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Is the J-Curve Effect Observable for Egypt Economy?

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The primary purpose of this paper is to examine the effects of bilateral real exchange rate RER, relative gross domestic product GDP and relative income Y on the bilateral trade balances TB for Egypt vis-à-vis 20 of her major trading partners (Algeria, Brazil, Canada, China, Denmark, France, Germany, Greece, India, Italy, Japan, Jordon, Morocco, Sudan, Saudi, Spain, Turkey, Syria, UK, USA) over 1989 : 2010. Results based on the ARDL bounds procedure estimated by FGLS, Pooled Mean Group PMG estimator and Dynamic Fixed Effects model DFE confirm that a stable, long-run relationship exists among TB and RER , GDP and Y. The main finding of this paper is that real exchange rate variations explain a considerable part of the trade balance change in Egypt. The results indicate that, in short run, depreciation deteriorated the trade balance TB, but depreciation improved the TB in the long run, and these results consistent with Marshall-Lerner condition and the J-Curve Effect in Egypt case. The implications of the findings are (i) the exchange rate policy stays the almost possible tool for Egyptian policy maker , (ii) after given time real depreciation can improve the trade balance and increase export competitiveness of Egypt.

I. Introduction

The Egyptian economy is a small open economy that mainly depends on her international trade. In 2010, Egyptian non-oil foreign trade grossed over US$72.3 billion represented 33% of GDP at current prices. Egypt exports grossed over US$19.5 billion. Main export partners are Saudi Arabia , USA , India , Spain, Japan and Germany. Egypt imports record US$52.8 billion in 2010. Main import partners are USA (10%), China (9.9%), Italy (7.3%), Germany (6.8%) and Saudi Arabia (4.9%). GOEIC (2012).

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Foreign trade can be stimulated by a through several channels. In particular, preferences, subsidies, quotas, taxes and other limitation could be used to push the trade balance in the desired direction. However, these tools are almost unavailable after Egypt joined the World Trade Organization(WTO). That is why the exchange rate policy stays the only almost possible tool.

For policy perspective The relationship between the exchange rate and the trade balance can be considered as the valuable inputs to policy makers, who may be able to target the trade balance at the time scale utilizing the information how the exchange rate changes affect the trade balance in the short-run and long-run. The reaction of trade quantities to the exchange rate also determines the reaction of trade prices to the exchange rate.

The study is important to know whether devaluation/depreciation of a currency improves the trade balance in the short-run or long-run. If real depreciation would deteriorate the trade balance in the short-run or long-run, monetary and fiscal policy may need to be considered to stabilize the currency value. On the other hand if real depreciation would improve the trade balance in the short-run or long-run, it may be desirable to accommodate to real depreciation to stimulate net exports and help the economy. If depreciation/devaluation improves the trade balance, then a more sustainable economic growth path can be achieved in the long-run. Hence, understanding the relationship between exchange rate and the trade account is essential to a successful monetary and trade policy, both of which are particularly important for a small open economy like Egypt. Hence, this study is helpful not only from a current account perspective but also from a growth perspective.

How the exchange rate affects the trade balance to be more specific, is an issue with a long history in economics. Formally, the answer to this inquiry is based on whether a currency depreciation results in a sufficient increase in export volume and a decrease in import volume (the volume effect) to overcome the increase in import prices (the import value effect). If so, the trade balance rises as a result. In contrast, if the value effect is stronger than the volume effect, the trade balance diminishes. The above condition is often discussed in terms of elasticities; if the price elasticities of import and export demand in absolute terms are sufficiently high (low), then the trade balance will rise (fall) in response to currency depreciation.

This issue is complicated by the fact that the price elasticities for import and export demand may be expected to change over time, resulting in the J-curve. The J-curve is a J-shaped time path of the trade balance in response to depreciation, i.e., after such an exchange rate change, the trade balance initially falls and then slowly rises, perhaps to a higher level than initially. This situation arises because import and export demand elasticities may be expected to be low initially after the exchange rate change (in the short run), and higher after some time (in the long run). Several reasons could lead to the low initial elasticities. For example, it takes some time for old export and import orders to be fulfilled, and it may take some time to change input patterns in production.

Traditional studies on aggregate trade data investigate export and import demand elasticities to establish whether the so-called Marshall-Lerner condition holds (in the long run). The main shortcoming of the traditional approach is that it suffers from an aggregation bias. The problem is that even if there exist a significant elasticities with some trading partners, it can be more than offset by insignificant elasticities with other trading partners. If the responses to changes in exchange rates differ across trading partners, the aggregate trade flow approach could provide misleading results.

In order to avoid the aggregation bias problem, more recent studies have concentrated on estimating trade elasticities on a bilateral basis. However, the prices of exports and imports are no longer available when estimating bilateral trade equations. Hence, other measures of relative price must be applied, e.g., the exchange rate. Thus, this study is the first attempt to estimate the effects of bilateral real exchange rates on bilateral trade balances for Egypt.

In this paper we use an autoregressive distributed lag model (ARDL) bounds testing procedure estimated by FGLS, Pooled Mean Group (PMG) and Dynamic Fixed Effects (DFE) models for a panel data for Egypt vis-à-vis 20 of her major trading partners over 1989 : 2010.

