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Intertemporal Solvency of Turkey's Current Account

Summary: We test for sustainability of Turkey's current account position be-
tween 1987 and 2009 using the intertemporal solvency model of Craig S. Hak-
kio and Mark Rush (1991) and Steven Husted (1992). According to this ap-
proach, the intertemporal budget constraint is satisfied if there is cointegration
between exports and imports+ (which include imports, net interest income and
unilateral transfer payments). We test for, and find evidence of, cointegration
using the standard Johansen test as well as the Allan W. Gregory and Bruce
Hansen (1996) test. The latter allows for a structural break in the cointegrating
relation. Further, dynamic GLS estimation shows a statistically significant rela-
tion between exports and imports+, although, we reject strong current account
sustainability. Our evidence suggests that Turkey remains vulnerable to rever-
sals in capital flows, but we believe this vulnerability will diminish as the service
component of trade increases.

Key words: Cointegration, Current account sustainability, Dynamic GLS, In-
tertemporal budget constraint, Turkey.

JEL: F32, F41.

In this paper we examine the present solvency of Turkey's current account position.
The current account is made up of the trade account of merchandise and services,
unilateral transfers and income accounts. Typically, and this is true for the case of
Turkey as well, the trade account is the driving force of current account defi-
cits/surpluses. 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 East Asia. This has also been the case for
Turkey, where high current account deficits were observed prior to the two crises in
1994 and 2001. Turkey's current account position has been continuously and se-
verely deteriorating since the early 2000s. Thus, there has been a great deal of con-
cern that Turkey will face another crisis.

　　　　While high and persistent current account deficits could be a sign of unsus-
tainability, there is no agreement of what constitutes a high or persistent current ac-
count deficit. Gian M. Milesi-Ferretti and Assaf Razin (1996) have argued that a cur-
rent 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 persistence is also not available. While some countries have faced a high current
account deficit for over a decade without a crisis, as in the case of Australia (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 (Figure 1). On the other hand, in the mid-2000s, Turkey's current account deficit to GDP ratio exceeded the 5% threshold, reaching 9% in 2006, before narrowing again in the latter part of the decade (Figure 1). Nevertheless, at close to 5% in the first quarter of 2010, the current account deficit to GDP continues to be of some concern. In this paper we examine how Turkey is able to tolerate current account deficits of this magnitude, and analyze the sustainability of this situation. We use the intertemporal solvency model to assess Turkey's current account position.

The intertemporal approach of the current account position examines cointegration between exports and imports+ (which include imports, net interest and unilateral transfer payments[1]). 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. Using quarterly data, we find that a cointegrating relation exists between exports and imports+ from 1987 to 2009. We then use dynamic GLS to estimate their long run relationship and find a statistically significant relation between them. We reject the hypothesis that the sustainability of the current account is strong.

The paper is organized as follows: the next section provides background on the Turkish current account, which is followed by a review of the literature. Section 3 explains the theoretical framework, which is followed by the econometric methodology used to examine current account sustainability. Section 5 discusses the empirical results and the last section concludes.

1. Background

In the 1960s and 1970s import substitution policies were applied and Turkey's trade volume remained at a fairly modest level. 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.

Figure 1 shows the trend of the Turkish current account as a ratio of GDP between 1987 and 2009. The high current account deficits prior to the two crises describe the economic position of Turkey in the nineties. In the 1990s, Turkey could not tolerate persistently high current account deficits. Turkey suffered a crisis in 1994 following the high current account deficits in 1993, which averaged 3.95% of GDP over the four quarters. This pattern was repeated in 2000 and led to the crisis of February 2001. In both cases, high current account deficits were observed for a relatively short duration, compared with periods of several years, which were reported in the empirical literature for other crisis-affected countries. Turkey's deficits spanned approximately a year prior to the two crises, and showed the country's low tolerance of large current account deficits in the 1990s.

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[1] This is the convention in the literature. See Husted (1992).

This changed in the 2000s, when the threshold for large current account deficits became much higher, as shown in Figure 1. Since the last quarter of 2003, there have been persistently high deficits which reached as high as 9% in the second quarter of 2006. These levels of current account deficits far exceed those observed prior to the two crises discussed earlier. Thus, compared to the 1990s, Turkey appears to have been able to sustain larger current account deficits in the first decade of the 21st century.

