



The Marshall-Lerner Condition in the Fragile Five Economies: Evidence from the ARDL Bounds Test Approach

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Abstract: *This paper evaluates the Marshall-Lerner condition in the fragile five economies of Brazil, India, Indonesia, South Africa, and Turkey and, in the process, offers an indication of whether the evaluation of this condition is subject to the limitations that have previously been identified in the literature. This research is novel as it studies a set of countries known as the fragile five, often overlooked in the literature. The ARDL Bounds methodology is used to estimate separate export and import demand equations. Results of the study show little evidence supporting the validity of the Marshall-Lerner condition in these five countries. All the models, except for those relating to Turkey, show signs of underlying issues such as model misspecification. The results imply that future empirical work on the Marshall-Lerner condition, particularly work centred on the fragile five, would likely need to address these underlying empirical issues in order to produce more consistent results.*

Keywords: Marshall-Lerner Condition, Fragile Five, ARDL Bounds Test, Trade Elasticities, Emerging Markets

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1. Introduction

An increasingly integrated world economy has seen trade between countries grow at a rapid pace in recent decades. Many emerging markets have opened their economies to trade to capitalise on this trend. While these economies have experienced economic growth and development, they have also encountered problems such as trade deficits, current account deficits and exchange rate volatility (Matlasedi, 2016).

Many countries look towards exchange rate policies to address problems relating to the trade balance and the current account. In determining the feasibility of such policies, the effect of real exchange rate movements on a country's trade balance and, by extension, the current account must first be assessed. These relationships have been and continue to be evaluated through the Marshall-Lerner (M-L) condition, which provides the circumstances under which an exchange rate depreciation would likely improve a country's current account in the long run. It is named after the two economists, Alfred Marshall and Abba Lerner, who first observed the relationship between a country's exchange rate and its trade balance at the start of the 20th century.

While the literature evaluating the M-L condition is extensive, Bahmani *et al.* (2013), in a comprehensive review of the literature on the M-L condition, found that relatively few empirical studies

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evaluate the M-L condition in emerging and developing countries. They noted that limited availability of data was a likely cause of this underrepresentation and that of the few emerging and developing countries that had previously been studied, the focus was generally on a small group of these countries. This small group of emerging and developing countries included South Africa, the Philippines, and certain Latin American countries such as Argentina and Colombia. Our first contribution to the literature is novel in that there is no other study that evaluates the validity of the M-L condition by focusing specifically on the homogenous group of countries of Brazil, India, Indonesia, Turkey and South Africa, informally known as the fragile five. These countries are large and open emerging market economies with similar structures in that they have seen persistent current account deficits and have currencies that are particularly vulnerable to foreign capital flows.

Our second contribution is that we evaluate the M-L condition's validity by using more refined econometric techniques used in the most recent empirical studies of the M-L condition. We are cognizant of the fact that there may be certain underlying issues that may hinder the evaluation of the M-L condition. The purpose of the research is therefore twofold: Firstly, we provide insight into whether an exchange rate depreciation could be a general solution to the persistent current account deficits of the fragile five economies and secondly, we identify empirical and methodological issues that may prevent us from drawing unambiguous conclusions in the evaluation of the M-L condition at an aggregate level in these five economies. Therefore, this paper offers insights into aspects that future empirical studies evaluating the condition in these countries would need to consider. The remaining sections of this paper are structured as follows: Section 2 discusses the economic theory relating to the content of this research, gives a brief overview of the fragile five and gives a comprehensive literature review of the empirical literature on the M-L condition. Section 3 expands on the model and the econometric methodology, and Section 4 reports and discusses the results, while section 5 concludes.

2. Literature Review

2.1. Theoretical Framework

There are three main approaches to the balance of payments that seek to explain the relationship between the current account and the exchange rate: The monetary approach, the absorption approach and the elasticities approach. The monetary approach explains the relationship through money demand and supply. Under certain assumptions, the basic premise is that excess money supply over money demand leads to money outflows to the rest of the world, worsening the trade balance (Matlasedi, 2016). The absorption approach looks at the effect of an exchange rate depreciation or devaluation on expenditure. The concept of absorption refers to the total expenditure on real goods (including imports) by different economic participants. The core idea behind the absorption approach is that a depreciation in the currency will only improve the current account if there is an increase in production relative to absorption (Black, Hashimzade, & Myles, 2017).

The M-L condition has its foundations in the elasticities approach to the balance of payments since the condition's validity depends on the price elasticities of a country's exports and imports. The elasticities approach postulates that a real exchange rate depreciation (or devaluation) can improve a country's current account. A depreciation in the country's real effective exchange rate (REER) leads to imports becoming more expensive while exports become relatively cheaper and more competitive. These changes then result in reduced levels of imports but increased levels of exports, improving the current account (Henry & Longmore, 2003).

As Liu et al. (2006) indicate, the elasticities approach sometimes does not hold due to the prevalence of two effects: the volume and value effects. The volume effect of a currency depreciation sees greater quantities exported but fewer quantities imported, improving the trade balance. However, when currency depreciation occurs, the domestic currency price of imports increases immediately while the domestic currency price of exports remains the same, worsening the trade balance in what is known as the value effect. Therefore, it is clear that a currency depreciation will only improve the current account if the volume effect

dominates the value effect. The M-L condition provides the circumstances under which this would be the case by stating that currency depreciation will lead to a current account improvement if the price elasticities of exports and imports sum to an absolute value greater than one (Lerner, 1944).

Therefore, the M-L condition is a necessary condition for currency depreciation to lead to an improvement in the current account. Indeed, if the absolute sum of the elasticities is less than unity, a depreciation will worsen the current account (Matlasedi, 2016). However, a common assumption in the derivation of the M-L condition is that the economy begins with a trade balance equilibrium in the current account. Brooks (1999) derives the M-L condition mathematically and shows that if an economy is initially in deficit, then the M-L condition can be a more stringent than necessary condition for currency depreciation to improve the current account.

2.2. The Fragile Five

In the wake of the Global Financial Crisis, the US Federal Reserve lowered interest rates to the zero-lower bound and implemented more unconventional monetary policy through quantitative easing. These unconventional policy actions resulted in capital flowing to large emerging markets and led to an increased dependence on volatile foreign investment to finance critical aspects of their economy, such as budget and current account deficits. As the US Federal Reserve implemented policy “normalisation”, these emerging markets experienced capital outflows. In 2013, a report by Morgan Stanley ranked Brazil, India, Indonesia, Turkey and South Africa as the five countries most vulnerable to these capital outflows, thus coining the term fragile five. As Chadwick (2019) indicates, these capital outflows resulted in the deterioration of key macroeconomic indicators and the depreciation of the fragile five currencies. Table 1 contains some of these indicators.