This paper is organized as follow: Section II, provides a brief review of previous studies on trade balances and exchange rate. Section III, presents the theoretical model and data used here. Section IV, discusses the methodology. Section V, the empirical results and analysis. Section VI, the final section, provides the summary and conclusions.

II. Literature Review

Review of current literature would show inconclusive evidence concerning the impact of depreciation on trade balance, both in the short-run and long-run. Studies analyzing the link between depreciation and bilateral trade balances can be classified into three groups. First group utilizes developed country samples. In this group, Marwah and Klein (1996), Shrivani and Wilbrate (1997), Bahmani-Oskooee and Brooks (1999), Hacker and Hatemi (2003) and Bahmani-Oskooee and Ratha (2004) identify significant short- as well as long-run responses of trade balances to depreciation. However, Rose and Yellen (1989) investigating U.S. bilateral trade with the member of G-7 countries are unable to estimate either short- or long-run adjustments in trade balances to shock in the real exchange rates.

A second group [Wilson (2001), Baharumshah (2001), Bahmani-Oskooee and Tatchawan (2001), Onafowora (2003)] analyzing newly industrialized country data, and also, reports conflicting results. For example, Wilson and Baharumshah, using Malaysian data, estimate limited long-run adjustment while fails to identify any short-run adjustment in the trade balance following depreciation. By contrast, Bahmani-Oskooee and Tatchawan observe limited short-run adjustment in the Thailand bilateral trade with 7 developed countries, but, no long-run adjustment in the trade balance. In the third group, Arora, Bahmani-Oskooee and Goswami (2003) and Bahmani-Oskooee and Ratha (2003), investigate the issue using data from developing countries. For example, Arora et al. examine bilateral trade data of India with her 7 largest trading partners while Bahamni-Oskooee et al. investigate the U.S. trade balance with 14 developing country partners. Both studies find limited support for short-run adjustment to the trade balance.

Khan & Hossain, (2010) analyzed a model of bilateral trade balance and its determinants. The study uses data of 50 trading partners of Bangladesh over 1980:2005. The results showed a significant effect of all the variables on the bilateral trade balance of Bangladesh.

Sulaiman, M. D. (2010) analyzed the long run and short determinants of trade deficit in Pakistan. Annual data for the period from 1975 to 2008 is used. The Johansen cointegration technique is adopted for long run analysis, and Vector Error Correction model is used for short run analysis. Foreign income, domestic consumption, real effective exchange rate and foreign direct investment are the determinant variables. Results showed that all the variables have a significant effect on the trade deficit in Pakistan.

Three important points emerge from the brief review of literature [and also from the comprehensive review on this topic by Bahmani-Oskooee and Ratha (2004)]. First, existing literature provides inconclusive evidence on the issue of response of the trade balance to exchange rate shock. Second, the studies investigating developing country samples are limited both in number and in the coverage of developing countries. Third, studies (for example, Bahmani-Oskooee and Brooks (1999), Bahmani-Oskooee and Ratha (2004), Bahmani-Oskooee and Tatchawan (2001) utilizing a recent development, auto-regressive distributed lag approach, in the cointegration literature appears to identify some kinds of adjustment in the trade balance following currency depreciation.

III. The theoretical model and data:

1-The standard model of trade balance:

Since trade balance is a function of various macroeconomic variables, such as real outputs, exchange rates, money supplies, etc., there exist bound to be direct or indirect causal feedback between a trade balance and such macro variables. Dornbusch (1980) and Rose (1990) formulated a simple relationship between trade balance and exchange rate by assuming that a domestic economy produces exportables and importables that are used for consumption. Under this assumption, trade balance TB, defined in domestic currency, is given as follows:

$$TB = P^d X - (ER)\, P^f M \qquad (1)$$

where:

P^d : domestic price of exports.

P^f : foreign price of imports.

X : quantity of exports. M : quantity of imports.

ER : nominal exchange rate in domestic currency units per unit of foreign currency.

Dividing equation (1) by P^d , we have the real trade balance (RTB) equation:

$$RTB = X - (ER)\frac{P^f}{P^d}M = X - (RER)M \qquad (2)$$

Where RER is the real exchange rate.

We can express export demand function as: $X=f(RER,Y^f)$, and import demand function as: $M=f(RER,Y^d)$

Where:

Y^f : real foreign income

Y^d : real domestic income.

Then, we can define the real trade balance function or the standard model of trade balance as follows:

$$RTB = f(\text{RER}, Y^d, Y^f) \qquad (3)$$

This model of the trade balance consists of three explanatory variables, real exchange rate (RER), real domestic income (Y^d), and real foreign income (Y^f). The three explanatory variables are thought to capture the effects on RER in a model that puts together (nets) the elasticity, absorption and monetary approaches as follow:

••According to the elasticity approach, devaluation improves the trade balance by changing the relative prices between domestic and foreign sourced goods (expressed in the RER).

••In the absorption approach, an exchange rate changes can affect the trade balance if changes induce an increase in income greater than the increase in total domestic expenditure.

••The monetary approach analyses the balance of payments, from the point of view of the supply and demand of money, asserts that exchange rate changes only have temporary effects. Hence, there should be no long-run equilibrium relationship between the trade balance and RER. The monetary approach assumes that an increase in income improves the trade balance.