Figures 2 and 3 map the trend of the components of the current account. Specifically, Figure 2 shows exports and imports+ measured in billions of U.S. dollars, and Figure 3 illustrates exports and imports+ as a percentage of GDP. Figure 2 shows a continuous upward trajectory in exports and imports, while that trend is much less pronounced in Figure 3 due to the high growth in Turkey's GDP. Both graphs show that imports exceeded exports and the gap widened over the period. They also confirm the import-export gap (which translates into large current account deficits) prior to the two crises.[2] This gap is wider in the post 2001 period and the graphs show a continuous substantial deficit from 2003 onwards.

These large deficits have once again raised concerns about the sustainability of the current account position and the possibility of a crisis. The lack of sustainability of the current account position is based on several factors. Milesi-Ferretti and Razin (1996) provide a framework for understanding current account sustainability which 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; Australia, Chile, Ireland, Israel, Malaysia, Mexico and South Korea, concluding that external debt, exports and fiscal positions are identifiers of sustainable and unsustainable current account positions. Ayla Ogus Binatli and Niloufer Sohrabji (2008) 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) with 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 economic improvement 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) as a result of IMF programs. One of the more important reforms was the abandoning of the pegged exchange rate regime, considered overvalued, and to be a factor in the 2001 crisis, 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 responsible for Turkey's ability to sustain higher current account deficits, this indicates that there have been structural improvements in the economy, which in turn, 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 vul-

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[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.

nerability, but rather should be viewed as necessary for economic improvement. We examine the literature on current account sustainability in the following section.

2. Literature Review

The intertemporal approach for exploring current account sustainability is well established in the literature. Two main methods for determining this sustainability have been developed. 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. Ogus and Sohrabji (2008) use this technique to study Turkey's current account position between 1992 and 2004, finding that the current account position was unsustainable. However, they also found a structural break in the deviation of actual and optimal net external liabilities in the period since 2001. Thus, while the external position was unsustainable for the whole period, there was a change in Turkey's external position following the 2001 crisis. This period coincides with exchange rate and financial sector reforms. Thus, although current account deficits in Turkey had increased significantly since the mid-2000s, this does not imply that the current account was unsustainable because other factors which impact on the external position need to be considered.

In this paper we employ a second, alternative intertemporal approach, based on the theoretical model of Hakkio and Rush (1991) and Husted (1992). This model examines the long-run relation between exports and imports+. Cointegration between exports and imports+ (assuming both are integrated of order one) implies the intertemporal solvency of the current account. This approach has been used for both developed and developing countries by a number of authors including Husted (1992) for the U.S.; Lori Leachman and Michael Thorpe (1998) for Australia; Nicholas Apergis, Konstantinos P. Katrakilidis, and Nicholas M. Tabakis (2000) for Greece; Augustine C. Arize (2002) for 50 developed and developing countries; Ahmad Z. Baharumshah, Evan Lau, and Stilianos Fountas (2003) for Indonesia, Malaysia, Philippines and Thailand; Manuchehr Irandoust and Johan Ericsson (2004) for France, Germany, Italy, Sweden, U.K. and U.S.; Paresh K. Narayan and Seema Narayan (2005) for 22 least developed countries; Sabri Azgun and Taner Ozdemir (2008) for Pakistan; Laszlo Kónya (2009) for the Czech Republic, Hungary and Slovenia; and Sohrabji (2010) for India.

This theoretical framework has also been used for Turkey by Hüseyin Kalyoncu (2005) and Osman A. Peker (2009). Kalyoncu (2005) uses quarterly data from 1987-2002 and Peker (2009) employs monthly data from 1992 to 2007. While Kalyoncu (2005) supports the view that Turkey's current account is sustainable in the long run, Peker (2009) concludes that this is not the case. We build on their work in two ways. Firstly, we extend the period of analysis to include data until 2009, which allows a more thorough analysis of this period of rising and persistently high deficits. Our sample period also makes it possible to carefully study the impact of the reforms undertaken after the 2001 crisis (such as a shift in the exchange rate regime). Secondly, we use the Gregory and Hansen (1996) procedure to explore the possibility of

a structural break in the cointegrating relationship, thus enabling us to estimate the long run equilibrium relationship between exports and imports+, using dynamic estimation proposed by James H. Stock and Mark W. Watson (1993). Our results support Peker's (2009) conclusion, and contrast with Kalyoncu (2005) in that we find evidence of cointegration between exports and imports+, but reject the hypothesis of strong sustainability of the current account. The theoretical model and econometric methodology is presented in the next section.

