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Empirical Examination on the long run Purchasing Power Parity: Evidence from Parallel and Official Market Exchange Rates

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Abstract

The thesis undertakes an empirical analysis of the parallel market exchange rate behavior in the post-Bretton-Woods era based on monthly data spanning the period 1973m01 to 1998 m12 for a heterogeneous group of 56 countries across the globe. The preliminary investigation regress a crash dummy on parallel market premium using a Binary Choice model. The main analysis is conducted by estimating the traditional and a parallel market variant of PPP using the Johansen Multivariate Cointegration method. Based upon the VEC models obtained the hypothesis of a weak-form and a strong-form PPP are tested in the form of identifying restrictions on the cointegrating vectors, respectively, whilst the joint hypothesis of a long-run strong from PPP for parallel rate as well as long-run informational efficiency in the parallel market is tested for the alternative model. The empirical results obtained suggest that: weak-form PPP models receive stronger support than the alternative model across the whole sample especially for the Latin American economies. The strong-form PPP is best received for African economies but mostly for the parallel exchange rate solely. The use of parallel market exchange rates and wholesale price indices has been shown to be more supportive of the PPP validity, especially for the strong-form PPP. The empirical findings emphasize the need to adopt more flexible exchange rate policies, while the liberalization of the capital flows and the global integration of the currency markets are in favour of the countries that avoid adopting restrictive macroeconomic policies.

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Author's Declaration

I declare that, except where explicit reference is made to the contribution of others, that this dissertation is the result of my own work and has not been submitted for any other degree at the University of Glasgow or any other institution.

Signature

Printed Name

Chapter 1: Introduction

Subsequent to the demise of the Bretton Woods adjustable peg exchange rate system in the early 1970s , most of the large industrialized countries have undergone the shift from fixed to floating exchange rate regime (Sager & Taylor, 2006, Frankel & Rose, 1994) , arising intense concerns and extensive disputes upon the foreign exchange market amongst academic economists, policymakers and practitioners. The generalized floating exchange regime, as Frankel & Rose (1994) note, provided economists with required empirical data set for solving such academic disputes and meanwhile brought about more immediate policy issues. A large extent of ensuing literature focused on the development and estimation of empirical exchange rate models under floating exchange rate regime, among which the macro-fundamental based models of exchange rate determination dominated the others during the decade. This class of models range from the simple Purchasing Power Parity (PPP) model, the flexible monetary models of exchange rate and the sticky-price overshooting models to portfolio balance models.

The PPP hypothesis has been the building block of international economics and underpins all the above-mentioned theoretical frameworks to exchange rate determination. The long-run validity of PPP, especially, has been posited as a long-run equilibrium condition for many dynamic exchange rate models[1]. The PPP proposition has been subject to substantial empirical investigation. Thanks to the development of new econometric methods, such as cointegration and non-stationary panel methods, recent tests of PPP, as summarized by MacDonald (2007, p50), have concentrated on using cointegration methods to test the relationship between the nominal exchange rate and relative price differentials, as well as the unit root methods to determine if real exchange rates are mean-reverting processes.

It is noteworthy that for most of the previous PPP studies, the focus is mainly on developed economies, with only minor coverage of developing economies. However,as we will discuss in the suceeding chapter, the PPP concept is quite important for less developed economies.[2] As stated in Cerrato & Sanrantis (2007), many of these (developing or less developed) countries tend to have some form of a fixed exchange rate system combined

[1] Consult Abuaf and Jorion (1990), Dornbusch (1976) and Mussa (1982) among many others in this strand of the literature.

[2] The importance of PPP concepts is articulated in Balhmani – Oskooee and Hegerty (2009) and discussed in section 2.3 of the thesis.

with foreign trade and capital restrictions and often suffer from high inflation and large external deficits, some are even prone to financial crises. This feature of developing economies have led to the emergence and development of parallel (black) market for foreign exchang. The black market exchange rates are fully market determined whilst the official exchange rate are often controlled by the monetary authorities in these countries. It is arguable, therefore, the paralllel market rate might reflect the true value of currency as opposed to the potentially misleading official exchange rate.

Similar arguments have been advocated by Reinhart and Rogoff (2004) who claims that :
"*Officially-reported exchange rate itself is often profoundly misleading. One often gets a false picture of the underlying monetary policy and the ability of the economy to adjust imbalances. Official rate can be meaningless and far removed from the rate at which transactions take place."*

According to their research based on a comprehensive data set chronicling the exchange rate regime history spanning the period 1946-1998 for 153 countries, dual or multiple rates, and/or parallel markets were far more commonplace than it is commonly thought. Among industrialized economies: dual or multiple rates were the norm in the 1940s and 1950s, whist amongst developing countries the existence of parallel market remained relatively commonplace through the 1980s. Over the course of post-World War Ⅱ history, virtually every country has relied, at one time or another, on capital controls and/or multiple exchange rate systems.

By comparing the evolution of both the official and parallel exchange rates, they find the history of exchange rate policy is interpreted very differently when market-determined rates are used instead of official rates. They believe that in comparison to the official exchange rates, the data on market-determined rates to be reliable and generally far better indicators of the underlying monetary policy. The findings of their empirical analysis are positive and consistent with the argument that the monetary policy stance is better reflected in market rates.

Empirical evidence concerning the activeness of parallel (black) markets is abundant. Take the experience of Latin American for example. The chronic high inflation rates and corresponding current account deficits of these countries since 1970s has led to the

emergence of a strong black market for dollars, one that has become an integral part of the countries' infrastructure. Illegal parallel market has been a norm in most of Africa and South Asia, as well in several Latin American countries, especially through the 1980.[3] Shachmurove & Yochanan (1999) has reported that there are only 17 countries whose currencies are free from an internal black market. More evidences for a broader coverage of countries have been documented by Ghei, Kiguel, and O'Connel (1996).

Given the importance of the parallel markets in the history of most developing countries and also some developed countries, it is of great interest to study the behavior of parallel market exchange and as Reinhart & Rogoff proposed, to achieve better understandings of monetary and exchange rate policies and maybe shed light on the understanding of the official exchange rate market, especially in a period of increasing financial instability and greater integration of the world economies

In prior to defining the central questions of study, it is necessary to provide a brief outline of some basic concepts and stylized facts concerning the parallel market exchange rate

A parallel foreign exchange market system is one in which transactions are conducted at more than one exchange rate and at least one of the prevailing rates is freely floating, market-determined rate (Kiguel and O'Connell, 1995). The parallel exchange rate can emerge only when the government imposes exchange controls (on the volume of certain foreign exchange transactions or on the price at which such transactions are made) and such controls can affect the demand or supply for foreign currencies. As Kiguel and O'Connell summarise, although details vary from case to case, the development of parallel foreign markets normally follow two paths: the economy might start from a unified foreign exchange market and the authorities adopt an official dual exchange rate system in response to a balance of payments crisis. Alternatively, a parallel market might emerge gradually as the authorities impose restrictions on access to foreign exchange in an effort to maintain an overvalued exchange rate.

The parallel rate markets can be classified in a simple way based on its legality. A common dichotomy is dual exchange rate and black market system. The former type of markets are

[3] More evidences concerning the activeness of the parallel market for foreign exchange can be found in Edwards (1989) and Montiel et al.(1993).

legal in which most current account transactions take place at a pegged commercial rate, capital account transactions, on the other hand, at a market-determined financial rate and the parallel market is used to insulate the rest of the economy from the shocks of short-term capital flows. The latter case, an illegal, black market system normally emerges when private agents attempt to evade restrictions on the price or quantity of foreign exchange transactions. A black market system can coexist along with a dual exchange rate system but it is necessary to distinguish between these two types of parallel markets as the underlying monetary policies objectives are different in some aspects. It is obvious that the term parallel market is a broader definition encompassing the black market for foreign currency.

The difference between the two types of markets is well illustrated in Kiguel and O'Conell (1995), an insightful exploration of empirical evidence on parallel systems based on a World Bank study of eight countries-Argentina, Ghana, Mexico, Sudan, Tanzania, Turkey, Venezuela, and Zambia. As summarized in this paper, governments adopt dual exchange rate system as a transitional effort to limit the inflationary effect of a devaluation (Flood 1978, Lizondo 1987, Kiguel and Lizondo 1990), specifically, to deal with balance of payments crises, increase the effectiveness of monetary policy or to help unify the foreign exchange market, amongst which a balance of payment crisis is the most common case. On the long-term basis, some countries have adopted a dual exchange rate system using the parallel exchange rate to deal with short-term capital flows (Flood and Marison 1982). An official parallel market is also adopted aiming to unify the foreign exchange market as a transitional device. In most developing countries, black markets are commonplace due to the unanimously prevailing restrictions on capital account transactions in the official exchange market from the 1940s.

It is commonly believed that, whilst a dual system temporarily installed normally serve as part of an overall policy adjustment, the emergence of a black market often reflects systematic bias against devaluation of the official exchange rate (Kiguel and O'Conell 1995). By observing the black market evolution patterns of many developing countries, it is easy to notice that the expansionary monetary and fiscal policies is often associated with the rise of inflation rate, leading eventually to an overvalued exchange rate, the balance of payments gradually worsens. As well explained by Kiguel and O'Conell, in the occasions that the government is not capable of correcting this imbalance, it will then be forced to impose restrictions on the access to official foreign exchange which will in turn cause the expectations of maxi-devaluation or tightening foreign exchange controls in the market.

The demand for foreign exchange hence will increase as importers will be encouraged to accumulate inventory and the substitution behavior of domestic assets for foreign exchange will be promoted and hence the emergence of black market.

The degree of influence of the parallel rate and their effects on overall economic performance depend largely on the size of the premium defined as:

$$PMP = \left(\frac{PE}{OE} - 1\right) \times 100 \qquad (1.1)$$

where *PMP* denotes parallel market premium, *PE* denotes parallel market exchange rate and *OE* denotes official exchange rate.[4]

It has been advocated in numerous researches that the parallel market premium often serves as a reliable guide to the direction of future official exchange rate changes (Ghei and Kamin 1999). For instance, Kiguel and O'Conell (1995) suggest that a significant spread between black market and official rate may be a signal of macroeconomics misalignments. This is an interesting perspective to explore the dynamics and interactions between the official and parallel exchange rate markets.

Having established the key definitions and facts of parallel market exchange rate, we proceed to define the central questions of this study as well as the methodology employed as follows:

First of all, as a preliminary investigation, we regress a currency crash dummy on the 12-month parallel market premium in line with Reinhart& Rogoff (2004) for 37 countries across the globe during the period 1973 M01 to 1998 M12 based on Monthly data. Our empirical analysis will help to clarify if the parallel market premium can be a good predictor of official exchange rate realignments.

The main empirical analysis is concentrated on testing the long-run validity of PPP based on Johansen cointegration analysis. The monthly data is used for the nominal and official exchange rates, the domestic price indices (both wholesale and consumer price indices) during the sample period mentioned above. Two alternative models are investigated: the

[4] The definition adopted here is in line with Caporale and Cerrato (2006).

traditional weak-form and strong form PPP framework as well as a version of PPP model proposed by Diamandis (2003) accountable for the presence of both official and parallel exchange rate markets.

The purpose of the study is twofold: while the main objective is focused on testing the validity of long-run PPP in the recent float for a heterogeneous group of countries and whether the market-determined parallel rates receives more support of the long run Purchasing Power Parity as opposed to the official rate, we also investigated the nexus between the two rates based on a parallel market version of PPP employing standard cointegration techniques. It needs to be mentioned that the original dataset we employed includes 56 countries but has been reduced to 37 countries for the preliminary investigation and 34 countries for the examination of PPP based on the two main models.[5]

The structure of the thesis is outlined as below:
The introductory chapter proposes the motivation of the study, outlines the key concepts involved mostly for parallel market exchange rate, as well as summarizes the main purposes of study. The second chapter conducts a selective survey of the extant literature of relevance. Whilst a brief summary of the macro-fundamentals is provided, more emphasis is placed on the PPP literature and the studies on parallel exchange rate and of course, the connection between these two classes of work which facilitates our empirical analysis. Chapter three presents the methodology employed in the thesis and more specifically, the theoretical framework for each stage of analysis as well as the corresponding econometric approaches having been used. Chapter four reports the results of our empirical analysis and analyzes the findings. Finally, chapter 5 summarizes the empirical findings, concludes and attempts to discuss the policy implications yielded from the empirical analysis.

[5] The details on the choice of countries for empirical analysis are discussed in chapter 3.

Chapter 2: Literature Review

This thesis copes with the behaviour of the official and parallel market exchange rates, their interactions and, most importantly, whether the use of the black market rate is sensible, in order to obtain improved results, in the investigation of the role of exchange rates in economic life. As is obvious, in order to appreciate the necessity of using the black market rates, it is essential to provide an overview of the economic research that have been conducted, on the field of exchange rate economics, until now. Of course, as the literature in this area is quite vast, we are going to focus on the work that has been done in the most important model in exchange rate economies, the so-called Purchasing Power Parity (PPP, hereafter). This is the workhorse model, against which most of the other models are compared, especially models that have to do with estimation of the equilibrium exchange rate. Thus, in order to do that, a brief discussion of the most important fundamentals-based models of exchange rate determination is first provided. Then, the emphasis will be on PPP and the relevant empirical work on it. In the final section of this chapter, the parallel exchange rate advocators' work is to be discussed, something that can provide more evidence, in favour of using the black market rates in our models, instead of the official exchange rate.

2.1 Macro- Fundamental Based Models of Exchange Rate Determination

Determining the value of a currency, in terms of the units of another currency is one of the most discussed and researched topics in economic profession. For many decades now, economists are in a strenuous effort to construct and empirically verify models that are able to spot the exchange rate, be it the nominal or the real or the effective one. Since modern world is much more integrated, the international trades determines, in great extent, the wealth of the countries around the world and the misalignments of the exchange rates in any region can affect more than the countries where this phenomenon takes place. The study of the exchange rate remains a very active research area. In this section, some of the most influential models of exchange rate determination are discussed.

One of the earlier models in exchange rate determination is the so-called flexible price monetary model. It is widely used for the relevant empirical work, since its assumptions

and approach is fairly simple and straightforward. As is very well documented by MacDonald (2000), as well as Taylor (1995), the exchange rate here is determined by the interaction of the supply and the demand for two currencies. The level of the money demand is determined by the real income of the economy (y), the price level (p) and the nominal interest rate (i). So, denoting the foreign country's variables with an asterisk, the equilibrium level of money is given by the following equations,

$$\begin{aligned} m_t &= p_t + \kappa y_t - \theta i_t \\ m_t^* &= p_t^* + \kappa y_t^* - \theta i_t^* \end{aligned} \tag{2.1}$$

where the money supply on the left hand side of the equations is equal to the demand (as it is determined by the previously mentioned variables). It should be noted that this model assumes that the PPP principle always holds[6]. Since, PPP is represented by the following (logarithmic) equation

$$s_t = p_t - p_t^* \tag{2.2}$$

and, by using the previous three equations, it can be easily shown that the exchange rate, according to the flexible price monetary model is as follows:

$$s_t = m_t - m_t^* - \kappa y_t + \kappa^* y_t + \theta i_t - \theta^* i_t^* . \tag{2.3}$$

As it can be seen, the domestic money supply increase can lead to domestic currency depreciation (since the exchange rate is defined as the units of domestic currency for a unit of the foreign one), while the relative increase of domestic income has the opposite effect. Finally, the domestic interest rate resembles the behavior of money supply. Due to its simplicity, the flexible price monetary model was extensively used in empirical economic research but, due to the PPP assumption which is considered quite strong and restrictive, its popularity and success as a tool of economic research has declined.

