Determinants of Trade Balance in Jordan

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Abstract

This paper examines the determinants of trade balance for Jordan. The newly introduced bounds co-integration test within an ARDL model is applied to annual data covering the period of 1970-2010. In addition, the generalized approach to error forecast variance decomposition and impulse response functions are simulated for further inference regarding the dynamic interactions among variables in the model. The determinants included are real exchange rate, domestic income, and foreign income. The empirical investigation, using ARDL bounds test shows that trade balance and its determinants are co-integrated. However, the analysis reveals that real exchange rate is insignificant determinant of trade balance in either the short or long run. In contrast to domestic income, foreign income appears to be an important determinant of trade balance in the long run. While generalized error forecast variance confirms only the insignificancy of real exchange rate, the generalized impulse response functions support the findings already found using ARDL approach.

Keywords : Trade balance, Cointegration, bounds testing, VAR, Jordan

Introduction

Studying factors determining trade balance has been the subject of plenty of research works during the past decades. Despite the fact that economic theory considers several factors that affect trade balance, such as real exchange rate, real domestic income, foreign direct investment, foreign income, and money supply, most empirical works emphasis the role of exchange rate. Economic theory postulates that changing nominal exchange rate can be used to improve trade balance position through changing the relative prices of exports and imports. The study of the effect of currency devaluation or depreciation on trade balance usually conducted under the elasticity approach which introduced and developed by Bickerdike (1920), Robinson (1947), and Mitzler (1948). According to the elasticity approach, for devaluation or depreciation to improve trade balance, the sum of the elasticities of demand for export and import must be greater than unity. This requirement is also known as Marshall-Lerner condition. The large body of empirical studies in this subject have come up with mixed results. Some Studies support a significant and important effect of exchange rate change on trade balance and Others found a weak statistical effect, whereas a third group of studies found unfavorable effect(1). Furthermore, the results of many other studies fall somewhat between the previous conclusions as there is a time lag between the exchange rate change and its effect on trade balance. The j-curve effect states that there are different effects of exchange rate changes on trade balance in the short run and long run (see Magee 1973 and Meade 1988). Accordingly, devaluation initially deteriorates trade balance before starting a stage of improvement and heading towards equilibrium in the long run and thus trade balance follows a j- curve time path. The literature on the J-curve effect is also mixed. Some studies found evidence of the effect and others found the opposite(2).

With reference to the case of Jordan, using interpolated quarterly data over the period 1971-1994, Bahmani-Oskooee (2001) investigated the relationship between real effective exchange rate and trade balance of eleven Middle Eastern countries including Jordan, and found a positive insignificant statistical effect using Engle-Granger co-integration and a positive significant effect using Johansen-Juselius co-integration in the case of Jordan(3). The current study aims to investigate the determinants of trade balance in Jordan through applying the ARDL bounds test, generalized approach to error forecast variance decomposition, and impulse response functions, to annual data covering the period from 1970 to 2010. It differs from the study of Bahmani-Oskooee (2001) in some aspects. First, it is fully devoted to the study of Jordan case. Second, it employs actual annual data, for a somewhat longer period, rather than using interpolated data. Third, the current study applies the newly developed bounds testing approach to co-integration compared to the traditional co-integration techniques, as they face the problem of the order of integration and require the data samples to be of large size. The ARDL bounds test developed by Pesaran and Shin(1999) and Pesaran et al.(2001) can be applied irrespective of whether the regressors are integrated of zero order, one, or mutually integrated. Furthermore, the bounds test is considered valid and suitable for small size samples (Nrayan, 2004) such as the current study. Additionally, this study applies two preferred and somewhat new methodologies of Vector Autoregressive model (VAR), namely generalized variance decomposition and generalized impulse response functions which introduced by Koop et al. (1996), and Pesaran and Shin(1998) since they cope with the setback of the traditional orthogonalized variance decomposition and impulse response. This setback lies in the fact that their outcome of results depends on the order of the variables in the VAR system. On the other hand, the results of the generalized approach to forecast error variance decomposition and impulse response functions are invariant to the order of variables.