2- An Extension Model of Bilateral Trade Balance:

The basic idea of the extended model is that, in bilateral trade the absolute size of a country in terms of income and population is not so important, rather the relative size (relative to trading partners) determines the export supply and import demand. In the extended model the bilateral trade balance of a country is denoted by the ratio of exports to imports ($TB = X / M$) in, the GDP of home country relative to her partner country denoted by ($GDP = GDP^f / GDP^d$) has affected her trade balance.

The GDP ratio of the trading pairs shows the relative production capacity in the partner country compared to home country. This also measure the relative size of a country compared to her trading partner.

The ratio of per capita income Y= (GNP^f / GNP^d) is a key determinant of import demand since it represents the relative absorption capacity for trading country pairs.

Therefore, in the extended model of bilateral trade balance, relative GDP and relative per capita income Y are considered in lieu of the three variables in the equation (3).

Therefore, bilateral real trade balance function (equation 3) stands as:

$$TB = f(RER, GDP, Y)$$

where:

TB : ratio of Egyptian export to Egyptian import to/from a trading partner.

RER : bilateral real exchange .

GDP : measures of productive capacity, $GDP = GDP^f / GDP^d$.

Y : measures of absorption capacity , Y=(GNP^f / GNP^d).

Taking logarithms (Ln) and adding time subscripts (t) ,the equation of trade balance becomes:

$$ln(TB)_t = \alpha_0 + \beta_1\, ln(RER)_t + \beta_2\, ln(GDP)_t + \beta_3\, ln(Y)_t + u_t \qquad (4)$$

where:

$Ln(TB)_t$: logarithms of the ratio of Egyptian export to Egyptian import to/from a trading partner =Ln(X)-Ln(M) at year t.

$Ln(RER)_t$: logarithms of bilateral real exchange rate $=Ln(ER)+Ln(CPI)^f - Ln(CPI)^d$, ER :nominal exchange rate expressed in Egyptian currency units per unit of a trading partner, CPI : price index number at year t.

$Ln(GDP)_t$: logarithms of measures productive capacity $=(LnRGDP^f - LnGDP^d)$,

$Ln(Y)_t$: logarithms of measures absorption capacity $=(LnGNP^f - LnGNP^d)$.

u_t : error term.

d: home country , f : foreign countries or trading partner.

Equation (4) gives an outline for the long-run relationship among the variables of the bilateral trade balance. It is expected that the effects of real exchange rate (RER) or β1 is positive. The more the real exchange rate (RER) index - a depreciation of the exporter's currency (Egypt) with respect to the currency of her trading partner - the trade balance (TB) improves with increasing export competitiveness (elasticity approach).

The higher the relative GDP implies that partner country produces more goods compared with Egypt and partner country comparatively has more capacity to meet her domestic demand as well as has more exporting capacity. This implies that the partner country will export more and import less from Egypt. Larger countries have more diversified production and tend to be more self-sufficient; and therefore, will have the negative impact on the bilateral trade balance of Egypt, then, β_2 is expected to be negative. In other words, an increase in GDP of partner country relative to GDP of home country will see deterioration in the trade balance of the home country.

If a partner country demands more of her domestic goods due to higher relative per capita Y, in other words a higher per capita income differential (absorption effect), β_3 would be negative. On the contrary, if she demands more of country-d's goods due to this income (absorption) rise, the sign of β_3 will be positive. The different absorption effects also depend on the type of goods demanded by country-d's export partners for a rise in their per capita income.

3- Data

The extended model of the trade balance has been examined empirically for Egypt using data on bilateral trade between Egypt and her major trading partners (Algeria, Brazil, Canada, China, Denmark, France, Germany, Greece, India, Italy, Japan, Jordon, Morocco, Sudan, Saudi, Spain, Turkey, Syria, UK, USA) for the period from 1989 to 2010.

Bilateral panel data of total 20 major trading partners of Egypt (10 industrialized and 10 developing partner countries) cover 85% – 90% of Egypt's trade in both directions. Exports and imports statistics over the sample period have been collected from Direction of Trade Statistics (DOT) database on the IMF website. The countries are chosen on the basis of its importance as a trading partner and availability of required data. The GDP and per-capita GNI data have been collected from World Development Indicator (WDI) database of the World Bank . Nominal exchange rate and consumer price indices, to calculate RERs, have been collected from the International Financial Statistics (IFS) database of the IMF .

IV. Econometric Methodology

1- ARDL Bounds testing cointegration approach

To analyze empirically, the long-run relationships and dynamic interactions among the variables of interest, the model has been estimated by using the bounds testing (or autoregressive distributed lag (ARDL)) cointegration procedure, developed by Pesaran et al. (2001). The procedure is adopted for the following three reasons. Firstly, the bounds test procedure is simple. Secondly, the bounds testing procedure does not require the pre-testing of the variables included in the model for unit roots unlike other techniques such as the Johansen approach. It is applicable irrespective of whether the regressors in the model are purely *I(0)*, purely *I(1)* or mutually cointegrated. The necessary condition for the applicability the bounds test procedures is the variables are not *I(2)*. Thirdly, the test is relatively more efficient in small or finite sample data sizes as is the case in this study.

