*Working Papers in Economics*

# Intertemporal solvency of Turkey's current account

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**Working Paper # 08/05**

**September 2008**

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**Abstract**

We test for sustainability of Turkey's current account position between 1992 and 2007 using the intertemporal solvency model of Hakkio and Rush (1991) and Husted (1992). This approach examines the relationship between exports and imports+ (which include imports, net interest and unilateral transfer payments). Cointegration between inflows and outflows implies that the intertemporal budget constraint is satisfied. We use the Johansen and the Gregory and Hansen (1996) cointegration tests to determine linkages between exports and imports+ in Turkey. Using the Johansen test we find no cointegration and thus reject intertemporal solvency of the current account for this period. If we allow for a structural break in the cointegrating relation using the Gregory Hansen procedure we do find evidence of cointegration between the two series. This result can be used to estimate the long-run relationship between exports and imports+ using dynamic OLS and test for weak and strong sustainability of the current account position. We find evidence for weak sustainability but reject strong sustainability of the Turkish current account position in recent years.

*Key Words*: Current account sustainability, intertemporal budget constraint, Turkey, cointegration
*JEL Classification*: F32, F41

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## 1. Introduction

In this paper we examine the present solvency of Turkey's current account position. Large current account deficits can indicate a lack of competitiveness. Moreover, if these deficits are high and persistent they signal economic vulnerability which could lead to a crisis. High current account deficits have been associated with crises in the 1990s such as Mexico and countries in East Asia. This is also true for Turkey which experienced high current account deficits prior to the two financial crises in 1994 and 2001. The current account position has been continuously and severely deteriorating since the 2001 crisis. Thus, there has been a great deal of concern that Turkey will face another crisis.

While high and persistent current account deficits could be a sign of unsustainability, there is no agreement of what constitutes a high or persistent current account deficit. Milesi-Ferretti and Razin (1996) have argued that a current account deficit to GDP ratio in excess of 5% is large and unsustainable, although countries with larger deficits have not always experienced crises. A clear definition of a persistent current account deficit is also not available. While countries have faced a high current account deficit for over a decade without a crisis as in the case of Australia discussed in Milesi-Ferretti and Razin (1996), other countries have suffered a crisis following only a few years of high current account deficits. In Turkey's case, the financial crises in 1994 and 2001 were both preceded by high current account deficits, but these deficits were only observed for a few quarters prior to the crisis. On the other hand, since 2003 Turkey has exceeded the 5% threshold for the ratio of current account deficit to GDP and reached 6% in 2006 without facing a crisis in 2007. Why is Turkey able to tolerate current account deficits of this magnitude in the present period? We address this question through an intertemporal solvency model of the current account.

The intertemporal approach of the current account position examines cointegration between exports and imports+ (which include imports, net interest and unilateral transfer payments). If there is a long-run relation between exports and imports+ we can conclude that current account deficits are adding to the productive capacity for Turkey and thus are sustainable. We find no evidence of cointegration between exports and imports+ for the 1992-2007 period which implies that Turkey's current account was unsustainable for the period as a whole. This is not surprising given that this period includes two major financial crises. However, when we allow for a structural break in the cointegration relation, we find evidence of cointegration between exports and imports+. Thus, we conclude that while Turkey violated the intertemporal solvency condition for the period as a whole, there is a change in the current account position since the mid-2000s.

The paper is organized as follows: the next section provides background on Turkey current account which is followed by a review of the literature. Section 4 presents the theoretical model of the intertemporal model for examining current account sustainability and section 5 explains the econometric methodology. Section 6 discusses the empirical results and the last section concludes.

## 2. Background

In the 1960s and 1970s import substitution policies had been applied and Turkey's trade volume had remained quite modest. Turkey initiated economic and trade liberalization after the 1980 military coup. By the 1990s, coupled with the added impetus of globalization, Turkey's trade volume had reached over 30% of its GDP and current account deficits started to become a problem. In 1994, Turkey suffered its first current account related economic crisis.

Figures 1 and 2 show the trend in the components of the Turkish current account between 1992 and 2007. Figure 1 maps exports and imports+ measured in U.S. dollars and figure 2 graphs real exports and imports+ as a percentage of GDP.[1] Both figures show a continuous upward trajectory in exports and imports. The trend is stronger in figure 1 but less pronounced in figure 2 which shows some stagnancy especially for exports. This is related to the high growth in

[1] Real imports and exports series are based on the real exchange rate.

the Turkish economy in this period. The two graphs show an increasing gap between exports and imports. Both figures highlight the excess of imports over exports prior to the two (1994 and 2001) crises.[2] This gap is wider in the post 2001 period and the graphs show a continuous large deficit (difference between exports and imports) from the end of 2003 onwards.

Figure 3 which maps Turkey's real current account balance to GDP ratio combines the information in the individual series. This graph shows the seasonal nature of Turkey's current account which is related to tourism revenues which peak in August and September. The gap between exports and imports prior to the two crises discussed above are reflected in high current account deficits to GDP ratios. The high monthly current account deficits prior to the two crises tell Turkey's economic tale in the nineties. Economic growth for Turkey has been accompanied by high current account deficits since the 1980s. Hence, the period of current account surplus in Turkey coincides with the 1994 and 2001 crises which were recessionary periods in Turkey.

Moreover, figure 3 shows that Turkey in the 1990s is not tolerant to persistent current account deficits. For example, following 9 consecutive months of current account deficits and breaching the 5% threshold in some months results in the 1994 crisis.[3] Again, after 13 months of persistent current account deficits Turkey suffers a crisis in February 2001. In this period, current account deficits are larger than the previous crisis, averaging 4.96% of GDP for the period and reach close to 9% in several months. Although, the second crisis has larger current account deficits for a longer period than the first, in both cases the current account deficits are observed for a shorter duration than other crisis affected countries in the empirical literature. Milesi-Ferretti and Razin (1996) for example, note that sustainability is related to breaching the 5% current account deficit to GDP ratio for a number of years. In comparison, with deficits spanning

[2] This is also observed in the 1996-1997 period. This represents the period surrounding Turkey's entry into the Customs Union which sparked an increase in trade.

[3] The months following the 1994 crisis also have large current account deficits. However, those are followed with sharp reversals. Thus, even though monthly current account deficits sometimes reach 9% of GDP, surpluses in other months prevent a crisis.

approximately a year prior to the two crises, Turkey's tolerance to high current account deficits was low in the 1990s.

This tolerance has changed in the 2000s. As figure 3 demonstrates, Turkey's threshold for large current account deficits is much higher in the 2000s when compared with the 1990s. Since December 2003, there have been 46 months of deficits barring two months (August and September 2004) which record minor surpluses. In this period, the current account deficit to GDP ratio exceeded 10% for 17 months and reached 14% in a couple of months. These levels of current account deficits have never been observed earlier. Moreover, relatively large current account deficits for about a year led to a crisis. Thus, compared to the 1990s, Turkey appears to be able to sustain larger current account deficits in the 2000s.