Table 1. Key Indicators for the Fragile Five following the Global Financial Crisis

	2010	2011	2012	2013	2014	2015	2016	2017
	Real GDP Growth (%)							
Brazil	7.53	3.97	1.92	3.00	0.50	-3.55	-3.28	1.32
India	8.50	5.24	5.46	6.39	7.41	8.00	8.26	7.04
Indonesia	6.22	6.17	6.03	5.56	5.01	4.88	5.03	5.07
S. Africa	3.04	3.28	2.21	2.49	1.85	1.19	0.40	1.41
Turkey	8.49	11.11	4.79	8.49	5.17	6.09	3.18	7.47
	Current Account (% GDP)							
Brazil	-3.6	-2.9	-3.4	-3.2	-4.1	-3.0	-1.3	-0.7
India	-3.3	-3.4	-5.0	-2.6	-1.3	-1.1	-0.5	-1.4
Indonesia	0.7	0.2	-2.7	-3.2	-3.1	-2.0	-1.8	-1.6
S. Africa	-1.5	-2.2	-5.1	-5.8	-5.1	-4.6	-2.8	-2.5
Turkey	-5.8	-8.9	-5.5	-5.9	-4.2	-3.2	-3.1	-4.8
	Real Effective Exchange Rate (Index; 2010=100)							
Brazil	100	104.7	94.7	90.2	89.3	74.6	79.3	86.4
India	100	100.1	93.8	89.4	90.7	97.5	98.7	103.1
Indonesia	100	100.0	96.3	93.1	87.1	88.5	92.5	94.0
S. Africa	100	98.1	92.2	82.0	77.1	75.2	70.0	79.5
Turkey	100	88.4	91.7	90.5	85.3	83.5	82.0	73.1

Source: World Bank World Development Indicators, Bank for International Settlements.

These five countries have seen economic growth wane over time and have run persistent current account deficits. Except for India, these countries' currencies have also depreciated extensively. Recent years have also seen growing political instability and economic mismanagement, particularly in Brazil, South Africa and Turkey, contributing further to poor economic outcomes. Challenges aside, evaluating the M-L condition

in these five economies is relevant as it could shed light on the effects of currency depreciation on the current account, which becomes critical when a country runs a persistent current account deficit, as is the case with the fragile five.

2.3. Empirical Literature

Empirical evaluations of the M-L condition have a long history. Houthakker and Magee (1969) laid the foundations for modern literature in their estimation of import and export elasticities. They used the Cochrane-Orcutt methodology, which accounts for serial correlation in the residuals of the estimated model. Other studies followed in the 1970s and 1980s that used various econometric techniques. An example was Arize (1987) who used a Two-stage Least Squares (2SLS) model to estimate import and export elasticities in eight African countries and found that the M-L condition held for seven of them (South Africa was not one of the countries included in this study). Empirical studies of the M-L condition started using cointegration analysis since it was introduced by Engle and Granger (1987) as it offered a way around the possibility of ending up with spurious results. Cointegration means that even if the variables of interest are all integrated of order one (that is, they are non-stationary), a stationary linear combination of these variables may still exist. This stationary combination represents a long-run cointegrated relationship. The studies of the M-L condition that followed tended to estimate the reduced-form equations of the import and export functions. The Engle-Granger two-step cointegration method, as applied initially, found very little support for the M-L condition. For example, Andersen (1993) found that most of the 16 countries in his study exhibited either an insignificant coefficient or one of the incorrect sign, contrary to what the theory predicted. Rose (1991) examined five industrial countries and did not find sufficient evidence of cointegration. However, Bahmani et al. (2013) noted that following further developments in time series analysis, such as work done by Johansen and Juselius (1990), empirical studies became generally more supportive of the M-L condition.

Differences between studies tend to arise in the way the M-L condition is tested. In the literature, the M-L condition is evaluated either directly or indirectly. According to Brooks (1999), the direct method involves the direct estimation of the import and export elasticities and evaluating whether the absolute sum of these elasticities is greater than unity. The indirect method differs in that it estimates the dynamic effects of a real currency depreciation on the trade balance. The indirect method generally falls into the realm of J-curve literature which seeks to evaluate whether a currency depreciation leads to a short-run deterioration of the trade balance before seeing an improvement in the long-run (Matlasedi, 2016). If there is a statistically significant improvement in the long-run, it can be inferred that the M-L condition holds. The reviewed literature comprises of both these methods.

2.3.1. Single-Equation Direct Method

The Johansen and Juselius (1990) method was the most commonly used cointegration procedure to measure the M-L condition following its introduction. Bahmani-Oskooee and Niroomand (1998) used this approach to test the trade flows for 30 countries and found evidence of cointegration; they then obtained point estimates to infer that the M-L condition was met. Another example was Eita (2013), who used a Vector Error Correction Model (VECM) approach to evaluate the condition in Namibia and found that a currency depreciation led to improvements in the current account.

Single-equation methods have, however, been able to provide more detailed estimates. Reinhart (1995) used annual data from 12 less-developed countries (LDCs) for the period 1968-1992 and applied a dynamic OLS (DOLS) method. DOLS, an augmented OLS method that controls for non-stationarity by adding the differenced values of the explanatory values, was then used to produce the elasticity estimates for each country. The price ratio estimates indicated that the M-L condition was met. Mixed results were also obtained by Prawoto (2007), who used the single-equation DOLS technique to test the M-L condition for four Asian countries. The M-L condition was shown to hold for Malaysia and Thailand but not for Indonesia and Singapore. Sinha (2001) tested for cointegration of the export and import flows with measures of the relative income and price ratios for Sri Lanka, Japan, India, the Philippines and Thailand using the Johansen method. Once cointegration was established (for all countries except India), the Phillips and Hansen (1990) fully

modified OLS (FMOLS) procedure was applied to the non-stationary series. The price elasticities suggest that the M-L condition was met for all countries except for Sri Lanka.

Another popular single-equation estimation method is the autoregressive distributed lag (ARDL) approach of Pesaran et al. (2001). This method has the advantage that it can use both stationary and non-stationary variables, and a short-run error-correction model is specified by placing lagged levels of each variable separately into a short-run model. A single equation produces short-run and long-run coefficients, and if the level variables are shown to be jointly significant in the regression, cointegration among the variables in the specification is confirmed. Razafimahefa and Hamori (2005) use the ARDL method to test for the M-L condition of Madagascar and Mauritius from 1960 to 2000. They find that all their specifications are cointegrated but that the price elasticities only show that the M-L condition is met for Mauritius. Bahmani-Oskooee & Kara (2005) use the ARDL cointegration technique to estimate export and import demand functions over the 25 years following the 1973 breakdown of Bretton Woods for 28 countries. They used the standard price ratio and nominal effective exchange rate of each country. They found that all equations were indeed cointegrated, and the point estimates of the import and export price ratios tended to be greater than one for many countries. For some, particularly in Europe, this condition was, however, not met. Shahzad et al. (2017) used a random-effects OLS model to evaluate the M-L condition for South Asia, consisting of Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka for the period 1993 to 2010 and found the M-L condition not to hold for any of these countries.

