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ORIGINAL PAPER

On the optimality and sustainability of Turkey's current account

Ayla Ogus · Niloufer Sohrabji

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Abstract We analyze Turkey's current account optimality and sustainability between 1992 and 2004. Using the intertemporal benchmark model for Turkey's current account we test for its intertemporal solvency. Based on traditional and alternative tests (which account for persistence in the current account), we conclude that Turkey breached the intertemporal solvency condition in the sample period. In addition, stationarity tests of the deviation between actual and optimal net external liabilities series confirm that Turkey's current account deficit was unsustainable for that period. However, further econometric investigation and analysis of reforms causes us to question our conclusions of non-optimality and unsustainability of the Turkish current account for the latter part of the period.

Keywords Current account optimality and sustainability · Intertemporal benchmark model · Multicointegration · Turkey

JEL Classification C32 · F32 · F37 · F41

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A. Ogus
Department of Economics, Izmir University of Economics,
Sakarya Cad. No:156, Balcova, Izmir 35330, Turkey

N. Sohrabji (✉)
Department of Economics, Simmons College, 300 The Fenway, Boston, MA 02115, USA
e-mail: sohrabji@simmons.edu

1 Introduction

Although Turkey has suffered from large current account deficits earlier, there have been ever increasing current account deficits since 2003. These large deficits have caused a great level of discussion of the Turkish 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. Our paper addresses this issue by computing Turkey's optimal consumption smoothing current account for the period between 1992 and 2004 using an intertemporal benchmark model (IBM) and tests for optimality of the current account. This allows us to determine if the current account deficit is excessive. The size of the current account deficit is important for two reasons. If the current account deficit is excessive, it implies that the country is not optimizing lifetime utility. It may also indicate an unsustainable current account deficit which could lead to a crisis.

Our analysis of current account optimality in Turkey is based on the intertemporal benchmark (IBM) model used by Sheffrin and Woo (1990) and Ghosh and Ostry (1995). Their models which build on the work done by Sachs (1982), Campbell and Shiller (1987) and reviewed by Obstfeld and Rogoff (1995) determined current account optimality based on intertemporal solvency. The intertemporal approach 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, the current account deficits are *excessive* meaning that the country is not optimizing lifetime utility.

Sheffrin and Woo (1990) test the IBM for four developed countries using annual data from 1955 to 1985. They conclude that the IBM works for Belgium and Denmark but fails for Canada and UK. Ghosh (1995) tested the IBM for 5 developed countries including 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. Makrydakis (1999) evaluated the optimality of the Greek current account from 1950 to 1995 and concluded that Greece breached the intertemporal solvency condition for that period. Hudson and Stennett (2003) conclude that the current account did not breach the intertemporal solvency condition for Jamaica. Adedeji (2001) uses both the model and examines macroeconomic indicators from 1960 to 1997 to conclude Nigeria's actual current account was excessive in some years in that period. We add to this literature by analyzing the size and optimality of the current account deficit of Turkey from 1992 to 2004. To our knowledge, this is the first time that the intertemporal approach has been used to model the Turkish current account. Similar to Makrydakis (1999) for Greece and Adedeji (2001) for Nigeria we find that Turkey breached the intertemporal solvency condition in the sample period. Therefore, we find that the Turkish current account deficit was excessive in the sample period.

An excessive current account deficit may also imply an unsustainable current account deficit that can 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. Following Makrydakis (1999) we examine the issue of sustainability in the current account by analyzing the stationarity of the deviations between actual and optimal net external liabilities. Makrydakis (1999) concludes that, for Greece this deviation series is stationary around the mean for the sample period, but the mean may have shifted around the 1989/1990 crisis. Thus the broad conclusion is that Greece's current account is following a sustainable path despite the 1989/1990 crisis. We reject stationarity of the deviation series between the actual and optimal net external liabilities for Turkey in the sample period. Thus, we conclude that the Turkish current account was unsustainable for the sample period.

Optimality and sustainability are affected by capital liberalization policies. Alper and Onis (2003), for example argue that a "democratic deficit" results in imperfect capital liberalization and thus a "problematic" current account deficit. They note that the factors that led to a crisis in Turkey in 1994, namely government control of interest rates and lowering of Turkey's credit rating, would not have made a big impact if the capital market was functioning well. However, these factors combined with the lack of transparency and accountability resulted in a speculative attack. Thus imperfect capital liberalization and excessive current account deficits together contribute to unsustainability of the current account. Turkey undertook economic reforms following the 2001 crisis. We analyze trends in the data to determine if these reforms have improved the current account position in Turkey. Like Makrydakis (1999) concludes for Greece, we are hopeful for a reversal of the negative trend in the Turkish current account. We believe that the Turkish current account position has improved in the latter part of the sample period.

The paper is organized as follows: the following section provides background on the Turkish current account. Section 3 discusses the analytical framework for the intertemporal approach to study the current account. This is followed by the empirical analysis in Sect. 4 which provides evidence for excessive and unsustainable current account deficits in Turkey in the sample period. Section 5 summarizes and concludes.

2 Background

In this section we discuss Turkey's current account and components. Capital account liberalization intensified in the 1990s which increased the volatility of the current account in that period. Turkey experienced higher surpluses and deficits in the 1990s than in the previous decade. We graph 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 in that period and Fig. 2 shows the trend in net investment income and unilateral transfers.

The seasonal component of both the current account and the trade balance is apparent from Fig. 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 which resulted in capital outflows led to current account surpluses as seen in the graph. We also observe a current account surplus in

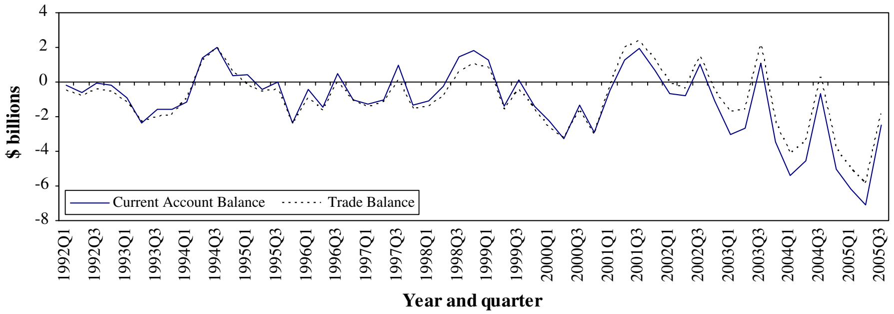

Fig. 1 Turkey's current account and trade Balance (1992:Q1 to 2005:Q3). *Notes:* The current account balance and the trade balance are expressed in billions of dollars. *Source:* Central Bank of Turkey