The organization of the rest of this paper will be as follows: section 2 gives a brief view of Jordan trade balance. Section 3 introduces the econometrical methodology and data. Empirical analysis is conducted in section 4 and conclusions are presented in Section 5.

Jordan Trade Balance

Jordan is one of the developing countries classified, according to the world bank, as an upper middle income country with a population of 6 million and a per-capita GDP of US $4,445 in 2010 (see World bank 2011). It encounters a permanent trade deficit and thus current account deficit in most years. Trade balance deficit increased from 3585 million JD in 2006 to 4722 million JD in 2010 and averaged, as a percentage to GDP, 29.8% during 2006-2010. This deficit is mainly driven by an increase in international prices of commodities, particularly fuel products, which is translated into a rise in the imports bill. On the other hand, goods export mainly includes: clothes, pharmaceuticals, potash, phosphates, fertilizers, vegetables. The surplus of the services, income, and current transfers accounts cover a large part of this deficit and therefore mitigate the current account deficit in most years and cover full deficit and thus turns current account to a surplus in some other years. As a percentage to GDP, current account deficit averaged 9.1% over the period 2006-2010. As a result, Jordan dependency on financial and capital account, particularly foreign direct investment inflows, left the stability and equilibrium in the external sector vulnerable to external shocks. Historically, Jordan Dinar (JD) has been pegged to some key currencies and SDR and devalued several times particularly in the 1980s and 1990s. At the end of the 1980s a managed float exchange rate system was implemented followed by a dual (official pegged and floating) one. From October 1995 on, Jordan has adopted a pegged exchange rate system, whereby JD is pegged to the U.S Dollar at an average price of 709 fils per Dollar.

Econometric Methodology and Data

This study starts with a reduced form model of direct relationship between trade balance and its de terminants similar to that of Rose and Yellen (1989) and Bahmani-Oskooee (2001) as follows:

$$\ln TB_t = a + b \ln Y_t + c \ln RER_t + d \ln YW_t + \varepsilon_t \qquad (1).$$

TB is trade balance measured as the ratio of export value X to import value M, Y is domestic income, RER is real exchange rate, YW is foreign or the rest of the world income, and ε is an error term. The definition of trade balance TB as X/M has been widely used and preferred in literature since the ratio is insensitive to units measurement and can be interpreted as nominal or real trade balance (see Bahmani-Oskooe, 1991, and Hsing, 2005). RER is defined as $E\,P^f/P$ where E is nominal exchange rate defined as the number of units of home currency per unit of foreign currency, P^f stands for foreign prices, and P is domestic prices. Accordingly, an increase in RER represents devaluation or depreciation of home currency value whereas RER decrease presents revaluation or appreciation of the same.

The sign of b is difficult to be expected a priori and therefore only empirical investigation can show weather income is demand or supply determined and therefore weather demand or supply effect dominates the sign of b. According to the Keynesian model of income determination in an open economy, domestic income is demand determined and thus its increase that brought about by domestic aggregate demand increase, leads to deterioration in trade balance as part of the increased domestic expenditure is directed toward imports. As a result, the sign of b is expected to be negative. From a supply side perspective, the export side and import substitute effects of domestic output (income) change turn the expected sign of b to be positive. If domestic output (income) increase, exportables and import substitutes tend to increase and thus improve trade balance. With regard to the sign of *c*, it is expected to be positive as the increase in RER implies a devaluation or depreciation of domestic currency and thus improvement (increase) in trade balance TB. If a negative sign is initially observed in the ARDL followed by a positive one, this would be consistent with J-curve effect. However, the sign of *d* is usually expected to be positive as the increase in foreign countries' income leads to the rise of the country’s exports and thus improve trade balance and vice versa.