3. Intertemporal Solvency Framework for Analyzing 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 which gives us the following:

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

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

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 this implies "bubble financing" of external debt while a negative B_t suggests the country could improve welfare by lending less.

Noting that trade balance is the difference between exports (X) and imports (M), equation (1) can be rewritten as follows, $X_t - M_t = Y_t - C_t - I_t = -B_t + (1 + r_t)B_{t-1}$. Also, assuming that the 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 $M_t + (1 + r_t)B_{t-1} + r B_{t-1} - r B_{t-1} = X_t + B_t$. Thus equation (1) can be rewritten as the following:

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

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

Solving equation (3) by forward substitution, Hakkio and Rush (1991) and Husted (1992) obtain

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

where $\lambda = \dfrac{1}{1+r}$, Δ is the first difference operator. Also note: $X_t - M_t - r_t B_{t-1}$ is the current account balance (Husted 1992). For a more comprehensive discussion of the model please refer to Kónya (2009).

Following Husted (1992), assuming X_t and Z_t are non-stationary processes with a drift such that, $X_t = a_1 + X_{t-1} + v_{1t}$ and $Z_t = a_2 + Z_{t-1} + v_{2t}$, equation (4) can be expressed as

$$M_t + r_t B_{t-1} = X_t + \frac{(1+r)^2 (a_1 - a_2)}{r} + \sum_{j=0}^{\infty} \lambda^{j-1} \left(v_{1t} - v_{2t} \right) + \lim_{t \to \infty} \lambda^{t+j} B_{t+j} \tag{5}$$

Equation (5) can be rewritten as

$$X_t = a + MM_t - \lim_{t \to \infty} \lambda^{t+j} B_{t+j} + v_t \tag{6}$$

where $a = \dfrac{(1+r)^2 (a_2 - a_1)}{r}$, $MM_t = M_t + r_t B_{t-1}$ and $v_t = \sum_{j=0}^{\infty} \lambda^{j-1} \left(v_{2t} - v_{1t} \right)$. Assuming the limit term in equation (6) is zero, the regression equation is given as

$$X_t = \alpha + \beta MM_t + \varepsilon_t \tag{7}$$

If X_t (exports) and MM_t (imports+) 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 β to be greater than 1. This means that the current account deficit is sustainable. The econometric methodology used to analyze the model is discussed in the next section.

In cointegration analysis of two series, which variable is taken as the dependent variable is just a normalization, with no consequences for cointegration between the two series.[3] We use this specification as it is dominant in the literature. A few examples of this are Husted (1992); Jyh-Lin Wu, Show-Lin Chen, and Hsiu-Yun Lee (2001); Mark J. Holmes (2006); Tuck C. Tang (2006); Holmes, Jesus Otero, and Theodore Panagiotidis (2010); Kalyoncu and Ilhan Ozturk (2010); Sohrabji (2010).

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[3] Normalization will have consequences when cointegration between three or more series is under investigation, for a discussion see Heejoon Kang (1999).

4. Econometric Methodology

In this paper we test for cointegration between exports and imports+. This section focuses on the econometric methodology related to testing this cointegrating relation. The first task is to determine the order of integration of both series. To do so we use the Augmented Dickey-Fuller (ADF) test, the Phillips Perron (PP) test and the KPSS test.

Once the order of integration is determined, we test for cointegration using the standard Johansen 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, Lau, and Fountas (2003) and Steven Cook (2004), we use the Gregory and Hansen (1996) cointegration procedure to account for structural breaks. In the case of Turkey, there have been crises followed by reforms, a situation which could imply a structural change in the cointegrating relationship. Rather than setting an a priori structural break, the Gregory and Hansen (1996) cointegration test determines the structural break endogenously. They consider three models, the first allowing for a level shift, the second a level shift and trend, and the third a level and slope shift. We focus on the last model, which is the most comprehensive given as

$$X_t = \mu_1 + \mu_2 D_t + \beta_1 MM_t + \beta_2 MM_t D_t + \varepsilon_t \tag{8}$$

where τ is the structural break point, D_t is a dummy variable which takes a value of one for the period following the structural break point and all other variables are as previously defined.

