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DETERMINANTS OF TURKISH MINING TRADE BALANCE WITH EU(15): ESTIMATES FROM BOUND TESTING APPROACH

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Mehmet Yazici[1], M. Qamarul Islam[2]
[1]Cankaya University. myazici@cankaya.edu.tr
[2]Cankaya University.: islammq@cankaya.edu.tr

ABSTRACT

We estimate the short-run and long-run determinants of the trade balance of Turkish Mining with EU (15) countries as well as impact of Customs Union (CU) agreement using the bounds testing approach to the cointegration and the error correction modeling. In selecting the optimal model, we follow Yazici and Islam (2011a, 2011b, 2012) and Yazici (2012) and adopt their model selection strategy where selection is made from the set of those models that satisfy both diagnostic tests and cointegrtion, thus ensuring the selection of a statistically reliable and cointegrated model. Estimation results based on the data for 1988-I to 2008-IV period indicate that in the determination of mining trade balance in the short-run only real domestic income matters. Long-run results indicate that real exchange rate and real domestic income variables have coefficients with expected signs but they are not statistically significant. Only statistically significant long-run determinant of mining trade balance is real EU(15) income. Dummy variable for the customs union agreement does not have a statistically significant coefficient, meaning that the agreement does not have a significant long-run effect on mining trade balance of Turkey with EU(15).

Keywords: Bounds testing approach, exchange rate, customs union, mining trade balance, Turkey
JEL Classification: C13, C22, F14, F31

1. INTRODUCTION

Trade balance is equal to export revenue minus imports expenditure. Every nation desires to have a trade balance with surplus meaning that it exports more than it imports because, otherwise, it will have to find ways such as borrowing from abroad to finance excess imports expenditure or trade balance deficit. It is undoubtedly important to know factors affecting trade balance especially for the policy makers to able to design and implement correct policies.

Trade balance is analyzed extensively in the empirical literature. Analysis is done at three levels: aggregate level (trade balance of a country with the rest of the world), bilateral level (trade balance of a country with a major trading partner) and sectoral level (trade balance of a country's sector with rest of the world or a major trading partner).[1] Bahmani-Oskooee (1985), Noland (1989) and Gupta-Kapoor and Ramakrishnan (1999) can be cited as examples of aggregate level studies. Examples of bilateral level studies include Rose and Yellen (1989), Marwah and Klein (1996), Arora *et al*. (2003) and Bahmani-Oskooee and Ratha (2004b). Carter and Pick (1989), Doroodian *et al*. (1999) and Baek *et al.* (2009) are examples of sectoral level studies.

The purpose of this paper is to explore the short-run and long-run determinants of the trade balance of Turkey's mining with EU (15) countries and the impact of customs union agreement using bounds testing approach with the model selection strategy developed by Yazici and Islam (2011a, 2011b, 2012) and Yazici (2012).

2. LITERATURE REVIEW

Regarding the mining trade balance of Turkey, it is investigated in the literature but in a few papers, which, to the best of our knowledge, are Yazici (2008) and Yazici and Klasra (2010). Yazici (2008) examines and compares, using Almon lag technique, the response to exchange rate changes of trade balances with the rest of the world of three Turkish sectors; agriculture, manufacturing and mining. It is found that in the short-run in response to domestic currency depreciation mining trade balance first improves, then worsens and then improves again and in the long-run agricultural trade balance improves as a result of depreciation of domestic currency. Yazici and Klasra (2010) investigates, in the context of manufacturing and mining sectors of Turkish economy that use imported inputs at different rates, how the response of trade balance to currency devaluation is affected by usage of imported inputs in production of exports. They report that in none of the two sectors j-curve effect exists and that violation of j-curve effect is less severe in the sector with lower import content, mining.

These papers, Yazici (2008) and Yazici and Klasra (2010), are close to ours in the sense that they also examine the Turkish mining trade balance. Despite this similarity, there are three main differences: they look into Turkey's mining trade in the context of world trade, not trade with EU (15), different econometric methods, Almon lag technique and impulse response function, are employed by them and they don't consider the effect on the trade balance of customs union agreement.

