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Testing the relationship between trade balance and terms of trade: the case of Turkey

Abstract

The aim of this study is to investigate the long-run relationship between trade balance and terms of trade in Turkey over the period from 1989Q1 to 2007Q4. We adopt the form model specification of Wong Hock Tsen (2006). The study examines Granger causality between trade balance and terms of trade. It uses commodity terms of trade and income terms of trade. Moreover, the Johansen (1991) cointegration method is used to examine the long-run relationship between trade balance and terms of trade. The cointegration results show that there is a long-run relationship between trade balance and income terms of trade. However, there is no long-run relationship between trade balance and commodity terms of trade.

Keywords: macroeconomics, balance of trade, terms of trade, cointegration test.
Jel Classification: E00, C51, F10, F41.

Introduction

One of the topics commonly discussed in international economics literature is the correlation between balance of foreign trade and foreign trade rate. An increase in terms of trade could lead to a decrease or an increase in trade balance. This theoretical prediction is the Harberger-Laursen-Metzler (HLM) effect (Harberger, 1950; Laursen and Metzler, 1950).

Koussi et al. (1998) examined the relationship between current account balance and terms of trade in Cote-d'Ivoire using annual data over the period fof 1960-1995. The results reached in the study are as follows: Terms of trade along with domestic income, French income, and foreign real interest rates have significant long-term relationships with the current account deficit. Singh (2004) studied on the variables of trade balance in India. The classified data on trade balance in durable and nondurable goods were not readily available and therefore the model was developed for overall balance of trade without making any distinction between trade balance in durable and nondurable goods over the periods from 1951-1952 to 1995-1996. In the study by Zhang and Wan (2007), structural vector auto regression techniques were used to investigate the China's trade balance fluctuations in the period of 1985-2000. They found out that the recent movements in China's trade balance were likely to persist in the future. In addition a revaluation of the exchange value of the Chinese currency, Renminbi (RMB), or a monetary measure in general, would not, in their view, sufficed to redress the 'imbalance' of trade.

The literature of trade balance and terms of trade studies focuses mainly on the movements of trade balance and terms of trade or the relationship between them. The long-run relationship between trade balance and terms of trade is not in the focus. In addition, studies have been using mainly commodity terms of trade, which is defined as export price divided by import price. Commodity terms of trade are also known as barter terms of trade. Another measure of terms of trade is income terms of trade, which is defined as export price multiplied by export volume and divided by import price. Alternatively, an income term of trade is approximate to exports value divided by import price (Tsen, 2006).

Commodity terms of trade focus only on the relationship between export price and import price. Conversely, income term of trade tries to quantify the trend of export-based capacity of a country to import goods. A rise in commodity terms of trade will imply that export price is relatively higher than import price or a unit of exports from a country is able to purchase a larger quantity of imports. However, commodity terms of trade and income terms of trade do not have to move in the same direction. A rise in export price relative to import price could be more than offset by a decline in quantity of exports. Therefore, there is no increase in trade balance. Also, a rise in commodity terms of trade for a country can be reinforced by a rise in quantity of exports, so that income terms of trade rise to a greater extent than commodity terms of trade (Appleyard and Field, 2001, p. 111).

Because of inadequate hard currency income in balance of payments besides the problems of employment and economic growth, Turkey put into effect the export based growth model along with the of 24th January1980 decisions. Effective application of these decisions has only been possible after 1983 due to some political problems. This arrangement aims at having the country's economy run in accordance with free market forces and to integrate with world economy. Through flexible peg system, export incentives and liberation of foreign trade great effort was made to activate the system. Exports of 1980 were $2.9 billion and imports were $7.9 billion, while exports of 1990 were $12.9 billion and imports of the same year were $22.3 billion. In 1993 exports and imports were $15.35 and $22.4 billion, respectively. However, in 1994 due to some external factors such as stagnation of world economy and Gulf War crisis besides the internal factors such as high inflation rate, public deficits and

increasing stocks of internal and external debts, an economic crisis was experienced and as a result, while exports increased to $18.1 billion imports decreased to $23.2 billion. Together with the 5th April decisions competitive capacity of the country improved and increase rates of imports and exports have been accelerated again. In 1995 Turkey joined the World Trade Organization and decision of initiating customs union with the countries of the European Union on January 1st 1996 was made.