Unsustainability of the current account position is based on several factors. Milesi-Ferretti and Razin (1996) provide a framework for understanding current account sustainability. The framework uses structural features such as external debt and exports as well as macroeconomic indicators such as fiscal sustainability and the exchange rate position to examine current account sustainability. Milesi-Ferretti and Razin (1996) use this framework to analyze the current account experiences of seven countries including Australia, Chile, Ireland, Israel, Malaysia, Mexico and South Korea. They conclude that external debt, exports and fiscal positions are identifiers between sustainable and unsustainable current account positions. Ogus and Sohrabji (2009b) extend this framework to examine current account sustainability for Turkey. They analyze these indicators for high current account deficit periods by comparing periods prior to the two crises (1994 and 2001) and non-crisis periods (2004, 2005 and 2006). They conclude that despite some vulnerability in the external debt and exchange rate position, there has been sufficient improvement in the Turkish economy in the fiscal and export position which has allowed Turkey to accumulate high current account deficits without facing a crisis.

This improvement may be related to the substantial economic and financial reforms undertaken post 2001, some of which had been initiated earlier (in 1999) through an IMF program. One of the more important reforms was that the pegged exchange rate regime which was considered overvalued and a factor in the 2001 crisis was abandoned in favor of a floating exchange rate. In addition, political reforms gained pace as Turkey started negotiations to join the European Union in 2003. If these reforms are related to Turkey's ability to sustain higher current account deficits, it implies that there have been structural improvements in the economy. This implies that the high current account deficits are financing investment rather than consumption. In this context, high current account deficits are not a sign of vulnerability, but rather should be viewed as necessary for economic improvement. We examine this issue of current account sustainability in the following sections.

## 3. Literature review

The intertemporal approach for exploring current account sustainability is well established in the literature. There have been two ways to determine intertemporal sustainability of the current account. The first is through the intertemporal benchmark model (IBM) where the optimal consumption-smoothing current account series is estimated and compared to the actual consumption-smoothing current account. Testing deviations between the two series and the variances of the two series can determine if the country is on an optimal current account path. While this technique has been used extensively, the only study that conducted this for Turkey was done by Ogus and Sohrabji (2009a). Using quarterly data from 1992-2004, they find that Turkey's current account position was unsustainable. However, they also found that there is a structural break in the deviation of actual and optimal net external liabilities since 2001. Thus, while the external position was unsustainable for the whole period, there is a change in Turkey's external position following the 2001 crisis. This period coincides with exchange rate and financial sector reforms undertaken in Turkey. Thus, although current account deficits in Turkey had increased significantly since the mid-2000s, it does not imply that current account was unsustainable since other factors can impact the external position.

In this paper we employ a different intertemporal approach. This is based on the theoretical model of Hakkio and Rush (1991) and Husted (1992). The model examines the long-run relation between exports and imports+. Cointegration between exports and imports+ (assuming both are integrated of order one) implies intertemporal solvency of the current account. This approach has been used by several authors for developed and developing countries including Husted (1992) for the U.S., Leachman and Thorpe (1998) for Australia, Apergis, Katrakilidis and Tabakis (2000) for Greece, Arize (2002) for 50 developed and developing countries, Baharumshah, Lau and Fountas (2003) for Indonesia, Malaysia, Philippines and Thailand, Irandoust and Ericsson (2004) for France, Germany, Italy, Sweden, U.K. and U.S., Narayan and Narayan (2005) for 22 least developed countries and most recently Konya (2008) for Czech Republic, Hungary and Slovenia.

To the best of our knowledge the only paper to explore Turkey's current account sustainability using this approach is Kalyoncu (2005). Using quarterly data from 1987-2002, Kalyoncu (2005) finds that Turkey's current account is sustainable in the long run. We build on this work in two ways. Firstly, we use monthly data from 1992 to 2007. Thus, we are able to update the analysis. Our sample covers the period following the 2001 crisis after which reforms were undertaken and we are thus able to empirically evaluate the impact of these reforms. In addition Zhou (2001) shows that using higher frequency data when only shorter time spans are available can improve cointegration analysis. More importantly, we use the Gregory and Hansen (1996) procedure to explore the possibility of a structural break in the cointegrating relationship. This allows us to estimate the long run equilibrium relationship between exports and imports+ using dynamic OLS (DOLS). The theoretical model is presented in the next section followed by a discussion of the econometric techniques employed in this paper.

## 4. Intertemporal approach to determining current account sustainability

The theoretical model for examining current account sustainability is based on Hakkio and Rush (1991) and Husted (1992). The approach assumes that an open economy faces the following budget constraint:

$$C_t = Y_t + B_t - I_t - (1 + r_t) B_{t-1} \tag{1}$$

where $C_t, Y_t, B_t, I_t$ are consumption, income, net borrowing and investment respectively; $r_t$ is interest rate per period and $(1 + r_t) B_{t-1}$ is net debt from the previous period.

Equation (1) must hold in every period, thus we obtain

$$\begin{aligned}
B_{t+1} &= -(Y_{t+1} - C_{t+1} - I_{t+1}) + (1 + r_{t+1}) B_t \\
B_{t+2} &= -(Y_{t+2} - C_{t+2} - I_{t+2}) + (1 + r_{t+2}) B_{t+1} \\
&= -(Y_{t+2} - C_{t+2} - I_{t+2}) - (1 + r_{t+2})(Y_{t+1} - C_{t+1} - I_{t+1}) + (1 + r_{t+2})(1 + r_{t+1}) B_t \\
&\vdots \\
B_{t+n} &= -(Y_{t+n} - C_{t+n} - I_{t+n}) - (1 + r_{t+n})(Y_{t+n-1} - C_{t+n-1} - I_{t+n-1}) - \cdots \\
&\quad - (1 + r_{t+n})(1 + r_{t+n-1}) \cdots (1 + r_{t+2})(Y_{t+1} - C_{t+1} - I_{t+1}) \\
&\quad + (1 + r_{t+n})(1 + r_{t+n-1}) \cdots (1 + r_{t+1}) B_t
\end{aligned}$$

Rearranging the above and letting *n* approach infinity we obtain

$$B_t = \sum_{i=1}^{\infty} \lambda_i \left[ Y_{t+i} - C_{t+i} - I_{t+i} \right] + \lim_{n \to \infty} \lambda_n \, B_{t+n} \tag{2}$$

where $\lambda_i = \prod_{j=1}^{i} \frac{1}{1 + r_{t+j}}$.

Noting trade balance is the difference between exports (*X*) and imports (*M*) equation (1) reduces to $X_t - M_t = Y_t - C_t - I_t = -B_t + (1 + r_t) B_{t-1}$. Equation (2) implies that the amount a country borrows or lends in international markets equals the present value of the future trade surpluses or deficits assuming the last term equals zero. If the limit term is nonzero and $B_t$ is positive then it implies "bubble financing" of external debt while a negative $B_t$ suggests the country could improve welfare by lending less.