Another important model, which has attempted to be more realistic, is the sticky price monetary model, as developed by Dornbusch (1976). The basic idea behind this model is that, since there is evidently a lag of responsiveness of the goods markets adjustment to changes in the money market, and then the overshooting phenomenon can occur in exchange rate market. If we assume a case of credit growth (that is, an increase in the

[6] Since we briefly present the major exchange rate determination theories, most of which are based on the PPP existence, we will not discuss PPP properties in details, until the relevant section of this chapter will arise.

supply of money), then there will be an overshooting behaviour of the short-term exchange rate, in order for the markets to equilibrate. Due to the fact that the financial assets market immediately reacts in such an effect, this can lead to higher prices in the good markets, while the excessive money supply would force interest rates to decrease. This would cause an outflow of capital from the domestic economy, forcing the national currency to depreciate (something that is equal to an increase in the price of foreign exchange). Of course, this would be a short-term event and, eventually, the long-term exchange rate will be lower than the one prevailing now. Thus, the case of overshooting, which is nothing more than the higher initial value of the exchange rate, compared to the long-run one.

Another strand of the exchange rate literature is the type of models, where the exchange rate is determined by economic agents, who follow a utility maximization behaviour. In this kind of models, inter-temporal budget constraints are used, while the agents are optimizers. In their implications, these models are similar to the flexible price monetary model, with the major difference of assuming the existence of representative agents' behaviour. Moreover, in brief, we should mention the so-called portfolio balance model, which, as is stated by Taylor (1995), their main feature is the lack of perfect substitutability of domestic and foreign assets. So, according to the policy decisions made by the monetary authorities, there would be the respective reaction by the economic agents, which in turn affects the level of exchange rate. As it has been shown in the literature, the empirical work on this type of models is rather limited and, mostly, unsuccessful.

Turning our interest to models which are extensively used in the relevant empirical work, it should be noted that there exist a battery of empirical models that are used to infer, regarding exchange rate behaviour. MacDonald (2000) provides an exhaustive exposition of these approaches. One of those is the capital-enhanced exchange rate (CHEER) model. Combining the concepts of uncovered interest parity (UIP) and the PPP, it can be said that this approach focuses mostly on the real exchange rate – capital account relation, while it neglects any effects stemming from any other determinants (such as output or net foreign assets). This approach can be useful, especially in the current economic framework, where the free floating exchange rates are followed by intensive financial and fiscal imbalances. Since, as is emphasized by MacDonald (2000), exchange rate misalignments coexist with such imbalances, the finance of these imbalances from the capital account seems to be a way to return to equilibrium.

A very popular approach for estimating equilibrium exchange rates is the Behavioral Equilibrium Exchange Rate (BEER) model, developed by Clark and MacDonald (1999). As previously, the UIP condition is the main building block of this approach, augmented with a risk premium factor. That is,

$$\Delta q_{t+k}^{e} = -(r_t - r_t^*) + \lambda_t \qquad (2.4)$$

where λ_t is the aforementioned risk premium factor. As is documented by MacDonald (2000), the BEER model is quite convenient in specifying the determinants of the real exchange rate and, usually, the real effective exchange rate is used in the relevant empirical literature. Based on the previously stated parity condition, the real exchange rate, according to BEER, should be

$$q_t = q_{t+k}^{e} + (r_t - r_t^*) - \lambda_t \qquad (2.5)$$

where q_{t+k}^{e} represents the long-run part of the real exchange rate. It is assumed that the most important determinants of this part of the exchange rate are the net foreign assets, the terms of trade and a factor representing the Balassa-Samuelson effect. A relevant modelling approach produces the Permanent Equilibrium Exchange Rate (PEER) model. It is nothing more that the decomposition of the real exchange rate into its permanent and transitory parts:

$$q_t = q_t^{P} + q_t^{T} \qquad (2.6)$$

with the two factors at the right hand side of the equation representing the aforementioned exchange rate parts. The permanent component is, then, considered to represent the long run equilibrium level of the exchange rate. In modeling this approach, several econometric techniques have been used, including decomposition techniques (like univariate and multivariate Beveridge – Nelson decomposition), structural VARs and cointegration approach.

The last two approaches are based on the notion of the internal and external balance, which is nothing more than the level of equilibrium exchange rate on which the economy achieves a level of output in accordance to a low level of inflation and unemployment, while the amount of net savings is capable of covering the current account imbalances. In this line of thought, Fundamental Equilibrium Exchange Rate (FEER) model is one of the most heavily used, especially from international organizations and governments. In order

to implement this approach, the most usual approach is to impose the necessary condition for internal and external balance on a calibrated macroeconomic model and extract from it the real exchange rate that is consistent with them. This would be the FEER. Another popular approach here is to set the current account equation equal to the one, with the relevant variables calibrated in these values that can verify the validity of the internal and external balance. Thus, once more, the real exchange rate that is computed in this way is the FEER. Although this modeling approach seems to have useful features for the policy makers, its implementation is not that simple or straightforward, since different types of problems can arise when it is applied (the most important of them the validity of the calibrations used to determined FEER). Also, speculative capital flows are not considered, rendering the model less realistic.

The last approach, using the concept of the internal – external balance, is the Natural Real Exchange Rate (NATREX) model. Again, this model assumes that the capital account imbalances should be covered by the net savings of an economy. In mathematical form, it is:

$$S(tp, nfa) - I(w, q, k) = CA(q, k, nfa) \tag{2.7}$$

with S representing savings, which are dependent on the rate of time preference and the net foreign assets. Additionally, investments are a function of productivity (w), capital stock (k) and the real exchange rate (q). NATREX is considered as a model producing both medium – term and long – term equilibrium, based on the behavior of the respective variables of the model.

Having completed this brief discussion of the major models and approaches for exchange rate determination, we are going to proceed to the analysis of PPP, which is the most important and most analyzed concept in international macroeconomics and finance.

2.2 Purchasing Power Parity

Purchasing Power Parity (PPP) theory has been the cornerstone of exchange rate models in international economics and also one of the simplest macro fundamental exchange rate models. It has been widely used to measure the equilibrium values of currencies and is often turned to by professions when it comes to measuring the misalignment of an

equilibrium exchange rate (MacDonald, 2007). Especially, the long-run validity of PPP has been posited as a long-run equilibrium condition for many dynamic exchange rate models[7]. PPP is so influential in exchange rate literature, that Dornbusch and Krugman(1976) has remarked: "Under the skin of any international economist lies a deep-seated belief in some variant of the PPP theory of the exchange rate".

The PPP exchange rate corresponds to the nominal exchange rate level such that the purchasing power of a unit of currency is exactly the same in the foreign country as in the domestic country, as long as it is converted into foreign currency at that rate (Taylor, 2003). The principle is built upon the Law of One Price (LOOP) which stipulates that the homogeneous good should cost the same worldwide once the currencies are converted at the market exchange rate (Bahmani-Oskooee and Hegerty, 2009). In its absolute version, LOOP may be formalized as:

$$P_{i,t} = S_t P_{i,t}^* \qquad i = 1, 2, \ldots, N \tag{2.8}$$

where $P_{i,t}$ denotes the price of the homogeneous good *I* expressed as the home currency at time *t*, the asterisks denote the corresponding foreign magnitude, S_t is the nominal spot exchange rate[8] at time t.

The mechanism that forces the absolute LOOP condition is based on the idea of frictionless goods arbitrage (Sarno & Taylor, 2002) which assumes that goods produced internationally are perfect substitutes, and there is no tariffs, trade costs, trade barriers such that transaction costs are negligible. In this case, the condition of no profitable arbitrage would ensure the equality of prices for homogeneous goods across countries.

Under this assumption, if there are n goods produced in each country, and each of these goods has as its counterpart a homogeneous equivalent in the foreign country, then by summing across the n goods a measure of the overall price level in each country may be obtained as:

$$P_t = \sum_{i=1}^{n} \alpha_i P_{i,t} \quad \text{and } P_t^* = \sum_{i=1}^{n} \alpha_i P_{i,t}^* \tag{2.9}$$

[7] Consult Abuaf and Jorion (1990), Dornbusch (1976) and Mussa (1982) among many others in this strand of the literature.

[8] The nominal exchange rate is expressed as home currency price of one unit of foreign currency hereby unless specified otherwise.

Where α denotes the weight used to aggregate the individual prices, $\sum_{i=1}^{n} \alpha_i = 1$ and the weights are assumed to be identical across countries.

Based on the previous analysis, the absolute version of PPP can be derived as:

$$S_t = \frac{P_t}{P_t^*} \tag{2.10}$$

Alternatively, taking the natural logarithms of the above mentioned variables, we end up with the following:

$$s_t = p_t - p_t^* . \tag{2.11}$$

Combining the absolute PPP with the real exchange rate definition as mentioned before:

$$q_t = s_t + p_t^* - p_t \tag{2.12}$$

Therefore, if the absolute PPP holds for a currency, the log of the real exchange rate would be independent of the nominal exchange rate and remain invariant.

Nevertheless, it is apparent that the presumptions made by the absolute PPP are rather unrealistic. First of all, the notion of perfect substitutability for most of the traded goods does not exist due to product differentiation across countries. Besides, the industry structure and development level vary across countries, therefore, it would be unreasonable for different countries to use the same weights for each specific good in constructing the aggregate price index. The absence of transaction costs also violates reality where we have tariffs, non-tariff trade impediments, customs duties, transportation costs and so on.

Apart from the absolute version of PPP, there is the relative version of it, presenting weaker conditions:

$$\Delta s_t = \Delta p_t - \Delta p_t^* \tag{2.13}$$

where Δ represents a first difference operator .

A long-lasting debate in economic profession is about the type of the price index that is most suitable for usage in PPP empirical work. Some of the earlier proponents of absolute

PPP argue for the use of only traded goods price in constructing PPP[9], whilst others support the use of a broader range of commodities in measuring the price level, with both traded and non-traded goods included[10]. Frenkel (1976) summarizes that using only traded good prices for PPP computation reflects an emphasis of the role commodity arbitrage plays, whereas the advocators of a broader price measure underpin the asset approach of exchange rate determination. In this light of thoughts, the wholesale price index (WPI) has been considered to be optimal for studies of PPP because of its higher proportion of traded goods. For instance, McNown and Wallace (1989) and Liu (1992) have shown using the CPI rather than the WPI causes PPP to be rejected. However, Wu and Chen (1999) arrive at the opposite result that PPP holds using CPI instead WPI. In our study therefore, both the consumer and wholesale price indices are used in the interest of clarifying the debate. Similar evidence has also been reported by MacDonald (1995).

The rapid development and advancement of the cointegration techniques, initially proposed by Engle and Granger (1987), has enabled the recent cointegration and unit root-based test of the PPP hypothesis which has concentrated on the application of cointegration methods to an equation such as

$$s_t = \alpha + \beta_1 p_t + \beta_2 p_t^* + \varepsilon_t \qquad (2.14)$$

where s_t, as mentioned before, denotes the nominal exchange rate whilst p_t and p_t^*,the home and foreign price level respectively, all measured in natural logarithms. Also, α denotes a constant term and ε_t a random error term. In particular, weak-form PPP (MacDonald,1993) exists if s_t, p_t and p_t^* are I(1) series , and ε_t is found to be I(0) ,i.e., stationary. Furthermore, if the joint symmetry/proportionality condition holds for the coefficients, which requires $\beta_1 = -\beta_2 = 1$, then the so-called strong form PPP can be found existent with the specification:

$$s_t = \alpha + p_t - p_t^* + \varepsilon_t \qquad (2.15)$$

The strong-form PPP is often assumed implicitly for the unit root test based test of PPP to examine the existence of unit root in the real exchange. The real exchange rate has been defined in equation (2.12):

$$q_t = s_t - p_t + p_t^* \qquad (2.16)$$

[9] See, inter alia, Angell (1922) and Viner (1937).
[10] Cassel (1928), Samuelson (1964)

A number of researchers[11] have applied different variants of unit root tests to examine the properties of the real exchange rate. If a unit root is found for real exchange rate, then the strong-form PPP is rejected. An excellent summary of the empirical evidence on the weak and strong form PPP is provided by MacDonald (2007). In there, the author presents findings in favour of the weak-form PPP. Nevertheless, it seems that the implied mean reversion of real exchange rate is painfully low. Despite the potential short-run variation, an important condition for long – run validity of PPP is the real exchange rate to be stationary over time. If the opposite holds, the nominal exchange rate and the price differential will permanently tend to deviate from each another. Based on these ideas, it is reasonable to apply stationarity tests to real exchange rate data, in order to examine them for long-run purchasing power parity.

In this section a set of basic concepts and definitions of the PPP proposition have been illustrated and the next section proceeds to discuss a selective of recent empirical evidences, researching the validity of PPP and the emphasis is placed on the long-run perspective.

2.3 PPP – Empirical Evidence for Official Exchange Rate

Since PPP proposition is so influential in the construction of models in international macroeconomics and finance, it is reasonable to find out that the relevant empirical work on this topic is voluminous. Many economists coped and still work on topics that include the econometric analysis of PPP, as one of their major research area. A wide range of econometric techniques have been used, while the framework has followed the evolution of the advances in econometric tools and the computational abilities of modern economists. Since it is a laborious task to include every piece of research conducted on PPP here, we will try to remain selective and discuss some of the most important papers, with special emphasis given to the long run implications of the PPP model.

Much of the PPP literature has been summarized well by Sarno and Taylor (2002) and Taylor and Taylor (2004), who concentrate on specific issues, highlighted by the wide range of previous analyses performed, mainly for industrial countries. Of course, the PPP

[11] see, for instance, Roll (1979); Darby (1980); MacDonald (1985); Enders (1988); Mark (1990).

research was not limited to industrial countries. It, rather, covers almost every country in the world, depending on the focus of each piece of research.

In order to facilitate the analysis, we first consider the so-called “early evidence” on PPP. That is, empirical estimates conducted, mostly, in the 1960s through to the 1980s, and then proceed to consider more recent empirical tests that largely, but not exclusively, rely on unit root and cointegration testing.

The initial efforts to empirically challenge the hypotheses of PPP focused on estimations of models that follow similar specifications to the equation (2.14), above. Additionally, some of these papers have imposed restrictions in the model, of similar fashion as those discussed in the previous section of this chapter. Regarding the relative version of PPP, the models that were used were of similar type, with the major difference to be in the use of differenced variables and not variables in levels. One major drawback of these studies was the neglect from the economists of any possibility of dynamic behavior in these models. Thus, the first studies had a static representation. Probably, this was one of the main reasons that these works failed to support the PPP hypothesis. Moreover, it should be also noted the ignorance of the very important issue of stationarity from the researchers, which was also a major problem with these pieces of work.

As is evident, the next natural step in the empirical work on PPP involved the usage of the newly developed approaches for testing the existence of unit roots in the series under consideration. Most of the papers, in this case, used to test the real exchange rate for its stationary properties. If they were I(0), this would be a clear evidence of long-run validity of PPP. Here, the models were similar to the equation (2.12), described right above. The most popular tests employed here are the well know ADF test and the Phillips – Perron one. In their paper, Sarno and Taylor (2002), another popular means of examining the stationarity properties of the series was the variance ratio test, calculated as below:

$$z(k) = \frac{1}{k}\frac{Var(q_t - q_{t-k})}{Var(q_t - q_{t-1})} \qquad (2.16)$$

where k is a positive integer and Var stands for variance of the difference between the current value of the real exchange rate from its lag. It is assumed that whenever this ratio is equal to one, then the real exchange rate follows a random walk process. Whenever its value is below one and above zero, then it should have a unit root. A final approach here

was the examination for fractionally integrated series, a technique allowing for the series to be able to follow many different processes (ARMA etc.), according to the respective specification. Even though the econometric modeling was increasingly sophisticated, the econometric results remained poor and against the PPP hypothesis. Especially for the case of long-run PPP, the mean – reversion concept for the exchange rate was strongly rejected, in particular, for developed economies.