Basically, the ARDL approach to cointegration involves estimating the conditional error correction version of the ARDL model for the trade balance. Due to the short span of time-series data in our panel, we set the highest order of the lags in ARDL model at p_{max} = 2. or ARDL(2, 2, 2, 2):

$$\Delta LnTB_t = \alpha_0 + \delta_1 LnTB_{t-1} + \delta_2 LnRER_{t-1} + \delta_3 LnGDP_{t-1} + \delta_4 LnY_{t-1} + \phi_1 \Delta LnTB_{t-1} + \phi_2 \Delta LnTB_{t-2} + \varpi_0 \Delta LnRERi_t + \varpi_1 \Delta LnRERi_{t-1} + \varpi_2 \Delta LnRERi_{t-2} + \varphi_0 \Delta LnGDP_t + \varphi_1 \Delta LnGDP_{t-1} + \varphi_2 \Delta LnGDP_{t-2} + \gamma_0 \Delta LnY_t + \gamma_1 \Delta LnY_{t-1} + \gamma_2 \Delta LnY_{t-2} + \sum_{j=1}^{19} \alpha_1 D_j + + \sum_{t=1}^{21} \alpha_2 D_t + \varepsilon_t \quad (5)$$

where: Δ is first-difference operator, the *Dj* are cross dummy variables such that: D_j= 1 for observations for country *j* (*j* 1, . . . , 19) and D_j= 0 otherwise, the D_t are time dummy variables such that: D_t= *1* for observations for time t (t 1, . . . , 21) and D_t= 0 otherwise .

The first until fourth expressions (δ_1 to δ_4) on the right-hand side correspond to the long-run relationship. The remaining expressions with the summation sign represent the short-run dynamics of the model.

The F test is used for testing the existence of long-run relationship. When a long-run relationship exists, F test indicates which variable should be normalized. The null hypothesis for no cointegration among variables in equation (5) is H_o: $\delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$ against the alternative hypothesis:

H_1: $\delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq 0$. This can also be denoted as:

F: tb(tb | rer, gdp, y, D).

The F-test has a non-standard distribution which depends on (i) whether variables included in the model are *I(0)* or *I(1),* (ii) the number of regressors, and (iii) whether the model contains an intercept and/or a trend. The test involves asymptotic critical value bounds, depending whether the variables are *I(0)* or *I(1)* or a mixture of both. Two sets of critical values are generated which one set refers to the *I(1)* series and the other for the *I(0)* series. Critical values of the *I(1)* series are referred to as upper bound critical values, while the critical values for *I(0)* series are referred to as the lower bound critical values.

If the F test statistic exceeds their respective upper critical values, we can conclude that strong evidence of a long-run relationship exists between the variables regardless of the order of integration of the variables. If the test statistic is below the upper critical value, we cannot reject the null hypothesis of no cointegration (no long-run relationship), and if it lies between the bounds, a conclusive inference cannot be made without knowing the order of integration of the underlying regressors.

2- LSDV, FGLS, PCSE estimators for panel ARDL

Critical issues should be considered when testing the determinants of the bilateral trade balance using a panel dataset for Egypt as a developing country. These problems are due to the special characteristics of developing countries data and the properties of panel data (cross-section& time series). Hence, the researcher should use of more than 2 techniques for tests. The use of only 2 tests often leads to conflicting results in case of developing countries. The use of the third test, technique or estimate will support the acceptance or rejection of the results and make it stronger.

For OLS estimators be the best linear unbiased estimators (BLUE), the Gauss-Markov theorem must hold. However, in the case of Egypt these assumptions are almost violated. Error terms for one unit of one year often correlate with those of the previous year (autocorrelation), or error terms for one unit correlate with those of another unit (spatial or contemporaneous correlation). In addition, error distributions may differ across units (heteroscedasticity).

Feasible Generalized Least Squares (FGLS) regression corrects for contemporaneous correlation, panel heteroscedasticity, and unit specific serial correlation. The correction for contemporaneous correlation also corrects for panel heteroscedasticity unless years(T) are considerably larger than countries(N) (Beck and Katz 1995).

In the Parks correction FGLS for unit specific serial correlation, a relatively small T/N ratio also causes estimates to be biased downwards. As a consequence, the FGLS estimates may be inferior to OLS estimates. Beck and Katz use Monte Carlo experiments to show that Parks FGLS estimates of standard errors are severely overconfident (up to 600% when N and T are 20). They show that the Panel Corrected Standard Errors model (PCSEs) resolve this problem. In addition, even in the case of homoscedasticity and contemporaneously independent errors where OLS standard errors are accurate, PCSEs performed exactly as well as the OLS standard errors. PCSEs are also comparatively efficient to Parks estimates when contemporaneous correlation of the errors rises to 0.75 and T is twice N.

Beck and Katz further argue that serial correlation and panel heteroscedasticity can better be controlled for via modeling than through statistical correction. Modeling for serial correlation involves the inclusion of a lagged dependent variable (LDV). This lagged dependent should control for any presence of serial correlation. However, the problem with the inclusion of an LDV is that this independent variable consumes so much of the explanatory power, that it is hard to find significant effects for other independent variables.

The choice among these models is difficult. FGLS models yield overconfident estimates of standard errors, but corrects for autocorrelation and heteroscedasticity. PCSE models yield reliable standard errors, but corrections for autocorrelation and heteroscedasticity with LSDVs consume much of the explanatory power

Another issue with time-series data is non-stationarity. Stationary time-series exhibit a clear-cut tendency to return to a constant value or a given trend. This is a requirement for the estimation of linear models. The presence of a unit root indicates that time-series are not stationary. When a unit root is present, this problem can be dealt with by taking the first differences of the dependent and key independent variables rather than their absolute values.