Bahmani et al. (2013) reviewed estimates made in various prior studies that used the direct method of evaluating the M-L condition to determine whether the absolute sum of the reported elasticities was significantly greater than one. Of the 92 coefficient estimate pairs which, when summed, state that the M-L condition holds, only 27 of them sum to a value significantly greater than one, implying that the M-L condition may not hold in many of the cases for which it is claimed to do so.

2.3.2. Indirect Method

Another way to achieve the stated goal of confirming the M-L condition is to determine whether devaluations/depreciations improve a country's trade balance by focusing on the trade balance rather than on exports and imports separately. Some studies that claim to test the M-L condition using this method include McPheters and Stronge (1979), Floyd and Hynes (1968), Miles (1979), Bahmani-Oskooee (1985), Himarios (1985, 1989) and Rose (1990). Rose (1991) studied whether a currency depreciation led to improvements in the trade balance of the five main Organisation for Economic Cooperation and Development (OECD) countries using the Engle-Granger and non-parametric techniques and concluded that a currency depreciation does not improve the trade balance. He further argues that he could not find any evidence to support the existence of a statistically significant relationship between the trade balance and the real effective exchange rate (REER). Brooks (1999) indicates, however, that the use of the Engle-Granger technique by Rose (1991) does not allow for the possibility that income and the trade balance could be influencing each other simultaneously, resulting in the direction of causality being unclear. Brooks (1999) also indicates that the use of the Engle-Granger technique can lead to inaccurate estimations.

While Arize (1994) is of the opinion that this is an acceptable alternative for testing the M-L condition, he states that the true M-L condition is not tested explicitly because no separate elasticities are obtained. Most of these studies are categorised under the "J-curve" literature, which has been examined in detail by Bahmani-Oskooee and Ratha (2004) and Bahmani-Oskooee and Hegerty (2010). More recently, the trade balance was addressed by Boyd et al. (2001) for eight industrial countries. Country-specific studies using this method include Marwah and Klein (1996) for Canada; Tang (2004) for the ASEAN-5; Gomes and Paz (2005) for Brazil; Akbostanci (2004) and Halicioglu (2008) for Turkey; Duasa (2007) and Yusoff (2009) for Malaysia; Matesanz and Fugarolas (2009) for Argentina; Kim (2009) for Korea; Ratha (2010) for India; and Hussain and Muhammad (2010) for Pakistan.

2.3.3. More Recent Developments

More recent empirical studies have sought different specifications and used more advanced econometric estimation techniques to resolve issues of seemingly inconsistent results. Sastre (2012) reformulates the M-L condition to include the cross elasticities of imports and exports and finds that the condition holds for Spain. Arize et al. (2017) argue that past studies have assumed the effect of exchange rate changes on the trade balance to be symmetric, that is, a currency depreciation is assumed to have the same effect as a currency appreciation. They use a nonlinear autoregressive distributed lag (NARDL) model and allow for asymmetries to evaluate the M-L condition in a series of Asian countries, validating it and finding that the trade balance responds more strongly to a currency depreciation than to an appreciation. Ultimately, however, questions surrounding model specification and econometric methodology are likely to persist.

2.3.4. M-L Condition in the Fragile Five

There have been somewhat inconsistent results when it comes to the M-L condition in South Africa. It has been shown to hold by Bahmani-Oskooee and Gelan (2012), Bahmani-Oskooee and Niroomand (1998), and Matlasedi (2016). Bahmani et al. (2013) and Narayan and Narayan (2010) both used the Autoregressive Distributed Lag (ARDL) Bounds methodology, and they were unable to find evidence that the condition held for South Africa.

Findings for the other fragile five countries are mostly supportive of the M-L condition. Gomes and Paz (2005) and da Silva and Moura (2005) tested for it in Brazil over similar periods using monthly data. The latter study used a Markov-Switching VECM to account for any structural breaks in the data. Both studies found evidence supporting the M-L condition. Studies by Hsing (2010) and Pandey (2013) were supportive of the M-L condition in India. The M-L condition was also found to hold in Turkey (Türkay, 2014), while Prawoto (2007) found that Indonesia was one of the Southeast Asian countries for which it did not hold (the other country was the Philippines; the condition held for Malaysia and Thailand). Turkey and Indonesia have also had the M-L condition evaluated on a bilateral basis. Cambazoğlu and Güneş (2016) estimated trade elasticities between Turkey and its largest trading partner, Germany, and found evidence supporting the condition. Similarly, Adiningsih et al. (2013) evaluated trade between Indonesia and its largest trading partners (China, Japan and the USA) and found that the M-L condition held in trade with China and Japan.

While not a study of the M-L condition in a fragile five country, research by Caporale et al. (2015) evaluating the M-L condition in Kenya indicated that even if the M-L condition held, the inflationary effects of a currency depreciation must also be considered since it could nullify the potential benefits of a depreciation in the currency, as was the case in Kenya. This observation is also pertinent to the fragile five, given that inflation remains high relative to the developed economies with which they trade.

The inconsistency displayed in the results for South Africa, and the conflicting outcome for Indonesia depending on whether the study has a bilateral focus, present some of the most common problems encountered in the empirical estimation of the M-L condition, namely possible misspecification of the model and differences arising from the level of data aggregation. The M-L condition is fundamentally an aggregate condition, but as Brooks (1999) notes, there is a possibility that aggregation bias could affect the elasticity estimates. He gives the example that too much weight is attached to items with large prices in the aggregate estimates. This aggregation bias is one of the reasons behind some studies choosing to evaluate the M-L condition bilaterally. Barker and Pesaran (1990) suggest that if the purpose of the research is to offer policy prescriptions, then disaggregation is more appropriate, given that it is likely to produce more precise estimates. However, should the researcher merely intend to describe an economic phenomenon, such as the M-L condition, then aggregation is suitable for drawing general conclusions. Certainly, research using disaggregated data to evaluate the M-L condition in a bilateral policy environment, such as research by Brooks (1999) and Bahmani-Oskooee and Hosny (2013), would likely need to focus on a single country given the intricacies of the analysis and thus falls outside the scope of our research which primarily seeks to draw general conclusions on the M-L conditions for a group of countries.

Prior empirical studies evaluating the M-L condition have overwhelmingly focussed on developed countries. Bahmani et al. (2013), in a comprehensive literature review of prior studies, report 217 individual estimates used to test the validity of the M-L condition, of which merely 56 are from emerging markets and developing economies, with South Africa being one of the more common emerging markets. The M-L condition has therefore not been sufficiently investigated among emerging and developing markets. Furthermore, the fragile five countries have never been subjected to an estimation of the M-L condition using data for the same period and applying the same methodology representing the most recent developments in econometric techniques. In this paper, we use the direct method - as according to Arize (1994) - it is the only way to test the true M-L condition.