Before proceeding to the discussion of the use of cointegration for PPP testing, it should be noted that the unit root testing discussed above was conducted in, mainly, time series dimension. This could be a disadvantage and, for this reason, many researchers extended their research portfolio to the usage of pane unit root tests. In this way, they aimed in increasing the power of their test and, thus, the possibility for favourable results. One of the most important studies here was conducted by Abuaf and Jorion (1990). But, again, even though the results were improved, still there is no unanimous acceptance of the PPP proposition. Nevertheless, the aforementioned authors indicate that the results might fail to work in favour of purchasing power parity, but this should probably be mainly attributed to the inability of the econometric tools to verify their existence and not that much to the inaccuracy of the assumptions underlying them.

Finally, cointegration techniques are widely employed in studying PPP, especially the Johansen methodology. In general, their results are again discouraging, especially in the case of the long run validity of the strong-form PPP. On the other hand, these studies of the long run relation between the real exchange rates and the price levels revealed some interesting aspects, for the international financial arrangements. First of all, the results were in accordance to the PPP existence for specific historical periods, namely the interwar period, while it seems to hold in the case of countries with high inflation. Additionally, it was found that in periods where fixed exchange rate regimes prevail, it is common to reject the case of cointegration. What is very important here and of special interest for this thesis is the fact that there is strong evidence in favour of PPP, in these cases where the wholesale price index (WPI) is used as a proxy of the price level, compared to the usual consumer price index (CPI). In the econometric analysis that follows in the next chapters, our analysis is implemented by using both price indices. This is done for reasons of comparability, as well as for robustness check.

A final strand of the empirical literature on PPP involves the use of data for very long time periods, the so-called long span studies. The logic behind this is that in order to capture the mean reverting properties of the real exchange rates, it is necessary to study periods involving data for many years, since the whole process of long rung adjustment is a slow one. On the other hand, there is intensive criticism on these kind of studies, since the investigation of data for such long periods involves many imperilments, such as the existence of structural breaks on the series, stemming from any kind of macroeconomic or financial shock, or because of the frequent changes in the exchange rate arrangements of many countries (especially less developed countries, which have gone through tough periods of financial instabilities and currency and balance of payment crises).

It is interesting to note here that for most of the PPP studies, the focus is on developed economies, with only minor coverage of developing economies. But, as Balhmani – Oskooee and Hegerty (2009) emphasize, the PPP concept is quite important for less developed economies, for a number of reasons. Above all, it provides a better indicator for living standards comparison, especially in poor , labour-endowed countries, than measuring it in monetary terms (for instance, in dollars). But even in this case, the effectiveness of the econometric techniques that we analysed before, is limited in the case of these countries. Only in African countries, it seems to have encouraging results. The authors discuss a number of reasons where this failure can be attributed, some of which have to do with the analysis per se (similar justification as the one previously provided) and the data quality. Nonetheless, it is useful to examine the relevant studies, concerning developing countries, in order to ascertain whether PPP can actually contribute to a better understanding of these economies.

Moreover, a common characteristic of the aforementioned empirical studies is that they have all employed official exchange rates in testing the PPP. In the introduction chapter we have documented the existence, activeness and even prevalence of the black (parallel) market for foreign exchange in most developing countries during the recent float. The data availability of the black market exchange rate has intrigued yet another group of studies which holds the viewpoint that PPP receives relatively more support when parallel market exchange rates are used in testing the theory as opposed to official rates. The rationale behind this class of studies rests on the belief that while the official exchange rates suffer from the influence of various non-market driven factors such as the central bank

intervention and is often fixed by the monetary authorities, black market rates can be closer proxies of the floating exchange rate since they are market determined so that the band of fluctuations is much wider. Such flexibility in black market could yield empirical support for PPP due to the fact that PPP hinges on such flexibility to facilitate the spatial arbitrage process which is the fundamental building block of LOOP. The empirical work conducted for this purpose can be traced back to Culbertson (1975) and Phillip (1988) while recent studies are Luintel (2000), Kouretas and Zarangas (2001), Nagayasu (2000), Bahmani-Oskooee and Goswami (2005) among others. Further discussion on parallel market exchange rate fuelled study for PPP is provided in the following section, where a selective survey of recent literature on the behaviour of parallel market exchange rate is conducted.

2.4 A Selective Survey of Literature on Parallel Market Exchange Rate

As mentioned in the preceding section, we will examine the extant literature concerning the parallel market exchange rate based test for PPP but our survey does not limit to this scope. Rather, we would like to provide a full account of the extant literature concerning the behavior of parallel market to exploit broader perspectives that the studies of parallel market exchange rate can offer.

The studies are presented and discussed, according to their main focus. For this reason, this section is divided to further subsections, in order to facilitate the presentation of the relevant literature. First, some theoretical work is discussed, while applications concerning parallel market rates follow.

2.4.1 Theoretical Models

One of the core issues being largely concerned in the theoretical literature is to address the determination of the black market exchange rate and more importantly, its premium. Diamandis and Drakos (2005) have conducted a comprehensive survey of the alternative models on this topic and have divided them into three categories.

According to the previously mentioned authors, the first class of models is the so-called real trade models. It emphasizes the transactions demand for foreign currencies. The

demand for foreign currency is determined from a number of different activities. These are the purchase of illegal imports, the supply of foreign currency derived from illegal sources such as smuggling and under-invoicing of exports. The aforementioned determine the formulation of the black market for foreign currencies.[12] The second strand of models is built upon the monetary approach to the determination of exchange rate. This class of models assumes that the official foreign exchange market satisfies the demand of foreign currencies stemming from the international purchases of goods while the demand of black currencies is generated by the agents' needs to alter the portfolio composition. It pays particular attention to the importance of the monetary factors on the behaviour of the parallel market.[13]

The final set of models, namely, the portfolio balance models combines the features of both theoretical literature strands, mentioned above. They are considered as the foundations of the recent theoretical models on the determination of black market exchange rate. This type of model was initially developed by Dornbusch *et al.* (1983) and subsequently extended by Phylaktis (1991). In Dornbusch *et al.* (1983), the black market is treated in a partial-equilibrium stock and flow framework. Specifically, the stock demand for black dollars arises as the result of portfolio diversification of agents and the flow market arises as the result of international trade ,both reported and unreported.

The portfolio balance models consider that at any point in time, the black market rate is determined by the effects of foreign exchange rate restrictions conditions in the asset markets whilst both the black market and official exchange rates are affected by the current account. It also claims that in the long-run, the black market exchange rate depreciates in the same proportion as the official rate which will give a constant or stationary black market premium eventually. Regarding to the determination of the premium, they suggest that the current level of black market premium is influenced by the expectation of future exchange rates when rational expectations are presumed whilst in general, the level of the black market premium is determined by the official real exchange rate, the official, depreciation-adjusted interest differential, as well as seasonal factors associated with tourism. It is noteworthy that in the Dornbusch *et al.* (1983) model, portfolio preferences are assumed to be constant, it is however conceivable that the preferences might shift over

[12] See Sheikh (1976, 1989) and Pitt (1984) for example.

[13] Studies of this type includes Blejer (1978); Gupta (1980); Van den Berg and Jayanetti (1993); Kouretas and Zarangas, (1998); Kouretas and Zarangas, (2001) among others.

time, which would widen the premium.

In Phylaktis (1991) paper, the previously analysed stock flow model is extended, taking into account restrictions on foreign exchange for the international trade and capital transactions. Here, the black market exchange rate is considered as part of a portfolio, which is determined by the fixed local and international interest rates, the official exchange rate, the foreign restrictions on global transactions and the local currency value of non-dollar assets. Changes in the financial markets induce a jump in the premium and a following adjustment for the stock of dollars and the premium, respectively. As a case study here, Chilean exchange rate market is studied and an error correction model is fitted to the previously described theoretical framework.

A modified version of the Dornbusch *et al*. (1983) model, in order to examine the behaviour of the black market rate in a wide number of countries, is formulated by Fishelson (1988). The modifications consist of a substitution of black market rate of change from the official rate, as a potential devaluation expectations' formulator. Moreover, the Fisher equation is used, so that the domestic interest rate is calculated according to the former. In this way, the author suggests that black market premium is negatively affected by the real official rate while, on the same time, there is a positive effect from expected profits from taking long positions in the foreign exchange market. The empirical approach of Fishelson's model to nineteen (developed and developing) economies, indicate that the black market exchange rate behaviour can be uniform, irrespective to the distinctive (economic, political, social) characteristics of each economy.

A model, where the parallel market rate is preferable for the formation of monetary policies, compared to the official exchange rate, is presented by Ghei and Kamin (1996). The authors support the view that, in countries where black market has a prevalent size on the transactions volume, it could be in the interest of the local governments to employ the black market rates in their monetary framework, compared to the official one. In their work, the researchers provide a narrative approach in this concept, providing definitions and descriptive statistics for the prevailing conditions in the economies with strong black markets. As expected, most of them are developing economies from Latin America, Africa and Asia. The parallel market premium ranges quite a while, from as small as around 5% to Venezuela, up until almost 270% to countries like Algeria and Zambia. Getting to their

model details, it is a simple small open economy model, with two goods produced (one domestic and one non domestic), with fixed prices equal to unity. There is also a non-traded good, the output and price of which are also fixed. There are no distortions to international trade (like trade barriers or tariffs) and the monetary and fiscal policies are at their long run sustainable levels. It is also assumed that the official exchange rate is overvalued, compared to the equilibrium rate. Hence, the flow demand for dollars (it is Thetaken as the only international currency in this model) is higher than the flow supply. The model is of the usual stock-flow framework, where the parallel rate is the one covering the excessive demand for the international currency. For any value of the official exchange rate **e**, a specific parallel market rate $\mathbf{e^p}$ would equate the demand and supply of dollars in the market's equilibrium. In functional form, this would be:

$$D(e^p) = \phi X + OS(OX) \qquad (2.17)$$

The left hand side of this equation depicts the demand for dollars, while the right is the supply. The latter is determined by the share of exports (X) proceeding through the parallel market, while OS is the official dollar sales to importers. Since the aforementioned is a function of the official exchange rate (e), the central bank's decision on the official exchange rate setting would affect the equilibrium value of the parallel market exchange rate.

A study that is not explicitly theoretical but is interesting for the analysis of the black market exchange rates is the one by Akgiray *et al.* (1989). In this paper, the authors use statistical techniques, in order to examine the distributional properties of the parallel market exchange rates. The examination takes place for twelve Latin American economies, for the period April 1973 to April 1983. Using regression techniques, the authors estimate the values of stable Paretian parameters for the countries' exchange rates under examination. Based on these results, the authors indicate that, for most of the cases, the black market exchange rates means and variances may be undefined. Moreover, half of the series examined are positively skewed[14].

[14] In line with the analysis here, Grosse (1992) analyze the black market exchange rate market of Colombia. In his paper, the author provide a well rounded account of the basic features and the reasons for which, in most of the Latin American countries, black markets of foreign currencies exist.

2.4.2 The Nexus between Parallel Market Premiums and Official Exchange Rate Policies

Given the wide acceptance in the literature of the linkage between the parallel market premium and expected currency devaluation, it is natural to explore the nexus between the parallel market premiums with the fluctuations of official exchange rates.

It has been documented in numerous studies that the parallel market premium often serves as a reliable guide to the direction of future official exchange rate changes (Ghei and Kamin, 1999). For instance, Kiguel and O'Conell (1995) advocates that a significant spread between black market and official rate may be a signal of macroeconomics misalignments.

In the extant literature, the most comprehensive dataset to date and explore the history of parallel markets and exchange rate policies is employed by Reinhart and Rogoff (2004) .Their monthly data for official and market-determined exchange rates covers the period 1946 to 1998 and their sample consists of 153 countries. They hold a belief that the data on market-determined rates are reliable and, generally, far better indicators of the underlying monetary policy than the official exchange rates. In order to illustrate this argument, they regress a currency crash dummy on the parallel market premium for each of the developing countries in their sample. Their results indicate that the coefficient on the parallel premium is positive and in accordance to the viewpoint that the monetary policy stance is better reflected in market rates. The estimated coefficients on the market-determined exchange rate are positive and consistent with the argument that the monetary policy stance is better reflected in market rates in almost all cases. In the thesis, we conduct a preliminary analysis using the same approach and obtained very similar findings to Reinhart and Roggoff (2004). They will be further discussed in Chapter 4.

A somehow related piece of research is the one by Blejer (1978). Here, the author studies whether the governmental interventions to the black market exchange rate market can have undesirable effects to the implemented macroeconomic stabilization policies. The empirical study is conducted for three Latin American Economies (namely, Brazil, Chile and Colombia). More precisely, the effects on the demand for money are estimated. According to the results, the money demand is negatively affected by increasing

expectations of black market rate depreciation, while the inflation rate effect on money demand is overestimated (when the black market proxy is not included in the model).

2.4.3 Empirical Investigation of Basic Stock – Flow Model

A plethora of empirical work examines the theoretical framework, developed by Dornbusch *et al.* (1983). Some of the most important papers are discussed here.

To begin with, Caporale and Cerrato (2008) examine the potential factors of the formulated black market premium for a number of developing economies. The authors suggest that the cointegrating coefficient would change over time and drift away from the unit value implied by standard portfolio balance models. They test the proportionality restriction using a panel Wald test to examine the unity restrictions imposed on the cointegrating coefficients. Furthermore, they have investigated the short-run dynamic adjustment between the two types of exchange rate by the means of estimating impulse response functions using bootstrap methods.

They employ monthly data from January 1973 to January 1998 on both black market and official exchange rates for six emerging market economies, namely, Iran, India, Indonesia, Korea, Pakistan and Thailand.

The risk premium is modelled as a function of inflation (I) ,expected devaluation(E) (10-year bond yield differential between the domestic country and the United States , and dummy variables to account for capital controls (D),which takes the value of one when markets are not unified and zero otherwise .The back market premium is formalised as below:

$$P_t = a_0 + a_1 I_t + a_2 E_t + a_3 I_{t-k} + a_4 E_{t-k} + a_5 D_t + u_t \qquad (2.18)$$

They have obtained statistically significant coefficients for the lags of inflation and expected devaluation with the latter correctly signed (i.e., positive, implying that an expected devaluation leads to a rise in the premium). Overall, their empirical analysis suggests that there exists a long-run linkage between the black market and official rates. But the proportionality restriction is rejected, indicating that the adjustment towards equilibrium in response to short-run shocks is incomplete. The short-run analysis has

confirmed the partial reversion to the long-run equilibrium and demonstrates that the initial overshooting does not totally fade away. It is also concluded by the authors that capital controls and expected currency devaluation have a positive impact on the size of the premium, whilst the impact of inflation receives weaker evidence.

Using monthly data, from 1985 to 1989, for seventeen developing economies, Shachmurove (1999) aims to provide evidence for the potential economic factors, determining the black market exchange rate premium. The model for this research is estimated, using pooled OLS regressions, including dummies able to capture the effect of tourism on these economies, as well as seasonality of this effect. The obtained results are in strong accordance with the theoretical framework. The premium is positively affected by the interest rate differentials, as well as from the assets value. On the other hand, the dummies are not significant.

2.4.4 Modeling Cointegrating and Causal Relationships between the Official and the Parallel markets exchange rates

By means of cointegration and error-correction modeling techniques, several recent studies have attempted to determine the convergence of the black market exchange rate and the official exchange rate. Additionally, the potential causal interconnections are examined. For instance, Akgiray *et al.* (1989) use monthly data and the simple Granger and Sims test to find that the two rates Granger cause each other in the short-run. According to the Granger Representation theorem[15], if two non stationary variables are cointegrated, then their vector autoregressive representation can be expressed as an error correction mechanism. Therefore , if the causality runs from the official exchange rate to the parallel market exchange rate, it implies that past information on the official exchange rate can be used to systematically forecast the black market exchange rate and vice versa.