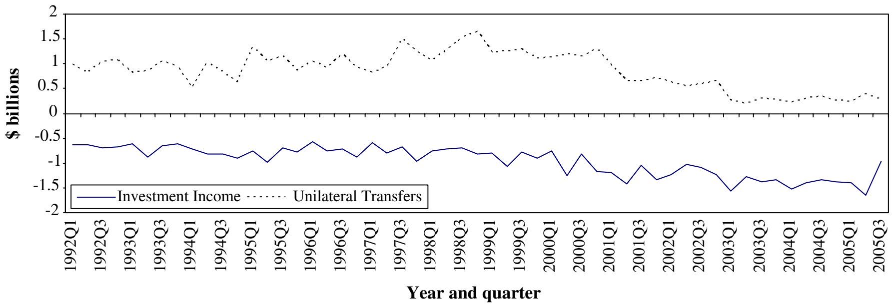

Fig. 2 Turkey's net investment income and unilateral transfers (1992:Q1 to 2005:Q3). *Notes:* Unilateral transfers and investment income, are expressed in billions of dollars. *Source*: Central Bank of Turkey

1998. The contagion effect of the East Asian financial crisis and the Russian ruble crisis may have impacted Turkey as well which explains the capital outflows and hence current account surplus in that period.

The current account and trade deficit increased significantly in 1993 and again in 2000 (periods prior to the crises). The annual current account deficits in these periods were approximately $ 6 billion and $ 10 billion while the annual trade deficits exceeded the current account deficits at approximately $ 7 billion and $ 11 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.

What is particularly interesting about the trend in Fig. 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 change in the impact of the different components of the current account, which are related to changed fundamentals in the Turkish economy.

The other components of the current account namely investment income and unilateral transfer accounts are graphed in Fig. 2. The unilateral transfers account is the only component which has been consistently positive in Turkey for the entire period. While the account appears to be declining, this is due to a change in accounting practices rather than fundamental changes in the economy. Remittances that were earlier counted in this account are now no longer a part of it.

From the graph we also see that 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 worsening from approximately \$–4 billion to \$–6 billion. This component is a major contributor to the current account deficit. If this investment income were related to direct investment, it would reflect Turkey's profitability and potential. However, the high levels of negative net investment income are related to government portfolio investment and actually reflect the inability of Turkey to borrow at lower levels of interest.

From Figs. 1 and 2 we see a worsening position for all components and therefore the current account in Turkey from 1992 to 2005. This raises concerns about the excessiveness of the current account. If the current account is excessive it implies that Turkey's current account is not on an optimal path and the country is not maximizing utility. To determine optimality, we need to study the future potential of Turkey. If Turkey can repay present deficits by generating trade surpluses in the future, then the high current account deficit is not problematic. To shed light on optimality we use the intertemporal model for current account determination (discussed in the next section).

Excessive and non-optimal current account deficits may also indicate unsustainability. That is certainly of some concern given the trends in the data. As noted by Milesi-Ferretti and Razin (1996), conventional wisdom suggests that a current account deficit to GDP ratio of 5% or higher implies that the current account is unsustainable. Figure 3 which maps the current account to GDP ratio shows that Turkey breached this

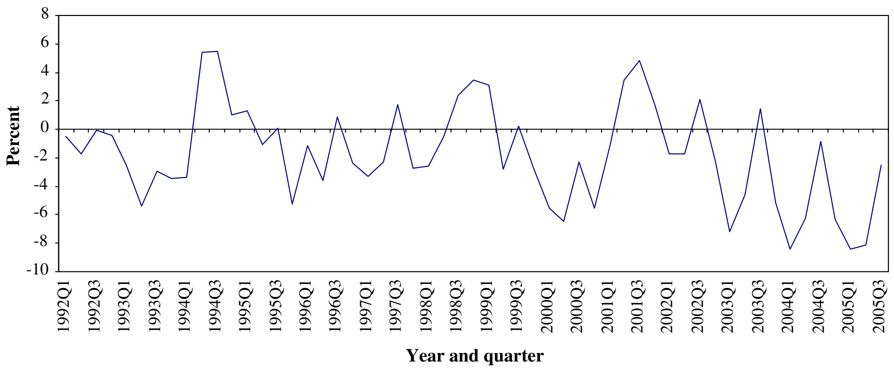

Fig. 3 Turkey's current account to GDP ratio (1992:Q1 to 2005:Q3). *Notes:* The GDP series was expressed in current Turkish lira. To make the two series comparable, the current account series which was expressed in dollars, was converted to Turkish lira (using the indicator selling nominal exchange rate from the Central Bank of Turkey). The above series is the ratio of current account to GDP in percentage form. *Source:* Central Bank of Turkey

threshold prior to both previous crises. Figure 3 also shows that this ratio is worsening since 2003 and is well over the 5% threshold. This raises fears of unsustainability in the Turkish current account position. Figure 1 provides support for this concern. We see that the current account deficit has increased significantly since 2003 and is higher than what Turkey faced prior to the two financial crises. However, a high current account deficit by itself does not indicate unsustainability. Moreover, as Hudson and Stennett (2003) show, countries can breach the 5% current account to GDP threshold without having unsustainable current account deficits. Therefore, we need more analysis to address the issue of sustainability of the Turkish current account. To test for sustainability we follow Makrydakis (1999) and study the deviations between actual and optimal net external liabilities.

Our study of optimality and sustainability of the Turkish current account is based on the intertemporal model of current account determination. The analytical framework of this approach is discussed in the following section.

3 Intertemporal model of current account determination

We use the intertemporal model of current account determination used by Sheffrin and Woo (1990), Ghosh and Ostry (1995) and others. 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) note that a country is more likely to borrow if they are growing. We discuss the theoretical model in the following sub-section.

3.1 The theoretical model

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 $\left[u'(c_t) > 0\right.$ and $\left.u''(c_t) < 0\right]$, and c_t 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_t and b_{t+1} are the level of foreign bonds held by the economy in time period t and $t + 1$, 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

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

where ca_t is the current account.

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).[1] 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:

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

where $y_t = q_t + r\, b_t$ and all other variables are as described earlier.

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 (as opposed to the regular current account which includes consumption tilting) 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 Eqs. (4) and (5) we get the optimal consumption smoothing current account

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

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

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

From Eq. (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.

3.2 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. Computation of θ is discussed later in this sub-section. 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, however, the computation of the optimal consumption smoothing current account does not require such an estimation because the necessary information is already reflected in the current account. This is based on Campbell and Shiller's (1987) work on savings and income.

