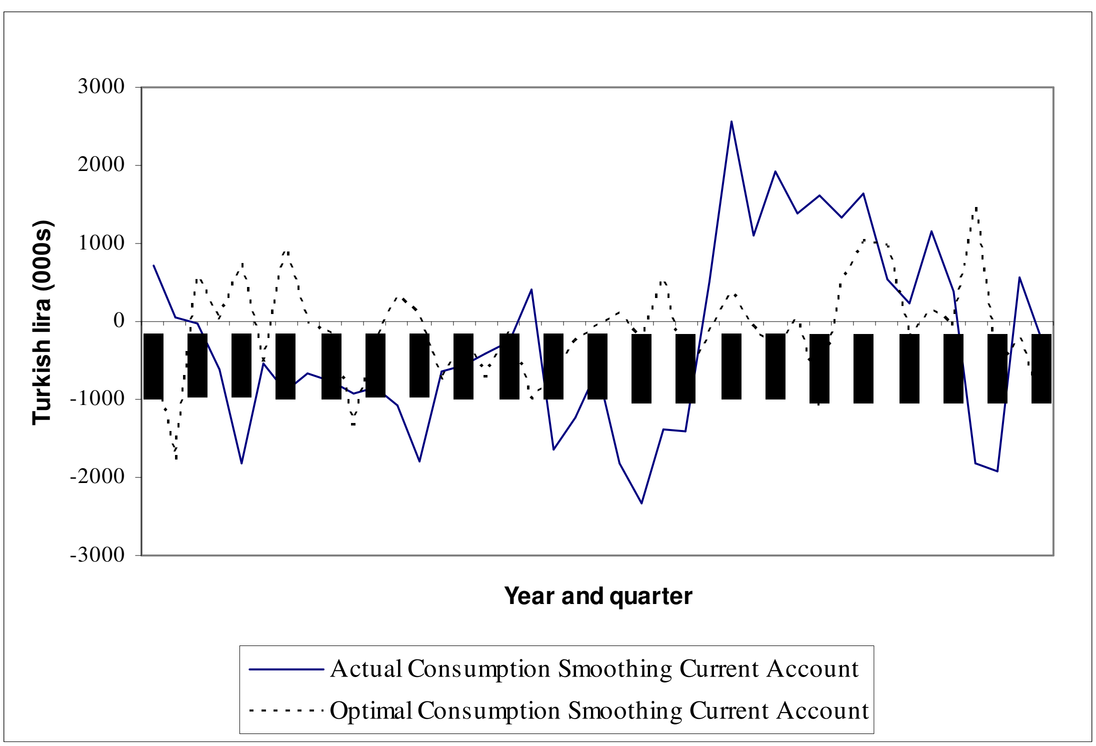

Table I: Unit Root Tests

	Levels		First Differences	
Variables	**ADF statistic**	**Critical value (1%)**	**ADF statistic**	**Critical value (1%)**
$y_t - i_t - g_t$	-0.6394	-2.6090	-10.1113	-2.6090
c_t	0.0477	-2.6090	-9.2887	-2.6090
$q_t - i_t - g_t$	-1.7729	-2.6090	-10.7964	-2.6090
ca_t	-7.8787	-2.6090		

Table II: Vector error correction estimates

Cointegrating Eq:	**CointEq1**	
$(y_t - i_t - g_t)$	1.000	
c_t	0.92885	
	(0.01174)	
	[79.1312]	
Error Correction:	$\Delta(y_t - i_t - g_t)$	Δc_t
CointEq1	-2.389532	-0.981355
	(0.54524)	(0.30161)
	[-4.38250]	[-3.25376]
$\Delta(y_{t-1} - i_{t-1} - g_{t-1})$	1.020788	0.373852
	(0.48236)	(0.26682)
	[2.11625]	[1.40114]
$\Delta(y_{t-2} - i_{t-2} - g_{t-2})$	-0.015802	-0.013759
	(0.50947)	(0.28182)
	[-0.03102]	[-0.04882]
Δc_{t-1}	-1.470476	-0.649994
	(0.79101)	(0.43756)
	[-1.85897]	[-1.48551]
Δc_{t-2}	-0.065547	-0.075175
	(0.86049)	(0.47599)
	[-0.07617]	[-0.15793]
R-squared	0.587589	0.507467
Adjusted R-squared	0.550097	0.462692
Sum square residuals	8.41E+08	2.57E+08
S.E. equation	4372.412	2418.637
F-statistic	15.67242	11.33354
Determinant Residual Covariance		9.98E+12
Log Likelihood		-872.3769
Akaike Information Criteria		36.09702
Schwarz Criteria		36.56032