Assuming world interest rate is stationary with a mean of *r* we can add and subtract $r\,B_{t-1}$ and rewrite the equation to obtain $M_t + (1+r_t)B_{t-1} + r\,B_{t-1} - r\,B_{t-1} = X_t + B_t$. Finally, we can rewrite equation (1) as the following:

$$Z_t + (1+r)B_{t-1} = X_t + B_t \tag{3}$$

where $Z_t = M_t + (r_t - r)B_{t-1}$.

Rewriting equation (3) we obtain

$$\begin{aligned}
B_t &= Z_t - X_t + (1+r)B_{t-1} \\
B_{t+1} &= Z_{t+1} - X_{t+1} + (1+r)B_t \\
&= Z_{t+1} - X_{t+1} + (1+r)(Z_t - X_t) + (1+r)^2 B_{t-1} \\
&\vdots \\
B_{t+n} &= \sum_{j=0}^{n} (1+r)^{n-j}\left(Z_{t+j} - X_{t+j}\right) + (1+r)^{n+1} B_{t-1}
\end{aligned}$$

From the above, we get

$$B_{t-1} = \sum_{j=0}^{n} (1+r)^{-j-1}\left(X_{t+j} - Z_{t+j}\right) + (1+r)^{-n-1} B_{t+n}$$

$$B_{t-1} = \sum_{j=0}^{n} \lambda^{j+1}\left(X_{t+j} - Z_{t+j}\right) + \lambda^{n+1} B_{t+n}$$

where $\lambda = \dfrac{1}{1+r}$. As *n* approaches infinity,

$$B_{t-1} = \sum_{j=0}^{\infty} \lambda^{j+1}\left(X_{t+j} - Z_{t+j}\right) + \lim_{n\to\infty} \lambda^{n+1} B_{t+n} \tag{4}$$

Equation (4) can be rewritten as,

$$B_{t-1} = \lambda(X_t - Z_t) + \lambda^2 (X_{t+1} - Z_{t+1}) + \lambda^3 (X_{t+2} - Z_{t+2}) + \ldots + \lim_{n\to\infty} \lambda^{n+1} B_{t+n} \tag{5}$$

Equation (5) can be further manipulated to obtain,

$$\begin{aligned}
B_{t-1} &= \lambda(X_t - Z_t) + \lambda^2 (X_{t+1} - Z_{t+1}) - \lambda^2 (X_t - Z_t) + \lambda^2 (X_t - Z_t) + \lambda^3 (X_{t+2} - Z_{t+2}) \\
&\quad - \lambda^3 (X_{t+1} - Z_{t+1}) + \lambda^3 (X_{t+1} - Z_{t+1}) + \ldots + \lim_{n\to\infty} \lambda^{n+1} B_{t+n} \\
&= \lambda(X_t - Z_t) + \lambda \sum_{j=1}^{\infty} \lambda^j \left(\Delta X_{t+j} - \Delta Z_{t+j}\right) + \lambda \sum_{j=0}^{\infty} \lambda^{j+1}\left(X_{t+j} - Z_{t+j}\right) + \lim_{n\to\infty} \lambda^{n+1} B_{t+n}
\end{aligned}$$

Using equation (4), the above reduces to,

$$B_{t-1} = \lambda(X_t - Z_t) + \lambda \sum_{j=1}^{\infty} \lambda^j (\Delta X_{t+j} - \Delta Z_{t+j}) + \lambda B_{t-1} + (1-\lambda) \lim_{n\to\infty} \lambda^{n+1} B_{t+n} \qquad (6)$$

Rearranging the above we obtain,

$$\frac{1-\lambda}{\lambda} B_{t-1} = (X_t - Z_t) + \sum_{j=1}^{\infty} \lambda^j (\Delta X_{t+j} - \Delta Z_{t+j}) + \frac{(1-\lambda)}{\lambda} \lim_{n\to\infty} \lambda^{n+1} B_{t+n} \qquad (7)$$

Given that $\lambda = \dfrac{1}{1+r}$ and taking $Z_t$ to the left hand side we can rewrite equation (7) as,

$$Z_t + r B_{t-1} = X_t + \sum_{j=1}^{\infty} \lambda^j (\Delta X_{t+j} - \Delta Z_{t+j}) + r \lim_{n\to\infty} \lambda^{n+1} B_{t+n} \qquad (8)$$

Assuming $X_t$ and $Z_t$ are random walks with a drift such that,

$X_t = \alpha_1 + X_{t-1} + \varepsilon_{1t}$ and $Z_t = \alpha_2 + Z_{t-1} + \varepsilon_{2t}$ we can rewrite equation (8) as

$$\begin{aligned} Z_t + r B_{t-1} &= X_t + \sum_{j=1}^{\infty} \lambda^j (\alpha_1 - \alpha_2 + \varepsilon_{1t+j} - \varepsilon_{2t+j}) + r \lim_{n\to\infty} \lambda^{n+1} B_{t+n} \\ &= X_t + \frac{\alpha_1 - \alpha_2}{r} + \sum_{j=1}^{\infty} \lambda^j (\varepsilon_{1t+j} - \varepsilon_{2t+j}) + r \lim_{n\to\infty} \lambda^{n+1} B_{t+n} \end{aligned} \qquad (9)$$

As noted earlier $Z_t = M_t + (r_t - r)B_{t-1}$, thus, equation (9) can be rewritten as

$$M_t + r_t B_{t-1} = X_t + \frac{\alpha_1 - \alpha_2}{r} + \sum_{j=1}^{\infty} \lambda^j (\varepsilon_{1t+j} - \varepsilon_{2t+j}) + r \lim_{n\to\infty} \lambda^{n+1} B_{t+n} \qquad (10)$$

Assuming the limit term is zero and defining $\alpha = \dfrac{\alpha_2 - \alpha_1}{r}$ , $\varepsilon_t = \sum_{j=1}^{\infty} \lambda^j (\varepsilon_{2t+j} - \varepsilon_{1t+j})$ and

$MM_t = M_t + r_t B_{t-1}$ the regression equation is given as

$$X_t = \alpha + \beta MM_t + \varepsilon_t \qquad (11)$$

If $X_t$ and $MM_t$ are integrated of order one then cointegration between exports and imports+ implies that the intertemporal budget constraint is satisfied. Under the null hypothesis that the country is satisfying its intertemporal budget constraint, we would expect $\beta$ to equal 1. This means that the current account deficit is sustainable. The econometric methodology used to analyze the model is discussed in the next section.

## 5. Econometric Methodology

In this paper we test for cointegration between exports and imports+. The following sub-sections discuss the econometric methodology related to testing this cointegrating relation.