We estimate an 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 Eq. (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:

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

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

$$\text{where} \quad X_t = \begin{bmatrix} \Delta z_t \\ \vdots \\ \vdots \\ \Delta z_{t-p+1} \\ ca_t \\ \vdots \\ \vdots \\ ca_{t-p+1} \end{bmatrix},$$

$$\Psi = \begin{bmatrix} a_1 & \cdots & a_p & b_1 & \cdots & b_p & & \\ 1 & 0 & \cdots & \cdots & & 0 & & \\ 0 & 1 & 0 & \cdots & \cdots & 0 & & \\ \vdots & 0 & \ddots & 0 & & \vdots & & \\ c_1 & \cdots & c_p & d_1 & \cdots & d_p & & \\ 0 & \cdots & \cdots & 0 & 1 & 0 & \cdots & 0 \\ 0 & \cdots & \cdots & & 0 & 1 & \cdots & 0 \\ \vdots & 0 & \ddots & 0 & & & \vdots & \end{bmatrix} \quad \text{and} \quad v_t = \begin{bmatrix} u_{1t} \\ 0 \\ \vdots \\ \vdots \\ u_{2t} \\ 0 \\ \vdots \\ \vdots \end{bmatrix}$$

The k-step ahead expectation is therefore given as

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

Thus,

$$\mathrm{E}_t\left(\Delta z_{t+k}\right) = [1 \quad 0 \quad \cdots \quad 0]\, \Psi^k X_t. \tag{10}$$

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

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

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 Eq. (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), Makrydakis (1999), Adedeji (2001) and others which we conduct as well. An important implication of the IBM is that the actual consumption smoothing current account ca_t equals the optimal consumption smoothing current account ca_t^*.

The optimal consumption smoothing current account given in Eq. (11) can be rewritten as follows:

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

The coefficients of $\Gamma_{\Delta z}$ and Γ_{ca} (which are both $1xp$ vectors) are computed using the VAR estimates as well as the world rate of interest according to the methodology described in Eq. (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. Equality of the actual and optimal consumption smoothing current account implies that Eq. (12) can be rewritten as

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

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.

A less strict test 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 third implication of the model is the equality of the variance of the actual and the optimal consumption smoothing current account. As noted by Makrydakis (1999) the comparison of the two variances sheds light on the perfect capital mobility hypothesis which is implied in the model. If the actual current account is more volatile than the optimal then it suggests an inappropriate use of capital flows in smoothing consumption. We test for equality of variance between the two series and present the results in the following section.

Following (Makrydakis 1999) we also test for sustainability of the current account. For this we analyze actual versus optimal net external liabilities. The actual and optimal net external liabilities are computed by cumulating the actual and optimal consumption smoothing current account series. We use the IBM to compute the optimal series. If the deviations between the actual and optimal net external liabilities are stationary, we can conclude that the Turkish current account was sustainable and vice versa.

Before we can test the implications of the model or use it for computing optimal net liabilities, we must first estimate 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. To compute the actual consumption smoothing current account, we need to determine the cointegrating relation between the national cash flow inclusive of interest payments, $(y_t - i_t - g_t)$ and consumption, (c_t). If both series are I(1) and cointegrated then the consumption tilting parameter θ can be computed as the cointegrating parameter between the two series as in Eq. (5). That consumption tilting parameter allows us to compute the actual consumption smoothing current account, $ca_t = y_t - i_t - g_t - \theta\, c_t$ which is an I(0) series.

There is however, a possibility of what Granger and Lee (1989) describe as a "deeper form of cointegration called multicointegration". In this case, if there are two I(1) series which are cointegrated such that the residual series is I(0), then the cumulated residual series is I(1). If this cumulative residual series is cointegrated with either one or both of the original I(1) series then there is multicointegration. Engsted et al. (1997) extend multicointegration analysis, which they write, "implies that essentially there are two levels of cointegration between just two I(1) series". Leachman et al. (2005) apply multicointegration to analyze fiscal sustainability and Siliverstovs (2003) uses multicointegration to study US consumption data. Multicointegration would imply that the cumulative current account series (which is computed from the cointegrating relation between national cash flow inclusive of interest payments and consumption) is I(1) and is integrated with either national cash flow inclusive of interest payments or consumption or both. If in fact, multicointegration exists and we compute the current account series as a standard cointegration between national cash flow inclusive of interest payments and consumption, as described earlier, then our cointegrating relation would be misspecified.

To test for multicointegration we follow Enders (2004). If there is multicointegration, then cumulative national cash flow inclusive of interest payments,

$\sum_{j=1}^{t}\left(y_j - i_j - g_j\right)$ and cumulative consumption, $\sum_{j=1}^{t} c_j$ are I(2) and the two series in levels are I(1). The procedure to test for multicointegration requires that we estimate the following equation

$$\sum_{j=1}^{t}\left(y_j - i_j - g_j\right) = \beta_1 \sum_{j=1}^{t} c_j + \gamma_1 \left(y_t - i_t - g_t\right) + \gamma_2 c_t + \varepsilon_t \tag{14}$$

The residuals from the above estimation are the current account series ca_t. The regression of the residual series is given as

$$\Delta \hat{ca}_t = \rho \hat{ca}_{t-1} + \sum_{j=1}^{p} \rho_j \hat{ca}_{t-j} + \nu_t \tag{15}$$

Rejection of the null hypothesis that ρ (the coefficient for $\hat{ca}_{t-1}$) equals 0, implies multicointegration. The critical values for this test are based on sample size as well as on the regressors in Eq. (14) and are provided in Enders (2004).

All the tests and other empirical work for the IBM are discussed and presented in the next section.

4 Data and results

We test the optimality and the sustainability of Turkey's current account deficits for the period from 1992 to 2004. To do so, we follow the literature that employs the intertemporal approach to modeling the current account. We discuss our data in the following sub-section.

4.1 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) 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 and inflation rates 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 related to our earlier discussion of the interesting trends in the current account in this period.

We used quarterly data because of the short time period. All data for the econometric analysis is seasonally adjusted.

4.2 Testing for cointegration and multicointegration

The first task in modeling the optimal consumption smoothing current account for Turkey is to compute the actual consumption smoothing current account. The determine the current account series we require the cointegrating parameter, θ which is determined by the relation between national cash flow inclusive of interest payments and level of consumption. As noted earlier, there is a possibility of multicointegration. If there is multicointegration, then we use cumulative national cash flow $\left[\sum_{j=1}^{t}\left(y_j - i_j - g_j\right)\right]$ and cumulative consumption $\left[\sum_{j=1}^{t} c_j\right]$. The existence of multicointegration requires that $\sum_{j=1}^{t}\left(y_j - i_j - g_j\right)$ and $\sum_{j=1}^{t} c_j$ are I(2), $(y_t - i_t - g_t)$ and c_t are I(1) and $\Delta\,(y_t - i_t - g_t)$ and $\Delta\, c_t$ are I(0).