The application of ARDL bounds test to the above trade balance model starts with testing the long run relationship between trade balance and its determinants. To do so, a conditional error correction representation of equation (1) is formulated and estimated as follows:

$$\Delta Ln\, TB_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i}\, \Delta Ln\, TB_{t-i} + \sum_{i=0}^{n} \beta_{2i}\, \Delta Ln\, Y_{t-i} + \sum_{i=0}^{n} \beta_{3i}\, \Delta Ln\, RER_{t-i} + \sum_{i=0}^{n} \beta_{4i}\, \Delta Ln\, YW_{t-i} + \beta_5 LnTB_{t-1} + \beta_6 Ln\, Y_{t-1} + \beta_7 Ln\, RER_{t-1} + \beta_8 Ln\, YW_{t-1} + e_t \quad (2),$$

where Δ refers to the first difference operator and ***n*** is the maximum lag length. The parameters β_1, β_2, β_3, and β_4, stand for the short run dynamics whereas β_5, β_6, β_7, and β_8 present the long run relationship. A joint significance test of no co-integration between TB, Y, RER, and M is applied with the null hypothesis $(H_0 : \beta_5 = \beta_6 = \beta_7 = \beta_8 = 0)$ as against the alternative hypothesis $(\mathrm{H}_1\!: \beta_5 \neq \beta_6 \neq \beta_7 \neq \beta_8 \neq 0)$. The bounds test procedure of Pesaran et al.,(2001) depends on the Wald test (F statistics) with an asymptotic non standard distribution. Pesaran, Shin and Smith (1996) established two bounds of critical values for different model specifications. If the computed F statistic, at a chosen significance level, exceeds the upper critical bound value, the null hypothesis of no co-integration is rejected. Similarly, if the computed F statistics falls below the lower critical bound value, the null hypothesis of no co-integration is not rejected. When the computed F statistics falls between the two critical bound values, the result is considered inconclusive.

Once a long run relationship is confirmed, the long run coefficients are estimated using the following model:

$$Ln\, TB_t = b_0 + b_1 LnTB_{t-1} + b_2 Ln\, Y_{t-1} + b_3 Ln\, RER_{t-1} + b_4 Ln\, YW_{t-1} + \varepsilon_t \quad (3).$$

The selection of the lag length of different variables of the above model can be done via different criteria such as AIC (Akaike Information Criterion), SBC (Schwarz Bayesian Criterion), and HQ (Hannan and Quinn) . The next step in the ARDL bounds test is to estimate the error correction representation of the above long run model to investigate the short run dynamics . The error correction model can be established as follows:

$$\Delta Ln\, TB_t = \alpha_0 + \sum_{i=1}^{n} \alpha_{1i}\, \Delta Ln\, TB_{t-i} + \sum_{i=0}^{n} \alpha_{2i}\, \Delta Ln\, Y_{t-i} + \sum_{i=0}^{n} \alpha_{3i}\, \Delta Ln\, RER_{t-i} + \sum_{i=0}^{n} \alpha_{4i}\, \Delta Ln\, YW_{t-i} + \theta ECM_{t-1} + \varepsilon_t \,, \quad (4)$$

where θ is the speed of adjustment parameter and ***ECM*** is the residuals that are obtained from the estimation of equation (3). To make sure about the goodness of the selected model, tests of serial autocorrelation, functional form misspecification, error term non normality, and heteroskedasticity are performed.

For further investigation and inference about the dynamic interaction and causal relationships between the variables of trade balance model, two methodologies within the VAR system are used; generalized error forecast variance decomposition and generalized impulse response function. Variance decomposition technique as introduced by Sims (1980), measures the proportion of the forecast error variance for each variable in the VAR system which is explained by its own innovations and those of other variables. Consequently, from variance decomposition it can be shown the importance of the independent variables of trade balance model in explaining fluctuations in trade balance. The impulse response function simulates the effects of a shock to one variable in the system on the conditional forecast of another variable. In other words, it describes how one variable responds over time to a one-time impulse in itself or in any other variables.

The data of Jordan used in this study are annual data for the period 1970 – 2010. All variables are logged and thus the parameters estimates are interpreted as elasticities. The variables of the study can be defined as follows: TB is trade balance calculated as the ratio of the value of merchandise exports to the value of merchandise imports and both were taken from the UNCTAD database. Y is domestic real GDP (2005=100) collected from the UN statistical database. RER is real exchange rate calculated as the nominal exchange rate of Jordanian Dinar / dollar multiplied by the ratio of foreign price index (2005=100) to Jordan consumer price index (2005=100). The used data are those issued by the Central bank of Jordan and the UN database. YW is the U.S real GDP as a proxy of foreign income collected from the UN database. All estimations are computed using Microfit 5 and Eviews 7 softwares.