3. Methodology

It is evident from the literature review that empirical work to test for the M-L condition has produced mixed results, with no clear consensus on which model specification, method of testing (that is, directly or indirectly) and econometric methodology is best suited to the empirical evaluation of the condition. Therefore, it is probable that the empirical work that this paper undertakes is likely to be subject to many of the limitations and inconsistencies identified in Section 2.3. This paper intends not to propose a new method of evaluating the M-L condition but rather to apply an existing methodology, namely the ARDL Bounds methodology, to a group of countries generally overlooked in the literature, all the while remaining cognizant of the inherent limitations.

3.1. Model Specification and Data

As previously mentioned, the direct method of evaluating the M-L condition entails modelling both export and import demand equations. It is also the surest way to evaluate whether the absolute sum of the export and import price elasticities is greater than one. The model specification used in this research paper is similar to that of Brooks (1999), Bahmani et al. (2013), and Eita (2013).

The export demand and import demand models are given respectively as:

$$\ln EXP_t = \alpha_0 + \alpha_1 \ln WY_t + \alpha_2 \ln REER_t + \varepsilon_t \quad (3.1)$$

$$\ln IMP_t = \beta_0 + \beta_1 \ln RGDP_t + \beta_2 \ln REER_t + \varepsilon_t \quad (3.2)$$

From (3.1):

The dependent variable, $\ln EXP_t$, is the natural logarithm of the country's export volumes (real exports).

$\ln WY_t$ is the natural logarithm of world income. The variable for world income is proxied by the OECD's World Industrial Production Index. This index has been used as a proxy in other studies (Bahmani, Harvey, & Hegerty, 2013; Eita, 2013). It is expected that the coefficient α_1 will be positive as an increase in world income will likely increase demand for the country's goods, increasing its exports.

$\ln REER_t$ is the natural logarithm of the country's Real Effective Exchange Rate index. An increase in the index represents an appreciation of the country's currency. In line with the elasticities approach discussed in Section 2.1, an appreciation in the REER is likely to make the country's goods relatively more expensive, thus reducing demand for these goods in foreign markets. Consequently, exports would be expected to decline, leading to the expectation of the coefficient α_2 being negative.

From (3.2):

The dependent variable, $\ln IMP_t$, is the natural logarithm of the country's import volumes (real imports).

$\ln RGDP_t$ is the natural logarithm of the country's real GDP, representing the country's real domestic income. An increase in income is expected to lead to a greater demand for foreign goods, boosting imports. Thus the coefficient β_1 is expected to have a positive sign.

The coefficient of $\ln REER_t$, β_2 , is expected to have a positive sign. The intuition for this is simply the converse to that of (3.1): an appreciation in the REER is likely to make foreign goods relatively cheaper, thus increasing the demand for these goods and increasing imports.

The so-called "price" component in both (3.1) and (3.2) is given by the REER, which is the fundamental difference between this model specification and the alternative specification used by other studies using the direct method to evaluate the M-L condition. In some cases, a relative price ratio is used instead of the REER. Cambazoğlu and Güneş (2016) argue that the elasticity of REER does not represent price elasticities of exports and imports but rather the exchange rate elasticity and that if the effect of exchange rates on imports and export prices is muted, then there may not be a correlation between the exchange rate and prices. However, Caporale et al. (2015) show in the derivation of their model that domestic and foreign prices are accounted for in the real exchange rate, a point also noted by Bahmani et al. (2013). Eita (2013) argues that the exchange rate forms the crux of the M-L condition and should be included in the models. It is for these reasons that this paper makes use of the REER.

Finally, the M-L condition would be said to hold if $|\alpha_2 + \beta_2| \geq 1$.

This study uses quarterly data from 1996Q1-2019Q4. Due to data availability issues for two countries, namely India and Turkey, data obtainable from the sources used does not span back to 1996Q1. Consequently, the M-L condition is evaluated from 1997Q1-2019Q4 in India and 1998Q1-2019Q4 in Turkey. Because our focus is not necessarily to evaluate the M-L condition over a particular period, and since we obtain our data for each of the five countries from two primary sources, we make use of these heterogeneous sample periods instead of a common period in order to maximise the number of observations contained within each series.

The Bank for International Settlements (BIS) was used to obtain data on each country's Real Effective Exchange Rate (REER). Data on domestic GDP, real exports, real imports and world income (all seasonally adjusted) was sourced from the OECD Main Economic Indicators. The primary reason for using these two sources was to ensure a consistent methodology used in the data collection and index calculation processes. All data is analysed with EViews.

3.3. Unit Root Testing

One of the initial and crucial steps to estimating a time series regression is to conduct unit root tests on the data to identify whether the variables in question are stationary. If a regression is performed on non-stationary variables, there is the possibility that the estimation results from this regression turn out to be spurious. A spurious regression would suggest that variables are related when, in fact, they may be entirely unrelated, only exhibiting a contemporaneous correlation as opposed to any causal relations. This research paper uses the Augmented Dickey-Fuller (ADF) (Dickey & Fuller, 1979) unit root test, one of the most common unit root tests used in empirical research. In the context of the ARDL Bounds methodology, the unit root test serves to ensure that no variable in the model is integrated of order two (I(2)).

The model used in the ADF Test is specified as follows:

$$\Delta y_t = \mu + \gamma t + \rho^* y_{t-1} + \sum_{i=1}^n \delta_i \Delta y_{t-i} + \varepsilon_t \quad (3.3)$$

In (3.3), μ represents a constant while γt represents the model's time trend component. $\sum_{i=1}^n \delta_i \Delta y_{t-i}$ is the augmentation included to allow for the possibility of the data arising from an autoregressive data generating process with an order greater than one. The Akaike Information Criterion (AIC) determines the optimal number of lags that should be included in the model. This augmentation aims to correct for any

issues of serial autocorrelation in the residual term ε_t . The parameter ρ^* is the most relevant parameter for the ADF unit root test. The null and alternative hypotheses can be given as follows:

$$H_0: \rho^* = 0; y_t \text{ is nonstationary}$$

$$H_a: \rho^* < 0; y_t \text{ is stationary}$$

The above hypothesis test does not take the form of a standard t-test for significance but rather uses the critical values derived by MacKinnon (1996).

3.4. ARDL Model Specification and the Bounds Test for Cointegration

ARDL models have long been used in applied work, although their usefulness as a means of testing for cointegrating relationships among different time series is a relatively recent advancement following the work of Pesaran et al. (2001). This ARDL Bounds Test methodology has some advantages: it can be used when there is a mixture of I(0) and I(1) variables, and it is a single-equation model, which makes it a simple methodology with which to work. As a result, this methodology has grown in popularity in recent years. Given its advantages and the fact that it is a relatively modern technique, this paper uses the methodology to test for cointegrating relationships among the variables and estimate the long-run coefficients, thus allowing for the evaluation of the M-L condition.