We use several tests for stationarity including the Augmented Dickey Fuller (ADF) test, the Phillips–Perron test, the KPSS test[2] of Kwiatkowski et al. (1992) and the Zivot and Andrews (1992) test[3] (referred to as Zivot–Andrews) which are reported in Table 1. We find that cumulative and level of both national cash flow inclusive of interest payments and consumption series are nonstationary. Also, the first difference of the two series (level of national cash flow inclusive of interest payments and level of consumption) are found to be stationary.

Following the procedure in Enders (2004) we test for multicointegration. As discussed in the previous section, if the null hypothesis of $\rho = 0$ from Eq. (15) is rejected, we conclude there is multicointegration. The cointegration ADF statistic is compared to the critical value given in Enders (2004) based on the sample size and the number of I(1) and I(2) variables. Using a sample size of 50 and given that we have two I(1) variables and one I(2) variable, our critical value is −4.30 at the 5% level of significance. Our *t*-statistic is −2.06 so we fail to reject the null hypothesis and thus conclude there is no multicointegration.

We now turn to cointegration which is the relation between national cash flow inclusive of interest payments and consumption in levels only. The unit root tests on levels and differences of the series reported earlier, hold for this test as well. Following Ghosh (1995) we test for cointegration by using the Cointegrating Regression Dickey–Fuller (CRDF) test which is similar to the multicointegration test discussed earlier. The test on the residual series (current account) reveals the series to be stationary which is also reported in Table 1. Thus, we compute θ as a cointegrating parameter between level of national cash flow inclusive of interest payments and level of consumption.

The consumption tilting parameter for Turkey is estimated to be 0.93 with a long run standard error of 0.01. 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.

[2] The Kwiatkowski, Phillips, Schmidt and Shin (KPSS) test is a test for stationarity around a level or a trend.

[3] The Zivot and Andrews unit root test allows for structural breaks.

Table 1 Unit root tests

Variables	ADF			Phillips–Perron			KPSS		Zivot–Andrews	
	t_0	t_μ	t_τ	τ_0	τ_μ	τ_τ	η_μ	η_τ	$t_{\inf}$	T_B
$\sum_{j=1}^{t} c_j$	0.38	2.13	−3.06	7.05	5.33	−1.59	1.09*	0.23*	−3.13	2003:1
	[4]	[5]	[5]						[3]	
c_t	1.47	−1.04	−2.44	0.74	−1.66	−3.35**	0.79*	0.11	−4.10	2000:4
	[3]	[4]	[4]						[2]	
Δc_t	−2.99*	−5.86*	−5.77*	−10.20*	−10.49*	−10.34*	0.06	0.05	−6.67*	1998:2
	[3]	[2]	[2]						[2]	
$\sum_{j=1}^{t} (y_j - i_j - g_j)$	0.03	2.88	−0.76	12.33	−0.64	7.40	1.09*	0.27*	−1.86	2002:2
	[2]	[5]	[5]						[5]	
$(y_t - i_t - g_t)$	1.43	−0.60	−3.21	1.39	−1.87	−6.59*	1.00*	0.06	−4.29	1999:2
	[1]	[1]	[4]						[4]	
$\Delta (y_t - i_t - g_t)$	−14.51*	−14.76*	−14.63*	−15.12*	−16.51*	−16.34*	0.06	0.04	−14.96*	1998:3
	[0]	[0]	[0]						[0]	
$(q_t - i_t - g_t)$	1.48	−0.61	−3.63*	1.31	−1.83	−6.66*	1.01*	0.05	−4.31	1999:2
	[1]	[1]	[4]						[4]	
$\Delta (q_t - i_t - g_t)$	−14.87*	−15.16*	−15.01*	−14.98*	−16.28*	−16.10*	0.07	0.04	−15.27*	2001:3
	[0]	[0]	[0]						[0]	
ca_t	−2.98*	−3.16*	−3.25*	−2.98*	−3.19*	−3.29*	0.22	0.09	−4.86*	2001:1
	[0]	[0]	[0]						[0]	

Table 1 continued

Variables	ADF			Phillips–Perron			KPSS		Zivot–Andrews	
	t_0	t_μ	t_τ	τ_0	τ_μ	τ_τ	η_μ	η_τ	t_{inf}	T_B
d_t	−0.11 [1]	−2.59 [1]	−2.08 [1]	−0.17	−1.71	−1.42	0.59*	0.19*	−4.28 [1]	2001:2

Notes: * and ** indicate statistical significance at the 5 and 10% level, respectively

t_0, t_μ and t_τ are the Augmented Dickey–Fuller test statistics when the auxiliary regression involves no deterministic component, a constant, and a constant and a trend respectively. The null hypothesis for the ADF test is that the series is non-stationary. Numbers in square brackets correspond to lags. Maximum lags were set at 12 and lag length is determined by sequentially eliminating the last lag using *t*-tests at 5% level of significance

τ_0, τ_μ and τ_τ are the Phillips–Perron test statistics when the auxiliary regression involves no deterministic component, a constant, and a constant and a trend respectively. The null hypothesis for the PP test is that the series is non-stationary. The lag truncation parameter, q, is determined to be three according to Newey–West criteria

η_μ and η_τ are the KPSS (Kwiatkowski et al. 1992) test statistics for level and trend stationarity respectively. The null hypothesis for the KPSS test is that the series is stationary. Rejection of the null therefore implies that the series is non-stationary. The $l(4)$ formula of Schwert (1987) is used for determination of lag truncation parameter

t_{inf} is the Zivot–Andrews (1992) test statistic for evaluating a unit root against the alternative of a shifting mean and/or trend. The null hypothesis is that the series is non-stationary. Numbers in square brackets correspond to lags. As in the case of the ADF test, the maximum lags are set at 12 and lag length is determined by sequentially eliminating the last lag using *t*-tests at 5% level of significance

Table 2 Likelihood ratio tests to determine lag length of the VAR of the national cash flow and consumption smoothing current account

	$p_1 = 5$ and $p_0 = 4$	$p_1 = 6$ and $p_0 = 5$
χ^2	9.53	6.19
Critical $\chi^2(4)$ (at 5% level of significance)	9.49	9.49

Notes: For the Likelihood Ratio 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 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

Using the χ^2 test the appropriate lag length is determined to be five. 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

Ghosh and Ostry (1995) find that most developing countries shift consumption to the present. Out of 45 developing countries in their sample (not including Turkey), 35 countries displayed consumption tilting from the future to the present. In their sample, 13 countries including Ghana, Tunisia, India, Malaysia, Philippines, Thailand, Argentina, Brazil, Colombia, Guatemala, Mexico, Peru, and Uruguay had a consumption tilting parameter in the range from 0.90 and 0.98. The estimated standard errors for these countries range from 0.01 to 0.04 with the exception of Malaysia which has a standard error of 0.08. These statistics are comparable to Turkey's case. Moreover, our estimates are similar to those computed by Makrydakis' (1999) for Greece which showed a consumption tilting parameter of 0.95 with a standard error of 0.02.