The best that can be done in this situation is to estimate both models (with LSDV, FGLS and PCSE) and compare the results. The following tests are first carried out to help choose the estimation techniques.

3-PMG and DFE estimators for panel ARDL approach

Recent papers by Pesaran, Shin, and Smith (1997, 1999) offer two important new techniques to estimate nonstationary dynamic panels in which the parameters are heterogeneous across groups: the mean-group (MG) and pooled mean-group (PMG) estimators. The MG estimator relies on estimating N time-series regressions and averaging the coefficients, whereas the PMG estimator relies on a combination of pooling and averaging of coefficients. Assume an autoregressive distributive lag (ARDL) (p; q1; … qk) dynamic panel specification of the form:

$$LnTB_{i,t} = \sum_{j=1}^{p} \delta_{ij} LnTB_{i,t-j} + \sum_{j=0}^{q} \lambda_{ij} Z_{i,t-j} + \mu_i + \varepsilon_{it} \quad (5)$$

where:

i =1, 2,…,N: the number of groups.

t = 1, 2,…,T: the number of periods.

Z_{it} is a k x 1 vector of explanatory variables (RER, GDP and Y).

δ_{it} are the k x 1 coefficient vectors. λ_{it} are scalars.

μ_i is the group-specific effect. ε_{it} is the error term.

Thus it is common to reparameterize (6) into the error correction equation:

$$\Delta LnTB_{i,t} = \phi_i (LnTB_{i,t-1} - \theta_i' Z_{it}) + \sum_{j=1}^{p-} \lambda^*_{ij} LnTB_{i,t-j} + \sum_{j=0}^{q-} \delta'^*_{ij} Z_{i,t-j} + \mu_i + \varepsilon_{it} .....(7)$$

The parameter ϕ_i is the error-correcting speed of adjustment term. If ϕ_i=0, then there would be no evidence of a long-run relationship. This parameter is expected to be significantly negative under the priorθ assumption that the variables show a return to a long-run equilibrium. Of particular importance is the vector θ_i , which contains the long-run relationships among the variables.

4-Panel Unit Root Test:

Before we proceed with the ARDL bounds test, we test for the stationarity of all variables to determine their order of integration. This is to ensure that the variables are not *I(2)* stationary to avoid spurious results. According to Ouattara (2004) in the presence of *I(2)* variables the computed F-statistics provided by Pesaran et al. (2001) are not valid because the bounds test is based on the assumption that the variables are *I(0)* or *I(1).*

There exist a variety of tests for unit roots or stationarity in panel datasets. Levin–Lin–Chu(LLC), Breitung(B), Im–Pesaran–Shin(IPS), and Fisher-type (ADF and PP) test the null hypothesis that all the panels contain a unit root. The Hadri Lagrange multiplier (LM) test the null hypothesis that all the panels are (trend) stationary.

V- The empirical results:

1-Results of panel unit root tests:

The results obtained are reported in Appendix. The results in (Tables (1)a and (1)b) show that the trade balance variable is *I(0)* –stationary - for all tests except for Hadri test it is nonstationary *I(1).* The real exchange rate and relative income are *I(1)* when we use LLC, Breitung and Hadri tests and are *I(0)* from other tests. The relative real GDP is *I(1)* when we use PP – Fisher and Hadri tests but it *I(0)* when we use LLC and Breitung tests. Then all variables included in the model are *I(0)* or *I(1)* , the integration orders of the variables are not the same and none of a variable is *I(2)*or beyond.

Therefore, ARDL approach is the appropriate model for cointegration test and the computed F-statistics provided by Pesaran et al. (2001) are valid.

2- LSDV regression and diagnostic checks

The first step in the ARDL (2, 2, 2, 2) approach is to estimate the equation (5) by Least Squares Dummy Variable (LSDV). The table (2) show to the following diagnostic tests:

Testing for two-way effects model: The null hypothesis is a joint test to examine the dummies for all years are equal to zero, and if it's equal to zero, no time fixed effects are needed. The results in Table 2 show that F statistic = 2.34 , probability = 0.000), then we can reject the null and conclude that two-way effects model is appropriate.

Testing for serial correlation: The null hypothesis of the Wooldridge test for autocorrelation in panel data is no serial correlation. The F statistic of the Wooldridge test =38.724, probability =0.000. The null hypothesis of no serial correlation is strongly rejected. Then we have an autocorrelation problem which must be corrected.

Testing for heteroscedasticity: The null hypothesis of this test is that no problem of heteroscedasticity, for all j =1..... N, where N is the number of units. Modified χ^2 Wald statistic for groupwise heteroskedasticity in the fixed effect regression model =662.9, probability = 0.000. The test indicates that we reject the null and we have a problem of heteroscedasticity

Testing for Cross-independence: One way to test Cross-independence CD problem through Pesaran's test of cross sectional independence. The CD test rejects the null hypothesis of no cross-sectional dependence (F= -2.306, probability = 0.0211). We can get the average absolute correlation between the cross-sectional units.

All diagnostic checks are suggesting the presence of contemporaneous correlation, heteroscedasticity and autocorrelation in ARDL(2,2,2,2) LSDS model under 2-way fixed effects specification. These problems can be solved together with estimates of Feasible Generalized Least squares (FGLS) or with Panel Corrected Standard Errors (PCSE) methods. Table (3) shows the results of estimating ARDL (2, 2, 2, 2) equation (5) by PCSE and (FGLS) Models.