( ) = standard errors
[ ] = t-statistics

Table III: Likelihood Ratio tests to determine lag length

	$p_1 = 5$ and $p_0 = 4$	$p_1 = 6$ and $p_0 = 5$
χ^2	12.58530	6.687759
Critical $\chi^2(4)$ (at 5% level of significance)	9.49	9.49

Table IV: VAR Estimates for dependent variable – $\Delta z_t = \Delta(q_t - i_t - g_t)$

Variable	**Coefficient**	**Standard error**	**T-statistic**
Δz_{t-1}	-0.5445	0.2086	-2.6106
Δz_{t-2}	-0.0488	0.2272	-0.2146
Δz_{t-3}	-0.2472	0.2241	-1.1030
Δz_{t-4}	0.5985	0.2282	2.6230
Δz_{t-5}	0.2566	0.1577	1.6276
ca_{t-1}	-0.0434	0.1830	-0.2373
ca_{t-2}	-0.4479	0.2272	-1.9709
ca_{t-3}	0.4899	0.2425	2.0202
ca_{t-4}	-0.4388	0.2549	-1.7219
ca_{t-5}	0.2158	0.2075	1.0401
F-statistic for ca = 2.443 p-value = 0.0525			

Table V: VAR Estimates for dependent variable – ca_t

Variable	Coefficient	Standard error	T-statistic
Δz_{t-1}	-0.1523	0.2334	-0.6525
Δz_{t-2}	0.0301	0.2542	0.1184
Δz_{t-3}	-0.0231	0.2508	-0.0920
Δz_{t-4}	0.1633	0.2553	0.6396
Δz_{t-5}	0.2263	0.1765	1.2827
ca_{t-1}	0.7780	0.2048	3.7986
ca_{t-2}	-0.3181	0.2543	-1.2507
ca_{t-3}	0.1260	0.2714	0.4645
ca_{t-4}	0.3260	0.2852	1.1430
ca_{t-5}	-0.3679	0.2322	-1.5843
F-statistic for Δz = 0.5792 p-value = 0.7155			

Table VI: Γ coefficients

	World rate of interest		
Coefficients	**At r = 3%**	**At r = 6%**	**At r = 2%**
Δz_t	0.12570	0.14856	0.1166
Δz_{t-1}	-0.28255	-0.24566	-0.29682
Δz_{t-2}	-0.34635	-0.3139	-0.35877
Δz_{t-3}	-0.56315	-0.53404	-0.57442
Δz_{t-4}	-0.12544	-0.12134	-0.12717
ca_t	0.42043	0.39709	0.4285
ca_{t-1}	0.06800	0.07503	0.06536
ca_{t-2}	-0.18781	-0.17552	-0.1927
ca_{t-3}	0.18190	0.18104	0.18223
ca_{t-4}	-0.33335	-0.31116	-0.34146

Table VII: Test for equality of the optimal and actual current account

Restrictions	Coefficient	Standard error	T-statistic
$c_1 - a_1 = 0$	0.3922	0.209949	1.868074
$c_2 - a_2 = 0$	0.0789	0.228639	0.345085
$c_3 - a_3 = 0$	0.2241	0.22555	0.99357
$c_4 - a_4 = 0$	-0.4352	0.229637	-1.89516
$c_5 - a_5 = 0$	-0.0303	0.158773	-0.19084
$d_1 - b_1 = 1.0512$ [10]	0.8214	0.184162	-1.24781
$d_2 - b_2 = 0$	0.1298	0.228679	0.567608
$d_3 - b_3 = 0$	-0.3639	0.244109	-1.49073
$d_4 - b_4 = 0$	0.7648	0.256563	2.980939*
$d_5 - b_5 = 0$	-0.5837	0.208832	-2.79507*

* Reject the null, which implies that the restrictions do not hold.

[10] The restriction is $d_1 - b_1 = 1 + r$ where *r* is the world rate of interest. We use the average rate in our sample for this test.

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