This consumption tilting parameter is used to compute ca_t so we can estimate the VAR which is used by the IBM. The consumption tilting parameter being less than one does not by itself indicate whether the current account is optimal and/or sustainable. We discuss both in the following sub-sections.

4.3 Testing for optimality of the Turkish current account

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 1) indicate that $\Delta(q_t - i_t - g_t)$ and ca_t are stationary variables.

From the estimation of the VAR of the national cash flow and actual consumption smoothing current account in Eq. (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 (LR) test. Our test shows that the appropriate lag length is five. For details, please see Table 2.

Table 3 VAR estimates for dependent variable, $\Delta z_t = \Delta (q_t - i_t - g_t)$

Variable	Coefficient	Standard error	T-statistic
Δz_{t-1}	−0.69	0.22	−3.14
Δz_{t-2}	−0.26	0.26	−1.00
Δz_{t-3}	−0.46	0.26	−1.77
Δz_{t-4}	0.38	0.26	1.46
Δz_{t-5}	0.17	0.16	1.06
ca_{t-1}	0.03	0.18	0.17
ca_{t-2}	−0.44	0.22	−2.00
ca_{t-3}	0.46	0.24	1.92
ca_{t-4}	−0.43	0.25	−1.72
ca_{t-5}	0.12	0.21	0.57
F statistic for $ca = 2.38$			
p value $= 0.06$			

Notes: The table provides coefficients and t-statistics for the VAR with change in national cash flow less interest payments as the dependent variable and past values of the change in national cash low less interest payments and current account as the independent variables

Table 4 VAR estimates for dependent variable, ca_t

Variable	Coefficient	Standard error	T-statistic
Δz_{t-1}	−0.19	0.26	−0.73
Δz_{t-2}	−0.03	0.30	−0.10
Δz_{t-3}	−0.80	0.30	−2.67
Δz_{t-4}	0.10	0.30	0.33
Δz_{t-5}	0.20	0.19	1.05
ca_{t-1}	0.80	0.21	3.81
ca_{t-2}	−0.32	0.25	−1.28
ca_{t-3}	0.12	0.27	0.44
ca_{t-4}	0.33	0.29	1.14
ca_{t-5}	−0.39	0.24	−1.63
F-statistic for $\Delta z = 0.57$			
p value $= 0.72$			

Notes: The table provides coefficients and t-statistics for the VAR with current account as the dependent variable and past values of the change in national cash low less interest payments and current account as the independent variables

From the VAR results reported in Tables 3 and 4 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 5. To do a sensitivity analysis, we compare these coefficients to those computed over a range of interest rates which are reported in Table 5 as well. The results show that the coefficients are close over the different interest rate levels.

We begin testing the IBM with the less stringent, Granger-causality test. 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 3 and 4 for the dependent variables, Δz_t and ca_t, respectively. From Table 3, the F-statistic for (ca_t) is 2.38 with a p value of 0.06. Therefore, we conclude that the current account Granger-causes future movements in national cash flow at the 10% level of significance. We also test if national cash flow Granger-causes

Table 5 Γ coefficients

Coefficients	World rate of interest		
	At $r = 3\%$	At $r = 6\%$	At $r = 2\%$
Δz_t	0.46	0.48	0.46
Δz_{t-1}	−0.01	−0.05	−0.01
Δz_{t-2}	−0.17	−0.21	−0.16
Δz_{t-3}	−0.48	−0.55	−0.45
Δz_{t-4}	−0.21	−0.28	−0.20
ca_t	−0.62	−0.99	−0.55
ca_{t-1}	−0.13	−0.25	−0.11
ca_{t-2}	−0.57	−0.81	−0.53
ca_{t-3}	−0.27	−0.50	−0.23
ca_{t-4}	−0.30	−0.43	−0.28

Notes: For the formal test of equality between the actual and optimal consumption smoothing current accounts, the coefficient on the contemporaneous current account must equal unity and the coefficients on all other variables (contemporaneous and lagged national cash flow less interest payments and lagged current account) must equal zero. This has implications for Γ vector in Eq. (13) required to compute the Wald statistic, $(\Gamma - R)\,(Var(\Gamma - R))^{-1}(\Gamma - R)^T$ where R is the vector of restrictions given as $R = [0\,0\,0\,0\,0 \quad 1\,0\,0\,0\,0]$. The table provides computed coefficients of the Γ vector (for a world rate of interest of 3% which is the average in our sample as well as for 6 and 2% which are the maximum and minimum in our sample)

the current account. The F-statistic from Table 4 is 0.57 with a p value of 0.72 which implies that national cash flow is statistically not significant (at usual levels of significance) 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.

Computation of the optimal current account allows us to test the equality between the actual and the optimal consumption smoothing current account which is the main test of the IBM. The informal test is a visual check of the relation between actual and optimal consumption smoothing current accounts shown in Fig. 4. The graph provides informal evidence of the inequality of the actual and optimal consumption smoothing current account. In addition, the graph reveals interesting trends of the two accounts. Until the last quarter of 2000, the actual consumption smoothing current account under performs compared with the optimal series. Not only is the actual series below the optimal, but it is in deficit for most of the period. The optimal consumption smoothing current account on the other hand, shows both surpluses and deficits in the same time frame. The graphical representation of the two accounts after that period differs sharply from the trend above. Except for a large actual current account deficit in the first two quarters of 2004, the actual series outperforms the optimal in the latter part of the sample period.

To statistically test the observed differences between the two accounts we now turn to the formal test. For a higher order VAR, the formal test of equality of the two accounts requires that the coefficient of the contemporaneous current account is unity