### 5.1 Unit root tests

The first task before testing for cointegration between exports and imports+, is to determine the order of integration of both series. To do so we employ a battery of stationarity tests including classical unit root tests namely the Augmented Dickey-Fuller (ADF) test and the Phillips Perron (PP) test. Since these tests cannot distinguish between unit root and near unit root stationary processes, we also use other tests. These include the KPSS test[4] of Kwiatkowski et al. (1992) and the Zivot and Andrews (1992) test[5]. Once the order of integration is determined we can test for cointegration discussed below.

### 5.2 Cointegration tests

Following the literature on current account sustainability, we use the Johansen test for determining cointegration between exports and imports+. To determine the number of cointegrating vectors we use the Likelihood Ratio (LR) tests: the maximum eigenvalue test and the trace test.

One of the limitations of the Johansen approach is that it does not allow for the possibility of a structural break in the cointegrating relation. Following Baharumshah et al. (2003) and Cook (2004) we use the Gregory and Hansen (1996) cointegration procedure to account for structural breaks. In Turkey's case, there have been crises followed by reforms which could imply a structural change in the cointegrating relationship. Rather than setting an a priori structural break,

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[4] The KPSS (Kwiatkowski, Phillips, Schmidt & Shin) test is a test for stationarity around a level or a trend. As opposed to all other tests used, the null hypothesis for KPSS is that the series is stationary.

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

we use the Gregory Hansen cointegration test where the structural break is endogenously determined. Gregory and Hansen (1996) consider three models allowing for structural breaks in the cointegrating relation. They are denoted as level shift, level shift and trend, and regime shift and are specified as:

Model with level shift (C) $$X_t = \mu_1 + \mu_2 D_t + \beta MM_t + \varepsilon_t \tag{8}$$

Model with level shift and trend (C/T) $$X_t = \mu_1 + \mu_2 D_t + \gamma t + \beta MM_t + \varepsilon_t \tag{9}$$

Model with regime shift (C/S) $$X_t = \mu_1 + \mu_2 D_t + \beta_1 MM_t + \beta_2 MM_t D_t + \varepsilon_t \tag{10}$$

where $D_t = \begin{cases} 0\, if\ t \le \tau \\ 1\, if\ t > \tau \end{cases}$ and $\tau$ is the structural break point.

The Gregory Hansen procedure uses a grid search procedure where breakpoints in the central 70% of the sample[6] are considered. For each model the ADF is estimated. The breakpoint with the lowest value for the ADF (or highest absolute value) is chosen as the point at which the structural break occurred. If there is cointegration with a structural break, we can estimate the long-run relationship between exports and imports+ using dynamic OLS explained in the next sub-section.

### 5.3 Dynamic OLS (DOLS) estimation

Following the literature we use DOLS[7] proposed by Stock and Watson (1993) to estimate the long-run equilibrium relationship between exports and imports+. To eliminate simultaneity bias, DOLS includes lags and leads of the first difference of the regressors. In addition, DOLS captures differences from the structural break determined by the Gregory Hansen procedure. Thus, the DOLS equation to be estimated is given as below,

$$X_t = \alpha + \beta MM_t + \delta\left(MM_t - MM_\tau\right)D_t + d\left(L\right)\Delta MM_t + \varepsilon_t \tag{11}$$

[6] The interval between 0.15N to 0.85N is selected where N is the number of observations.
[7] Monte Carlo studies show that DOLS is found to have the lowest root mean square error (RMSE) of all asymptotic estimators.

where $MM_{\tau}$ is imports+ at the structural break point, $\Delta MM_t$ is the first difference of imports+, $d(L)$ represents lags and leads and all other variables are as previously defined.

## 6 Data and results

Following the literature, we estimate the relationship between exports and imports+ using two measures namely real exports and imports+ denoted as $RX$ and $RMM$ as well as real exports and imports$^+$ as a percentage of GDP denoted as $RXY$ and $RMMY$.

We use monthly data for 1992 to 2007 (ending in September). Our series include exports of goods and services, imports of goods and services, net interest payments, net unilateral transfer payments and GDP. GDP is expressed in Turkish lira and all other series are expressed in U.S. dollars. To determine the real value of exports and imports+ we need the real exchange rate which is computed from the nominal exchange rate (Turkish lira to U.S. dollar) and price levels for Turkey and for the U.S. We use the indicator selling rate for the nominal exchange rate and consumer price index (CPI) for price levels of both countries. From the above, we compute real exports (*RX*), real imports+ (*RMM*), real exports to GDP (*RXY*) and real imports+ to GDP (*RMMY*). All Turkish data is available from the Central Bank of Turkey. Data for U.S. CPI is available from the U.S. Bureau of Labor Statistics. We seasonally adjust the data and use this adjusted data for our econometric analysis.

Our first task is to perform unit root tests on all four series in levels and first differences. As noted in the earlier section, we employ several unit root tests. The results for the tests for different models and lag lengths (determined by AIC) are presented in table 1. The test results support our expectations that the series are I(1) in levels and I(0) in first differences.[8] Given these

[8] The only tests that contradicts these conclusions are the ADF, PP and KPSS tests (all with a trend term) for the *RMMY* series in levels. We believe that this relates to the difficulty in differentiating between trend stationarity and stationarity and thus conclude that the variables are nonstationary in levels and stationary in first differences.

conclusions, we can test for cointegration. Following the literature we use two tests, the Johansen test as well as the Gregory Hansen cointegration method which allows for structural breaks.

For the Johansen test we need to determine the appropriate lag length. We use the AIC lag specification criterion discussed in Enders (2004). The appropriate lag length for both sets of variables is determined to be 3 lags. Using this lag length, we test for cointegration between exports and imports+ measured in two ways as noted earlier. The Johansen cointegration test results (reported in table 2) show that there is no cointegration between the two series (measured both ways). This implies that the current account is unsustainable for the sample period as a whole. This is not a surprising result given the financial crises of 1994 and 2001.

One concern with the Johansen cointegration test is that it does not allow for changes in the cointegrating relationship. Gregory and Hansen (1996) allow structural breaks in the cointegrating relation and we use their procedure to test cointegration between exports and imports+. The results for the three models they consider are presented in table 3.

In general, the Gregory Hansen procedure results support the Johansen test results of no cointegration between exports and imports+ with one notable exception. In the first Gregory Hansen model (denoted as C) we find evidence of cointegration for the variables measured as a percentage of GDP (*RXY* and *RMMY*). This implies that while exports are not related to imports+ for the period as whole, there is a change in the relationship over the sample period. This break (determined to be April 2004) indicates a shift in the current account position. Given that we find evidence that now exports are related to imports+ it implies that presently, the current account deficit is not merely financing consumption, but rather investment.

Following the literature we use the above result to further explore the relationship between exports and imports+ using dynamic OLS (DOLS). As noted earlier, DOLS proposed by Stock and Watson (1993) is a more robust method for estimating the long-run relationship between exports and imports+. We use the break point of 2004:04 from Gregory Hansen results for the first model (denoted as C). Also, we determine the appropriate number of lags and leads as 8 using AIC. The results for the DOLS estimation are presented in table 4.