Later in 1997 and 1998 slowdown in world economy and the crisis that first appeared in Asian countries and then in Russia, moreover within the country economic shrinking due to the earthquake of 1999 affected the exports increase rate negatively and caused it take negative values. Within the country application of a tight monetary policy for the sake of fight with the high inflation and rise in burden of public borrowings caused a raise in interest rates and revaluation of national currency, which resulted in more complicated problems, and thus a new stabilization program was put into effect. In 2001 the growth rate of the world economy decreased due to the September 11 attacks; moreover, the political incidents in Turkey which led to an economic crisis all resulted in devaluation of the national currency.

Consequently exports had a value of $31,3 billion and decreasing 23% compared to the previous year imports were $41,4 billion. The elections of 2002 brought political stability, which in turn improved stability of prices and decreased stock of public borrowings thus both exports increase rate and economic growth rate took a positive direction. However, together with exports, imports also increased, which caused current deficits to become a chronic problem of the country. Although the current deficit weakens the country against internal and external shocks, it is financed for the time being through the revenues from privatization and foreign capital that enters the country.

In this relation the focus of this study is to investigate the long run relationship between trade balance and terms of trade in Turkey over the period from 1989Q1 to 2007Q4. Moreover, the study examines Granger causality between trade balance and terms of trade. It uses commodity terms of trade and income terms of trade. The Dickey and Fuller (1979) and Phillips and Perron (1988) unit root test statistics are used to examine the stationarity of the data. The Johansen (1991) cointegration method is used to examine the long-run relationship between trade balance and terms of trade. The rest of this article is structured as follows: In the next section we describe the data and the methodology in the study. The empirical results are reported in Section 2 followed by conclusions in the last section.

1. Data and methodology

We adopt the form model specification of Wong Hock Tsen (2006, p. 308) which takes the following form: trade balance (TB_t) is defined as $(X_t/P_{x,t})/(M_t/P_{m,t})$, where X_t is the value of exports; M_t is the value of imports; $P_{x,t}$ is the export price (2000 = 100), and $P_{m,t}$ is the import price (2000 = 100). Commodity terms of trade ($TOT1_t$) is defined as $(P_{x,t}/P_{m,t}) \times 100$. Income terms of trade ($TOT2_t$) is defined as $(X_t/P_{m,t}) \times 100$. The data were obtained from the Central Bank of the Republic of Turkey (2000 = 100) and International Financial Statistic (2000 = 100). The data are quarterly. Series relationships between $TOT1_t$&TB_t and $TOT2_t$&TB_t are shown in Figure 1.