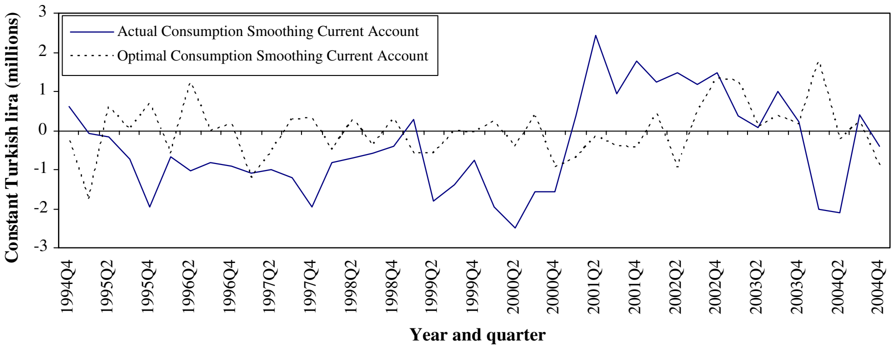

Fig. 4 Actual and optimal consumption smoothing current account (1994:Q4 to 2004:Q4). *Notes*: The actual consumption smoothing current account was computed using the cointegrating parameter, θ between national cash flow inclusive of interest payments and consumption. The optimal consumption smoothing current account is the predicted series from the IBM. The latter also requires the constant world rate of interest which includes the 10-year US treasury nominal bond yields and US inflation rates. The actual and optimal consumption smoothing current accounts are expressed in millions of 1987 constant Turkish lira. *Source*: Central Bank of Turkey, Bureau of Labor Statistics

and all other coefficients (for both the current account and the national cash flow) are zero. This places restrictions on the Γ vector shown in Eq. (13). The restriction in Eq. (13) can be rewritten for our VAR with five lags as follows:

$$R = [0\,0\,0\,0\,0 \quad 1\,0\,0\,0\,0] \tag{16}$$

where R refers to the restrictions imposed by the IBM. These restrictions can be tested jointly using the Wald test. The Wald statistic can be computed as $(\Gamma - R)(Var(\Gamma - R))^{-1}(\Gamma - R)^T$ which follows a χ^2 distribution with 10 degrees of freedom based on our lag length. Following Ghosh and Ostry (1995) $Var(\Gamma - R)$ can be computed numerically as $\nabla(\Gamma)^T \Sigma \nabla(\Gamma)$ where Σ is the variance–covariance matrix of the VAR. We find the Wald statistic to equal 99.51 and therefore reject the null hypothesis that the restrictions hold jointly. The formal test reveals the same conclusion as the visual inequality of the two current accounts.

One concern with the empirical findings discussed above, is persistence in the current account series discussed by Mercereau and Miniane (2004). From Eq. (11) we see the current account is a linear function of the inverse of $M = \left[I - \frac{\psi}{1+r}\right]$. If at least one eigenvalue of ψ were close to $(1 + r)$ it would lead to near-singularity of the matrix, M which invalidates the non-linear Wald test. This means our rejection of the IBM based on the Wald test discussed earlier may be a false rejection. One of our eigenvalues equals 1.11, which is close to $1 + r = 1.03$ and therefore there is a possibility of a near-singularity of the matrix, M. Thus we use the alternative to the non-linear Wald test discussed by Mercereau and Miniane (2004). The alternative is a simple F test which does not require a linear approximation and therefore is not affected by near-singularity of the matrix discussed above. For this test we need to first define $S = ca_t - (1 + r)\, ca_{t-1} - \Delta z_t$ and Q_{t-1} as the information set containing all the values of $ca_{t-1}, \ldots, ca_{t-\infty}, \Delta z_{t-1}, \ldots, \Delta z_{t-\infty}$. If the IBM holds, then it

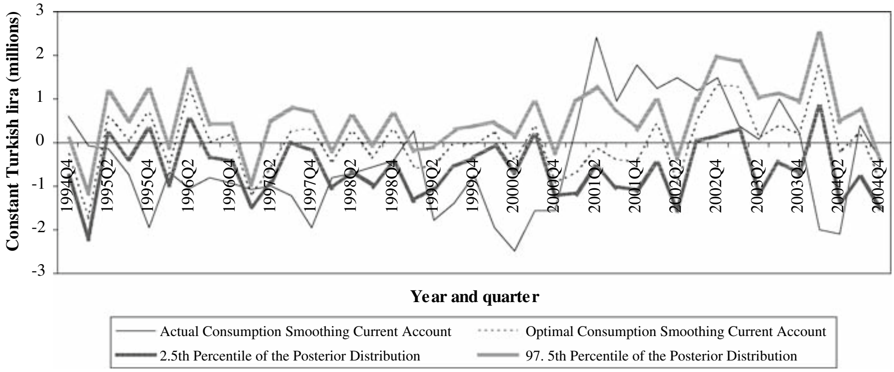

Fig. 5 Actual, optimal and confidence bands of consumption smoothing current account (1994:Q4 to 2004:Q4). *Notes*: We generate 1,000 draws from the multivariate normal distribution given the VAR parameters and the variance covariance matrix and compute the Γ vector. This gives us the posterior distribution of the optimal consumption smoothing current account. We plot the 2.5th and 97.5th percentiles of this posterior distribution. All series are in millions of 1987 constant Turkish lira

implies that $E_t(S_t \mid Q_{t-1}) = 0$. If S_t is regressed on Q_{t-1} given the correct lag length, then the F-test can determine joint statistical significance of the included regressors. Rejection of the null, that the coefficients of included regressors are jointly zero, implies rejection of the IBM. Our F-statistic is estimated to be 24.09 which must be compared to the critical $F_{0.05,\,2,\,40}$ of 3.23. Therefore we reject the null hypothesis and thus the IBM for Turkey in the sample period using the alternative test as well.

In addition to invalidity of the non-linear Wald test, Mercereau and Miniane (2004) note that near-singularity of the M matrix, leads to imprecise estimates of the optimal current account series. Thus, we cannot use the traditional F-test or χ^2 test for equality of the variances of the optimal and actual consumption smoothing current account series. Instead we compute confidence bands for our estimates and analyze the variance ratio of the two series based on the posterior distribution (discussed below).

To compute the confidence bands we follow Mercereau and Miniane (2004) and generate 1,000 draws from the multivariate normal distribution given the VAR parameters and the variance covariance matrix. For each draw we compute the Γ vector, and thus the posterior distribution of the optimal current account. To graphically evaluate robustness we follow Mercereau and Miniane (2004) and plot the 2.5th and 97.5th percentiles of the posterior distribution at each point of time in Fig. 5. The bands are fairly narrow and remain equivalent across the sample period, similar to what Mercereau and Miniane (2004) find for Sweden but unlike what they find for Belgium, Canada, Denmark and UK. Based on the graph, we conclude that the estimates of the optimal current account series are not imprecise.