The Gregory and Hansen (1996) method uses a grid search procedure, which considers breakpoints in the central 70% of the sample (between 0.15N to 0.85N where N is the number of observations). The ADF is estimated and the breakpoint with the lowest value for the ADF (or highest absolute value) is selected 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 Stock and Watson's (1993) dynamic estimation procedure. This includes lags and leads of the first difference of the regressors, and captures differences from the structural break determined by the Gregory and Hansen (1996) procedure. Thus, the equation to be estimated is given as,

$$X_t = \alpha + \beta MM_t + \delta (MM_t - MM_\tau) D_t + d(L) \Delta MM_t + \varepsilon_t \tag{9}$$

where MM_τ is imports+ at the structural break point, ΔMM_t is the first difference of imports+, $d(L)$ represents the vector of coefficient of lags and leads of ΔMM_t and all other variables are as previously defined. Estimation results are discussed below.

5. Data and Results

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

We use quarterly data for 1987:Q1 to 2009:Q4. Our series include exports of goods and services, imports of goods and services, net interest income payments, net unilateral transfer payments and GDP. GDP is expressed in thousands of Turkish lira and all other series are expressed in millions of U.S. dollars. To determine the real value of exports and imports+, we need the real exchange rate, 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 market exchange rate and consumer price index (CPI) for price levels of both countries (base year is 2003 for both series). From the above, we compute real exports (RX), real imports+ (RMM), real exports to GDP (RXY) and real imports+ to GDP ($RMMY$). All data is from the International Financial Statistics database of the IMF. In our econometric analysis, we use data which have been seasonally adjusted using the X11 additive method.

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 which are reported in Table 1. There are some instances of trend stationarity in levels. However, we rely mainly on the unit root tests with intercept only because the random walk specifications for exports and Z do not have a trend term. The main component of Z is imports which is also the main component of imports+. Thus, the results generally support our expectations that the series are I(1) in levels and I(0) in first differences. Given these conclusions, we can test for cointegration.

To test for cointegration we first use the Johansen procedure for which we must determine the appropriate lag length of the VAR. Based on AIC we find the appropriate lag length to be one lag. The Johansen trace and eigenvalue test results (in Table 2) show that there is cointegration between the two series (measured both in levels and as a ratio of GDP). Based on this procedure, we find the coefficient, $\hat{\beta}$, for RMM and $RMMY$ to be 0.80 and 0.75 respectively (Table 3). In both cases the coefficient is statistically significant indicating that exports are growing in relation to imports. However, similar to Peker (2009) but unlike Kalyoncu (2005) we reject the null that $\beta = 1$ (in favor of the alternative that $\beta < 1$) and thus find evidence that the Turkish current account position is not sustainable.

One concern with the Johansen cointegration test is that it does not allow for changes in the cointegrating relationship. Given the changes in the Turkish economy since the crises, there is a possibility that if we allow for a structural break in the cointegrating relation, and estimate the long run relation between exports and imports based on this assumption, we might reach a different conclusion. We use the Gregory and Hansen (1996) test to allow for a possible structural break and report results in Table 4.

In general, the Gregory and Hansen (1996) test results support the Johansen test results. Cointegration between exports and imports+ in levels is statistically sig-

nificant at 10%, with a break period in the fourth quarter of 2000. The results for the variables as a percentage of GDP are statistically significant at 5% with a break point in the last quarter of 1993. Both break points are meaningful as they coincide with the two major crises Turkey has faced, both of which were followed by reforms resulting in improvements in the economy. For example, the latter break period related to *RXY/RMMY* coincides with a high growth period in Turkey, while the former break point (*RX/RMM*) coincides with Turkey's enhanced export position where exports quadrupled in the 2000s, surpassing the $ 100 billion mark in 2007.

Following the literature we use the above result to further explore the relationship between exports and imports+ using dynamic estimation proposed by Stock and Watson (1993). This is a more robust method for estimating this long-run relationship. We use the break point from the Gregory and Hansen (1996) results noted earlier, and estimate equation (9) for both sets of variables. The number of lags and leads are determined by AIC.

We test the model for departures from standard assumptions such as serial correlation (LM test), heteroskedasticity (White test), stability (RESET test) and normality (Jarque-Bera or J-B test). We find that the model suffers serial correlation and thus use Dynamic Generalized Least Squares (DGLS) for our estimation (reported in Table 5). Heteroskedasticity which is a problem for the *RXY/RMMY* estimation is corrected by using heteroskedasticity-consistent standard errors. The model is stable (using the RESET test), but we reject the null of normality (J-B test). The latter result is a problem with skewness, which not being a significant concern, is left unchanged.