We test the model for departures from standard assumptions such as serial correlation (LM test), heteroskedasticity (White test) and autoregressive conditional heteroskedasticity (ARCH test). The results are not reported here, but are available on request. We find that the model suffers from the problems described. Following Kouretas and Zarangas (1998) we adjust the standard error using the Newey-West correction. The corrected standard error which allows us to test hypothesis of sustainability is reported in table 4.

Following the literature, we also test for normality of residuals and stability of the parameters of the model. For the former we use the Jarque-Bera test (reported in table 4) and find the model robust for normality of residuals. To determine parameter stability we use the cumulative sum of squares (CUSUMSQ) test shown in figure 4. We find that barring a brief period, the CUSUMSQ lies mostly within the 5% significance level thresholds. The brief departure is very slight and therefore not a cause for concern. We thus conclude that the model is robust for parameter stability.

We test for $\beta = 0$ and $\beta = 1$ and reject in both cases (details in table 4). This implies that while we reject strong sustainability of Turkey's current account position, there is evidence of a statistically significant relation between inflows and outflows. The latter result suggests an improvement in Turkey's external position in recent years which is linked to Turkey's enhanced export position. Turkey's exports quadrupled in the 2000s and surpassed the $ 100 billion mark in 2007.

Despite healthy exports, the current account deficit continues to be very high and is not strongly sustainable. This problematic current account deficit position is due to a structural problem in the Turkish economy. Production is heavily dependent on raw materials and intermediate goods that must be imported. While it is good news that imports are supporting exports now (as noted earlier) it implies that the increased export position comes at the cost of a higher import bill. Some have argued for a change in the production process that reduces reliance on imports. However, this solution may not be feasible, at least in the short run. It may not be possible to find alternative production processes. In that case, reduced reliance on imports would cause Turkey to slow down exports (and production in general) and could lead to destroying the recent advances in trade.

We believe the solution lies in focusing on strategic exports. The sectors that have seen significant improvement (in exports) in recent years include chemicals, automotives and auto parts. However, these sectors suffer from the problem discussed above namely, the need for imported inputs. Increase in exports in these sectors will require more imports and thus not improve the trade position. To improve the current account position, Turkey must focus on service sectors such as tourism, construction and retail which are healthy, vibrant and not reliant on imported inputs.

## 7 Conclusion

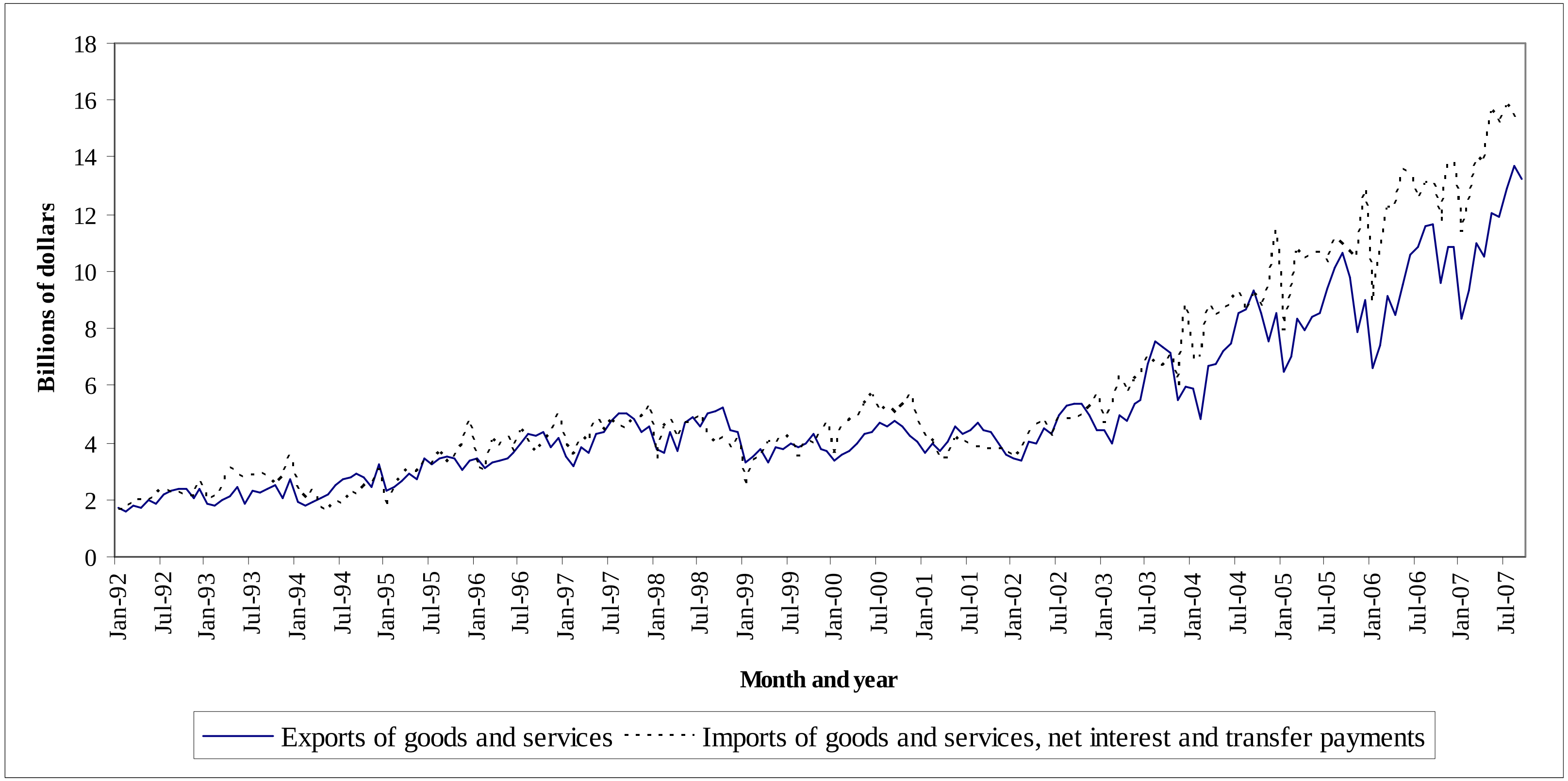
In this paper we analyze sustainability of Turkey's current account position using monthly data from 1992 to 2007. Our analysis uses the intertemporal solvency model by Hakkio and Rush (1991) and Husted (1992) which links exports and imports+. Assuming both are integrated of order one, cointegration between exports and imports+ implies that the intertemporal budget constraint of the current account has been satisfied and the current account is on a sustainable path.