Empirical Results

An important thing to do before implementing the bounds test, is to test the univariate properties of the variables series to identify their degree of integration by making use of both Augmented Dickey-Fuller and Phillips-Perron tests of unit root. Table 1 shows that all the variables of trade balance model are non stationary in level and stationary in the first difference or I(1). Consequently, the bounds test procedures can be started.

Table 1 : Unit Root Tests

	ADF		Phillips-Perron	
Variable	**intercept**	**intercept& trend**	**Intercept**	**Intercept& trend**
Ln TB	1.702	2.94	1.42	2.9
ΔLnTB	7.66*	7.69*	7.67*	16.50*
LnY	1.88	2.26	0.85	1.17
ΔLnY	3.74*	3.70**	3.51**	3.45***
LnRER	2.36	2.88	1.72	1.94
Δ LnRER	3.47**	3.48***	3.47**	3.48***
LnYW	1.49	2.54	1.55	1.68
Δ LnYW	5*	5.16*	4.89*	5.16*

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

The joint significance test of no co-integration resulted from the estimation of equation (2), suggests the rejection of the null hypothesis that there is no co-integration (long run relationship) between trade balance TB and its determinants. The calculated F statistic is 4.95 which is higher than the upper bounds critical value (4.66) at the 1% significance level.(4)

As the long run relationship between trade balance and its determinants is established, the long run coefficients can be estimated via estimating equation (3). Here, the maximum lag length and the lag length of different variables needed to be decided. In the case of annual data such as ours, Pesaran and Shin (1999) suggest 2 as a maximum lag length. The selected model, and thus lag length of various variables, according to AIC, SBC, and HQ is ARDL (1, 1, 0, 0). Table 2 illustrates the estimated long run model ARDL (1, 1, 0, 0) where Y displays a negative insignificant effect, RER shows a negative insignificant effect, and YW appears to have a positive and highly significant effect on TB. The negative effect of RER is consistent with the pessimistic view of exchange rate change policy and confirms the finding of Bahmani-Oskooee (2001) that REER is not an important determinant of trade balance using Engle-Granger co-integration technique. Despite the insignificant impact of Y, The negative sign of its coefficient is consistent with the Keynesian theory that views domestic income as demand determined. The positive and highly significant effect of YW is theoretically in line with expectation. If we take into consideration the difference between the definitions of variables between this study and Bahmani-Oskooee (2001), the signs of the three independent variables are the same in both studies. The values of R square, R par square, and F static indicate a good fit of the model whereas, the diagnostic tests show that the ARDL model is free of the key problems of regression (serial autocorrelation, misspecification problem, error term non normality, and heteroskedacticity) (see Table 2).

Table 2 : Long Run Coefficient of ARDL (1, 1, 0, 0)

Dependent variable LTB			
Regressor	**Coefficient**	**t-ratio**	**[prob]**
LY	-0.26	-1.45	0.156
LRER	-0.15	-0.38	0.710
LYW	1.05	5.84	0.000
INPT	-7.4	3.70	0.001
	R square= 0.89 R par square = 0.87 F(5, 33) = 53.1953 [0.000] DW - Statistic = 1.99 Durbin's h-statistic = 0.12960 [0.897]		
Diagnostic Tests	**LM version**	**F version**	
	Serial Correlation = 0.74 [0.978]	F(1, 32)= 0.606 [.981]	
	Functional Form = 1.58 [0.177]	F(1, 31)= 1.64 [0.213]	
	Normality Test = 0.046 [0.977]	Not applicable	
	Heteroscedacticity test = 1.77 [0.183]	F(1, 37)= 1.76 [0.192]	

note : serial correlation test is based on Lagrange multiplier test of residual serial correlation, functional form test based on Ramsey's RESET test using the square of the fitted values, normality test based on a test of skewness and kurtosis of residuals. Heteroscedacticity test based on regression of squared residuals on squared fitted values.