A short-run dynamic adjustment mechanism should be included in the estimation procedure, which, as indicated Bahmani-Oskooee and Hosny (2013), allows for the estimation of stable coefficients in the two original levels models in (3.1) and (3.2). Upon establishing the order of integration of the variables through unit root tests, the next step is to specify the unrestricted error correction model (ECM) forms of (3.1) and (3.2) respectively:

$$\Delta \ln EXP_t = \alpha_0 + \sum_{i=1}^{n1} \alpha_{1i} \Delta \ln EXP_{t-i} + \sum_{i=1}^{n2} \alpha_{2i} \Delta \ln WY_{t-i} + \sum_{i=1}^{n3} \alpha_{3i} \Delta \ln REER_{t-i} \quad (3.4)$$

$$+ \alpha_4 \ln EXP_{t-1} + \alpha_5 \ln WY_{t-1} + \alpha_6 \ln REER_{t-1} + \varepsilon_t$$

$$\Delta \ln IMP_t = \beta_0 + \sum_{i=1}^{n4} \beta_{1i} \Delta \ln IMP_{t-i} + \sum_{i=1}^{n5} \beta_{2i} \Delta \ln RGDP_{t-i} + \sum_{i=1}^{n6} \beta_{3i} \Delta \ln REER_{t-i} \quad (3.5)$$

$$+ \beta_4 \ln IMP_{t-1} + \beta_5 \ln RGDP_{t-1} + \beta_6 \ln REER_{t-1} + \varepsilon_t$$

The unrestricted ECMs in (3.4) and (3.5) are similar to conventional ECMs except that instead of having a single error correction term with one coefficient encompassing the long-run component in the ECM, the long-term variables in the two original levels models (namely, EXP , WY , $REER$, IMP , $RGDP$) are included into (3.4) and (3.5) with unrestricted coefficients (hence the name unrestricted ECM).

Therefore, in equation (3.4), coefficients $\alpha_4 - \alpha_6$ represent the long-run relationship between the variables from the original export demand equation in (3.1), while in equation (3.5), coefficients $\beta_4 - \beta_6$ represent the long-run relationship between the variables from the original import demand equation in (3.2). The coefficients $\alpha_{1i} - \alpha_{3i}$ and $\beta_{1i} - \beta_{3i}$ in (3.4) and (3.5), respectively, represent the short-run dynamics of the models. α_0 and β_0 are the respective drift components, and ε_t represents the error term.

The Bounds test is relatively simple as it entails performing what is akin to an “F-test” for joint significance on the null hypothesis of no cointegration against the alternative hypothesis that the variables are cointegrated.

Thus, for (3.4), the null and alternative hypotheses can be given as:

$$H_0: \alpha_4 = \alpha_5 = \alpha_6 = 0; \text{ no cointegration among the variables}$$

$$H_a: \alpha_4 \neq \alpha_5 \neq \alpha_6 \neq 0; \text{ variables are cointegrated.}$$

Similarly, for (3.5), the null and alternative hypotheses are:

$H_0: \beta_4 = \beta_5 = \beta_6 = 0$; *no cointegration among the variables*

$H_a: \beta_4 \neq \beta_5 \neq \beta_6 \neq 0$; *variables are cointegrated.*

The Bounds test is intuitive. As with most tests for cointegration, the objective is to test for the lack of a cointegrating, long-run equilibrium relationship between variables. In the case of equations (3.4) and (3.5), the absence of a cointegrating relationship would be seen through zero-coefficients of their respective long-run components. Non-zero coefficients lead to a rejection of the null hypothesis, implying that there is sufficient evidence to conclude that the variables exhibit a long-run cointegrating relationship.

While the Bounds test is similar in structure to a standard Wald Test ("F-test"), it is not an "F-test" because the test statistic does not follow a standard F-distribution. Pesaran *et al.* (2001) provide bounds on the critical values based on the asymptotic F-distribution. The lower bound assumes that all variables in the model are $I(0)$, while the upper bound assumes that they are $I(1)$. If the test statistic calculated falls below the $I(0)$ bound, then the variables cannot be cointegrated as it can be concluded that the variables are $I(0)$. If the test statistic is greater than the upper bound, it is concluded that the variables are $I(1)$ and cointegrated. A test statistic between the bounds is inconclusive (Giles, 2013).

Since the M-L condition is fundamentally a long-run condition, this paper focuses on the long-run cointegrating relationship and the long-run coefficients and not the short-run adjustments to equilibrium. Therefore, once the presence of a cointegrating relationship has been established, the long-run coefficients in (3.1) and (3.2) can be "extracted" from the unrestricted ECMs by normalising on the variables $\ln EXP_{t-1}$ and $\ln IMP_{t-1}$ in (3.4) and (3.5) respectively. For example, from equation (3.4), the long-run coefficients for $\ln WY_t$ and $\ln REER_t$ in (3.1) are given by $-\left(\frac{\alpha_5}{\alpha_4}\right)$ and $-\left(\frac{\alpha_6}{\alpha_4}\right)$ respectively. The same intuition is used to find the long-run coefficients for (3.2) from (3.5).

It is worth noting at this point that as long as the unrestricted ECM from the ARDL Bounds methodology is used to test for cointegration, then valid inferences can be made on the long-run coefficients. Pesaran and Shin (1999) and Pesaran *et al.* (2001) prove that if the unrestricted ECM is used, the long-run estimates possess the OLS property of super-consistency, allowing for valid inferences to be made.

4. Results, Discussion and Recommendations

4.1. Unit Root Test

In almost all the cases, the null hypothesis of non-stationarity cannot be rejected when the variables are in levels form. However, performing the ADF test on the first differences of the variables allows for the rejection of the null hypothesis in all cases. The results of the unit root tests are shown in Tables A1-A5. Therefore, there is sufficient evidence to conclude that the variables in question are all $I(1)$ and that the ARDL Bounds methodology can be used.

4.2. ARDL Bounds Test for Cointegration

Table 2 shows the critical bounds derived by Pesaran *et al.* (2001) to test for cointegration. If the calculated F-statistic exceeds the upper bound (the so-called $I(1)$ bound), then the null hypothesis of no cointegration is rejected, and the variables are said to be cointegrated.

Table 2. Bounds Test Critical Values

Null Hypothesis: No levels/cointegrating relationship		
Significance Level	Lower Bound: I(0)	Upper Bound: I(1)
10%	2.63	3.35
5%	3.1	3.87
2.50%	3.55	4.38
1%	4.13	5

Source: Pesaran et al. (2001).