In the estimation of the mining trade balance we employ a commonly used econometric technique of bounds testing approach developed by Peseran *et al*. (2001). The previous papers other than Yazici and Islam (2011a, 2011b, 2012) and Yazici (2012) that have employed the bounds testing approach first select the model for estimation using a certain model selection criterion such as Akaike Information Criterion (AIC), estimate it and then apply the cointegration and diagnostic tests to this model. Whatever results come up regarding the cointegration and diagnostics are reported in the end even though some or all of the diagnostics may not be satisfied and/or cointegration may not exist in the selected model, thus making the reported model unreliable. In this paper we follow Yazici and Islam (2011a, 2011b, 2012) and Yazici (2012) and use their model selection strategy where first the cointegration and diagnostic tests are applied to all possible models, given a maximum lag length, and then the subset of models satisfying both the cointegration and the diagnostics is determined. Finally, a model selection criterion is applied to this subset in order to come up with the optimal model for estimation.[2] Unlike the other studies, this strategy of model selection ensures that the estimated optimum model is co-integrated and passes the diagnostics, thus resulting in a statistically reliable estimated model.

The rest of the paper is organized as follows. In the following section the sources of data are described and their time series characteristics are displayed. Then the trade balance model is set out. The next section presents and discusses the empirical results, and the last section contains the key findings and the concluding remarks.

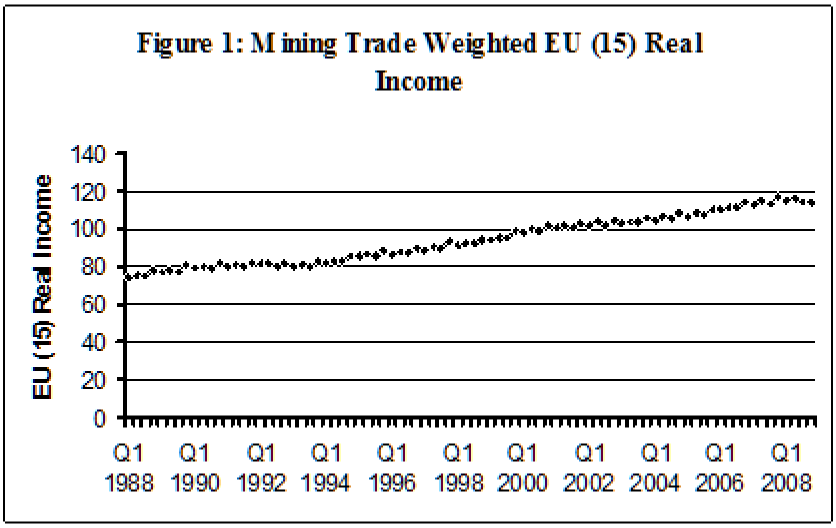
3. DATA AND METHODOLOGY

3.1. Description and Time Series Characteristics of Data

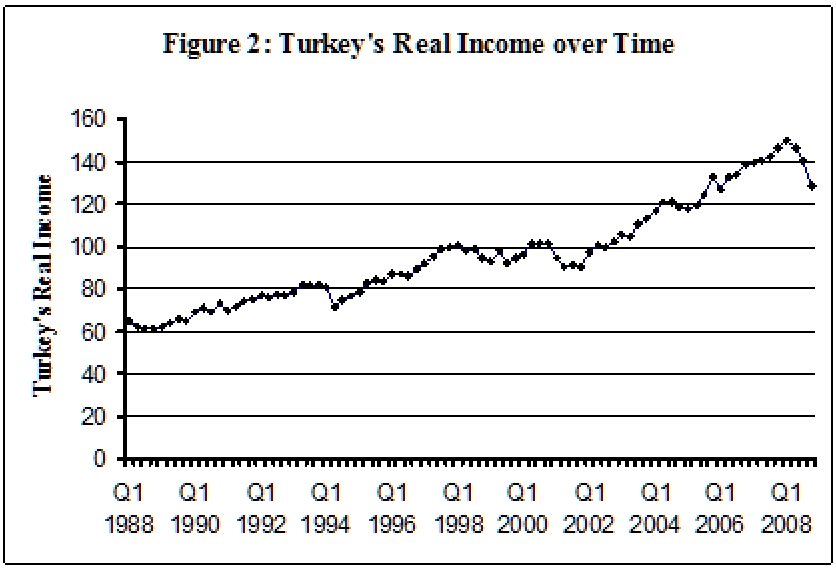
We use quarterly data covering the period from 1988:I to 2008:IV. Using 2000 quarterly average as the base, we have indexed the data. Besides, our data is also seasonally adjusted. Data come from three sources; IMF-IFS Country Tables, Statistics Office of Turkey and Eurostat. Export and import data is taken from Statistics Office of Turkey. Data for Real Gross Domestic Product (GDP), Industrial Production Index except for Greece, GDP Deflator and Consumer Price Index (CPI) are compiled from IMF-IFS Country tables. Source for Industrial Production Index of Greece is Eurostat.