Beck and Katz (1995) showed that the standard errors of PCSE are more accurate than FGLS but as table (3) indicates the FGLS model is more accurate in the case of Egypt because we cannot reject the Hausman null that FGLS estimators is the best vs. PCSE Estimators .

3-Results of the ARDL bounds testing of cointegration:

We begin our ARDL bounds tests using FGLS estimator for equation (5). The optimal length of the model has been selected using a general to specific (GSS) testing strategy that suggested by Campbell and Perron (1991) and Hall (1994). According to Campbell and Perron the last lagged difference term of the regressor with the least significant coefficient is deleted, and the equation (5) is re-estimated until all the last lagged difference terms of the regressors are all significant.

Following this procedure, estimated long-run coefficients of the bilateral trade balance model is the ARDL (2, 2, 2, 1) in table 4.

To verify the presence of a long-run equilibrium relationship among the variables in the equation (5), a joint significance test (Wald test) for H0 : $\delta 1= \delta 2= \delta 3 = \delta 4 = 0$ was performed. The calculated F-statistics equal =60.3 is higher than the upper bound critical value of 5.61 at the 1% significance level, suggesting that the null hypothesis of no cointegration cannot be accepted. This result confirms a stable, long-run relationship between TB and RER, GDP and Y in Egypt over 1988:2010.

5- Results of PMG and DFE estimators:

Table 5 shows the estimation of the restricted error correction model using PMG and DFE estimators equation (7) . Results of Hausman test indicate that the simultaneous equation bias is minimal for these data and we conclude that the DFE model is preferred over the PMG model. The results in Table 5 show that the coefficient θ_1 of the long-run real exchange rate (elasticity) is positive, significant, and greater than unity(1.84).

Theoretically, Marshall-Lerner condition require that the long-run RER elasticity θ_1 is positive and equal or greater than unity. To verify the condition the null hypothesis H_0 : $\theta_1= 1$ was performed . The corresponding probability value for χ^2 is (0.78) leads to not reject the null hypothesis of unity RER elasticity. These results hint us to conclude that the Marshall-Lerner condition is fulfilled and an increase in the real exchange rate RER has improved the Egyptian trade balance in the long-run.

In the short-run the coefficient of lagged difference of RER is negative (-0.497) and significant. This implies that depreciation lowers the export to import ratio of Egypt in the short-run. This is consistent with J-curve effect in Egypt case.

The coefficient of the relative (GDP) is negative (-1.7) and highly significant (p=0.00). This implies that the trade balance of Egypt deteriorates when GDP of partner countries increases relatively more than of Egypt. It means partners' production and exporting capacity increases at a higher rate than of Egypt. In bilateral trade, this usually results in more export to Egypt or less import from Egypt, and hence, adversely affects the bilateral balance of trade of Egypt.

The coefficient of the relative per capita Y is positive (2.96) and also significant as expected. Since the per capita GNI is the determinant of absorption capacity of a country, therefore, higher relative per capita implies a higher absorption capacity of the country. Due to increase absorption capacity, it is expected that the country imports more. Trading partners of Egypt with relatively higher Y import more from Egypt and improve the balance of trade of Egypt.

The lagged error term, the speed of adjustment estimates ϕ_i (coefficient of ECT_{t-1} in table 5), from PMG and DFE models are negative and significant at the 1% level. The coefficient of the DFE estimator(-0.40) indicates a high rate of convergence to equilibrium. The significance of an error correction term shows the evidence of causality in at least one direction. The main findings of all models, when comparing the long-term elasticities, is in the 1990-2010 period TB is more changes by the real exchange rate RER in short and long -run.

(VI) Summary and conclusions.

The primary purpose of this paper is to examine the effects of bilateral real exchange rate RER, relative Gross Domestic product GDP and relative income Y on the bilateral trade balances TB for Egypt vis-à-vis 20 of her major trading partners over 1989-2010. The extended model postulates that the relative value of GDP of trading countries (the relative production capacity GDP), relative per-capita income(relative absorption capacity Y) and real exchange rate RER (relative prices) determine the trading pattern and hence the trade balance of a country in bilateral trade with partners.

All variables included in the model are *I(0)* or *I(1)* but none of the variables is *I(2)*or beyond. This reason ARDL approach is the appropriate model for cointegration test and the computed F-statistics provided. To solve panel data problems we use Feasible Generalized Least squares (FGLS) and Panel Corrected Standard Errors (PCSE). Results indicate that the ARDL (2,2,2,1) of 2-way fixed effects model estimated by FGLS is the more accurate model for Egypt data and it confirms a stable, long-run relationship among TB and RER , GDP and Y.

To verify the presence of a long-run equilibrium relationship among the variables in the equation (5), a joint significance test (Wald test) for H0 : $\delta1= \delta2= \delta3 = \delta4 = 0$ was performed. The calculated F-statistics equal =60.3 is higher than the upper bound critical value of 5.61 at the 1% significance level, suggesting that the null hypothesis of no cointegration cannot be accepted. This result confirms a stable, long-run relationship between TB and RER, GDP and Y in Egypt over 1988:2010.