Table 3 gives the calculated F-statistics for each country's export and import equations which are then compared to the critical bounds presented in Table 2 to determine whether the variables used in the respective export and import equations form a cointegrating relationship.

Table 3. Outcome of the Bounds Test for Cointegration

Equation	F-Statistic	Outcome
Brazil		
Exports	9.55	Cointegrated
Imports	1.30	Not Cointegrated
India		
Exports	5.86	Cointegrated
Imports	2.92	Inconclusive
Indonesia		
Exports	5.72	Cointegrated
Imports	12.50	Cointegrated
South Africa		
Exports	11.94	Cointegrated
Imports	5.67	Cointegrated
Turkey		
Exports	5.67	Cointegrated
Imports	4.67	Cointegrated

Two anomalies arise from the Bounds test for cointegration. Firstly, as indicated in Table 3, it appears as though real imports, the REER and real GDP for Brazil do not form a long-run cointegrating relationship. Other cointegration tests that can be performed in EViews confirm this outcome. Secondly, the Bounds test is inconclusive in establishing a cointegrating relationship between the variables in India's import equation. Pesaran et al. (2001) suggest that when the F-Bounds test is inconclusive, then the t-statistic of the error correction term's coefficient can be used as an alternative approach to testing for cointegration. If said t-statistic is smaller than the upper bound t-critical value they provide (smaller due to the t-statistics being negative), it is possible to conclude that cointegration exists. Table 4 shows the outcome of the t-Bounds Test.

Table 4. Outcome of the t-Bounds Test for India's Import Equation

t-Bounds Test					
Test Statistic	Value	Significance Level	Lower Bound: I(0)	Upper Bound: I(1)	Outcome
t-statistic	-3.48	10%	-2.57	-3.21	Cointegrated

Source: Pesaran et al. (2001) for the t-Bounds critical values.

Therefore, it is possible to conclude that the variables in India's import equation constitute a cointegrating relationship. The issue of the non-existence of a cointegrating relationship for Brazil's import equation is likely an empirical one, especially since cointegrating relationships in the import equations of the other countries evaluated are shown to exist. Nonetheless, it would make little sense to evaluate Brazil's import equation's long-run effects when there appears to be no cointegrating relationship between the variables. The next step is to estimate the long-run coefficients of the equations shown to exhibit cointegration in Table 3.

4.3. Long-run Estimation Results and Diagnostic Tests

Table 5 presents the variables' long-run estimated coefficients from the export and import equations of each country evaluated.

Table 5. Long-Run Estimates and Marshall-Lerner Condition Evaluation

	Export Equation			Import Equation		
	Constant (a)	LNREER (b)	LNWY (c)	Constant (d)	LNREER (e)	LNRGDP (f)
Brazil	-45.67 (-1.14)	2.55 (0.83)	8.21 (1.41)			
India	-6.22 (-0.28)	-2.82 (-0.48)	6.13** (2.08)	-17.46 (-1.05)	3.83 (0.83)	0.75 (1.21)
Indonesia	-6.99** (-2.62)	1.99*** (3.75)	2.44*** (3.01)	-2.93*** (-2.98)	1.11*** (4.02)	0.74*** (7.74)
South Africa	-2.32*** (-3.61)	-0.04 (-0.63)	1.71*** (17.67)	-8.74*** (-8.82)	0.41*** (3.07)	1.86*** (21.67)
Turkey	-23.23*** (-4.05)	-0.12 (-0.24)	6.19*** (5.17)	-4.32*** (-5.94)	0.54*** (4.10)	1.08*** (16.95)

*/**/** denotes statistical significance at a 10%/5%/1% respectively.
Values in brackets represent the individual t-statistics.

4.3.1. Interpretation of Results

To evaluate the M-L condition, the most relevant results in Table 5 are the coefficient estimates contained within columns (b) and (e). However, what is immediately apparent from the table is that some of these estimated coefficients are not statistically significant. The economic theory and empirical literature underpinning the model specification used in this study points towards the inclusion of price ($\ln REER$) and income variables ($\ln WY$ and $\ln RGDP$) for the respective export and import equations, thus we include them in the estimation of the two equations despite the statistical insignificance of the variables in certain cases.

The fact that some of the coefficient estimates are not statistically significant poses an issue in the sense that it suggests that we cannot explicitly quantify the effect of $\ln REER$ on the respective dependent variable as there is no evidence allowing us to conclude that the coefficient estimate in question is significantly different from zero. However, we can still rely upon the signs on each of the estimates to determine whether the effect on the dependent variable is positive or negative.

Column (b) in Table 5 shows the coefficient estimates on the $\ln REER$ variable in the export equation. For three of the five countries (India, South Africa and Turkey), the sign on the coefficient conforms to the theory that an appreciation in the currency is likely to reduce exports. However, these coefficients are not statistically significant. Brazil and Indonesia have positive coefficients, as shown by the bold and underlined values in column (b) in Table 5. These positive coefficients suggest that an appreciation of each country's respective REER results in an increase in exports which is counterintuitive and goes against what is dictated by economic theory. While these two results are counterintuitive, they are not unsurprising as they reflect the observations of Bahmani *et al.* (2013). They noted that it was not uncommon to find positive coefficients on the variable representing the REER in the export equations of some of the 29 countries for which they evaluated the M-L condition.

Unlike some estimates in the exports equation, all the coefficient estimates on the $\ln REER$ variable in the import equations tabulated in column (e) in Table 5 have the expected signs and conform to the economic theory stating that a currency appreciation likely increases imports. Of these tabulated results, only the estimate for India is not statistically significant. Thus a one per cent increase in the country's REER is expected to increase imports by 1.11%, 0.41% and 0.54% in Indonesia, South Africa and Turkey, respectively, *ceteris paribus*.

The estimates for Brazil's import equation are obtainable, given that they can still be "extracted" from the unconditional ECM that is first estimated before cointegration is established. However, they are not reported in Table 5 since it would be of little value to discuss any long-run effects of the variables when they do not constitute a long-run cointegrating relationship.

4.3.2. The Evaluation of the Marshall-Lerner Condition

The issues identified in Section 4.3.1 relating to some coefficient estimates failing to conform to economic theory or not being statistically significant makes the evaluation of the M-L condition less clear-cut.

Firstly, for two countries, namely Brazil and Indonesia, the absolute sum of the price elasticities (column [b] + column [e]) is greater than one. However, the results for Brazil and Indonesia cannot be taken at face value. In Brazil's case, the M-L condition is not truly evaluated, given that the long-run coefficients of the imports equation are not given due to the absence of a cointegrating relationship between the variables. Additionally, the sign of the coefficient on the price elasticity of exports is positive and does not conform to economic theory, thereby likely pointing to issues within the model itself and thus affecting the evaluation of the M-L condition. This latter point is also applicable to Indonesia since the price elasticity of exports also has an incorrect sign. Bahmani et al. (2013) put forward the failure of the estimates to conform to economic theory as grounds for rejecting the validity of the M-L condition. We agree with this stance and thus opt for the prudent approach of concluding that the M-L condition does not hold for these two countries.