As Mercereau and Miniane (2004) do, we plot the variance ratio of posterior distribution in Fig. 6 to compare volatility between the actual and optimal series. The variance ratio is the ratio of the variance of the actual to optimal consumption smoothing current account. Thus, a variance ratio greater than 1 indicates that the actual series is more volatile than the optimal and vice versa. Figure 6 shows that there is approximately 98% probability that the actual series is more volatile than

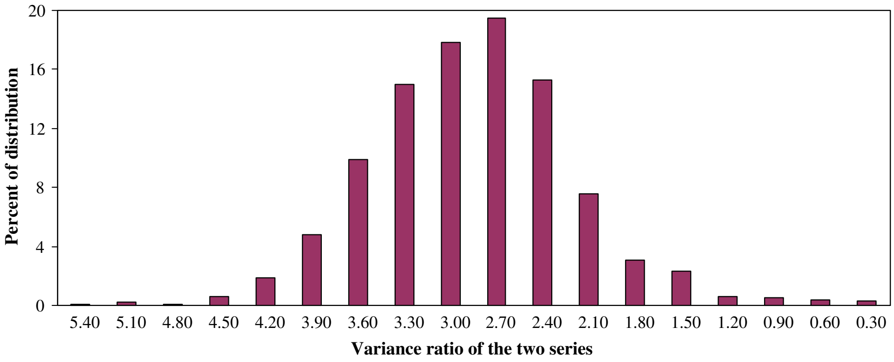

Fig. 6 Posterior distribution of the variance ratio of the actual to optimal consumption smoothing current account. *Notes*: The variance ratio (plotted on the x-axis) is the variance of the actual consumption smoothing current account divided by the variance of the optimal consumption smoothing current account. Thus a variance ratio greater than 1 corresponds to the actual series being more volatile than the optimal series and vice versa. Plotted on the y-axis, is the percent of the distribution corresponding to the variance ratio of the two series

the optimal series. There is only an approximately 2% probability associated with a variance ratio equal to or less than one which means that there is very little probability that the optimal series is more or equally volatile compared with the actual consumption smoothing current account. Based on these probabilities, we conclude that volatility of the actual consumption smoothing current account in Turkey is greater than the optimal consumption smoothing current account. Therefore, we reject the perfect capital mobility hypothesis for Turkey. Moreover, as Makrydakis (1999) notes for Greece, the above conclusion implies inappropriate use of capital flows to smooth consumption in Turkey.

Mercereau and Miniane (2004) also evaluate the claim of validity of the IBM based on a high correlation between the series (even if they are not equally volatile). Just as they do, we also plot the posterior distributions of the correlation between the actual and optimal consumption smoothing current account series in Fig. 7. The graph shows that there is over 80% probability associated with correlation ranging from −0.06 to 0.01 and thus provides evidence of very little correlation between the two series. Thus, we conclude that Turkey was not following an optimal consumption path in the sample period.

Our econometric analysis thus rejects the IBM for Turkey in the sample period which means that the Turkish current account deficit was excessive in this period. This implies that Turkish consumption was not optimizing utility. This may, but does not necessarily imply that the current account was unsustainable in this period. To shed light on the sustainability of the current account we turn to the following section.

4.4 Testing for sustainability of the Turkish current account

To analyze sustainability of the current account we follow Makrydakis (1999). As Makrydakis (1999) does, we create a series of the difference between actual and optimal net external liabilities which in turn are computed by accumulating the actual

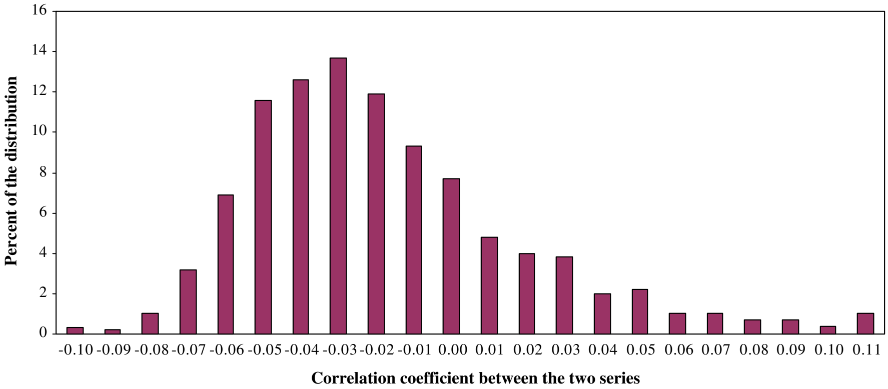

Fig. 7 Posterior distribution of the correlation coefficient between the actual and optimal consumption smoothing current account. *Notes*: The correlation coefficient between actual and optimal consumption smoothing current account is computed and plotted between −0.1 and 0.11 on the x-axis. Again, the percent of distribution corresponding to the correlation is plotted on the y-axis

and optimal current account, respectively. If this difference series (denoted as d_t) was stationary for the sample period, then it implies that the current account was sustainable (even though it was excessive as shown above). On the other hand if d_t was nonstationary, then we conclude that the Turkish current account was unsustainable for the sample period.

As we did with other series, we conduct the full set of unit root tests on this newly created series also reported in Table 1. All the tests show support that the series is nonstationary for the sample period. This implies that the Turkish current account was unsustainable for that period.

Based on our econometric work discussed in this and the previous sub-section we conclude that the Turkish current account path was non-optimal and unsustainable for the sample period. However, we believe that this general trend of the current account has reversed in the latter part of the sample period. To support this point we use visual and econometric tests discussed below.

Figure 5 which graphs the actual, optimal, and confidence bands of the consumption smoothing current account shows that the actual series lies outside (sometimes above and other times below) of the confidence bands for most of the sample period. This indicates that the actual current account was not following the optimal path. However, after the second financial crisis in 2001, the actual current account falls within the confidence bands.[4] This indicates that in the latter part of the sample, the actual current account is close to the optimal path. Thus, although the actual current account was non-optimal for the period as a whole, this may not necessarily be true since 2002.

In addition, we also examine the behavior of the d_t series to examine changes in sustainability. Figure 8 graphs the d_t series as well as the actual and optimal external liabilities. From the graph we see an increasing difference (in absolute value) between the actual and optimal net external liabilities until the first quarter of 2001. This

4 Except for two quarters in the beginning of 2004, which may be linked to an oil price surge.

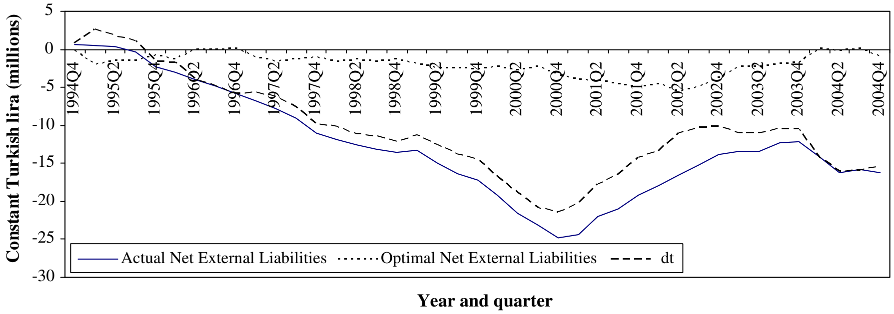

Fig. 8 Actual and optimal net external liabilities, (1994:Q4 to 2004:Q4). *Notes*: The actual and optimal net external liabilities are computed by accumulating the actual and optimal consumption smoothing current account, respectively. The series dt is the difference between actual and optimal net external liabilities. All series are in millions of 1987 constant Turkish lira. *Source:* Central Bank of Turkey

supports our empirical tests that the series is nonstationary which implies that the current account is unsustainable. The financial crisis in that period lends support to our conclusion. However, the difference between the actual and optimal net external liabilities starts declining after the 2001 crisis.[5] This may explain why although Turkey had much more severe current account deficit to GDP ratio in that period reaching close to 7% (well above the 5% threshold) in the first quarter of 2003, it did not suffer a financial crisis.[6]

This conclusion of changing trends can be seen by the structural breaks in the data. The structural breaks for ca_t and d_t from the Zivot–Andrews tests are the first quarter of 2001 and the second quarter of 2001, respectively. What is interesting about the period of the structural breaks is that it coincides with reforms undertaken by Turkey following the February 2001 crisis.