In this light of thoughts, empirical work on the joint dynamics of the official and parallel market exchange rates has paid particular attention of the issue of market efficiency, or alternatively, whether agents are able to use information from one exchange market to predict the future path of exchange rate in the other market. There is a growing amount of studies conducted, using this approach (for instance, Booth and Mustafa 1991, Agenor and

[15] See Engle and Granger(1987) for details.

Taylor 1993).

Moore and Phylaktis (2000) examine the efficiency of black and official exchange markets in seven Pacific Basin countries for the period January 1974 to June 1993. They suggest that, for the existence of information efficiency in the black market exchange rate, the black market and official exchange rate must be cointegrated with a cointegrating parameter one. Otherwise, the two rates would drift arbitrarily far apart so that position takers would be able to attain arbitrage profits without any obvious upper bound.

On the other hand, Baghestani and Noer (1993) investigate the case of India, using the Engle–Granger cointegration technique. Their dataset consists of quarterly data over the years 1973–1990. According to their findings, the black market exchange rate and the official rate between the Indian rupee and the U.S. dollar are cointegrated. Whilst their study focus solely on the long-run relationship between the two rates, Agenor and Taylor (1993) use monthly data over the period 1974–1986, in order to examine the case of nineteen developing countries. The Johansen's cointegration technique is employed to establish cointegration between the two exchange rates. Also, an error-correction model is used to detect short-run causality between the two rates. Although they manage to establish cointegration in 14 out of 19 countries, no clear pattern, concerning the direction of causality between the two rates, has been demonstrated. The authors argue that the lack of such a systematic pattern among countries might be due to the divergent nature of exchange rate policies, pursued by the different countries. Similar results were obtained between the parallel and official rates in seven Asian countries by Phylaktis and Kassimatis (1994), in four East European countries by Dockery and Taylor (1997), and in four Latin American countries by Kanas and Kouretas (2002).

Kouretas and Zarangas (2001) examine the case of the Greek black market rate and whether PPP holds for the Greek drahma – US dollar exchange rate. In order to complete their analysis, they use a number of cointegrating and stationarity techniques. More precisely, the Johansen - Juselius approach in cointegration is their workhorse model. The authors identify a long run relationship between the official and the black market rates, as well as between the parallel market rate and the respective price levels. This is an indication that PPP holds in the long run. Moreover, the error-correction representation reveals that the black market rate is more sensitive to macroeconomic shocks and adjusts

fast to the long-run level. Of course, it should be mentioned here that these conclusions are robust and evident of the period, prior to the adoption of the common currency and, even more important, before the establishment of the EMU.

Diamandis (2003) has also attempted to address the informational efficiency issue based on monthly data of four Latin American countries, namely, Argentina, Brazil, Chile and Mexico. They employed Johansen's full information maximum likelihood multivariate cointegration technique to test the hypothesis of a joint structure implying both long-run strong-form PPP for parallel market rate and the long-run informational market efficiency. The hypothesis cannot be rejected for all 4 countries under examination, validating long run informational efficiencies for the countries of interest. It is noteworthy that they have used the parallel market exchange rate in testing the PPP proposition. The variant of PPP formulation they provide has incorporated the presence of both official and parallel market. It has been employed in the thesis as an alternative of the traditional cointegration-based test PPP. Since the theoretical framework has been described in detail for their work, the details of this work will not be reviewed here.

Diamandis (2003) falls into the group of literature which relies on parallel or black market exchange rate in testing the PPP proposition. As mentioned in section 2.3, proponents of this approach believed amongst researchers of parallel market exchange rate that PPP receives relatively more support when parallel market exchange rates are used in testing the theory as opposed to official rates. The official exchange rate is often fixed by the monetary authorities whilst the parallel exchange rates price of foreign currency in the black market is expected to be determined mainly by 'market forces', so it can be closer proxies of the floating exchange rate[16].

The Balassa-Samuelson hypothesis is empirically tested, using black market exchange rates, by Bahmani-Oskooee and Gelan (2006). The empirical work is conducted for three countries (namely, Chile, Colombia and Costa Rica) and it is one of the first papers employing parallel market rates to examine the productivity bias hypothesis. They argue that, in these cases where strong black markets exist, it makes sense to use these rates in such empirical examinations. The main reason is the much faster adjustment of these rates

[16] Studies examining similar issues are those from El-Sakka and McNabb (1994), Baghestani (1997), Sanchez-Fung (1999), Cerrato and Santantis (2007).

to foreign exchange adjustments, compared to the official ones. The cointegration modeling results indicate the usefulness of this approach, in the cases underlined before.

In their effort to provide further evidence in favour of the existence of cointegrating relationship, between the official and the parallel exchange rates, Bahmani-Oskooee and Goswami (2004) employ the Johansen modelling framework. Their dataset is quite large, covering 31 developing economies, for a period of forty years (1955 – 1995). Beyond this, they also proceed to an investigation of weak exogeneity of the above mentioned rates. According to these authors' work, the existence of long run relationship between the two exchange rates is verified, for most of the cases examined. On top of that, they also managed to pinpoint the fact that black market rates are weakly exogenous to the official rate (for eight out of fifteen cases examined). Based on this outcome, their argument is that black market rate is actually the rate leading the exchange rate market and, as a consequence, the adjustment policies followed by central banks in the exchange rate market.

Two other papers, aiming to provide an answer on the formulation of the money demand function of countries with parallel exchange rate markets, are those from Bahmani – Oskooee and Tanku (2006) and Bahmani – Oskooee (1996). In the latter, the author examines the case of the Iranian economy, using the Johansen – Juselius cointegration analysis and the exclusion test. Annual data, for the period 1959 – 1990, are employed for the money supply, the real GDP, the price level and the exchange rate (official or black market, depending on the specification) of the Iranian currency vis-à-vis US dollar. The outcome of this work is the suitability of the parallel market rate, as the exchange rate to be used in such empirical applications.

In Bahmani – Oskooee and Tanku (2006), the previous estimation is conducted for 25 countries. This time, the bounds testing approach to cointegration and error correction modelling is used. The analysis is completed for countries from different regions (Latin American, African and Asian economies). Based on this work, a general conclusion cannot be reached. The use of the official or the black market rate is a country – specific feature,

while there are cases where the parallel market premium is the most useful proxy for the estimation of the money demand function.

Chapter 3: Methodology and Econometric Approach

The thesis presents an empirical analysis of the parallel market exchange rate behavior in the post-Bretton-Woods era in 56 countries across the globe. The purpose of the study is twofold: while the main objective is focused on testing whether the market-determined parallel rates is more supportive of the long run Purchasing Power Parity proposition than the official rate, we also investigated the nexus between the two rates based on a parallel market version of PPP employing standard cointegration techniques.

Monthly data spanning the period 1973m01 to 1998 m12 have been employed in the analysis. The variables of interest, as suggested by standard PPP formulations, include the official and parallel nominal exchange rates, the price indices of domestic countries and those of the United States as U.S dollar is used as the numeraire currency. For the price indices we employ both Consumer Price index (CPI) and Wholesale Price index (WPI). As is well known, the building block of PPP is the Law of One Price which relies crucially on the activity of goods arbitrage. It is more natural for wholesalers to take advantage of price differences across countries hence are more capable to engage in the goods arbitrage process (MacDonald, 2007). Therefore, it has been advocated in the literature that in comparison with CPI, WPI gives a more accurate measure of the prices of traded goods (see Sánchez-Fung 1999 for example). We want to use both indices to test the PPP hypothesis to provide a more comprehensive coverage of results and for countries where the WPI are not available; we use CPI solely in the investigation.

The consumer price indices are abstracted from IMF International Financial Statistics (IFS); line 64 whilst the wholesale price indices for most countries are obtained from Datastream. The nominal exchange rates are accessible from IFS, line rf. The monthly data on parallel market exchange rate are sourced from *Pick's Currency Yearbook* (various editions) and provided by my thesis supervisors[17]. This was an annual outlook of the macroeconomic conditions of several countries around the world. It also included monthly data on the black market exchange rates of these economies. Moreover, the parallel market premium (vis-à-vis the official exchange rate) of the economies' currencies towards US dollar is also incorporated in this yearbook. This edition ceased to get published on 1998. As is obvious,

[17] Later, it was renamed to World Currency Yearbook but is still well known as Pick's.

this is a serious obstacle, in order to extend the empirical analysis beyond the end of 1998. Apart from this, it is reasonable to assume that the importance of the parallel exchange rate markets becomes less and less crucial, with the global economic and financial integration. Additionally, the wide range of sources and the ability of economic agents to absorb the necessary funds from official channels and the increasing reforms and tighter monitoring and regulation of the exchange rate markets render such illegal activities obsolete (at least for the majority of the economies around the globe).

The data on parallel rate from the first month of 1973 to the last month of 1998 are available for the 56 countries under examination, however, due to the lack of consistent price indices and inactivity of parallel market, a number of countries are precluded and a subset of 34 countries have been employed for the estimation of the two variants of PPP models we aim to investigate and assess. According to their geographical distribution, these countries are divided into 4 groups, namely, African economies (6 countries), Asian Economies (13 countries), the Western-developed economies (1 country) and Latin American economies (14 countries).

3.1 The currency crash dummy model

3.1.1 The theoretical framework

Prior to illustrating and testing the two PPP model specifications briefly introduced in Chapter 1, we intend to provide some extra evidence in favor of the importance of the parallel market exchange rate, as a tool to evaluate monetary and exchange rate policy implications for a country. In order to do that, the model suggested by Reinhart and Rogoff (2004) is employed. In what follows, a brief discussion of the model is provided, while the econometric approach on estimating it for our sample of countries is presented afterwards.

In their effort to develop a system of historical exchange rate classification regimes, Reinhart and Rogoff (2004) use a dataset consisting of parallel or black market exchange rates for a wide number of countries, both developed and developing. They emphasize the importance of distinguishing between the official exchange rate and the unofficial one, providing evidence that the parallel rate is beneficial, when it comes to use it as a benchmark of the followed monetary policy from the governments. Indeed, as they

support, it offers interesting insights in the forthcoming state of the monetary stance, as well as it can work as a kind of leading indicator for the transformations of this policy. Moreover, using the market-determined exchange rates, the authors justify that the classification of the different monetary regimes that were followed by different countries are not really the ones declared, when the economic profession uses the official rates for this classification. Results are substantially different, when the black market exchange rate is in use. In brief, it can be said that, according to the authors, the most popular exchange rate regimes are the pegged one, together with the crawling peg one. They also formalize a new kind of exchange rate regime, the so-called freely falling, which is the case for the countries for very high annual inflation level.

In this line of thought and, based on the modeling approach of the previously mentioned authors, we intend to empirically examine the importance of studying the market exchange rates. In this way, it can be justifiable the use of these rates, both for policy implications analysis, as well as for the examination of the linkages and relation between these two rates. Their approach is rather straightforward and involved the estimation of a simple model, where the parallel exchange rate acts as a potential predictor of the official rate's realignments. In order to do it, the following model is employed:

$$D_{ot} = \alpha + \beta \Delta P_{t-i} + u_t \,. \qquad (3.1)$$

Here, the independent variable is the 12-month change of the parallel exchange rate premium (that is, the market exchange rate, α is the intercept of the model, while D_{ot} is a dummy variable, created based on the official exchange rate. What this dummy represents is the cases of currency crashes in each country. According to the definition we use, a currency crash takes place when the value of the official rate depreciates, at least, by 15%[18]. The choice of the cut-off point for the currency crash dummy is based on the vast literature of early warning indicators of currency crises and, more specifically, on the literature of indicators of sudden changes in exchange rates. Since the choice of the depreciation that indicates a currency crash is rather arbitrary [for instance, Frankel and Rose (1996) opt for 25% change, while Kraay (2003) for 5% to OECD and 10% otherwise], we believe a value somewhere in the middle can work in the current framework. Hence, the currency crash dummy takes up the value of 1, in case of

[18] In their paper, Reinhart and Rogoff (2004) use a slightly different definition of the currency crash, where they distinct between severe and mild currency crashes. In any case, for our empirical investigation, the adopted definition of 15% depreciation suffices.

depreciation higher than 15% and zero, otherwise. Based on this model, it can be said that, if we expect to find a significant relationship between the parallel exchange rate returns and the official rate, then the beta in the aforementioned model should be significant and positive. Otherwise, we do not really validate a connection between the two rates. If our results will be in line with those of the authors, then we should expect the results to be in favor of the existence of the relation between the two exchange rates. Hence, it is fruitful and interesting to approach the modeling framework, by using the parallel market rate, which is the one influencing the formation and future development of the official exchange rates. This is the value added of providing the potentially favorable evidence from the currency crash model.

3.1.2 The Econometric Approach

A binary probit model is implemented for the investigation and the econometric approach employed is illustrated in the following subsection. As is well established, it is, first of all, necessary to check the stochastic properties of the time series data we employed. In order to conduct the econometric analysis without the potential risk of spurious regression, the order of integration of the series is assessed using the conventional Augmented Dickey-Fuller (ADF) test.

In brief, this is an extension of the original Dickey-Fuller test, for taking into account cases, where the series under examination follows an autoregressive process of higher order than one. Thus, the regression for the test is

$$\Delta y_t = \alpha y_{t-1} + x_t^{'}\delta + \beta_1 \Delta y_{t-1} + \beta_2 \Delta y_{t-2} + \ldots + \beta_\rho \Delta y_{t-\rho} + \upsilon_t \qquad (3.2)$$

where α is the coefficient of interest, determining whether the series is an explosive one or not. The hypothesis testing procedure involves the following null and alternative hypothesis: H_0: $\alpha = 0$ (non – stationarity) again H_1: $\alpha < 0$ (stationarity). As it has been noted above, in order to use the series in the econometric analysis, the series should be I(0). That is, they should be stationary, so that the results from the estimations to be reasonable and meaningful. ADF test is sensitive to the number of lagged difference terms; therefore it is crucial to select the appropriate lag length for ADF test to ensure uncorrelated residuals. We run the test with the maximum lag 12, which is usually

appropriate for monthly data, and pares down the model using information criterion SIC as in practice, SIC will choose a more parsimonious model than AIC. The other issue concerning the test is to choose exogenous regressors. We have the choice of including a constant, a constant and linear trend or neither. For all the level variables, we start to run the test with both constant and a linear trend, since the latter two cases are just special case for this more general specification. The trend is removed if the t-statistics in the test results suggests it is significant. We present the unit root test results for this model in table A.1 to A.4 in the appendix.

Having verified that the series are stationary, we proceed to the implementation of the econometric approach that is suitable for the previously presented and discussed model. Given that the dependent variable of our model is a binary one, the most efficient way to estimate the model is by following a binary choice model. More specifically, the econometric methodology used in this case is the one called probit model. This kind of models are suitable for these cases, a simple linear regression is not the proper way to approach this estimation. In general, the binary choice models are based on the following model

$$P\{y_i = 1 : x_i\} = G(x_i, \beta) \tag{3.3}$$

where depending on the distribution function, we get a different type of binary choice model. In the case of probit model, this should be the standard normal distribution function. That is,

$$G(x_i, \beta) = F(x_i^{'}, \beta) = \Phi(w) = \int_{-\infty}^{w} \frac{1}{\sqrt{2\pi}} \exp\left\{-\frac{1}{2}t^2\right\} dt \tag{3.4}$$

where Φ is the cumulative distribution function of the standard normal distribution. The most suitable estimator for such a model is the maximum likelihood estimator. Regarding the interpretation of the resulted estimations, it is well known the peculiarity of the estimated coefficients produced by a probit model. In any case, due to the nature of our empirical investigation with this model and, since, our focus is mainly set on specifying the interrelation of the two exchange rates, the produced significance and signs of the respective coefficients are more than enough for our empirical investigation.