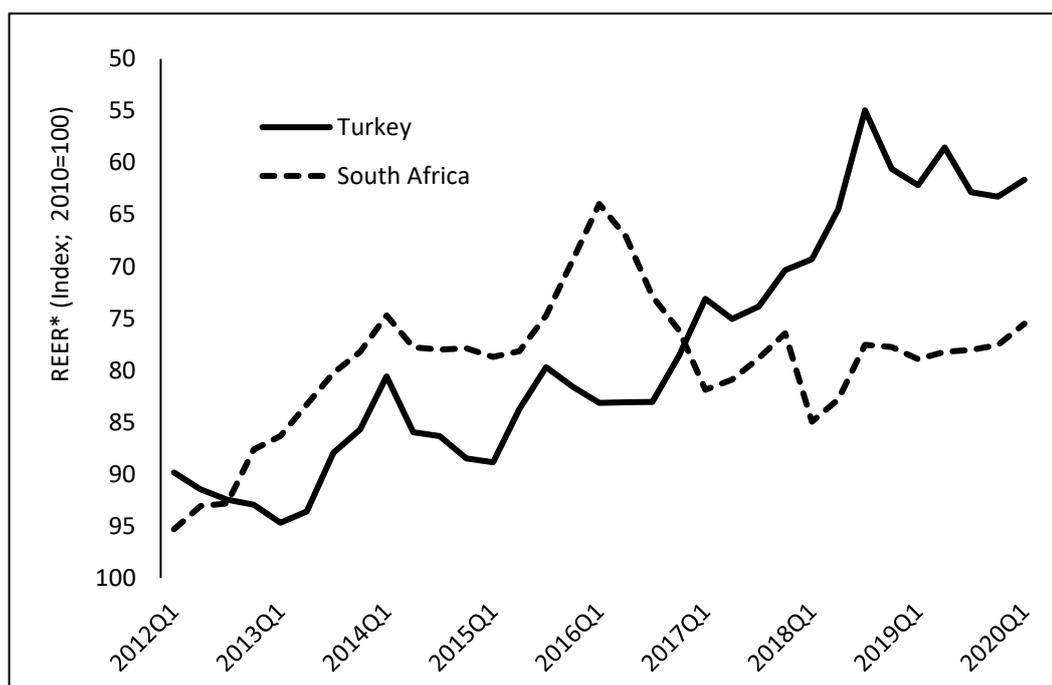
The second concern relates to evaluating the M-L condition despite some coefficients being statistically insignificant. This issue is prevalent in the estimates for the other three countries evaluated (India, South Africa and Turkey). For India, the coefficient estimates of $\ln REER$ in both the export and the import equation are not statistically significant. Therefore, we cannot say that the M-L holds in India's case despite the absolute sum of the coefficient estimates in columns (b) and (e) being greater than one.

For South Africa and Turkey, we see that only the price elasticities in the import equation are statistically significant. Furthermore, these price elasticities in the import equation are inelastic as they are smaller than one in value (0.41 for South Africa and 0.54 for Turkey). Thus, a one per cent depreciation in the currency would reduce import demand by less than one per cent in both of these countries, increasing the value of imports and likely worsening the trade balance. This result contradicts the M-L condition, which suggests that a currency depreciation would improve the current account.

This failure to validate the M-L condition in South Africa and Turkey would explain the persistent current account deficits seen in these two countries in recent years despite their respective currencies being volatile and showing a tendency towards depreciation, as shown in Figure 1. A possible reason why the M-L condition does not hold in these two countries could be identified by assessing the nature of goods the country imports. In South Africa, a substantial portion of imports consists of machinery that tends to be demand inelastic. Walter & Fowkes (2017) note that these machinery imports have remained persistent over the years. It is probable that the depreciating Rand has increased the share of GDP spent on machinery, thereby sustaining the current account deficit despite the currency's depreciation. If this effect is substantial enough, it could be a contributing factor invalidating the M-L condition in South Africa.

A similar effect is probably at play in the case of Turkey. Yurdakul and Cevher (2015) note that Turkey has become increasingly dependent on imports of resources like oil and inputs to production, like machines, all of which are likely to demand inelastic. Therefore, like South Africa, an exchange rate depreciation may sustain the current account deficit rather than reduce it, thereby invalidating the M-L condition.

Figure 1. The Real Effective Exchange Rate for Turkey and South Africa



*Note: The graph has an inverse scale. Movement away from an index value of 100 to smaller index values represents a currency depreciation.

Source: The Bank for International Settlements.

4.3.3. Diagnostic Tests

Table 6 presents the results of some standard diagnostic tests used to evaluate the estimated unrestricted ECM for each country’s respective export and import equations.

Table 6. Results of Model Diagnostic Tests

	Jarque-Bera	RESET	Breusch-Godfrey LM	ARCH LM	White	CUSUM	CUSUMSQ
	H ₀ : Residuals Normally Dist.	H ₀ : No Misspecification	H ₀ : No serial correlation up to 2nd order	H ₀ : No ARCH	H ₀ : No Heteroscedasticity		
Export Equation							
Brazil	15.51***	2.36	2.72	10.38***	20.74**	S	S
India	40.7***	5.44**	3.98	0.37	11.42	S	S
Indonesia	2.36	0.02	0.38	3.75	33.85***	S	US
South Africa	2.32	29.77***	2.75	0.05	8.12	US	S
Turkey	1.25	1.67	1.72	1.54	10.33	S	S
Import Equation							
Brazil	11.94***	2.08	2.09	0.89	16.45	S	S
India	0.68	5.93*	0.29	0.7	5.13	S	S
Indonesia	2.24	15.01***	11.38***	1.73	26.46**	S	US
South Africa	3.26	0.56	0.66	0.88	10.24	S	S
Turkey	6.92**	3.28	1.8	0.56	10.28	S	S

*/**/** denotes rejection of null at a 10%/5%/1% respectively. S= Stable; US= Unstable.

The diagnostic results in Table 6 confirm the findings of Bahmani et al. (2013), which are that even though the export and import specifications in (3.1) and (3.2) are well-known and often used, they show signs of misspecification and other issues. Only in Turkey's case could it be said that both models appear to be

correctly specified and free from major issues (there are signs that the residuals are not normally distributed in the import equation, but this issue is often resolved asymptotically in large samples (Wooldridge, 2019)).