Turning to the short run dynamic, Table 3 displays the error Correction representation of ARDL (1, 1, 0, 0) as formulated in equation (3). It is clear that RER is also insignificant determinant of trade balance in the short run and thus the J-Curve hypothesis is not valid in the case of Jordan. However, domestic income and foreign income appear to be important determinants of trade balance in the short run. Error correction term ECM_{t-1} is statically significant at 1% with the appropriate (negative) sign which confirms the long run relationship between trade balance and its determinants in Jordan. The value of its coefficient

(0.67) refers to a moderate to high speed of adjustment (67% a year) of trade balance to changes in the explanatory variables before converging to its equilibrium value.

Table 3 : Error Correction Model

Dependent variable ΔLn TB			
Regressors	**Coefficient**	**T-ratio**	**[prob]**
ΔLn Y	-0.70	-3.50	[0.001]
Δ Ln RER	-0.10	-.38	[0.709]
Δ Ln YW	0.70	3.64	[0.001]
INPT	-4.94	-2.82	[0.008]
ECM_{t-1}	- 0.67	4.90	[0.000]
Diagnostic tests	R square =0.49 R par square=0.41 S.E of regression = 0.128 F(4,34)= 7.78 [0.000] Residual Sum of Square=0.54 Equation log likelihood= 28.22 D.W=1.98 ECM = LTB + 0.26 LY +0.15 LRER -1.05 LYW + 7.4		

To start further inference regarding the dynamic interaction and causal relationships, the VAR model requires the time series data to be stationary. Since the data of all variables of trade balance model are I(1), their first difference form are employed in estimating unrestricted VAR. The lag length of VAR is selected to be 2 according to AIC, HQ, FPE (final prediction error), and LR test (at 5% level). The results of the generalized variance decomposition are presented in Table 4 which shows the percentage of the forecast error in trade balance that can be attributed to different variables at different time horizons (1, 5, 10, 15, 20 years). It is obvious that the largest portion (around 86%) of error forecast variance of trade balance is explained by its own shocks. Among other variables, the effect of domestic income Y (around 18.7%) seems to be more important compared with that of foreign income YW(around 12.5%). This result is in contrast with that previously reached using ARDL bounds test which reveals a significant effect of foreign income YW on trade balance and insignificant effect of domestic income Y in the long run. In addition, the tiny percentage of error forecast variance of TB explained by RER supports the result of the ARDL estimates which indicates insignificant effect of RER.

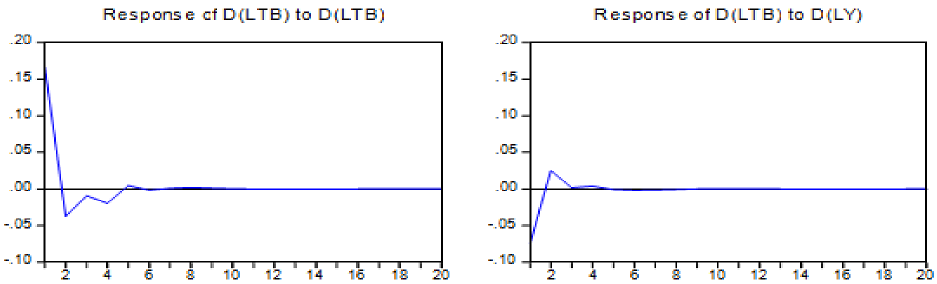
Table 4 : Generalized Variance Decomposition of forecast error for trade balance TB (%)

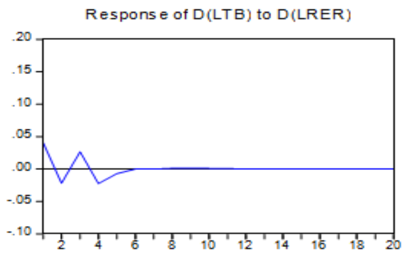
Horizon	DLTB	DLY	DLRE	DLYW
1	86.686	18.696	4.9566	12.595
2	86.698	18.687	5.0701	12.530
3	86.661	18.682	5.0696	12.561
5	86.660	18.682	5.0696	12.562
20	86.660	18.682	5.0696	12.562