3. 2. Testing the weak-form and strong-form PPP

3.2.1 Model 1 Specification

As mentioned earlier, we intend to apply both official and parallel market exchange rates to examine the long-run validity of the PPP proposition and in this section we briefly discuss about the PPP framework we investigate with. A weak-form PPP might be formalized as:

$$s_t = \alpha + \beta_1 p_t + \beta_2 p_t^* + \varepsilon_t \quad (3.5)$$

where s_t, as mentioned before, denotes the nominal exchange rate whilst p_t and p_t^*,the home and foreign price level respectively, all measured in natural logarithms. α denotes a constant term and ε_t a random error term.

In particular, weak-form PPP (MacDonald, 1993) exists if s_t, p_t and p_t^* are I(1) series , and ε_t is found to be I(0) ,i.e., stationary.

In addition to the above mentioned conditions, if a restriction is imposed on the coefficients so that $\beta_1 = -\beta_2$, i.e., the estimated coefficients are equal but of opposite sign, which implies that the relative prices affect the exchange rate in a symmetric fashion, then the trivariate PPP framework in (1.1) can be written as a bivariate relationship:

$$s_t = \alpha + \beta(p_t - p_t^*) + \varepsilon_t \quad (3.6)$$

Furthermore, if the joint symmetry/proportionality condition holds for the coefficients which requires $\beta_1 = -\beta_2 = 1$, and $\alpha = 0$ then the so-called strong form PPP can be found existent with the specification:

$$s_t = p_t - p_t^* + \varepsilon_t \quad (3.7)$$

The strong form PPP is often assumed implicitly for the class of literature which examines the existence of unit root in the real exchange in order to test PPP. The real exchange rate, as mentioned previously, is formalized as:

$$q_t = s_t - p_t + p_t^* \quad (3.8)$$

Cerrato and Sarantis (2007) claims that, since the unit root based test of PPP often rely on the precondition of the symmetry and proportionality restriction, a failure of these tests to find evidence in favour of mean reversion in the real exchange rate might be caused by a failure of such a restriction. Various explanations have been cited for the distinction between the strong-form and weak-form PPP. Patel (1990) has relaxed some of the unrealistic assumptions made by earlier empirical work and interpreted PPP doctrine as a cointegration relation between the spot exchange rate and a constructed cost-of-living index:

$$s_t^{jk} = \beta_1 p_t^j - \beta_2 p_t^k + u_t^{jk} \qquad (3.9)$$

Whilst the formulation of the relation is similar to the PPP framework in equation (3.4), the betas will be different from utility. According to Patel, "*there are no hypotheses regarding the specific values of* β_1 *and*β_2*, except that they are positive*".

MacDonald (2007) has interpreted the potential causes that relative prices level need not have an equiproportionate effect on exchange rate. One of them is the transaction cost effect, empirical evidences favouring this explanation have been provided by Davutyan and Pippenger (1990) and Obstfeld and Taylor (1997). Sarno and Taylor (2002) has surveyed a comprehensive range of literature and advocates the dominant role that transport costs, tariffs and nontariff barriers play in the violation of strong-form PPP .

In our investigation, we will firstly use Johansen cointegration techniques to examine the weak-form PPP and with equation (3.5) holding, i.e., there exists a cointegrating relationship between the exchange rate, the domestic price level and the U.S. price level. Both official and parallel exchange rate are used in estimating equation

$$e_t^{o,b} = \alpha + \beta_1 p_t + \beta_2 p_t^* + \varepsilon_t \qquad (3.10)$$

where $e_t^{o,b}$ replaces the nominal exchange rate term in equation (3.5) and denotes the choice between official and parallel (black) market exchange rate. If the cointegrating relationship is validated amongst the variables of interest, we then further test two sets of hypothesis by imposing restrictions on the cointegrating vectors:

(1) $\beta_1 = -\beta_2$

(2) $\beta_1 = -\beta_2 = 1, and\ \alpha = 0$

Our findings will be able to verify first of all, if there exists systematic long-run equilibrium among the exchange rate and the price levels in home and foreign magnitude. Besides, by observing the signs of coefficients of the estimated cointegrating vectors, we will be able to validate the governing economic theory. In equation (3.10), specifically, $\beta_1$is expected to be positive whilst β_2 to be negative.

Furthermore, upon the existence of cointegrating relationships as mentioned above, if we cannot reject the restrictions imposed on the cointegrating vectors, then the joint symmetry condition holds and the strong-form PPP is supported. By comparing the results from official and parallel exchange rate market we will also be able to understand if the market-determined exchange rate can better validate the PPP proposition advocated in the previous literature.

3.2.2 Multivariate Cointegration Analysis

The econometric methodology employed for the estimation the weak-form PPP model as in equation (3.3) is the multivariate cointegration technique by Johansen (1995).

As has been done for the two aforementioned series for the estimation of the probit model, we need to first test the order of integration of the series under examination for the PPP model before proceeding to the cointegration analysis. We apply the same unit root test introduced in section 3.1.2, the conventional ADF test. Nevertheless, due to the large scale of sample coverage and the importance we assign to this part of analysis, extra caution is taken in determining the stationarity of the series. The DF-GLS test proposed by Elliot et al. (1996) therefore is also employed here to confirm the results from ADF tests.

The augmented Dickey-Fuller test has already been presented previously. Thus, a short discussion of the DF-GLS test is provided here. As illustrated by Fernandez et al. (2001), the DF-GLS test uses a regression similar to the ADF test only that in this test the series under consideration is de-trended and de-meaned. Thus, the regression equation is the following

$$\Delta y_t^d = \rho\, y_{t-1}^d + \sum_{i=1}^{k} \Delta y_{t-i}^d + \varepsilon_t \qquad (3.11)$$

Where $\Delta y_t^d = y_t - \alpha - \gamma t$ is the transformed series of interest that is tested for its stationarity. Again, a t-test is computed with which the null hypothesis of non-stationarity against the alternative of stationarity is examined. For the case of a model with constant, the test statistic is the same with the one from the ADF test, while for the case of the existence of a constant and a trend, Elliot et al. (1996) provide the necessary critical values. The results of unit root tests for all the additional variables are presented in table A.9 to A.12 in the appendix. As expected, the official and parallel exchange rates, as well as the home and U.S price indices are integrated of order 1, i.e., I(1) series for most of the countries in our sample. The results will be discussed in detail in chapter 4.

Having established the non-stationarity of most variables, we proceed to perform the cointegration analysis procedure proposed by Johansen (1995).The approach starts from a vector autoregressive representation of the form:

$$y_t = \mu + \sum_{i=1}^{p} \Pi_i y_t + \varepsilon_t \qquad (3.12)$$

where μ represents a (n × 1) vector of deterministic terms, k is the lag length, y_t denotes a (n × 1) vector of the n variables of interest, ε_t represents a (n × 1) vector of white noise residuals. Expression (3.7) can be reparameterised into an vector-error correction mechanism (VECM) as:

$$\Delta y_t = \Pi y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + \mu + \varepsilon_t \qquad (3.13)$$

where Π denotes a (n × n) coefficient matrix that contains information regarding the long-run relationships among the variables. The rank of matrix Π determines the number of cointegrating relationships.

If the matrix Π has reduced rank r ($0 < r < n$), it can be factorized into the product of two matrices α and β such that $\Pi = \alpha\beta'$, where α represents a (n x r) matrix of loading coefficients α, and β' represents a (n x r) matrix of cointegrating vectors. α includes the speed of adjustment to equilibrium coefficients while β' contains information for long run equilibrium.

As a first step, the number of cointegrating vectors among the variables contained in y_t is decided based on the trace test proposed by Johansen (1995).The procedure begins with estimating the vector autoregression (VAR) model in the form of equation (3.7). It is crucial to specify appropriate lag length in the VAR model in order to get uncorrelated

residuals. We start running the model with the longest plausible lags 12 and use a series of VAR lag order selection information criteria (mainly based on SIC and AIC) as an initial guide to find out a most selected lag length p and then estimate the VAR model again with p lag intervals included. Run the VAR lag exclusion Wald test on this new model, p is chosen if it passes the wald test, otherwise, smaller order of lags will be chosen to pare down the model until the model with selected lag length can pass the lag exclusion test. As suggested by Johansen (1995, page 84), 11 centred (orthogonalized) seasonal dummy variables have been included as exogenous terms which are necessary to account for short-run effects that could otherwise violate the Gaussian assumption (Diamandis,2003).

There has been a growing consensus that the trace statistics used in the cointegration test suffer from a small-sample bias, tending to reject the null hypothesis of no cointegration too often (Diamandis, 2003). A common approach to rectify the bias is to adjust the computed trace statistics with the factor (T-nk)/T as proposed by Reimers (1991), where T denotes the total number of observations while n and k as defined in equation (3.7).The significance of cointegrating vectors for the weak-form PPP model is reported in table A.13 to A.16.

The residuals from the estimated VAR model have been examined for autocorrelation. The Portmanteau autocorrelation test computes the multivariate Box-Pierce/Ljung-Box Q-statistics for residual serial correlation up to the specified order. According to the test, there has been no indication of serial autocorrelation. Similar to Diamandis (2003), nonnormality is detected in the residuals but as the aforementioned author has explained, it might be due to the fact that the official exchange rate has been set by the Central bank of each country and was not freely-determined throughout the period under investigation. Besides, Gonzalo (1994) has shown that the performance of the maximum likelihood estimator is little affected by the nonnormality of the error terms.

Following the determination of the cointegration rank, we have estimated the VECM for each country. The estimates of the normalized cointegrating vectors are presented in table 4.5-4.8 and the significance of the coefficients is indicated for the cointegrating equations. Based upon the significance of cointegrating vectors, we have imposed two sets of identifying restrictions on the cointegrating vectors as below:

(1) $\beta_1 = -\beta_2$

(2) $\beta_1 = -\beta_2 = 1, and\ \alpha = 0$

A likelihood ratio statistic with asymptotic χ^2 distribution is used to test the binding of restrictions. We reject the imposed restrictions if the reported probability for the LR statistics is of small value and cannot reject the restrictions if otherwise. The latter case implies the acceptance of the strong-form PPP.

3.3 A PPP model in the presence of dual markets for foreign currency

In this section we provide the description of a PPP variant incorporating the presence of both official and parallel markets followed by a discussion of the econometric approach employed.

3.3.1 Formulation of the model

Diamandis (2003) has examined the PPP doctrine from a long-run perspective for four Latin American countries including Argentina, Brazil, Chile and Mexico. In line with Kouretas and Zarangas (1998) and Phylaktis (1996), he has formalized a variant of PPP model for exchange rate determination that takes into account the presence of both an official and a parallel market for U.S dollars in these countries.

He considers the black (parallel) market exchange rate to be a weighted average of the official exchange rate and the price differential, the latter of which essentially is the PPP exchange rate. The model is formalized on basis of the demand-supply analysis for foreign currency in the parallel market as below:

According to Diamandis, the demand of foreign currency depends positively on the return from holding the foreign currency while the return is a function of the expected rate of appreciation of the foreign currency in the parallel market. It is further assumed that economic agents form their expectations by comparing the movements of the exchange rate with the movements of the relative prices between domestic and foreign countries. Under this setting, the demand for foreign currency is described as follows:

$$D_b = \beta_0 + \beta_1(p - p^* - e_b), \quad \beta_1 > 0 \tag{3.14}$$

Where D_b denotes the demand for foreign currency, e_b denotes the parallel market exchange rate, p and p^* denote the domestic and foreign price levels, respectively, all in natural logarithm. β_1 should be positive since if p increases faster than $p^*$and meanwhile, there is no corresponding rise in e_b, the economic agents would expect a depreciation of the parallel exchange rate by a percentage equal to the observed inflation rate differential

The supply of foreign currency, as suggested by the author, is mainly provided via the receipts from the overinvoicing of imports and underinvoicing of exports as well as receipts from tourism, shipping, and immigrants's remittances. The model considers these activities to be positively related to the differential between the official and parallel market exchange rates, therefore the supply can be written as:

$$S_b = \gamma_0 + \gamma_1(e_b - e_0) \;\; \gamma_1 > 0 \qquad (3.15)$$

Both e_b and $e_0$are defined as domestic currency per unit of foreign currency.

By Equating the demand and supply function

$$e_b = b_o + b_1 e_o + b_2 p + b_3 p^* \qquad (3.16)$$

where $b_1 = \gamma_1/(\gamma_1 + \beta_1)$,$b_2 = \beta_1/(\gamma_1 + \beta_1)$, $b_0 > 0, b_1 > 0. b_2 > 0$.and $b_3 < 0$.

This formulation enables the official exchange rate to converge to the PPP rate in the long run in the absence of capital controls and the official rate will eventually be equal to the parallel market rate, leading to a gradual elimination of the parallel market for foreign currency. Nevertheless, the official exchange rate will be different from the PPP rate in case intervention of some form exists, and the parallel rate will be a function of the official rate and the equilibrium rate implied by PPP. We have adopted this framework to identify the linkage between the parallel market rate with the official rate and the price differentials which are in essence the PPP equilibrium rate. Consistent with the second model, we continue to employ the Johansen procedure in the analysis. In the next section, we proceed to illustrate the econometric methodology being employed in the empirical analysis.

3.3.2 The econometric methodology

In terms of econometric approach, we adhere to the Johansen cointegration analysis and follow the same procedure illustrated in section 3.2.2.It is notable that Diamandis (2003) has detected 2 cointegrating vectors for all of the 4 Latin American countries they examined, namely, Argentina, Brazil, Chile, and Mexico. Similar results are obtained in our analysis in the sense that 2 cointegrating vectors have been found for 19 out of 34 countries including Argentina, Chile and Mexico.

Since two statistically significant cointegrating vectors were found, Diamandis continues with the identification of the system. In light of Johansen (1995b) and Johansen and Juselius(1994), the author has imposed independent zero and homogenous restrictions implied by economic theory with the first vector to identify the long-run PPP relationship amongst the parallel market exchange rate and the two prices , as well as a long run relationship between the two exchange rate with the second cointegrating vector.

Specifically, Let X=$[e_b, e_o, p, p^*]_t$, be the set of variables under investigation as defined in equation (3.11), the full set of identifying restrictions is given in the cointegrating coefficient matrix as below:

$$\beta = \begin{bmatrix} 1 & 0 & -1 & 1 & \alpha \\ 1 & -1 & 0 & 0 & 0 \end{bmatrix}$$

where the first vector of β with two linear homogeneous restrictions and a zero assumes the proportionality hypothesis between the parallel market exchange rate and the two price levels whist the constant term α is allowed to vary.

The second vector indicates a long run relationship between the two exchange rates. The proportionality hypothesis between the parallel and the official rate is imposed. In addition, the coefficients for the two price indices as well as the constant term are restricted to zero. According to Moore and Phylaktis (2000), the long run market efficiency in the parallel market requires that in the equation(3.11):

$$e_b = b_o + b_1 e_o + b_2 p + b_3 p^*$$

$b_1 = 0$, $b_1 = 1$, and $b_2 = b_3 = 0$

Therefore this setup provides a direct test of long-run informational efficiency. As explained by Diamandis(2003), both vectors are overidentified with the imposition of the

above restrictions and the overidentifying restrictions are tested using the likelihood ratio statistic with asymptotic χ^2 distribution as explained in the preceding section. The results of the estimated restricted vectors along with the likelihood ratio for the acceptance of the overidentifying restrictions are displayed and discussed in Chapter 4. As regard to the 15 countries for which 1 cointegrating vector is found, we provide the normalized cointegrating vectors following the same approach illustrated in section 3.2.2.