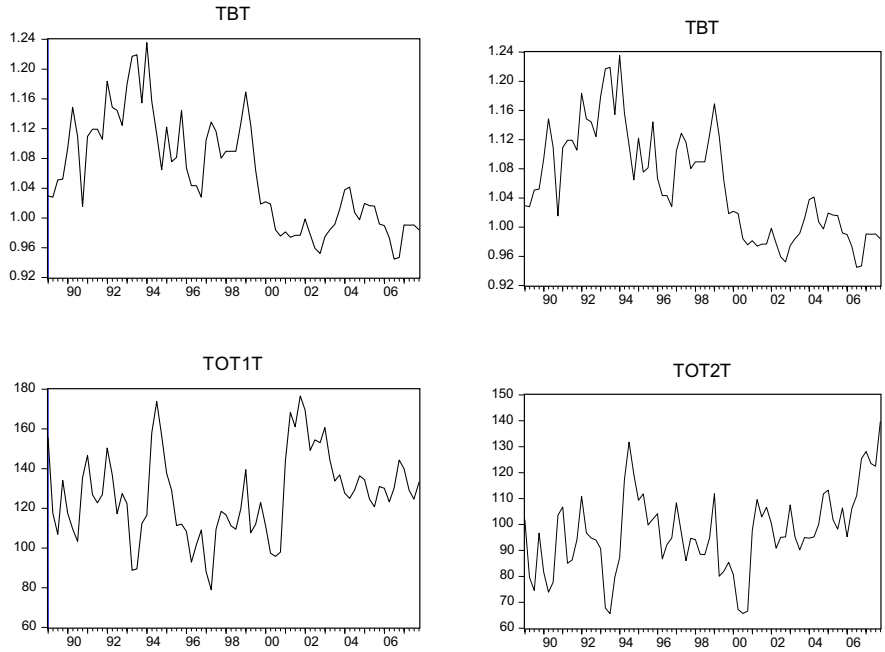

Fig. 1. Plots of TBT&TOT1 and TBT&TOT2

The Dickey and Fuller (1979) and Phillips and Perron (1988) unit root test statistics are used to test the stationarity of the data. The Johansen (1991) cointegration method is used to test the long-run relationship between trade balance and terms of trade. Two likelihood ratio (LR) tests may be constructed for the number of cointegration vectors *r*. The 'maximum eigenvalue' test:

$$\lambda_{Max} = -T\ln(1-\lambda_{r+1}) \quad (1)$$

tests the null hypothesis of *r* cointegrating vectors against the alternative hypothesis of $r + 1$ cointegration vectors.

The 'trace' test:

$$\lambda_{Trace} = -T\sum_{j+1}^{n}\ln(1-\lambda_j) \quad (2)$$

tests the null hypothesis of 'at most' *r* cointegration vectors, with 'more than' *r* vectors being the alternative hypothesis. Although not having standard asymptotic distributions, critical values are available from Monte Carlo simulations. The likelihood ratio test statistics can be sensitive to the choice of the lag length used in the estimation of the test statistics. Thus, the choice of the lag length in this study is determined by Schwarz Bayesian criterion. When series are cointegrated, the testing of Granger causality (Engle and Granger, 1987) is in an error correction model. More specifically, error correction models to be estimated in this study are:

$$\Delta\ln TB_t = \alpha_{10} + \sum_{i=1}^{a}\alpha_{11i}\Delta\ln TB_{t-i} + \sum_{i=1}^{b}\alpha_{12i}\times\Delta\ln TOT_{t-i} + \gamma_1 EC_{1,t-1} + \varepsilon_{1,t}\ , \quad (3)$$

$$\Delta\ln TOT_t = \alpha_{20} + \sum_{i=1}^{c}\alpha_{21i}\Delta\ln TB_{t-i} + \sum_{i=1}^{d}\alpha_{22i}\times\Delta\ln TOT_{t-i} + \gamma_2 EC_{2,t-1} + \varepsilon_{2,t}\ , \quad (4)$$

where Δ is the first difference operator; TOT_t is terms of trade; $EC_{i,t-1}$ (i = 1, 2) is the first lag of the disturbance term, which is obtained from the cointegrating regression and (i = 1, 2) is a disturbance term. The joint test of lag variables, namely $\Delta\ln TB_t$ and $\Delta\ln TOT_t$, respectively, by the mean of the *F*-statistic is significantly different from zero, which implies the presence of Granger causality. For example, if the joint test of lag variables of $\Delta\ln TOT_t$ in Equation 3 is significantly different from zero, then it implies that terms of trade Granger cause trade balance. The minimum final prediction error criterion proposed by Akaike (1971) is used to determine the optimal lags of the model. When series are not cointegrated, the testing of Granger causality is carried out without including an error correction term in the estimation.

2. Empirical results

The data used in the empirical investigation cover the period from 1989Q1 to 2007Q4. This section performs unit root tests for stationarity on the levels and the first differences of all variables. The Augmented Dickey-Fuller (ADF) unit-root tests (Table 1) show the existence of unit roots, and therefore non-stationarity on the levels of variables ($\ln TB_t$, $\ln TOT1_t$, $\ln TOT2_t$).

However, the first differences of three variables are stationary under the ADF tests. The Phillips-Perron (PP) unit-root test does confirm stationarity for the three variables in similar ADF test for level and differencing stages (Table 1). Hence it is concluded that these variables are integrated of order *I*(1).