In the estimation of mining trade balance four variables are used, namely Mining trade balance (TB) defined as the ratio of mining exports of Turkey to EU(15) countries over Turkey's mining imports from EU(15) countries, Turkey's real income (Y_{TR}), Real income of EU(15) countries (Y_{EU}), constructed as the weighted average of real income of these countries where weights are mining-sector specific and assigned based on each country's share in total mining trade of Turkey with EU(15) and Real effective exchange rate (RER) between Turkey and currencies of EU(15) countries where nominal exchange rate is defined as the amount of Turkish Lira per trading partner's currency. Real effective exchange rate (RER) we use in this study is also sector specific like Real GDP of EU(15) in the sense that when constructing RER, the share of a EU(15) country in Turkey's mining trade is assigned as the weight for the country in question.[3]

The behavior of these variables over the sample period is illustrated in Figure 1 through Figure 5.[4] Figure 1 shows EU (15)'s real income over sample period. As expected, it is increasing steadily over time.



In Figure 2 Turkey's real income over time is displayed. It is also rising. However, compared to EU(15)'s real income, we observe that Turkey's real income series has a lower starting value and a higher ending value. This indicates that Turkish real income changes more rapidly over time. We also observe that Turkey's real income fluctuates more so it has a greater variability.



The behavior of real effective exchange rate series over sample period is illustrated in Figure 3. Even though it shows increases from time to time, overall it has a declining trend, which means Turkish lira has appreciated over time with respect to Euro.

Figure 3: Mining Trade Weighted Real Effective Exchange Rate of Turkey with EU(15)

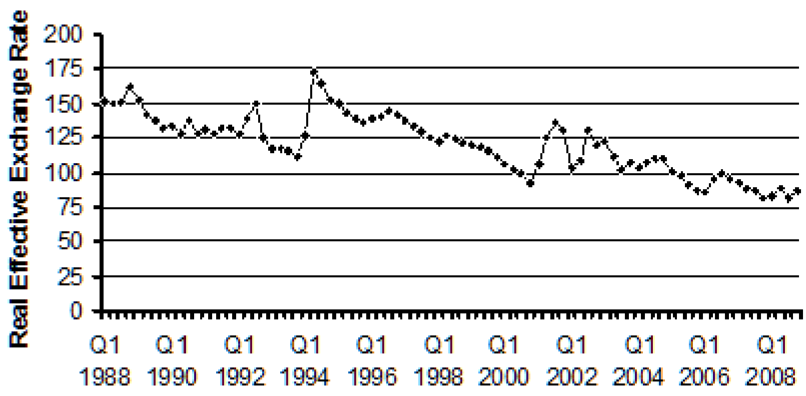
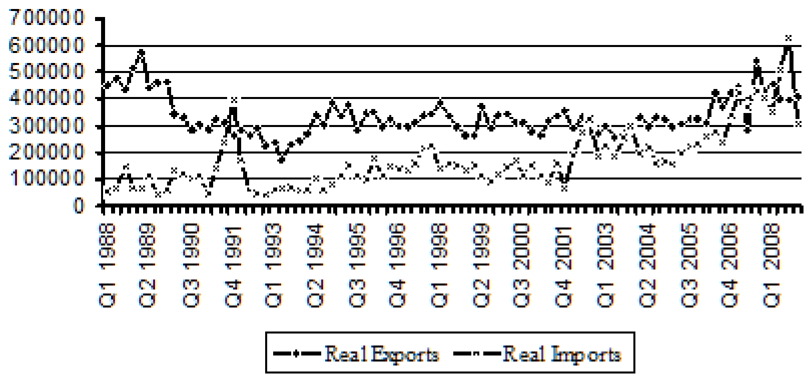