From the ARDL (2, 2, 2, 1) Pooled Mean-Group (PMG) and Dynamic Fixed Effects (DFE) estimators, results of Hausman tests indicate that the DFE model is preferred over the PMG model.

The results of the DFE model shows that the Long- run real exchange rate elasticity is (1.84), and is highly significant. It implies the depreciation increases the ratio X/M for Egypt in the long-run and improves the trade balance, and it suggests that the Marshall-Lerner condition is held in long-run in the case of Egypt.

The relative GDP elasticity is negative (-1.7) and highly significant. This implies that the trade balance of Egypt deteriorates when GDP of partner countries increases relatively more than of Egypt. The coefficient of the relative per capita Y is positive (2.96) and also significant as expected. The lagged error term (ECT_{t-1}), the speed of adjustment estimates, is negative and significant at 1% level. (-0.40) . The lagged difference of (RER) is negative and significant at 1% level implies that, there exist effect of RER on trade balance of Egypt in short-run. These results indicate that the J-curve effect is held in Egypt case in short-run.

The main findings of the bounds testing is that during 1990-2010 Egypt trade balance TB is more changes by the real exchange rate RER and Egypt TB has usually followed the J-curve pattern of adjustment.

The implications of the findings are:

(1) The exchange rate policy stays the almost possible tool for Egyptian policy maker , who may be able to target the trade balance at the time scale.

(2) After a given time(short- run) real devaluation can improve the trade balance and increase export competitiveness of Egypt.

(3) Understanding the relationship between exchange rate and the trade account is essential to a successful monetary and trade policy.

Finally, this study is helpful not only from a current account perspective but also from a growth perspective.

Table(1)a Panel unit root tests

Level

Method	TB	RER	GDP	Y
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t ^{bar}	-3.93***	3.25	-2.00**	1.08
Breitung t-stat	-5.54***	-0.84	-2.26**	-1.09
Null: Unit root (assumes individual unit root process)				
Im,Pesaran and Shin W-stat	-4.44***	-2.50***	-3.45**	-2.4***
ADF-Fisher Chi-square	79.01***	55.85***	81.0**	75.1***
PP - Fisher Chi-square	66.87***	79.80***	27.56	39.3***
Null: No unit root (assumes common unit root process)				
Hadri Z-stat	6.04***	5.15***	5.71***	5.84***

First difference Δ

Method	ΔTB	ΔRER	ΔGDP	ΔY
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-20.4***	-12.86***	-7.0***	-5.3***
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-18.4***	-14.0***	-8.8***	-8.4***
ADF - Fisher χ^2	326.1***	237.2***	153.2***	150.3***
PP - Fisher χ^2	405.3***	254.9***	154.8***	195.6***
Null: No unit root (assumes common unit root process)				
Hadri Z-stat	0.72	2.58	1.57	0.71

***, **, * imply significance at the 1%, 5% and 10% level, respectively

Table(1)b Comparisons of the Unit Root Tests

Tests / var	Levin, Lin & Chu	Breitung	Im,Pesaran and Shin W-stat	ADF-Fisher χ^2	PP - Fisher χ^2	Hadri Z
Ln(TB)	*I(0)*	*I(0)*	*I(0)*	*I(0)*	*I(0)*	*I(1)*
Ln(RER)	*I(1)*	*I(1)*	*I(0)*	*I(0)*	*I(0)*	*I(1)*
Ln(GDP)	*I(0)*	*I(0)*	*I(0)*	*I(0)*	*I(1)*	*I(1)*
Ln(Y)	*I(1)*	*I(1)*	*I(0)*	*I(0)*	*I(0)*	*I(1)*

Table(2) LSDV regression for ARDL (2, 2, 2, 2) , Dependent variable ΔTB

Model / Independent Var.	ARDL (2,2,2,2)
constant	1.418
$LnTB_{(t-1)}$	-0.375***
$LnRER_{(t-1)}$	0.623*
$LnGDP_{(t-1)}$	-0.067
$LnY_{(t-1)}$	0.374
$\Delta Ln\ TB_{(t-1)}$	-0.089
$\Delta Ln\ TB_{(t-2)}$	-0.099*
$\Delta Ln\ RER_t$	0.500*
$\Delta Ln\ RER_{(t-1)}$)	-0.367
$\Delta Ln\ RER_{(t-2)}$)	-0.679**
$\Delta Ln\ GDP_t$	1.995
$\Delta Ln\ GDP_{(t-1)}$	3.572*
$\Delta Ln\ GDP_{(t-2)}$	0.787
$\Delta Ln\ Y_t$	0.135
$\Delta Ln\ Y_{(t-1)}$	-1.547
$\Delta Ln\ Y_{(t-1)}$	-0.541
diagnostics	
Modified Wald test heteroskedasticity	$\chi^2(20)$=171.18 Pr= (0.000)
Wooldridge test for autocorrelation	F(1, 19) = 38.724 Pr =0.0000
Pesaran's test of cross sectional independence	-2.306, Pr = 0.0211
testparm :Year Dummies	F(18, 327) = 2.34 Pr = 0.0017

Notes:

1.Modified Wald test for groupwise heteroskedasticity in fixed effect regression model : H0: $\sigma^2(i)= \sigma^2$ for all i

2.Wooldridge test for autocorrelation in panel data H0: no first-order autocorrelation.