We use two methods to test for cointegration, the Johansen test and the Gregory Hansen procedure. The latter allows for a structural break in the cointegrating relationship between exports and imports+ which is important in the context of Turkey given the economic reforms in the 2000s. We find no cointegration between exports and imports+ using the Johansen test and thus reject intertemporal solvency for the 1992-2007 period as a whole. This is an expected result given the two financial crises observed in Turkey during that period. When we allow for a break in the cointegrating relation using the Gregory Hansen procedure, we find cointegration with a structural break in 2004. This indicates a changed relationship between exports and imports+ in recent years.

Using the Gregory Hansen results, we estimate the long-run relationship between exports and imports+ using DOLS and test for sustainability of the Turkish current account position. While we reject strong sustainability of the current account, we find an improvement in the current account position. The improvement is related to a better export position. Despite experiencing larger current account deficits, healthy exports have helped the Turkish current account position in recent years. Moreover, while imports+ were unrelated to exports for the period as a whole (from the Johansen cointegration test) we find that after accounting for a break in Turkey's external position, there is a relation (albeit weak) between imports+ and exports.

To achieve strong current account sustainability, Turkey must overcome the structural problems that continue to plague the Turkish economy namely, the dependence on imported inputs. While it is good news that higher imports are being used to further the export position, heavy and continued reliance on imports represents a weakness for the Turkish economy. Some have argued for a structural change in production to reduce dependence on imported inputs. However, we find that unfeasible at least in the short run. Moreover given Turkey's strong export performance in recent years this may not be necessary. Strategic focus on exports may benefit Turkey's current account position. Tourism and construction have been consistently healthy export sectors for Turkey and continued investment in these areas will strengthen the Turkish economy. In addition, retail is a growing sector for Turkey and can yield beneficial results for the Turkish current account position. Thus, while we reject strong sustainability of Turkey's current account position, there is potential for this to change in the coming years.

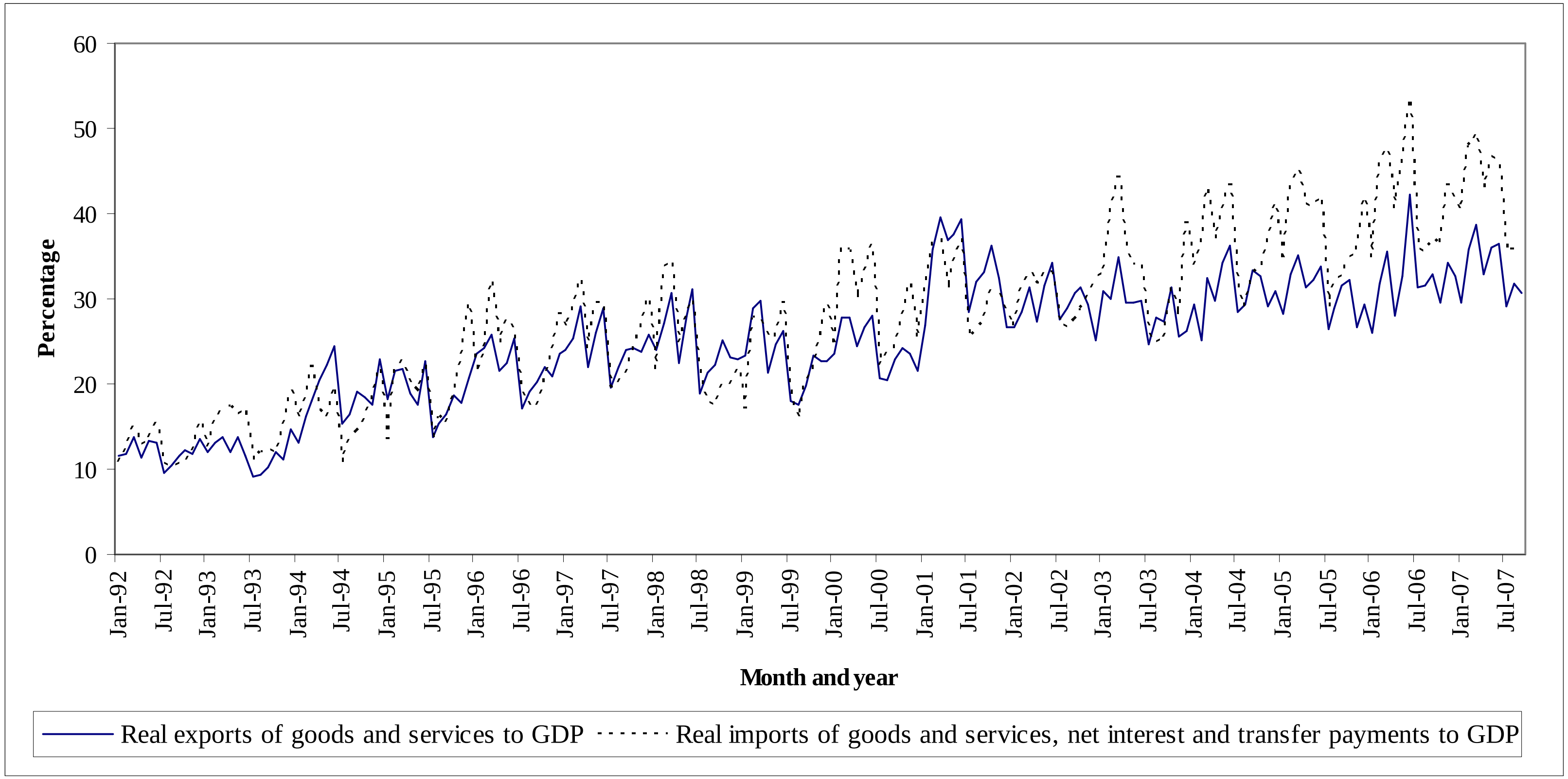
**Figure 1: Turkey's exports and imports+ (imports, net interest and transfer payments) [1992:01 – 2007:09]**




Note: Exports include goods and services. Imports include goods and services as well as net interest payments and net transfer payments. All series are expressed in U.S. dollars.

*Sources*: Central Bank of Turkey.