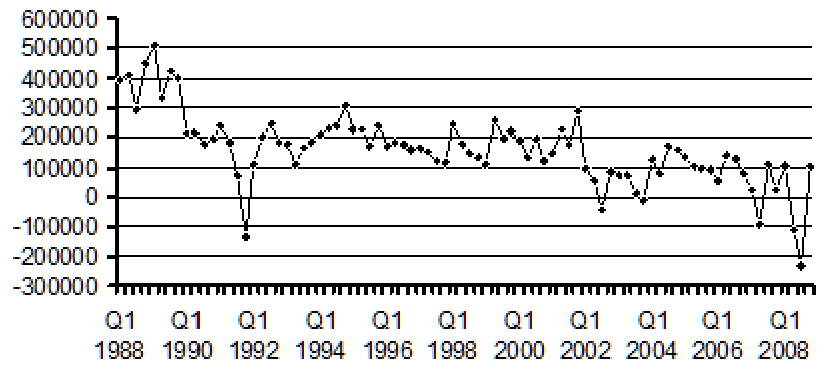
Figure 4 shows real mining exports and imports over time. First thing to note about them is that almost over the entire sample period real exports are greater than real imports, implying a surplus in mining trade balance of Turkey with EU(15) as also seen in Figure 5. Another feature of real exports and imports series is that the gap between two series is narrowing over the period.

Figure 4: Turkey's Real Mining Exports to and Imports from EU (15)



Real mining trade balance series is shown in Figure 5. Even though it fluctuates, it has overall a declining trend, confirming our earlier observation that imports are catching up with exports. Except for a few periods, Turkey's real mining trade balance with EU(15) is in general in surplus.

Figure 5: Turkey's Real Mining Trade Balance with EU (15)



3.2. Model

We employ the trade balance model most commonly used in the literature where trade balance depends on real domestic income, real foreign income and real exchange rate and we express it in log-linear form as follows [5];

$$\ln TB_t = a + b \ln Y_{TR,t} + c \ln Y_{EU,t} + d \ln RER_t + eD_t + \varepsilon_t \qquad (1)$$

Where TB_t is the real trade balance defined as the ratio of mining exports of Turkey to EU(15) countries over Turkey's mining imports from EU(15) countries, Y_{TR} is Turkey's real income, Y_{EU} is the real income of EU(15) countries constructed as the weighted average of real income of these countries where weights are each country's share in mining trade of Turkey with EU(15), RER is the real effective exchange rate between Turkey and currencies of EU(15) countries where nominal exchange rate is defined as the amount of Turkish Lira per trading partner's currency and D is the dummy variable for the customs union agreement. Mining products started to circulate freely after 1999. Therefore, D takes on value 0 for quarters before 1999 and value 1 afterwards. Real effective exchange rate (RER) we use in this study is also sector specific like Real GDP of EU(15) in the sense that when constructing RER for mining sector, the share of a EU(15) country in Turkey's mining trade is assigned as the weight for the country in question.

We have the following prior expectations about signs of the variable coefficients. Because real domestic income growth will stimulate the imports, it should have a negative coefficient. However, if increase in production of import-substitutes is generating much of domestic income growth, the impact on the trade balance of the domestic income will be positive. By similar reasoning, opposite of what we just said about domestic income would be the case for the coefficient of foreign (EU15) income. Finally, a rise in the real exchange rate (depreciation) will lead to an improvement in the trade balance by making the exports cheaper for foreigners and imports more expensive for that country, thus yielding a positive coefficient.