Chapter 4: Analysis of Empirical Results

Based on the theoretical framework and the econometric methodology we have explained in chapter 3, in this section we present the empirical results obtained and analyze our findings. Before proceeding to the discussion of the proper empirical results, we first provide a brief discussion of the countries' exchange rate behavior through time. In this respect, we are able to have initial insights on their currency markets, potential divergences between the two exchange rates and commentary on how these could have affected their macroeconomic conditions is provided. Then, section 4.2 presents and assesses the econometric outcome from the currency crash model. Here, the strong link between the official and parallel exchange rates is established, especially for countries more vulnerable to adverse macroeconomic conditions. Additionally, it provides further justification for the employment of the black market rates to the empirical modeling of equilibrium exchange rates for the countries where the black market rate prevails. Finally, the empirical results are presented and some policy implications from these results are discussed.

4.1 A Narrative Investigation of the Two Exchange Rates

The two exchange rates (official and parallel) for each one of the countries inspected are depicted in the graphs A.1 to A.10 in the appendix. Through this process, some commonalities in these countries exchange rate performance and behavior can be underlined, while such patterns are evident from countries with the same or similar economic structure and performance.

A common problem in exchange rate economics is the divergence between the official (de jure) and prevailing (de facto) exchange rate regime. Such an issue can have major effects on the macroeconomic performance of the countries, their international economic position and the potential instabilities in their exchange rate regime. Such a situation is evident from the countries of the sample. Since the 1970's and the collapse of the Breton Woods system, most developed economies do not fix their exchange rate. In this respect, the gradual elimination of the governmental interventions and any restrictions on the capital mobility, led to the high correlation between the official and the black market exchange rates. This is a strong element, underlining the declining importance of the parallel markets

in these economies. On the other hand, some countries (like Portugal, Greece and Ireland) represent a different behavior between the two rates. This can be justified as an evidence of uncertainty and instability in their open market operations, especially for countries with less robust macroeconomic conditions.

In contrast to the above situation, the picture is rather different for some other sets of countries. For instance, oil producing countries, which tend to fix their exchange rates vis-à-vis US dollar, face a very different situation with the parallel market rates. Countries, like Iran, Iraq and Algeria artificially keep their currencies undervalued. This is evident from the much higher price of US dollar (compared to their currencies), when it comes to the black market rates.

There is no significant difference between the two exchange rates, when the focus turns to countries with long history of repeated financial crises. Especially, for the case of the South American countries of the sample, this holds true. On the other hand, Asian countries that faced periods of serious crises episodes behave differently. In their case, the distinction between the official exchange rate and the parallel market's one is quite evident. Countries of this type include Thailand, Korea, and Indonesia as well. Philippines is also part of this general picture for the Asian economies.

From the above analysis, it can be easily inferred the crucial role parallel market behavior can have for a number of important economies around the world. When it comes to the case of oil producing economies, as well as countries that are more prone to currency crises outbreaks, it is of utmost importance to take into account and model the most relevant version of the exchange rate (official or parallel one). This general picture, regarding the macroeconomic performance of these economies and their exchange rate modeling can be further discussed later, when the econometric results will be presented. The previous discussion provides a useful taxonomy of the economies under investigation, in the sense that it turns the interest towards the countries for which this distinction between the two rates makes more sense.

4.2 Findings from a preliminary investigation

As illustrated in the preceding chapter, a simple regression of a currency crash dummy on the parallel market premium proposed by Reinhart & Rogoff (2004) is employed as a

preliminary investigation on the linkage between the official and parallel exchange rate market and the indicative power of the parallel market rate over the official rate realignment.

The Binary Probit model discussed in section 3.1.2 is adopted for the estimation of the model .Cautions have to be paid to the time series properties of ΔP_{t-i}, as the regressors for the Probit model must be stationary. The Augmented Dickey-Fuller (ADF) Test is implemented to investigate the stationarity of the 12 month parallel market premium for 56 countries categorized into 4 groups geographically. The sample spans from January 1973 to December 1998 on a monthly frequency. The author performed the test both including only a constant and including a constant and a linear trend, whilst the length of lags is jointly determined upon both Schwarz (SIC) and Akaike (AIC) information Criteria. Under this setting, ADF test overwhelmingly report stationarity of the 12-month parallel premium for the majority of the countries across the sample.

The results from ADF tests are displayed in Tables A.1 to A.4 in the Appendix. In these tables, the results are grouped in different categories, according to the geographical regions examined. In this way, we have four groups of economies, namely: Developed economies, Asian, Latin American and African countries. According to the test, ΔP_{t-i} for merely 3 out of 56 countries are indicated as nonstationary, i.e., contains a unit root.

In more details, the null hypothesis that a unit root exists in the series cannot be rejected for three countries, including one Latin American country (Colombia) and two Developed economies: Finland and France. The results are consistent for these countries whether only a constant or both a constant and a linear trend are included in testing the unit root. Consensus has also been achieved, on both occasions, for 46 out of 56 economies. Nonetheless, in these cases, the null hypothesis of unit root is strongly rejected. As presented in the tables at the appendix, for these countries, evidences of stationarity for ΔP_{t-i} are reported when only a constant as well as both a constant and a linear trend are regressed in the ADF test. However, contradictory results from the different choice of exogenous regressors appear for 7 countries, namely, Belgium, Benin, Denmark, Dominican Republic, Mexico, New Zealand and Uganda. In any case, since there is evidence of these series being stationary, we are going to use them for this econometric investigation.

Having clarified the stationarity of each individual series, the next step is focused on studying the linkage between the market determined-exchange rate and the realignments in the official exchange rate (Reinhart and Rogoff, 2004). The three countries with nonstarionary ΔP_{t-i} are removed from the original sample for further analysis. Within the reduced sample, however, there are a few economies where no occurrences of the currency crashes are detected during the observation period including: Belgium, Canada, Denmark, Germany, Iraq, Ireland, Italy, Japan, Kuwait, Morocco, Netherland, Norway, Pakistan, Singapore, Sweden and Switzerland. The above-mentioned countries are eliminated from the sample as well, since a Probit model cannot be estimated for dependant variables without variances.

The final sample encompasses a group of 37 countries with high heterogeneity in the sense that it features a fairly wide geographical coverage, development level diversities as well as industry structure variations. As summarized below in Table 4.1, a currency crash dummy $\boldsymbol{D_{ot}}$ is regressed on a constant $\boldsymbol{\alpha}$ and the 12-month parallel market premium $\mathbf{P_{t-i}}$ (i=12) as defined earlier, while $\mathbf{u_t}$ represents a random disturbance. According to Reinhart and Rogoff (2004), the coefficient $\boldsymbol{\beta}$ should be positive and statistically significant if the market determined rate consistently predicts devaluations of the official rate. If, in turn, the estimated coefficient on the lagged market exchange rate is negative, implying that the official rate does not validate the market rate, then the parallel market cannot serve as a good anticipator of currency crashes and exchange rate realignment.

Table 4.1: Summary of the Binary Dependent Variable Model

Binary Probit Model: $\boldsymbol{D_{ot} = \alpha + \beta \Delta P_{t-i} + u_t}$		
Number of countries for which:		In percentage (%)
β >0	33	89.19
β >0 and significant	24	64.86
β <0	4	10.81
β <0 and significant	1	2.70
Total number of countries	37	100

Notes: $\boldsymbol{D_{ot}}$ is a dummy variable that takes on the value of 1 when there is a realignment in the official exchange rate according to our definition in the methodology section and 0 otherwise, α and β denote a constant term and a slope coefficient, respectively.$\boldsymbol{\Delta P_{t-i}}$ is the lagged 12-month premium in the parallel exchange rate. The value of *i* is chosen in light of Reinhart& Rogoff (2004) and $\boldsymbol{u_t}$ is a random disturbance. The term currency crash employed here refers to a 15% or higher monthly depreciation in accordance with its conventional definitions in extant literature (consult methodology section for details).

Whilst the details for the country-specific models including the estimated coefficients, z-statistics and standard errors for **α** and **β** are presented in table A.5 to A.8, Table 4.1 offers a brief summary on the results obtained from the country-specific regressions. The coefficients on the parallel premium are positive for 33 countries and negative for 4 countries, namely, Algeria, Ghana, Nepal and Iran respectively. In about 89 percent of the cases, the sign on the coefficient is positive whilst 65 percent both positive and significant. There are 9 countries whose coefficients are positive but insignificant, including Egypt, Korea, Malaysia, Paraguay, Portugal, Spain, Sri Lanka and Uganda. It is noteworthy that for most Latin American countries in our sample apart from Paraguay, the coefficients

estimated are both positive and significant. The results, for each group of countries, are summarized in the following tables, where short discussion is also provided.

In table 4.2, the results for the so-called developed countries are provided. As it can be easily inferred, the sample is quite small (only four countries) after the nonstationary series are precluded based on ADF test.

Table 4.2: Probit Model for Developed Economies

Binary Probit Model: $\boldsymbol{D_{ot} = \alpha + \beta \Delta P_{t-i} + u_t}$		
Number of countries for which:		In percentage (%)
β >0	4	100
β >0 and significant	1	25
β <0	0	0
β <0 and significant	0	0
Total number of countries	4	100

Notes: $\boldsymbol{D_{ot}}$ is a dummy variable that takes on the value of 1 when there is a realignment in the official exchange rate according to our definition in the methodology section and 0 otherwise, α and β denote a constant term and a slope coefficient, respectively.$\boldsymbol{\Delta P_{t-i}}$ is the lagged 12-month premium in the parallel exchange rate. The value of *i* is chosen in light of Reinhart& Rogoff (2004) and $\boldsymbol{u_t}$ is a random disturbance. The term currency crash employed here refers to a 15% or higher monthly depreciation in accordance with its conventional definitions in extant literature (consult methodology section for details).

Despite the limited size of sample, it is easily observable that the model holds only for Greece, while for the other three countries, namely New Zealand, Portugal and Spain, do

not. It seems that the parallel market exchange rate premium does not really work as a leading indicator of abrupt changes in the official exchange rates, for most of the countries of the developed world.

Table 4.3: Probit Model for Asian Economies

Binary Probit Model: $\boldsymbol{D_{ot} = \alpha + \beta \Delta P_{t-i} + u_t}$		
Number of countries for which:		In percentage (%)
β >0	9	82
β >0 and significant	6	55
β <0	2	18
β <0 and significant	0	0
Total number of countries	11	100

Notes: $\boldsymbol{D_{ot}}$ is a dummy variable that takes on the value of 1 when there is a realignment in the official exchange rate according to our definition in the methodology section and 0 otherwise, α and β denote a constant term and a slope coefficient, respectively.$\boldsymbol{\Delta P_{t-i}}$ is the lagged 12-month premium in the parallel exchange rate. The value of *i* is chosen in light of Reinhart& Rogoff (2004) and $\boldsymbol{u_t}$ is a random disturbance. The term currency crash employed here refers to a 15% or higher monthly depreciation in accordance with its conventional definitions in extant literature (consult methodology section for details).

Turning now to the Asian countries, the first interesting thing here is the number of countries in the sample. In contrast to the number of developed economies, here, we deal with a total of 11 countries, some of which are quite important, in economic terms, not only for the Asian region but for the world economy as well. As far as the results concerned, Reinhart and Rogoff (2004) model has good results, since 82% of the countries

present one of the desirable properties. That is, a positive coefficient. Then, 55% of them have a significant and positive coefficient for the parallel market exchange rate returns. This percentage corresponds to six countries (India, Indonesia, Israel, Philippines, Thailand and Turkey), with the strongest relationship to be evident for Thailand and India and less for the rest. None the less, the results are in accordance to the proposed model and the percentages of it.

Table 4.4: Probit Model for Latin American Economies

Binary Probit Model: $\boldsymbol{D_{ot} = \alpha + \beta \Delta P_{t-i} + u_t}$		
Number of countries for which:		In percentage (%)
β >0	14	100
β >0 and significant	13	93
β <0	0	0
β <0 and significant	0	0
Total number of countries	14	100

Notes: $\boldsymbol{D_{ot}}$ is a dummy variable that takes on the value of 1 when there is a realignment in the official exchange rate according to our definition in the methodology section and 0 otherwise, α and β denote a constant term and a slope coefficient, respectively.$\Delta \mathbf{P_{t-i}}$ is the lagged 12-month premium in the parallel exchange rate. The value of *i* is chosen in light of Reinhart& Rogoff (2004) and $\mathbf{u_t}$ is a random disturbance. The term currency crash employed here refers to a 15% or higher monthly depreciation in accordance with its conventional definitions in extant literature (consult methodology section for details).

Table 4.4 briefly summarizes the situation that holds for the South American countries. It is surprising the number of countries, for which the model is meaningful, since only for

Paraguay the coefficient is not significant. It is also interesting to notice how strongly significant the results are, for all cases, since that the null hypothesis is rejected at the 1% level of significance, in all cases. Moreover, even though the results are in favour of the estimated model, the coefficients' values are rather small, with the minor exception of countries, like El Salvador and Dominican Republic. In any case, this is not of our main concern, since the goal here is to simply establish the connection between the two exchange rates.

Finally, in table 4.5, the situation in the African economies sample is discussed. Here, from the eight countries of the sample, six have a positive parallel market premium coefficient and, at the end, four of them significant as well. On the other hand, only two countries are against our expectations, with negative coefficients and, among them, only Ghana has also a significant coefficient. Once again, the results present desirable behaviour, in line with the model's prospects.

Table 4.5: Probit Model for African Economies

Binary Probit Model: $\boldsymbol{D_{ot} = \alpha + \beta \Delta P_{t-i} + u_t}$		
Number of countries for which:		In percentage (%)
β >0	6	75
β >0 and significant	4	50
β <0	2	25
β <0 and significant	1	13
Total number of countries	8	100

Notes: $\boldsymbol{D_{ot}}$ is a dummy variable that takes on the value of 1 when there is a realignment in the official exchange rate according to our definition in the methodology section and 0 otherwise, α and β denote a constant term and a slope coefficient, respectively.$\boldsymbol{\Delta P_{t-i}}$ is the lagged 12-month premium in the parallel exchange rate. The value of *i* is chosen in light of Reinhart& Rogoff (2004) and $\boldsymbol{u_t}$ is a random disturbance. The term currency crash employed here refers to a 15% or higher monthly depreciation in accordance with its conventional definitions in extant literature (consult methodology section for details).

To sum up, the findings are consistent with Reinhart& Rogoff (2004), who report 97 percent cases of positive coefficient and 81 percent both positive and significant, especially in the case of Latin American economies. On the other hand, the weakest results come from the developed world, while the results for the African and Asian region are, in general, consistent. This econometric investigation can also find empirical support in Bahmani-Oskooee *et al.* (2002), who conclude that in the long run, the official exchange rate will systematically adjust to the market-determined rate. Their work is based on a panel cointegration approach, using annual data from 1973 to 1990 for a group of 49 countries. The overall findings validate the hypothesis that the parallel market premium is indicative of the currency crashes hence might systematically predict official rate realignment in the long run.

4.3 The stationarity of the variables under examination

In chapter 3, it has been illustrated that testing the stationarity of variables of interest is an initial step in the procedure of time series data analysis. This is true for both the preliminary analysis using the crash dummy model and the two main PPP models to be investigated. Economic theory suggests that the variables under examination to be integrated of the same order 1 and if true, this would be the most desirable case for the multivariate cointegration analysis we conduct.

In the methodology part, two unit root tests were briefly described, the Augmented Dickey-Fuller test (ADF) test and the GLS-detrended Dickey-Fuller (DF-GLS) test[19] . These two tests are applied to the official and parallel exchange rate, the CPI and WPI indices of the countries under examination as well as those of United States, all of which are measured in natural logarithm. The foregoing discussion will be focused on the findings from the unit root tests we carried out as displayed in Table A.9 –A.11 in the appendix.

The first column of these tables presents the specific country name and its sample period coverage under investigation. The ADF test statistics with different choice of exogenous

[19] the DF-GLS test is proposed by (Elliot, Rothenberg, and Stock, 1996)

regressors are presented (C denotes a constant, C,T denotes a constant and a linear trend) . The leads/lags are chosen based on both SIC and AIC but with more weight on SIC. For each variable, in the occasion that the level is found to contain a unit root, the differenced term is then tested again for stationary . Apart from the test statistics, Mackinnon (1996) one-sided p-values are also reported for the ADF test. The last two columns of each table display the DF-GLS test results to confirm the findings from ADF test.