3.Pesaran's test of cross sectional independence. H0: cross-sectional independence.

4.Testparm: testing for time-fixed effects. H0: no time fixed effects.

5. ***, **, * imply significance at the 1%,5% and 10% level, respectively

Table(3) PCSE and FGLS Estimator of two –way fixed effect, Dependent variable ΔTB

Model / Independent Var.	FGLS ARDL (2,2,2,2)	PCSE ARDL (2,2,2,2)
constant	1.570***	1.276
$LnTB_{(t-1)}$	-.468***	-.4025***
$LnRER_{(t-1)}$	.594***	.5790**
$LnGDP_{(t-1)}$	-0.049	-0.213
$LnY_{(t-1)}$	.334*	0.523
$\Delta Ln\ TB_{(t-1)}$	-0.028	-0.082
$\Delta Ln\ TB_{(t-2)}$	-.075**	-0.119
$\Delta Ln\ RER_t$	.399***	.409*
$\Delta Ln\ RER_{(t-1)}$)	-.324***	-0.284
$\Delta Ln\ RER_{(t-2)}$)	-.677***	-.691***
$\Delta Ln\ GDP_t$	1.875***	1.916
$\Delta Ln\ GDP_{(t-1)}$	3.464***	3.409*
$\Delta Ln\ GDP_{(t-2)}$	.751***	0.653
$\Delta Ln\ Y_t$	0.250	0.183
$\Delta Ln\ Y_{(t-1)}$	-1.587***	-1.727
$\Delta Ln\ Y_{(t-1)}$	-0.257	-0.354
diagnostic		
Hausman test PCSE vs. FGLS	F(48)=0.24 Pr= (0.999)	

Notes:

1.(PCSEs): we used the command xtpcse in stata/SE11 by using Panel Corrected Standard Errors (PCSE) method which assumes that the disturbances are heteroskedastic and contemporaneously correlated across panels.

2.(FGLS): we used the command xtgls in stata/SE11 which fits panel-data linear models by using feasible generalized least squares. This command allows estimation in the presence of AR(1) autocorrelation within panels and cross-sectional correlation and heteroskedasticity across panels.

3.***, **, * imply significance at the 1%,5% and 10% level, respectively.

Table:4 FGLS estimator for 2- way Fixed Effects ARDL(2, 2, 2, 1) model , Dependent variable ΔLn(TB)

Variable	ARDL(2,2,2,1) FGLS
constant	1.579***
$LnTB_{(t-1)}$	-0.469***
$LnRER_{(t-1)}$	0.598***
$LnGDP_{(t-1)}$	-0.062
$LnY_{(t-1)}$	0.3539*
$\Delta Ln\ TB_{(t-1)}$	-0.0309
$\Delta Ln\ TB_{(t-2)}$	-.0740**
$\Delta Ln\ RER_t$	.3934***
$\Delta Ln\ RER_{(t-1)})$	-.3338***
$\Delta Ln\ RER_{(t-2)})$	-.675***
$\Delta Ln\ GDP_t$	1.869***
$\Delta Ln\ GDP_{(t-1)}$	3.531***
$\Delta Ln\ GDP_{(t-2)}$	.634***
$\Delta Ln\ Y_t$	.249
$\Delta Ln\ Y_{(t-1)}$	-1.574***
H_0: $\delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$	F(4)=60.3
Upper bound C.V for I(1) variables	F(4)=5.61
Lower bound C.V for I(0) variables	F(4)=4.29

Notes:

1. ***, **, * imply significance at the 1%,5% and 10% level, respectively
2. The normalization of F-stat= χ^2 ÷ numerator degrees of freedom
3. The relevant critical value (C.V) bounds are obtained from Table C1.iii (with an unrestricted intercept and no trend; with three regressors k=3) in Pesaran et al. (2001).

Table:5 Restricted error correction models PMG and DFE estimator of ARDL(2, 2, 2, 1) specification Dependent variable ΔLn(TB)

Independent variables.	PMG Regression	DFE Regression
constant	-2.083	0.641
long-run Coefficient Estimates		
Ln(RER)	1.873***	1.842**
Ln(GDP)	0.115	-1.822*
Ln(Y)	0.908	2.175
short-run Coefficient Estimates		
EC_{t-1}	-.769***	-.402***
ΔLn RER_t	-0.219	-0.037
ΔLn $RER_{(t-1})$	-0.442	-.389
ΔLn $RER_{(t-2})$	-0.357	-.497***
ΔLn GDP_t	0.243	3.386
ΔLn $GDP_{(t-1)}$	-5.115	3.330
ΔLn $GDP_{(t-2)}$	1.600	0.371
ΔLn Y_t	0.108	-1.645
ΔLn $Y_{(t-1)}$	-2.95	-1.481
ΔLn $TB_{(t-1)}$	0.170	-0.076
ΔLn $TB_{(t-2)}$	0.049	-0.087
Hausman test PMG vs. DFE	χ^2=0.26 Prob =(0.96)	

Notes:

1. PMG :Pooled Mean Group Regression , DFE: Dynamic Fixed Effect
2. ***, **, * imply significance at the 1%,5% and 10% level, respectively.
3. The DFE estimator, as PMG estimator, restricts the coefficients of the cointegrating vector to be equal across all panels. The DFE model further restricts the speed of adjustment coefficient and the short-run coefficients to be equal.

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