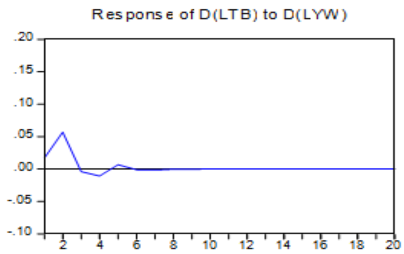
Note: The row values for the generalized variance decomposition do not have to sum to 100. The generalized version gives an optimal measure of the amount of forecast error variance decomposition for a variable as an average of the decomposition values that would result from various ways in which one could order the variables (see Pesaran and Shin, 1998).

While generalized variance decomposition gives the proportion of the forecast error variance in a variable that is explained by various determinants, the generalized impulse response functions give the direction and the nature of variation. The directions of generalized impulse responses observed in figure 1, to a large part, confirm the signs and nature of impacts obtained previously by the ARDL bounds test in both short and long run. A one standard deviation shock to the domestic income Y has a negative short run impact on Trade balance TB which seems to die out in the long run. However, a one standard deviation shock to the foreign income YW shows a positive effect in the first 3 years and turns to be negative for around two years before it again takes a short positive impact. The impact of a one standard deviation shock in RER seems to be unstable and limited which may support the insignificancy of the effect of RER on TB that is already found.

Figure 1: Response to Generalized One S.D. Innovations







Conclusions

This paper analyzes the long and short run relationships between trade balance and its determinants; domestic income, real exchange rate, and foreign income. Employing annual data over the 1970 – 2010 period, the most recent developments in econometric literature, especially in co-integration and VAR techniques, are used to investigate the long run relationships as well as the short run dynamic among trade balance and its determinants. To this end, a reduced form model of trade balance is borrowed from literature and estimated. ARDL bounds testing approach shows that there is a co-integration (long run relationship) between trade balance, real exchange rate, domestic income, foreign income. The long run and error correction estimations indicate that real exchange rate does not affect trade balance in both the long and short run. Furthermore, domestic income shows a significant effect on trade balance in the short run and appears to be insignificant in the long run. However, foreign income proved to be an important determinant of trade balance in the long run as well as in the short run. The generalized variance decomposition supports the insignificant role played by RER in determining trade balance whereas the generalized impulse response functions confirm the above mentioned directions and nature of impacts of the three independent variables on trade balance. The most important policy implication to be concluded from these empirical findings is that devaluation of JD cannot be used to accomplish an improvement in trade balance of Jordan. Additionally, as foreign income variable is out of the Jordanian policy makers' control, a part of Jordan trade balance fluctuations is determined depending on the developments in foreign economic conditions.

Margins

1- Studies support exchange rate effect like Goldstein and Khan (1985), Baharumshah (2001), Lal and Lowinger (2002), tochitskaya (2007), and Gomes and Paz (2005), and the studies found weak effect such as, Miles (1979), Rose (1991), Bulswar et al. (1996), and Wilson (2001). Examples of studies concluded unfavorable effect are: Bahmani-Oskooee (1985), Upadhyaya and Dhakal (1997), and Kale (2001).

2 - Among those studies that reached results consistent with the J-curve phenomenon are : Donovan (1981), Bahmani- Oskooee (1985), Gupta-Kapoor and Ramakrishnan (1999), Stucka (2004), Hisng (2008). On the other hand, Rose and Yellen (1989), Bahmani-Oskooee (1994), Demardine and Pastine (1995), Buluswar et al. (1996), and Bahmani-Oskooee et al., (2003), found no evidence of the same phenomenon.

3 - Bahmani-Oskooee (2001)used different definition for trade balance and real exchange rate and thus comparing his results with current study needs to take this fact in consideration.

4 - The two lower and upper bounds critical values are 3.65 and 4.66 respectively with k=3 and unrestricted intercept and no trend. See Pesaran et al.,(2001, p. 301).

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