We presented 4 separate tables from A.9 –A.11, each of them reports the unit root test results for one group of countries and overall, the results are consistent across groups. For a majority of countries in the sample, all the variables for our two main PPP models including the two exchange rates and all price indices are found to be I(1) series, i.e., integrated of order 1. For those series, the null hypothesis of unit root cannot be rejected in level but can be rejected in first difference. What's more, the ADF test and DF-GLS test provide consistent and unambiguous results, indicating these series contain one unit root. This is true for 31 out of 40 countries we examined.

For the 4 western developed countries we examined (Belgium, Portugal, Spain and United States), the exception is Portugal, for whom the domestic CPI is suggested as I(2) by ADF test whilst the DF-GLS test indicates it as I(1).

In the Asian group, inconsistent findings are obtained for 6 out of 15 countries. Specifically, the domestic CPI for Japan is found to be I(2) by both unit root tests. Contradictory result has been found for the domestic CPI of Korea by ADF test, suggesting its stationarity in level but nonstationarity in first difference. Nevertheless, DF-GLS test provides positive results showing that the price level is I(1) whilst the differenced CPI is stationary. The domestic price level of Indonesia, as well as the parallel market exchange rates of Malaysia are found to be I(1) by ADF test and I(2) by DF-GLS test. For these 2 countries, we suspect that the acceptance of unit root in first difference by DF-GL test might be due to the inclusion of too many lags (12) in both cases. The parallel market rate for Kuwait is indicated to be stationary by ADF test and I (1) by DF-GLS test. Finally, both the parallel market rate and the wholesale price index for Pakistan are suggested to be I(1) by ADF test but I(2) by DF-GLS test.

The results for the Latin American group are less ambiguous as opposed to the Asian group. Only the domestic price of Mexico receives different result from the two unit root tests. The ADF test suggests it to be I (1) while the DF-GLS test indicates it as I(2).

As regard to the 7African countries we examined, the domestic CPI of Algeria is indicated as I(2) by ADF test and I(1) by DF-GLS test. Besides, the domestic WPI is found to be I(1) by ADF test and I(2) by DF-GLS test.

Overall, the two exchange rates and price indices for most countries are found to be integrated of order 1 and even for the exceptions reported above, either DF-GLS or ADF test are supportive of the integration order as 1. The only case that has been strongly suggested as I(2) by both unit root tests is Japan. Although it is not compulsory that all the variables entering into the VEC models to be I(1), the presence of a mixture of I(0), I(1) and I(2) variables can massively affect the estimation results. Therefore, Japan is removed from the sample. Having established the non-stationarity and the same order of integration amongst the chosen variables, the next section moves forward to present the estimates of the two PPP models of interest.

4.4 Empirical Results for Model One

4.4.1 Results of Cointegration test

In this section we describe and analyse the findings obtained from the weak-form PPP model (hereafter denoted as model 1) estimation as defined in equation (3.5). As explained in section 3.2.2, the analysis encompasses two stages: the determination of cointegration rank and the estimation of VEC model.

The cointegration test results for model 1 are displayed in table A.13-A.16.We report the trace statistics provided by Johansen, the adjusted trace statistics mentioned before to rectify small-sample bias, as well as the critical value of trace statistics at 5% significance level. The results are again presented on basis of the 4 groups we categorized only that for the developed economies Belgium solely is kept for the PPP estimation whilst the price indices of United States are used as foreign country price level entering the PPP equation. For the other two developed countries, Portugal and Spain, the parallel markets were rather inactive during the examination period while a dual currency market was in presence for Belgium throughout the observation period. The results will be discussed based on geographical groups as follows.

Above all, the existence of at least one cointegrating vector is found for almost all the estimated VAR models with only few exceptions. Specifically, there is no cointegrating relationships amongst the nominal exchange rate (both official and parallel), the domestic price and the U.S. price when the wholesale price index is used as the price measure for Malaysia. Besides, no cointegrating relationship is found for Turkey amongst the official exchange rate, the domestic price level and the U.S price level when again, the wholesale price index is included in the estimation. These findings are encouraging for our further analysis as for most countries; the evidences of long run relationship within the variable set are supported, which enables us to test the PPP framework as established in the former chapter.

In order to have a deeper understanding of the results, we first take a closer look at the Latin American group of 14 countries. At least 1 cointegrating vector is found for all economies within the group, regardless of the choice between official and parallel exchange rate or the wholesale price index or consumer price index. However, the initial

cointegration test results for several economies are somehow confusing. Abnormal result has been reported for Bolivia that 3 cointegrating vectors are detected using both parallel and official exchange rate. This might be explained when looking into the evolvement of exchange rate regime during the observation period. The currency underwent a “hyperfloat” period from April 1984 to September 1985 and the two exchange rate markets were temporarily unified from August 29 1985–December 1986. If cointegration test is performed for a revised sample period from January 1987 to December 1998, the cointegration test indicates the existence of 1 cointegrating vector .This is true using both parallel and official exchange rates.

Similar revision has been made to Mexico for which the parallel market is absent from September 1976 to February 1982, the initial test covering the full sample indicates 2 cointegrating vectors for official exchange rates, the domestic price and the U.S price whist 3 cointegrating vectors amongst the parallel rate and the two price levels. We therefore revised the sample and test cointegration again amongst the variables of interest from March 1982 to December 1998. The cointegration rank is then found to be 1 using both exchange rates.

It is interesting to compare the evidence from using the official and parallel exchange rate for the nominal exchange rate variable in testing cointegration. In general, similar findings are produced by using either exchange rate apart from 4 countries, namely, Ecuador, El Salvador, Peru and Chile. 2 cointegrating vectors are found for both Ecuador and Peru, using both wholesale and consumer price index for official exchange rate while 1 cointegrating vector is found for parallel market exchange rate. The opposite results are found for El Salvador and Chile. There is no clear evidence which exchange rate is more in favour of validating the PPP theory so far and the results using different price indices are similar.

As regard to the African group of 6 countries, similar to the Latin American countries, evidences of cointegration have been reported for all the countries and 1 cointegrating vector is indicated for all but 2 countries. Specifically, the cointegration rank is 2 for Morocco using both exchange rate when wholesale price index is employed but 1 when the consumer price index is included. For Nigeria, the official exchange rate model suggests 2 cointegrating relationships but the parallel rate model suggests 1.

The western developed economy group contains Belgium only as most of the western developed countries in our original sample have been precluded due to reasons such as price index data unavailability and the inactivity (absence) of parallel market during the period under examination. Both the parallel and official exchange rate model are found to contain 1 cointegrating vector for Belgium and it is noteworthy, the trace statistics reports for 2 cointegrating equations while the adjusted trace statistics rectified it as 1.

Earlier we have discussed two cases where cointegration relationship is absent and both are from the Asian economies. Differing results have been reported more frequently in the Asian group when the magnitude of price and exchange rate vary. Whilst a majority of VAR models we estimated for the 13 economies in this group are found to contain one cointegrating vector, the parallel rate model for India and Nepal are suggested to contain 1 cointegrating vector using wholesale and consumer price index respectively. For Sri Lanka, 2 cointegrating relationships are suggested using both exchange rates when the wholesale price index is in place but 1 when the consumer price index is employed. Different results (1 or 2 cointegrating relationships) have also been obtained for Korea, Pakistan and Philippines from the two price indices but there is no definite pattern shown which price index is more supportive and the results from estimating the weak-form PPP models might be able to shed light on this.

4.4.2 VECM estimation

Section 4.4.1 has established that 1 cointegrating vector is found for most countries and we estimated the VEC models based on the estimated VAR models. The findings from our estimation are discussed in this section and presented in table 4.6-4.9

The long-run VEC model estimations for the African economies are displayed in table 4.6. The normalised cointegrating coefficients as well as their significance levels are indicated in the left panel of the table while in the right panel we present the likelihood ratio statistics and the corresponding probability for binding restrictions, the first hypothesis tests if the domestic and foreign prices have an effect on the exchange rate in an symmetric way while the second hypothesis tests if the strong-form PPP holds for the countries under examination. The PPP theory suggests that the exchange rate would depreciate i.e, s_t increase under our setting when the domestic price rises or the foreign price decreases.

Therefore the coefficient for domestic price β_1 is expected to be positive whilst the coefficient for foreign price β_2 is supposed to be negative. In the African group, we have obtained significant and correctly signed coefficients of reasonable magnitude for: Algeria using official exchange rate, Egypt using parallel exchange rate, Kenya, Nigeria and South Africa using both exchange rates. For Morocco, however, the estimated coefficients are wrongly signed and insignificant. For the remaining models we estimate, the parallel exchange rate model coefficients for Algeria is correctly signed but the coefficient for foreign price is insignificant. Similar findings are reported for the parallel exchange rate model of Egypt where the coefficients are correctly signed but insignificant for the domestic price level when consumer price index is used. It is noteworthy, however, using the wholesale price index and for parallel exchange rate, the coefficients are significant and correctly signed.

In sum, weak-form PPP holds for Kenya, Nigeria and South Africa using both parallel and official exchange rates. Positive but less strong evidences are discovered for Algeria and Egypt, for whom the weak-form PPP holds only when official exchange rate and parallel exchange rate are opted for estimation, respectively. Having found significant and meaningful long-run relationships for these countries, we further test the restrictions imposed to identify the joint symmetry/ proportionality hypothesis.

By observing the probability of likelihood ratio statistics, we cannot reject the joint proportionality (strong-form PPP) hypothesis for Algeria when the official rate is employed, Egypt when the parallel rate and wholesale price index are used, Kenya when both rates are used (the symmetry of home and domestic price coefficients is validated but the joint symmetry in the second set of hypothesis is rejected), Nigeria for both exchange rates and finally, South Africa when the official exchange rate and wholesale price index are under consideration. It seems that for the African group of economies, the wholesale price index is slightly more favourable in supporting the joint proportionality hypothesis when the weak-form PPP is already in place.

Table 4.6: VECM Estimation for African Economies

	$s_t = \alpha + \beta_1 p_t + \beta_2 p_t^* + \varepsilon_t$				Hypothesis tests	
	Normalized cointegrating coefficients				chi-square statistics , probability in [ ]	
	standard error in ( )				$\beta_1 = -\beta_2$	$\beta_1 = -\beta_2 = 1$ $\alpha = 0$
Algeria	s=LEO	β_1	β_2	α		
p(*)=LCPI(*)		1.706	-2.614	7.916	14.471	3.642
		(-0.11377)	(-0.31377)		[0.0142]	[0.1618]
		***	***			
	s=LEB	0.908	-0.192	1.602	2.005	1.416
		(-0.14583)	(-0.39282)		[0.1568]	[0.4926]
		***				
Egypt						
p(*)=LCPI(*)	s=LEO	0.9811	2.0300	-10.6518	5.3537	26.3510
		(0.6205)	(1.6537)		[0.0207]	[0.0000]
	s=LEB	0.9468	-2.2526	6.7229	6.2170	16.0553
		(0.2442)	(0.6516)		[0.0127]	[0.0003]
		***	***			
p(*)=LWPI(*)	s=LEO	0.6272	3.7509	-17.0654	22.3501	33.7338
		(0.3381)	(1.1197)		[0.0000]	[0.0000]
			**			
	s=LEB	1.1867	-3.9031	13.0965	21.8510	8.0336
		(0.2124)	(0.7001)		[0.0000]	[0.0180]
Kenya						
p(*)=LCPI(*)	s=LEO	0.9178	-0.9191	4.3280	0.0001	3.7125
		(0.0680)	(0.1797)		[0.9925]	[0.1563]
		***	***			
	s=LEB	0.9296	-1.1071	5.1842	0.5837	9.5908
		(0.1136)	(0.2962)		[0.4449]	[0.0083]
		***	***			
Morocco						
p(*)=LCPI(*)	s=LEO	-1.0638	1.5136	0.0075	0.9377	40.5300
		(0.7688)	(1.0302)		[0.3329]	[0.0000]
	s=LEB	-1.2468	1.7588	-0.2188	1.5617	39.1805
		(0.7476)	(0.9983)		[0.2114]	[0.0000]

p(*)=LWPI(*)	s=LEO	0.5454	-0.9990	3.5748	[1.1384]	[38.0323]
		(0.2988)	(0.5463)		[0.2860]	[0.0000]
	s=LEB	0.5609	-1.1158	4.3282	2.5390	34.1544
		(0.3162)	(0.5761)		[0.1111]	[0.0000]
			*			
Nigeria						
p(*)=LCPI(*)	s=LEO	1.6213	-51.7538	56.7924	4.6881	8.0418
		(5.5059)	(22.9395)		[0.0304]	[0.0179]
		***	***			
	s=LEB	1.0320	-2.1783	(9.4642)	1.6319	8.9625
		(0.2289)	(0.9382)		[0.2014]	[0.0113]
		***	***			
South Africa						
	s=LEO	1.3387	-1.8514	3.9900	7.7781	14.5596
p(*)=LCPI(*)		(0.1077)	(0.2529)		[0.0053]	[0.0007]
		***	***			
	s=LEB	1.3452	-2.0370	4.7917	10.6413	9.9592
		(0.1331)	(0.3092)		[0.0011]	[0.0069]
		***	***			
p(*)=LWPI(*)	s=LEO	1.5172	-4.7795	16.0616	0.5744	20.7479
		(0.1910)	(1.1971)		[0.4485]	[0.0000]
		***	***			
	s=LEB	1.2030	-1.8353	4.6607	0.0521	17.5006
		(0.1626)	(1.0149)		[0.8195]	[0.0002]
		***	**			

*** denotes rejecting the null hypothesis of unit root at 1% level,** denotes rejecting the null hypothesis of unit root at 5%level, *denotes rejecting the null hypothesis of unit root at 10% level.