DGLS results (also reported in Table 5) show that the long-run relationship between exports and imports for the two cases, *RX/RMM* and *RXY/RMMY* are 0.39 and 0.50 respectively. In both cases, β is statistically significant. This indicates that exports are growing in relation to imports. We also test for $\beta = 1$ against the alternative that $\beta < 1$ and reject the null hypothesis of strong sustainability (Table 5) similar to the Johansen test results.

Our results show that the exports are growing in relation to imports+. Exports growth in the face of a strong lira and a weakening dollar in the 2000s, although the composition of exports changed. While traditionally strong export sectors declined due a strong Turkish lira, other sectors were able to flourish in an environment where energy and other imported intermediate and capital goods became relatively more affordable. This sectoral shift has diversified and helped exports to grow. However, this improvement in the export sector has been due to an increase in the import component of exports. Thus, despite healthy exports and a strongly growing economy, the current account deficit remains at a very, and according to our empirical findings, unsustainable level. We believe Turkey will continue to be vulnerable to capital reversals unless a structural change in the trade sector leads to an increase in the service component of trade.

6. Conclusion

In this paper we analyze sustainability of Turkey's current account position using quarterly data from 1987 to 2009. 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.

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 that there is cointegration between exports and imports+ with and without a structural break. While this is a positive result, our estimation of the long-run relationship between exports and imports+ shows that the current account position is not sustainable, and Turkey continues to be vulnerable to a crisis.

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 positive news that imports are helping 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, this seems unfeasible, at least in the short run. Moreover, given Turkey's strong export performance in recent years this may not be necessary. Instead, we believe that a focus on export of services may benefit Turkey's current account position. Tourism and construction have been consistently healthy export sectors and continued investment in these areas will strengthen the economy. In addition, the growing retail sector can yield beneficial results for the current account position. Thus, while we reject the hypothesis that Turkey's current account position is strongly sustainable at present, we feel that there is potential for this position to change in the future.

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Appendix

Notes: Current account includes trade balance of goods and services, net income and net unilateral transfers. The GDP series was originally expressed in Turkish lira and current account series in US dollars. We convert the GDP into dollars using the market exchange rate and compute the current account balance as a percentage of GDP.

Source: IMF, International Financial Statistics Database.

Figure 1 Turkey's Current Account Balance as Ratio of GDP (1987:Q1 – 2009:Q4)

Notes: Exports include goods and services. Imports include goods and services as well as net income and net transfer payments. All series are expressed in billions of U.S. dollars.

Source: IMF, International Financial Statistics Database
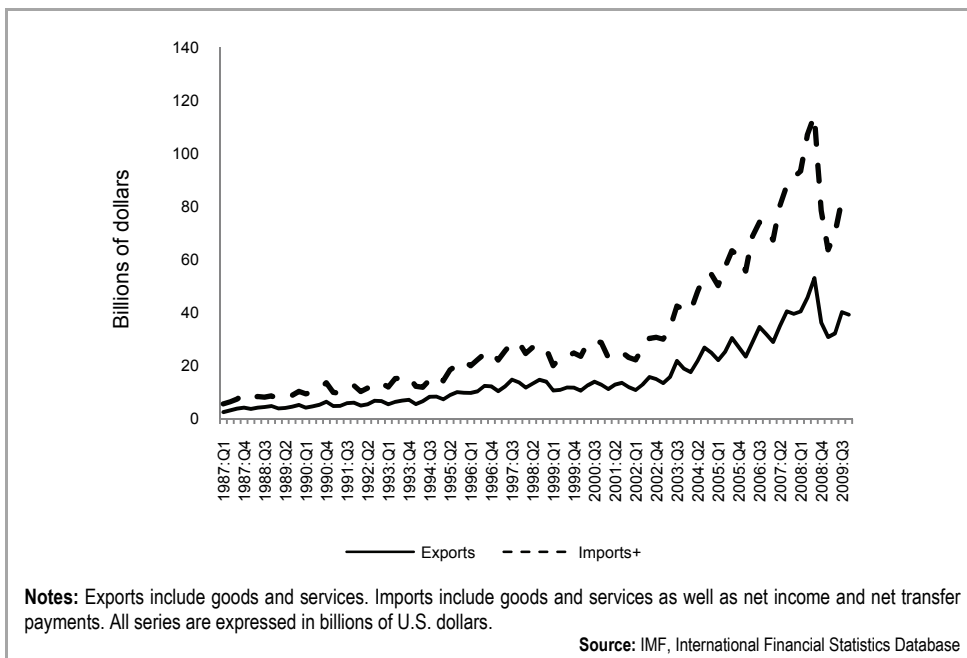
Figure 2 Turkey's Exports and Imports+ (1987:Q1–2009:Q4)