Table 1. The results of the ADF (1979) and PP (1988) unit root test

	(1989Q1-2007Q4)	
	t_γ *- trend*	Z (t_γ) *- trend*
$\ln TB_t$	- 3.0153 (2)	- 3.4608 (2)
$\Delta\ln TB_t$	- 5.3440** (3)	- 10.4137** (1)
$\ln TOT1_t$	- 2.7432 (0)	- 3.1054 (2)
$\Delta\ln TOT1_t$	- 5.2726** (1)	- 8.1271** (2)
$\ln TOT2_t$	- 2.0154 (1)	- 2.8125 (2)
$\Delta\ln TOT2_t$	- 5.1956** (2)	- 4.1868* (2)

Notes: t_γ -trend is the Dickey-Fuller (DF) or Augmented Dickey-Fuller (ADF) t-statistic. Z (t_γ) - trend is the Phillips and Perron (1988) t-statistic. Values in parentheses are the lag length used in the estimation of the unit root test statistics. **, * denote significance at the 1% and 5% level respectively.

The results of the Johansen (1991) cointegration method are reported in Table 2. The results of the λ_{Max} and λ_{Trace} test statistics are computed with intercepts and trends. Generally, the λ_{Max} and λ_{Trace} test statistics indicate the presence of one cointegrating vector for trade balance and income terms of trade.

However, the λ_{Max} and λ_{Trace} test statistics show no long-run relationship between trade balance and commodity terms of trade. In a longer period, an increase in export price would likely lead to a decrease in quantity of exports and therefore there is long-run relationship between trade balance and income terms of trade. The results that trade balance

and commodity terms of trade are not cointegrated, while trade balance and income terms of trade are cointegrated in the long run are the same for sample periods, 1989Q1 and 2007Q4.

Table 2. The results of the Johansen (1991) likelihood ratio test statistics

	λ_{Max} test statistic		λ_{Trace} Test Statistic	
Null	$r = 0$	$r = 1$	$r = 0$	$r = 1$
Alternative	$r = 1$	$r = 2$	$r = 1$	$r = 2$
$TOT1_t$	14.9037 (17.1476)	1.0715(3.8414)	11.4412(18.3977)	1.0715(3.8414)
$TOT2_t$	18.9037*(17.1476)	2.5073(3.8414)	26.9037*(18.3977)	2.5073(3.8414)

Notes: * denotes significance at 95% critical value. r – number of cointegrating vectors. The 95% critical values are given in parentheses that computed according to Mac Kinnon (1996). Johansen technique is carried out using EViews 5.1, a statistical package.

This study estimates only the long-run relationship between trade balance and income terms of trade. The results of the estimated cointegrating vector normalized by trade balance are reported in Table 3.

Table 3. The results of the normalized cointegrating vector

1989Q1- 2007Q4	$\ln TB_t = -0.80943 \ln TOT2_t$

Trade balance and income terms of trade are found negatively cointegrated. Thus, an increase in income terms of trade will lead to a decrease in trade balance in the long run.

Table 4. The results of the granger causality test

	$\ln TOT_t \Rightarrow \ln TB_t$	$\ln TB_t \Rightarrow \ln TOT_t$
$TOT1_t$	2.0167*	0.2355
$TOT2_t$	2.3888*	0.3883

Notes: the arrow ' ' denotes no Granger causality. * denotes significance at the 5% level.

The results of Granger causality test are reported in Table 4. For trade balance and income terms of trade, the testing of Granger causality is in an error correction model. Conversely, the testing of Granger causality for trade balance and commodity terms of trade is in a conventional Granger causality model. The results show that term of trade, either commodity terms of trade or income terms of trade Granger causes trade balance and not vice versa.

Conclusions

This study has investigated empirically the cointegrating relationship between trade balance and terms of trade, namely commodity terms of trade and income terms of trade, in the Turkish economy. Since the variables in this article are nonstationary and present a unit root, Johansen's cointegration technique has been applied. This methodology has allowed for obtaining a cointegrating relationship between these variables. Moreover, it examines Granger causality between trade balance and terms of trade. The Dickey and Fuller (1979) and Phillips and Perron (1988) unit root test statistics show that all variables are integrated in the same order. The results of the Johansen (1991) cointegration method show that trade balance and income terms of trade are cointegrated while trade balance and commodity terms of trade are not cointegrated. In other words, there is a long-run relationship between trade balance and income terms of trade, but no long-run relationship between trade balance and commodity terms of trade. Moreover, in the long run, an increase in income terms of trade will lead to a decrease in trade balance. The results of Granger causality show that term of trade Granger causes trade balance and not vice versa. Generally, a change in terms of trade will have an effect on trade balance in Turkey. In the long run, the impact of terms of trade on trade balance depends on the measure of terms of trade.

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