The reforms mentioned above include exchange rate, financial sector and public sector reforms. The exchange rate reform was a shift from a pegged to a floating regime. This reduced the need to hold large amounts of foreign reserves to defend the lira. Moreover, a move to market determination of the lira could be seen as a move to a correct real exchange rate which Mollick (2003) shows is necessary for stabilizing the current account.

Financial sector reforms included restructuring of the banking sector by closing down unviable banks and bank recapitalization. It also implied increased accountability and transparency in line with Basel II practices (see Steinherr et al. 2004; Airaudo et al. 2004 for details). Alper and Onis (2003) note that lack of transparency and accountability lead to imperfect capital liberalization. Our empirical work rejects perfect capital mobility which could be linked to imperfect capital liberalization. This

5 We see a widening deviation in the two series in the early part of 2004 which starts declining by the end of that year. The temporary increase in deviation may be linked to a jump in oil prices in the first half of 2004 as discussed earlier.

6 It is possible that this ability to maintain higher current account deficits is associated with lower interest rates in developed countries which affects Turkey's ability to attract greater capital flows. Our model is limited in that it uses a constant world rate of interest and therefore cannot shed light on this aspect.

can be corrected through these financial sector reforms. Through the improvement in capital liberalization, there could be a positive impact on optimality and sustainability of the current account deficit as well. Given the significant progress[7] Turkey has made toward Basel II practices, there is reason to support the notion of a reversal in unsustainability in the current account path in the latter part of the sample period.

Finally, Turkey also undertook public sector reforms in preparation of EU candidacy. The Maastricht Treaty requires that member countries have a public debt to GDP ratio of less than 60% and a fiscal deficit to GDP ratio of less than 3%. Turkey had initiated reforms such as pension and tax administration reforms as well as enhancing the role of the private sector and the Turkish Treasury.[8] announced that they expected to meet the above criterion by 2006–2007. The budget deficit issue is important in the light of the relation between budget and current account deficits. The relationship between the two has been discussed widely in the "twin deficits" literature. Khalid and Guan (1999) show support for the long run relation between the two deficits for developing countries and argue that for open economies foreign imbalances dictate domestic imbalances. The literature also shows that causation between current account deficits and fiscal deficits may run the other way. For example, Mann (2002) has argued that the current account deficits in the US in the 1980s were associated with the budget deficits at that time. This latter relation implies that an improvement in the budget deficit due to the reforms, could have a positive impact on the current account position in Turkey.

Taken together, the structural breaks in the data and the reforms suggest a change in the Turkish current account position in the latter part of the sample period. Thus, although we show evidence that Turkey's current account is not optimal and unsustainable for the sample period as a whole, we have reason to question that conclusion for the latter part of the sample period.

5 Conclusion

In this paper, we use the IBM framework to study the current account movements in Turkey from 1992 to 2004. To use the IBM we need to compute the consumption tilting parameter for Turkey. 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 estimate of the consumption tilting parameter for Turkey to the IBM literature on developing countries, which although extensive, had thus far excluded Turkey.

The IBM model has several implications that we test in our paper. One of the implications of the model is that the current account Granger causes future changes in the national cash flow. Our results show support of the IBM for Turkey when Granger-causality tests are performed on the current account. However, it should be

[7] Presentation by Undersecretary of Treasury, Ibrahim H. Çanakci at the International Conference on "Financial Stability and Implications of Basel II", May 17, 2005.

[8] Press Releases of the Turkish Treasury, March, 2005 and May 2005.

noted that the Granger causality test is a less stringent test of the model and does not provide conclusive evidence of intertemporal solvency for Turkey in this sample period.

The more stringent test for the IBM is the test of equality of the actual and optimal consumption smoothing current account. Traditionally, IBM literature uses the non-linear Wald test for testing equality of the two series which we do as well. We reject equality of the actual and optimal consumption smoothing current account based on this test. More recently, the validity of the traditional test has come under scrutiny if there is persistence of the current account. We thus also use an alternative F-test to test for equality of the two series. Similar to the traditional test, the alternative test also rejects equality of the two series. Based on this formal test of equality of the actual and optimal consumption smoothing current account, we conclude that the IBM is rejected for Turkey in the sample period.

The last implication of the model is equality of variance of the two series is also rejected. This is a test of perfect capital mobility. Since there is some concern of the precision of the estimates of our optimal consumption smoothing current account we compute confidence bands for the series. By analyzing the variance ratio of the actual to optimal series from the posterior distribution, we conclude that the actual series is significantly more volatile than the optimal consumption smoothing current account. Thus, Turkey exhibited imperfect capital mobility in the sample period.

Based on the tests of these implications we reject IBM for Turkey for the sample period. This implies that Turkey's current account deficit was not optimal and therefore not maximizing utility for that period.

In addition to optimality, we also analyzed sustainability of the current account by testing for stationarity of the deviations between actual and optimal net external liabilities. Stationarity of this series implies that although the actual and optimal current accounts are not equal, the deviations between the two series revert back to its mean. This would indicate that the current account deficit while not optimal (according to the evidence presented earlier) was sustainable. Our results showed that this series was nonstationary. Therefore, we conclude that the Turkish current account was not sustainable for our sample period.

While the empirical work shows that Turkey's current account deficit was both non-optimal and unsustainable for the sample period as a whole, we have reason to believe that there is a reversal of this trend in the latter part of the period. Empirical analysis of both the consumption smoothing current account series and the difference between actual and optimal net external liabilities show structural breaks in the early part of 2001. The change in trend can also be seen from the graphs (Figs. 4, 8) of the two series. Both the statistical and visual evidence of change is particularly compelling in light of the reforms undertaken by Turkey in response to the financial crisis in February 2001. Thus, we believe that in the latter part of our sample period, Turkey's current account position has improved.

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