Estimation of equation (1) gives us long-run determinants of the trade balance. We also want to find out the short-run determinants. For this purpose, following Peseran et al. (2001) and employing Autoregressive Distributed Lag Method (ARDL), we express equation (1) in the following error-correction modeling format.

$$\Delta \ln TB_t = \alpha + \sum_{j=0}^{k}\beta_j \Delta \ln Y_{TR,t-j} + \sum_{j=0}^{l}\gamma_j \Delta \ln Y_{EU,t-j} + \sum_{j=0}^{m}\lambda_j \Delta \ln RER_{t-j} + \sum_{j=1}^{n}\theta_j \Delta \ln TB_{t-j}$$

$$+ \delta_1 \ln Y_{TR,t-1} + \delta_2 \ln Y_{EU,t-1} + \delta_3 \ln RER_{t-1} + \delta_4 \ln TB_{t-1} + \delta_5 D_t + u_t \quad (2)$$

Using F-test, we test the null hypothesis of no cointegration ($H_0 : \delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$) against the alternative of cointegration ($H_1 : \delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq 0$) to find out whether or not there is a cointegration among model variables. Given the fact that under the null hypothesis F-statistic has a non-standard distribution, in conducting the test of the above hypothesis we use new critical values in Peseran et al. (2001).[6] We reject the null hypothesis in case the calculated F-statistic exceeds the upper bound critical value and thus conclude that variables are cointegrated.

4. FINDINGS AND DISCUSSIONS

As mentioned earlier, we have adopted the model selection strategy in Yazici and Islam (2011a, 2011b, 2012) and Yazici (2012), and have proceeded as follows in implementing it.[7] We have first set the maximum lag length of 10 on each first differenced variable in equation (2). We have estimated each model corresponding to every possible lag combination and kept those models satisfying the diagnostic tests of normality, no serial correlation and no heterescodasticty at least at 10 % level. We have then checked whether there exists a cointegration or not for each model in this set using F-test and have discarded those models for which no cointegration is eatablished.[8] At this stage we have the subset of those models that satisfy diagnostic tests and at the same time indicate a cointegration. As the last step, in order to determine the optimal model, we have applied AIC to this subset.

Having followed these steps, we have found out optimal lag combination as (k=0, l=1, m=0, n=9).[9] We have then estimated the model corresponding to this lag combination in equation (2) based on quarterly data for the period of 1988:I-2008:IV.

The short-run estimation results for Turkey's mining trade balance with EU(15) are demonstrated in Table 1. Looking at the table, we observe that only real domestic income has a statistically significant negative coefficient. Coefficients of real exchange rate and real EU(15) income variables are not statistically significant. This implies that in the determination of mining trade balance in the short-run only real domestic income matters. Coefficient of dummy variable for the customs union agreement is not statistically significant either, indicating that this agreement has not affected significantly Turkey's mining trade balance with EU(15) in the short-run.

In Table 2 long-run estimation results are reported. Results indicate that real exchange rate and real domestic income variables have coefficients with expected signs but they are not statistically significant. So exchange rate and domestic income are not significant determinants of mining trade balance in the long-run in trade with EU(15) countries. Only statistically significant long-run determinant of mining trade balance is real EU(15) income but its coefficient is negative, indicating that EU(15) countries grow, mining trade balance of Turkey worsens.

Table 1: Short-Run Estimates and Diagnostic Tests for Mining Trade Balance. Dependent Variable: $\Delta \ln TB_t$

Regressors	**Coefficient**	**t-value**
Constant	16.784**	2.485
$\Delta \ln Y_{TR,t}$	-2.885*	-1.793
$\Delta \ln Y_{EU,t}$	-11.501	-1.450
$\Delta \ln Y_{EU,t-1}$	12.486	1.542
$\Delta \ln RER_t$	-0.427	-0.503
$\Delta \ln TB_{t-1}$	0.728**	2.207
$\Delta \ln TB_{t-2}$	0.573*	1.883
$\Delta \ln TB_{t-3}$	0.367	1.355
$\Delta \ln TB_{t-3}$	0.425*	1.800
$\Delta \ln TB_{t-5}$	0.627***	2.792
$\Delta \ln TB_{t-6}$	0.369*	1.848
$\Delta \ln TB_{t-7}$	0.476***	2.927
$\Delta \ln TB_{t-8}$	0.247	1.547
$\Delta \ln TB_{t-9}$	0.236**	2.110
D_t	0.158	0.437
Diagnostic Tests	**Value of Statistic**	**p-value**
Normality[1]	1.4	0.49
No Serial Correl.[2]	6.7	0.16
No Heteroscedas.[3]	0.2	0.68
F (18,54)	3.96	0.00
F (Wald) [4]	4.25	
Adj. R^2	0.43	

Notes: *, **, *** indicate significance levels at 10%, 5%, and 1%, respectively. 1: Jarque-Bera test statistic is used having a $\chi^2(2)$ distribution. 2: LM test statistic is used having a $\chi^2(4)$ distribution. 3: LM test statistic is used having a $\chi^2(1)$ distribution. 4: The upper bound critical value for the F-statistic at 10% significance level is 3.77 (Peseran *et al*. (2001), Table CI, Case III, p.300).