Notes: Exports and imports+ are as defined earlier and expressed in U.S. dollars. The GDP series is expressed in Turkish lira. Using the same methodology noted earlier for the real current account balance to GDP ratio we compute exports and imports+ as a percentage of GDP.

Source: IMF, International Financial Statistics Database.
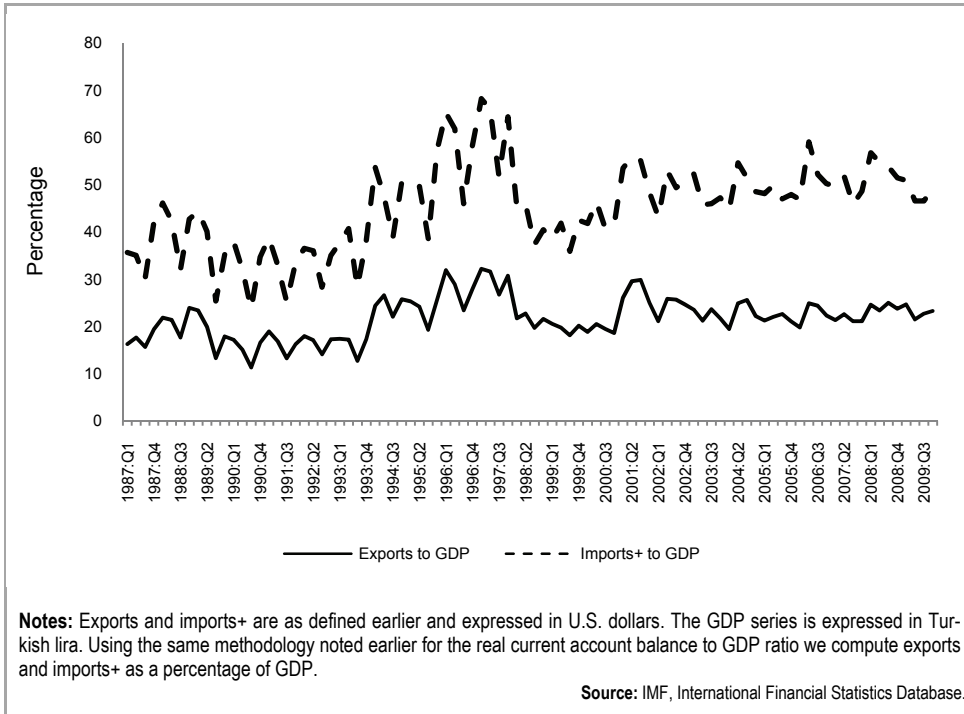
Figure 3 Turkey's Exports and Imports+ as a Ratio of GDP (1987:Q1–2009:Q4)

Table 1 Unit Root Tests

Variables	ADF		PP		KPSS	
	t_{μ}	t_{τ}	τ_{μ}	τ_{τ}	η_{μ}	η_{τ}
RX	0.01 [4]	-3.95* [0]	-0.33 (9)	-4.07 (2)	1.20* (7)	0.08 (5)
∆RX	-7.64* [3]	NA	-11.70* (11)	NA	0.07 (11)	NA
RMM	0.26 [5]	-2.05 [5]	-0.68 (3)	-3.36 (1)	1.16* (7)	1.15* (6)
∆RMM	-3.05* [6]	-7.08* [4]	-10.09* (4)	-10.03* (4)	0.05 (4)	0.04 (4)
RXY	-1.86 [0]	-3.32 [0]	-1.72 (4)	-3.32 (0)	1.04* (7)	0.11 (6)
∆RXY	-6.74* [3]	-6.69* [3]	-10.09* (6)	-10.01* (7)	0.05 (7)	NA
RMMY	-0.76 [5]	-2.87 [4]	-1.47 (3)	-3.75* (4)	1.10* (7)	0.06 (6)
∆RMMY	-5.78* [4]	-5.74* [4]	-11.71* (2)	NA	0.03 (3)	NA