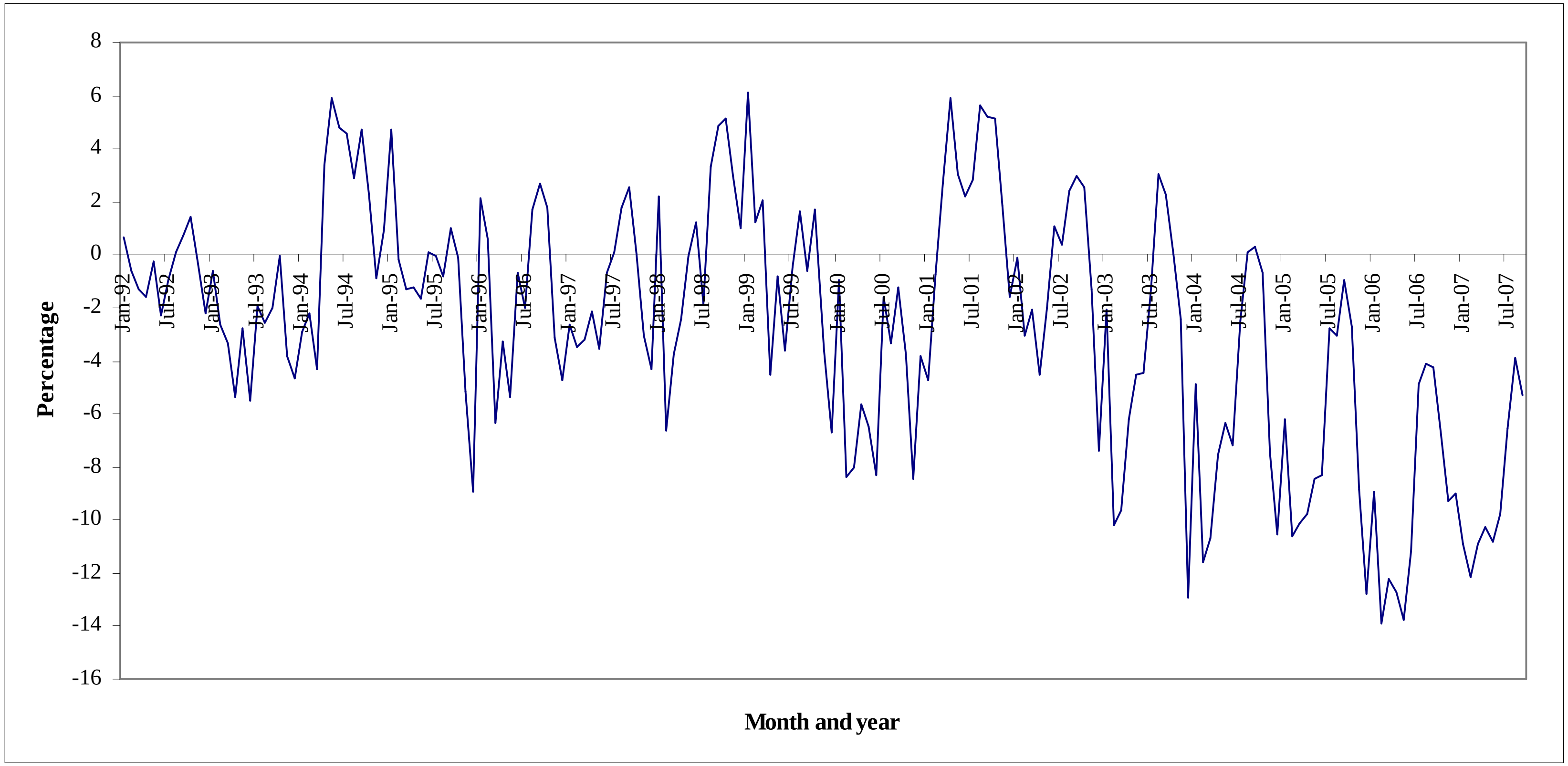
**Figure 2: Turkey's real exports and imports+ (imports, net interest and transfer payments) as a ratio of GDP [1992:01-2007:09]**




Notes: Exports include goods and services. Imports include goods and services as well as net interest payments and net transfer payments. All series are expressed in U.S. dollars. The GDP series is expressed in Turkish lira and export series in US dollars. Using the same methodology noted earlier for the real current account balance to GDP ratio we computed the real exports and imports to GDP ratios.

*Sources*: Central Bank of Turkey, U.S. Bureau of Labor Statistics.

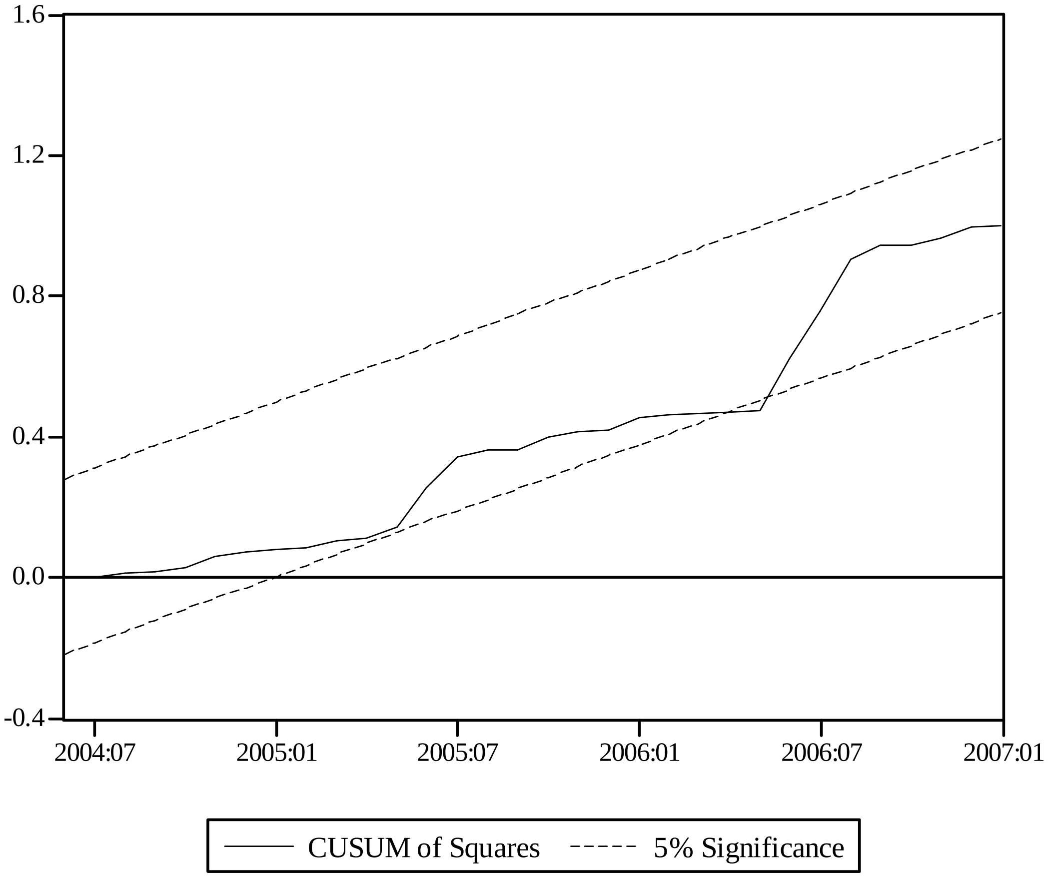
**Figure 3: Turkey's real current account balance to GDP ratio [1992:01 – 2007:09]**




Note: Current account includes trade balance of goods and services, net investment income and net unilateral transfers. The GDP series was expressed in Turkish lira and current account series in US dollars. To find the real current account series we first computed a real exchange rate based on the nominal exchange rate times the ratio of the foreign to domestic price index. For the foreign price index we used the U.S. CPI (2003 as the base year). The nominal exchange rate was the indicator selling rate and the domestic price index was the Turkish CPI (author calculations for 2003 as the base year). To compute real GDP we used nominal GDP deflated by the Turkish CPI with 2003 as the base year. If the series is negative it implies a current account deficit.