This will happen, as explained in model part of this paper, if mining production in EU(15) countries increases as their economies grow. Dummy variable for the customs union agreement does not have a statistically significant coefficient. This means the agreement does not have a significant long-run effect on mining trade balance of Turkey.

Table 2: Long-Run Estimates for Mining Trade Balance Dependent Variable: $\ln TB_t$

Regressors	Coefficient	t-value
Constant	12.826*	1.791
$\ln Y_{TR,t}$	-0.841	-0.360
$\ln Y_{EU,t}$	-1.489***	-3.576
$\ln RER_t$	0.499	1.305
D_t	0.121	0.095

Notes: *, **, *** indicate significance levels at 10%, 5%, and 1%, respectively.

5. CONCLUSION

This paper has estimated Turkish mining trade balance in trade with EU(15) countries to investigate particularly the impact of the exchange rate and that of customs union using bounds testing approach with the model selection strategy adopted from Yazici and Islam (2011a, 2011b, 2012) and Yazici (2012) based on the quarterly time series data over 1988:I-2008:IV period. This paper contributes to the literature by considering an important sector of Turkish economy, mining, in the context of trade with an important trading partner, EU(15) countries.

Estimation results based on the data for 1988-I to 2008-IV period indicate that in the determination of mining trade balance in the short-run only real domestic income matters. Long-run results indicate that real exchange rate and real domestic income variables have coefficients with expected signs but they are not statistically significant. As far as the use of exchange rate policy is concerned, depreciation of Turkish lira with respect to euro has no significant effect on mining trade balance, suggesting that exchange rate policy can't be used effectively to improve trade balance of Turkey's mining sector with EU(15). Only statistically significant long-run determinant of mining trade balance is real EU(15) income but its coefficient is negative, indicating that EU(15) countries grow, mining trade balance of Turkey worsens. This will happen if mining production in EU(15) countries increases as their economies grow. As for the impact of customs union agreement, the agreement does not have a significant effect on the mining trade balance.

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ENDNOTES

1. For a detailed review of the aggregate and bilateral level studies, see Bahmani-Oskooee and Ratha (2004a).
2. Steps followed in model selection process in order to find the optimal model are shown more explicitly in a flow chart diagram in Yazici and Islam (2012).
3. Weights used (in the order of importance) are 1-Italy: 0.276, 2-Sweden: 0.131, 3-Spain: 0.10, 4-Germany: 0.091, 5-UK: 0.089, 6-Austria: 0.08, 7-Holland: 0.053, 8-France: 0.044, 9-Greece: 0.043, 10: Belgium plus Luxemburg: 0.043, 11-Finland: 0.037, 12-Portugal: 0.009, 13-Ireland: 0.003, 14-Denmark: 0.001.
4. To be able see fluctuations over time better in series, variables in this figure are displayed without taking their logarithms and trade balance here is measured as the difference between real exports and real imports.
5. A detailed derivation of this model can be found in Yazici and Islam (2012).
6. The upper bound critical value for the F-statistic at 10% significance level is 3.77, taken from Peseran *et al*. (2001) (Table CI, Case III, p.300).
7. An algorithm developed by Dr. M. Qamarul Islam is used for this purpose.
8. The upper bound critical value for the F-statistic at 10% significance level is 3.77 (Peseran et al. (2001), Table CI, Case III, p.300).
9. What lag combination would have been selected if the method of the previous literature were adopted? The lag combination that would have been selected by the method of previous literature is (k=1, l=6, m=8, n=10), which is different from ours: (k=0, l=1, m=0, n=9). When compared with our strategy, however, no serial correlation assumption fails in this case.