4.4. Recommendations

Studies seeking to validate the M-L condition, such as the one undertaken in this paper as well as others like the one by Bahmani et al. (2013), have been clear in showing that the evaluation of the condition on a general basis with aggregated data often does not support the M-L condition and is in fact, subject to some empirical and methodological issues. It is apparent that a one-size-fits-all approach to evaluating the M-L condition, consisting of a relatively well-known specification for the respective export and import equations, will likely continue producing inconsistent results.

It is possible that different model specifications, such as the one used by Sastre (2012), or econometric methodologies which can account for nuances relating to a specific economy, such as the use of nonlinear ARDL methods by Arize et al. (2017) to account for the REER having asymmetric effects on imports and exports, may produce better results. Finally, the issues related to evaluating the M-L condition at an aggregate level make a strong case for evaluating the condition bilaterally or on a disaggregated basis. The results from such studies would likely also yield information that can serve to guide economic policy, as indicated by Barker & Pesaran (1990).

5. Conclusion

This paper sought, firstly, to evaluate the M-L condition for the so-called fragile five economies of Brazil, India, Indonesia, South Africa and Turkey by making use of the ARDL Bounds Testing methodology and secondly, to identify whether the evaluation of the condition for these five economies on an aggregate level is subject to some of the issues previously identified in the literature. There was little evidence to support the M-L condition in these five countries. Of the five economies evaluated, only the model for Turkey was shown to be free of major issues that would likely affect the evaluation of the M-L condition. Our results are in line with the findings by Bahmani et al. (2013) and Narayan and Narayan (2010) for South Africa, Hsing (2010) for India, and Prawoto (2007) for Indonesia. Our results differ from the findings by Gomez and Paz (2005) and da Silva and Moura (2005), who found evidence to support the M-L condition for Brazil and Turkey (2014) and Pandey (2013), who found the M-L condition to hold for Turkey and India respectively.

The results of our study do not preclude the further investigation of M-L condition in these fragile five countries- quite the contrary. Certainly, the evaluation of the M-L condition on a bilateral or a disaggregated basis and using model specifications that differ from the direct (traditional) one used in this paper should be the likely point of departure from here to understand better the underlying intricacies that may be influencing the evaluation of the M-L condition at an aggregate level. Results from studies evaluating the M-L condition on a bilateral basis may differ from the results of the single country analysis. For example, Cambazoğlu & Güneş (2016) estimated trade elasticities between Turkey and its largest trading partner, Germany, and found evidence supporting the condition. Similarly, Adiningsih et al. (2013) evaluated trade between Indonesia and its largest trading partners (China, Japan and the USA) and found that the M-L condition held in trade with China and Japan.

Ultimately, using these methods could ameliorate some of the issues encountered in the general evaluation of the M-L condition and hopefully produce more conclusive results on the validity of the M-L condition in the future.

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Appendix

Tables A1 – A5 present the results of the ADF tests for each of the countries evaluated.

Table A1. Brazil ADF Test

	None	Intercept	Trend & Intercept
lnexp	2.9667	-2.4579	-1.399
Δ lnexp	-11.7068***	-12.7301***	-9.1401***
lnimp	2.0719	-1.5163	-2.3522
Δ lnimp	-1.7880*	-3.9605***	-4.1579***
lnreer	-0.4474	-2.2415	-2.3589
Δ lnreer	-7.7362***	-7.7069***	-7.6745***
lnrgdp	3.1908	-1.5978	-0.6212
Δ lnrgdp	-6.5128***	-7.5777***	-7.7660***
lnwy	1.3835	-2.0318	-3.4642**
Δ lnwy	-5.2924***	-5.5080***	-5.5453***

*/**/** denotes rejection of null at a 10%/5%/1% respectively.

Table A2. India ADF Test

	None	Intercept	Trend & Intercept
lnexp	3.2412	-1.8624	-1.3469
Δ lnexp	-10.538***	-12.2168***	-12.6553***
lnimp	3.0399	-1.665	-08458
Δ lnimp	-1.7778*	-9.3172***	-9.5457***
lnreer	0.8197	-2.2803	-3.4376*
Δ lnreer	-6.0242***	-6.064***	-6.0244***
lnrgdp	16.7119	0.2812	-2.5284
Δ lnrgdp	-1.3442	-8.6454***	-8.5884***
lnwy	1.1804	-1.6938	-4.2551***
Δ lnwy	-5.354***	-5.5001***	-5.4887***

*/**/** denotes rejection of null at a 10%/5%/1% respectively.

Table A3. Indonesia ADF Test

	None	Intercept	Trend & Intercept
lnexp	2.3552	-0.207	-2.6663
Δ lnexp	-4.3055***	-6.4807***	-6.4494***
lnimp	0.9960	-0.7492	-2.5511
Δ lnimp	-5.5921***	-5.6852***	-5.6595***
lnreer	-0.2646	-2.7652*	-3.3156*
Δ lnreer	-5.1408***	-5.0936***	-5.0459***
lnrgdp	4.6408	1.0266	-10.03***
Δ lnrgdp	-1.9117*	-9.5451***	-8.0695***
lnwy	1.3835	-2.0318	-3.4642**
Δ lnwy	-5.2924***	-5.5080***	-5.5453***

*/**/** denotes rejection of null at a 10%/5%/1% respectively.

Table A4. South Africa ADF Test

	None	Intercept	Trend & Intercept
Lnexp	1.5824	-2.0957	-3.5988**
Δ Lnexp	-11.4590***	-11.6819***	-11.73195***
Lnimp	2.3491	-1.1559	-1.2290
Δ Lnimp	-5.6838***	-8.8281***	-8.8233***
Lnreer	-0.4539	-2.5011	-3.0088
Δ Lnreer	-8.1788***	-8.1477***	-8.0952***
Lnrgdp	3.4918	-1.7218	0.2475
Δ Lnrgdp	-1.8390*	-5.4098***	-5.7665***
Lnwy	1.3835	-2.0318	-3.4642**
Δ Lnwy	-5.2924***	-5.5080***	-5.5453***

*/**/*** denotes rejection of null at a 10%/5%/1% respectively.

Table A5. Turkey ADF Test

	None	Intercept	Trend & Intercept
Lnexp	3.5781	-0.0472	-4.2653***
Δ Lnexp	-3.2665***	-7.0625***	-7.0313***
Lnimp	1.8970	-1.3569	-1.8840
Δ Lnimp	-5.3178***	-5.7883***	-5.8319***
Lnreer	-0.2271	-1.4870	-1.3904
Δ Lnreer	-8.2183***	-8.1722***	-6.6390***
Lnrgdp	4.2752	0.3821	-3.3180*
Δ Lnrgdp	-6.7381***	-7.8634***	-7.8639***
Lnwy	1.1535	-1.8937	-4.3983***
Δ Lnwy	-5.1797***	5.3255***	-5.3173***

*/**/*** denotes rejection of null at a 10%/5%/1% respectively.