Notes: All tests are conducted assuming a constant and a constant and linear trend. Numbers in square brackets for the ADF test corresponds to lags. Maximum lags were set at 6 and lag length was determined using AIC. Numbers in brackets in the PP test correspond to lag truncation parameter, q, determined according to Newey-West criteria using the Bartlett Kernel. Numbers in brackets in the KPSS test correspond to lag truncation parameter determined by Schwert's I(4) formula. The year and quarter in brackets in the ZA test correspond to the structural break period. The null hypothesis for the ADF and PP tests are that the series is non-stationary and the null hypothesis for KPSS is that the series is stationary. * indicates rejection of the null at 5% level of significance.

Source: Authors' estimations

Table 2 Johansen Cointegration Test Results

	No. of CEs	Eigenvalue	5% C.V.	Trace value	5% C.V
RX and RMM	0	14.70*	14.07	15.49*	15.41
	1	0.78	3.76	0.78	3.76
RXY and RMMY	0	15.47*	14.07	18.24*	15.41
	1	2.77	3.76	2.77	3.76

Notes: The table reports cointegration between real exports and imports (including net income and transfer payments). We use the AIC formula to find the appropriate lag length, which is determined to be one lag for both cases (RX/RMM and RXY/RMMY). We test 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. * indicates rejection of the null at 5% level of significance.

Source: Authors' estimations.

Table 3 Johansen Cointegration Coefficient Results

Variables	$\hat{\beta}$	SE	H_0: β=1
RX and RMM	0.80*	0.04	-5.00*
RXY and RMMY	0.75*	0.07	-3.57*

Notes: The table reports the cointegrating coefficient (for *RMM* and *RMMY*), standard errors and β=1 test for strong sustainability using the Johansen cointegration test results. * indicates rejection of the null at 5% level of significance.

Source: Authors' estimations

Table 4 Gregory Hansen Cointegration Test Results (Assuming Level and Slope Shift)

Variables	T-statistics	Break period	Lag length
RX and RMM	-4.60**	2000:4	0
RXY and RMMY	-5.02*	1993:4	1

Notes: The table reports the results for the Gregory and Hansen (1996) test for cointegration assuming a structural break in the relation. The Gregory and Hansen (1996) test can be conducted for three models assuming (1) a level shift, (2) a level shift and trend and (3) a regime shift (level and slope shift). We report results of the most comprehensive model, the third model. The results for the other models (not reported) show similar conclusions. The null hypothesis is of no cointegration. The table reports the minimum t-statistics, the quarter and year of the break and number of lags (determined by AIC). * and ** indicates rejection of the null at 5 % and 10% level of significance respectively.

Source: Authors' estimations

Table 5   Dynamic Least Squares Results

	Diagnostic test results			Dynamic GLS estimation results				
	White test (p-value)	RESET test (p-value)	J-B test (p-value)	$\hat{\rho}$	Adj. R^2	$\hat{\beta}$	SE	$H_0: \beta=1$ test
RX and RMM	26.54 (0.43	3.00 (0.22)	39.75* (0.00)	0.95	0.98	0.39*	0.21	-2.91*
RXY and RMMY	29.34* (0.00)	2.33 (0.13)	142.33* (0.00)	0.77	0.94	0.50*	0.20	-2.50*

Notes: The break point for dynamic least squares estimation was based on Gregory-Hansen cointegration results which is 2000:4 for *RX* and *RMM* and 1993:4 for *RXY* and *RMMY*. The appropriate lag and lead length was determined by AIC which was three lags for cointegration between *RX* and *RMM* and 1 lag for cointegration between *RXY* and *RMMY*. Preliminary results (not reported here) showed existence of serial correlation for all models using ARCH LM test and was corrected by using generalized least squares estimation. The table reports diagnostic test results as well as the DGLS estimation results. Diagnostic tests include the White test for heteroskedasticity, Ramsey test for stability (RESET) and the Jarque-Bera test for normality of residuals (*J-B*) with both the test statistic and p-values reported. Rejection of the null indicates heteroskedasticity, non-stability and non-normality of residuals. If there is heteroskedasticity it was corrected using heteroskedasticity-consistent standard errors. The DGLS estimation results include the adjusted R^2, $\hat{\beta}$ and the $\beta=1$ test for sustainability. * indicates rejection of null at 5% level of significance.

Source: Authors' estimations.