*Sources*: Central Bank of Turkey, U.S. Bureau of Labor Statistics.

**Figure 4: Cumulative sum of squares stability test for DOLS between *RXY* and *RMMY***




Notes: The cumulative sum (CUSUM) squares test determines parameter stability of the model. If the plot of the CUSUM squares moves outside the 5% critical level it implies that the null hypothesis of stability over time is rejected.

**Table 1: Unit Root Tests**

| Variables | ADF | | | Phillips-Perron | | | KPSS | | Zivot-Andrews | |
|---|---|---|---|---|---|---|---|---|---|---|
| | $t_0$ | $t_\mu$ | $t_\tau$ | $\tau_0$ | $\tau_\mu$ | $\tau_\tau$ | $\eta_\mu$ | $\eta_\tau$ | $t_{\inf}$ | $T_B$ |
| *RX* | 1.555 | -0.611 | -2.319 | 1.360 | -0.954 | -2.958 | 1.526* | 0.139** | -4.198 | 1999:03 |
| | [12] | [13] | [13] | (3) | (3) | (2) | (11) | (10) | [13] | |
| Δ *RX* | -6.765* | -6.992* | -6.971* | -13.914* | -14.129* | -14.091* | 0.031 | 0.031 | -5.057* | 1998:02 |
| | [2] | [2] | [2] | (0) | (4) | (3) | (4) | (4) | [12] | |
| *RXY* | 1.333 | -1.669 | -2.511 | 0.711 | -1.676 | -3.444 | 1.612* | 0.209* | -3.330 | 2003:02 |
| | [13] | [13] | [13] | (7) | (6) | (1) | (10) | (10) | [13] | |
| Δ *RXY* | -4.415* | -4.805* | -4.878* | -13.510* | -13.628* | -13.608* | 0.043 | 0.023 | -5.299* | 2001:12 |
| | [12] | [12] | [12] | (6) | (7) | (7) | (7) | (7) | [12] | |
| *RMM* | 2.113 | -0.166 | -2.040 | 2.015 | -0.150 | -2.117 | 1.493* | 0.262* | -4.251 | 1998:04 |
| | [0] | [0] | [0] | (3) | (3) | (4) | (11) | (10) | [0] | |
| Δ *RMM* | -2.860* | -6.285* | -6.279* | -14.024* | -14.398* | -14.379* | 0.086 | 0.046 | -4.761** | 1998:03 |
| | [11] | [3] | [3] | (7) | (3) | (3) | (3) | (3) | [12] | |
| *RMMY* | 2.016 | -0.796 | -3.290** | 2.000 | -0.800 | -3.541* | 1.606* | 0.091 | -4.602 | 1998:04 |
| | [0] | [0] | [0] | (2) | (3) | (3) | (11) | (10) | [0] | |
| Δ *RMMY* | -13.434* | -13.818* | -13.782* | -13.443* | -13.817* | -13.781* | 0.024 | 0.023 | -13.945* | 1999:02 |
| | [0] | [0] | [0] | (2) | (2) | (2) | (3) | (3) | [0] | |

Notes:

- $^{*}$ and $^{**}$ indicate statistical significance at the 5% and 10% level respectively.
- $t_0, t_\mu$ and $t_\tau$ 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 15 and lag length is determined using the AIC criterion.
- $\tau_0, \tau_\mu$ and $\tau_\tau$ 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. Numbers in brackets correspond to lag truncation parameter, q, determined according to Newey-West criteria using the Bartlett Kernel.
- $\eta_\mu$ and $\eta_\tau$ are the KPSS (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. Number in brackets correspond to lag truncation parameter determined by the $l(12)$ formula of Schwert (1987).
- $t_{\inf}$ 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 15 and lag length is determined using AIC criterion.

**Table 2: Johansen cointegration test results for real exports and imports including net interest and transfer payments**

| Null | Alternative | Eigenvalue | 5% C.V. | Trace value | 5% C.V. |
|---|---|---|---|---|---|
| Panel A: *RX* and *RMM* | | | | | |
| $r = 0$ | $r = 1$ | 12.372 | 14.07 | 12.424 | 15.41 |
| $r \leq 1$ | $r = 2$ | 0.052 | 3.76 | 0.052 | 3.76 |
| Panel B: *RXY* and *RMMY* | | | | | |
| $r = 0$ | $r = 1$ | 14.036 | 14.07 | 14.675 | 15.41 |
| $r \leq 1$ | $r = 2$ | 0.640 | 3.76 | 0.640 | 3.76 |

Notes:

The table reports cointegration between real exports and imports (including interest and transfer payments). Using the AIC formula we find the appropriate lag length to be 3 lags. The number of cointegrating vectors is denoted by $r$ and we tested for no cointegrating relation as well as at most 1 cointegrating relation between the two variables. We report both the eigenvalue and trace statistics which are compared to their critical values (at 5% level of significance). The null hypothesis is there is no cointegration.

**Table 3: Gregory Hansen cointegration test results for real exports and imports including net interest and transfer payments**

| Variables | Model 1: C | Model 2: C/T | Model 3: C/S |
|---|---|---|---|
| *RX* and *RMM* | -4.101 (1994:06) | -4.232 (1994:06) | -4.223 (2001:01) |
| *RXY* and *RMMY* | -4.380** (2004:04) | -4.124 (2003:01) | -4.537 (2000:11) |

Notes:

Gregory and Hansen (1996) test for cointegration assuming a structural break in the relation. They consider three models including Model 1: with a level shift (C), Model 2: with a level shift and a trend (C/T) and Model 3: with a regime shift (C/S). We test for cointegration for all models. The null hypothesis is of no cointegration. The table reports the minimum t-statistics with the month and year of the break in brackets. These t-statistics are compared with the critical values obtained from Gregory and Hansen (1996). ** denote rejection of the null at 10%.

**Table 4: DOLS results for real exports and imports including net interest and transfer payments**

| | $\hat{\beta}$ | $SE(\hat{\beta})$ | $H_0 : \beta = 1$ | *J-B* |
|---|---|---|---|---|
| *RXY* and *RMMY* | 0.859 | 0.067 | -2.239* | 4.273 |

Notes:

Break point for the DOLS model was 2004:04 based on Gregory-Hansen cointegration results from table 3. The appropriate lag and lead length was determined by AIC. $\hat{\beta}$ is the estimated coefficient of real imports (including net interest and transfer payments). $SE(\hat{\beta})$ is the Newey West corrected standard errors using 4 lags. $H_0 : \beta = 1$ is the test for the strong form of sustainability and *J-B* is the Jarque-Bera test for normality of residuals. * indicates statistical significance at 5% level of significance.

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