The next set of counties to examine is the Latin American ones, for which the results are summarized in table 4.7. A majority of countries in the group have received positive results in favour of the weak-form PPP validity. The cointegrating coefficients are significant and of the correct sign for Argentina, Bolivia, Brazil, Chile, Colombia, Dominican Republic, Ecuador, El Salvador, Honduras, Peru, Suriname and Venezuela regardless of the choice between official and parallel exchange rates. For the remaining two countries, the coefficients for Costa Rica are significant but wrongly signed except for the estimation amongst the official exchange rate and wholesale price indices, where significant and

correctly signed coefficients are obtained. As regard to Mexico, only when the official exchange rate, the domestic and U.S consumer price indices are

Table 4.7: VECM Estimation for Latin American Economies

	$s_t = \alpha + \beta_1 p_t + \beta_2 p_t^* + \varepsilon_t$				Hypothesis tests	
	Normalized cointegrating coefficients				chi-square statistics ,probability in []	
	standard error in ( )				$\beta_1 = -\beta_2$	$\beta_1 = -\beta_2 = 1,$ $\alpha = 0$
Argentina		β_1	β_2	α		
p(*)=LCPI(*)	s=LEO	0.960364	-0.760463	0.609336	0.273492	23.70653
		(-0.01588)	(-0.36572)		[0.600999]	[0.000007]
		***	***			
	s=LEB	1.00772	-2.614411	7.29461	9.561265	25.42375
		-0.02176	-0.50236		[0.001987]	[0.000003]
		***	***			
Bolivia						
p(*)=LCPI(*)	s=LEO	1.039	-1.406	3.197	8.477	33.800
		(0.009)	(0.122)		[0.004]	[0.000]
		***	***			
	s=LEB	0.986	-1.031	1.871	0.039	29.886
		(0.015)	(0.210)		[0.844]	[0.000]
		***	***			
Brazil						
p(*)=LCPI(*)	s=LEO	1.067	-6.428	-23.7458	8.5006	26.4726
		(0.031	(1.574)		[0.0036]	[0.0000]
		***	***			
	s=LEB	1.0088	-4.2075	-14.2987	1.8451	30.9442
		(0.0316)	(1.6187)		[0.1743]	[0.0000]
		***	***			
p(*)=LWPI(*)	s=LEO	0.9793	-1.8975	-4.6464	5.9547	14.0468
		(0.0073)	(0.2888)		[0.0147]	[0.0009]
		***	***			
	s=LEB	0.9620	-1.2657	-2.0799	0.6365	18.1659
		(0.0066)	(0.2569)		[0.4250]	[0.0001]
		***	***			
Chile						
p(*)=LCPI(*)	s=LEO	2.5305	-4.6834	17.1445	0.4493	37.9358
		(0.2226)	(1.1356)		[0.5027]	[0.0000]
		***	***			
	s=LEB	0.4520	-2.8056	-5.5417	4.3678	39.5676
		(0.1962)	(0.9795)		0.0366	0.0000

		***	***			
p(*)=LWPI(*)	s=LEO	1.4964	-2.5444	11.6322	0.0359	34.0034
		(0.1127)	(0.8946)		[0.8498]	[0.0000]
		***	**			
	s=LEB	9.6474	-5.3695	1.668763	0.0447	42.1161
		(2.3791)	(17.4311)		[0.8325]	[0.0000]
		***				
Colombia						
p(*)=LCPI(*)	s=LEO	No Cointegrating relations				
	s=LEB	1.3896	-3.5033	16.9106	0.0644	0.5797
		(0.2273)	(0.9220)		[0.7996]	[0.7484]
		***	**			
p(*)=LWPI(*)	s=LEO	1.2962	-4.3747	20.8224	7.8482	9.4601
		(0.1615)	(0.8627)		[0.0051]	[0.0088]
		***	***			
	s=LEB	1.3234	-5.9727	27.3792	12.9319	14.0945
		(0.2367)	(1.2413)		[0.0003]	[0.0009]
		***	***			
Costa Rica						
p(*)=LCPI(*)	s=LEO	0.6232	0.6289	0.1980	14.6964	34.5176
		(0.0675)	(0.2423)		[0.0001]	[0.0000]
		***	***			
	s=LEB	0.0524	2.5837	-4.1427	25.1915	32.8526
		(0.1087)	(0.3889)		[0.0000]	[0.0000]
		***	***			
p(*)=LWPI(*)	s=LEO	1.0709	-1.1799	-6.6099	0.2275	9.3333
		(0.0279)	(0.1288)		[0.6334]	[0.0094]
		***	**			
	s=LEB	0.8226	0.3462	0.9799	5.3978	19.2946
		(0.1125)	(0.5254)		[0.0202]	[0.0001]
		***	***			
Dominican Republic						
	s=LEO	1.1813	-2.2190	7.8247	5.2172	13.8027
p(*)=LCPI(*)		(0.1600)	(0.5332)		[0.0224]	[0.0010]
		***	***			
	s=LEB	0.9676	-0.7831	3.5688	1.4705	12.3827
		(0.0471)	(0.1540)		[0.2253]	[0.0020]
		***	***			
Ecuador	s=LEO	1.1456	-1.9780	13.8545	17.6728	2.3593
		(0.0398)	(0.2214)		[0.0000]	[0.3074]
		***	***			
	s=LEB	0.9855	-1.0942	10.4544	0.2318	3.7223

		(0.0369)	(0.2025)		[0.6302]	[0.1555]
		***	***			
El Salvador						
p(*)=LCPI(*)	s=LEO	0.9685	-1.4522	4.4544	1.6247	5.1705
		(0.0769)	(0.2192)		[0.2024]	[0.0754]
		***	***			
	s=LEB	0.5884	-0.1831	2.6173	5.5513	7.1733
		(0.0895)	(0.0894)		[0.0185]	[0.0277]
		*				
Honduras						
p(*)=LCPI(*)	s=LEO	1.16237	-1.782479	5.507646	14.86285	7.665919
		(-0.11346)	(-0.23068)		[0.000116]	[0.021645]
		***	***			
	s=LEB	9.3305	-20.9523	74.0433	17.4528	13.3319
		(0.6527)	(3.0436)		[0.0000]	[0.0013]
		***	***			
Mexico						
p(*)=LCPI(*)	s=LEO	1.1090	-1.3813	3.9743	1.8520	27.1392
		(0.0296)	(0.1995)		[0.1736]	[0.0000]
		***	***			
	s=LEB	1.0068	-1.1009	2.9860	0.2082	23.2313
		(0.0327)	(0.2204)		[0.6482]	[0.0000]
p(*)=LWPI(*)	s=LEO	0.9898	0.3211	-3.0231	2.6665	21.9678
		(0.0348)	(0.7823)		[0.1025]	[0.0000]
		***				
	s=LEB	0.9332	0.7449	-4.6069	1.9209	16.3970
		(0.0497)	(1.1153)		[0.1658]	[0.0003]
		***				
Peru						
p(*)=LCPI(*)	s=LEO	0.8653	4.1024	-5.3241	16.7823	17.6289
		(0.0503)	(1.0679)		[0.0000]	[0.0001]
		***	***			
	s=LEB	0.9133	-1.5775	3.5862	1.5344	22.3978
		(0.0214)	(0.4569)		[0.2155]	[0.0000]
p(*)=LWPI(*)	s=LEO	1.0068	-1.7278	4.0027	0.9038	26.1395
		(0.0163)	(0.5784)		[0.3418]	[0.0000]
		***	***			
	s=LEB	1.1091	-11.1284	44.7463	4.7379	4.7682
		(0.0545)	(3.6453)		[0.0295]	[0.0922]
		***	***			
Suriname						

p(*)=LCPI(*)	s=LEO	1.3332	-1.5028	-9.7917	0.0328	9.0080
		(0.0976)	(0.5526)		[0.8562]	[0.0111]
		***	***			
	s=LEB	0.7837	-0.8954	7.4243	0.0738	14.3581
		(0.0730)	(0.4036)		[0.7859]	[0.0008]
		***	***			
Venezuela						
p(*)=LCPI(*)	s=LEO	0.7823	-1.7849	10.4650	6.1393	5.1725
		(0.0877)	(0.4096)		[0.0132]	[0.0753]
		***	***			
	s=LEB	0.5459	-1.0744	7.7339	1.0296	1.8856
		(0.1034)	(0.4753)		[0.3103]	[0.3895]
		***	***			

*** denotes rejecting the null hypothesis of unit root at 1% level,** denotes rejecting the null hypothesis of unit root at 5%level, *denotes rejecting the null hypothesis of unit root at 10% level.

included for estimation, significant and correctly signed cointegrating coefficients can be obtained.

Based upon the existence of significant and meaningful long-run cointegrating relationships, the two aforementioned sets of restrictions are tested. The likelihood ratio test statistics indicate that the symmetry between the coefficients for domestic and foreign prices ($\beta_1 = -\beta_2$) cannot be rejected for Brazil, Chile, Dominican Republic, El Salvador, Peru, Suriname and Venezuela for both exchange rates. Differing results due to the choice of exchange rates have been obtained for Argentina, Bolivia, Colombia, Costa Rica, Ecuador and Mexico. Specifically, the symmetry condition holds for the official exchange rates of Argentina, Costa Rica and Mexico as well as the parallel exchange rates of Bolivia, Colombia and Ecuador. A similar pattern having been observed in the African economies has demonstrated itself that the use of wholesale price index validates the symmetry hypothesis when the use of consumer price index leads to the rejection of the hypothesis sometimes. The evidences can be detected from the results obtained for Brazil, Costa Rica and Peru.

In addition to the positive results we obtained on the symmetry hypothesis test, the strong-form PPP is also supported for a few countries. Colombia, Ecuador and Peru have received positive result when the parallel market rate is under examination. As for Suriname and Venezuela, strong-form PPP is confirmed by using both exchange rates. In the Latin

American group, the parallel market exchange rate seems to be favoring the strong-form PPP hypothesis more than the official exchange rate.

The remaining part of analysis will be focused on the Asian economies based on the results displayed in table 4.8.

Table 4.8: VECM Estimation for Asian Economies

	$s_t = \alpha + \beta_1 p_t + \beta_2 p_t^* + \varepsilon_t$				Hypothesis tests	
	Normalized cointegrating coefficients				chi-square statistics ,probability in []	
	standard error in ( )				$\beta_1 = -\beta_2$	$\beta_1 = -\beta_2 = 1, \alpha = 0$
India		β_1	β_2	α		
p(*)=LCPI(*)	s=LEO	0.7316	-0.7472	(10.3851)	1.4171	4.8582
		(0.1161)	(0.1761)		[0.2339]	[0.0881]
	s=LEB	1.0757	-1.1459	(3.2691)	0.0023	8.5049
		(0.2596)	(0.4023)		[0.9620]	[0.0142]
		***	***			
p(*)=LWPI(*)	s=LEO	1.4935	-2.4968	2.6670	[6.7075	1.8808
		(0.2304)	(0.4636)		[0.0096]	[0.3905]
			**			
	s=LEB	1.3809	-2.8362	9.7895	5.3196	5.1318
		(0.3365)	(0.6682)		[0.0211]	[0.0769]
		***	***			
Indonesia						
p(*)=LCPI(*)	s=LEO	0.4199	1.3953	-1.6133	32.9663	43.3673
		(0.1162)	(0.0907)		[0.0000]	[0.0000]
			***			
	s=LEB	-0.5044	3.0473	-3.6598	21.2984	28.2756
		(0.4428)	(0.8347)		[0.0000]	[0.0000]
			***			
p(*)=LWPI(*)	s=LEO	1.1010	0.2035	6.7593	1.7066	26.6617
		(0.2741)	(0.8160)		[0.1914]	[0.0000]
		***				
	s=LEB	0.9652	6.2323	-20.5477	1.7296	20.3922
		(1.7265)	(5.0015)		[0.1885]	[0.0000]
Iran						
p(*)=LCPI(*)	s=LEO	1.2454	-6.8097	32.6388	5.7579	1.0181
		(0.8337)	(2.8298)		[0.0164]	[0.6011]
			**			

	s=LEB	0.4792	-9.4589	42.6706	0.3484	1.0122
		(1.9783)	(6.7024)		[0.5550]	[0.6028]
p(*)=LWPI(*)	s=LEO	2.8879	162.6057	-660.4582	15.7979	1.7523
		(9.0854)	(45.8736)		[0.0001]	[0.4164]
			***			
	s=LEB	0.8136	-6.5015	31.8550	2.7757	0.7131
		(0.4020)	(1.9730)		[0.0957]	[0.7001]
		**	***			
Korea						
p(*)=LCPI(*)	s=LEO	1.0242	-1.6991	9.5586	2.1091	19.1087
		(0.6422)	(1.0712)		[0.1464]	[0.0001]
	s=LEB	0.9977	-1.7539	9.8930	1.6729	17.0325
		(0.7756)	(1.2924)		[0.1959]	[0.0002]
p(*)=LWPI(*)	s=LEO	-0.7123	0.8449	5.8337	0.0252	30.1872
		(0.8997)	(1.5979)		[0.8740]	[0.0000]
	s=LEB	2.0678	-2.3862	8.3050	0.0002	14.9533
		(0.6682)	(1.1677)		[0.9899]	[0.0006]
		***	**			
Kuwait						
p(*)=LCPI(*)	s=LEO	-0.0966	-0.0700	-0.5628	4.0442	27.9055
		(0.1044)	(0.0563)		[0.0443]	[0.0000]
	s=LEB	-0.1093	-0.0224	-0.6903	3.7516	28.3182
		(0.0885)	(0.0474)		[0.0528]	[0.0000]
p(*)=LWPI(*)	s=LEO	0.2018	-0.2999	-0.8484	10.0167	48.9908
		(0.0631)	(0.0609)		[0.0016]	[0.0000]
		***	***			
	s=LEB	0.1732	-0.3141	-0.6686	10.6523	44.9822
		(0.0879)	(0.0844)		[0.0011]	[0.0000
		*	***			
Malaysia						
p(*)=LCPI(*)	s=LEO	12.4568	-5.1984	-28.8818	7.5862	25.1097
		(5.6750)	(4.0000)		[0.0059]	[0.0000]
		***				
	s=LEB	-20.4324	10.0843	43.6430	11.8949	20.5705
		(7.4527)	(5.2183)		[0.0006]	[0.0000]
		***				
p(*)=LWPI(*)	s=LEO	No Cointegrating relations				

	s=LEB	No Cointegrating relations				
Nepal						
p(*)=LCPI(*)	s=LEO	1.0823	-1.9774	7.4615	0.8984	1.609166
		(0.5148)	(0.9139)		[0.3432]	[0.4473]
		**	**			
	s=LEB	0.9831	-2.5760	4.0799	0.8883	9.9910
		(0.8277)	(1.4599)		[0.3459]	[0.0068]
		**	**			
Pakistan						
p(*)=LCPI(*)	s=LEO	0.9965	-0.3083	0.8594	14.8905	3.5347
		(0.1420)	(0.2293)		[0.0001]	[0.1708]
		***				
	s=LEB	1.0969	-0.5594	1.6601	25.6588	20.3952
		(0.1133)	(0.1800)		[0.0000]	[0.0000]
		***	***			
p(*)=LWPI(*)	s=LEO	0.9089	0.8996	-3.6337	16.3227	4.0272
		(0.2436)	(0.5783)		[0.0001]	[0.1335]
		***				
	s=LEB	0.9424	-0.3776	1.6188	23.8077	18.2489
		(0.0718)	(0.1650)		[0.0000]	[0.0001]
		***	***			
Philippines						
p(*)=LCPI(*)	s=LEO	0.6401	-0.9713	4.6134	0.4272	22.9011
		(0.3428)	(0.7723)		[0.5134]	[0.0000]
	s=LEB	0.9320	-1.1008	4.3175	0.5024	21.8543
		(0.1690)	(0.3792)		[0.4785]	0.0000]
		***	***			
Singapore						
p(*)=LCPI(*)	s=LEO	-10.4261	4.9856	25.7498	0.0207	48.3892
		(1.3849)	(0.7733)		[0.8857]	[0.0000]
		***	***			
	s=LEB	-9.5304	4.4097	−24. 2299	0.0449	18.3066
		(1.9594)	(1.0150)		[0.8321]	[0.0001]
		***	***			
p(*)=LWPI(*)	s=LEO	0.8156	-1.1865	1.9182	5.9165	36.2246
		(0.1619)	(0.0942)		[0.0150]	[0.0000]
		***	***			
	s=LEB	0.7831	-1.1726	2.0078	6.0438	35.4924
		(0.1681)	(0.0972)		[0.0140]	[0.0000]
		***	***			
Sri Lanka						
p(*)=LCPI(*)	s=LEO	0.0993	1.8358	-4.2983	0.7895	6.9853

		(0.0946)	(0.1940)		[0.3743]	[0.0304]
			***			
	s=LEB	0.2885	2.2417	-6.1686	5.2017	9.3235
		(0.4218)	(0.8695)		[0.0226]	[0.0095]
			***			
p(*)=LWPI(*)	s=LEO	0.6662	1.5182	-5.0045	4.4663	13.3288
		(0.2192)	(0.7457)		[0.0346]	[0.0013]
		***	*			
	s=LEB	0.6748	0.3708	-1.2027	6.0382	9.0098
		(0.1446)	(0.4846)		0.0140	0.0111
		***				
Thailand						
p(*)=LCPI(*)	s=LEO	1.2596	-1.4986	4.2769	2.2656	12.0884
		(0.6952)	(0.7672)		[0.1323]	[0.0024]
		*	*			
	s=LEB	1.2621)	-1.4684	4.1441	1.6509	10.5414
		(0.7311)	(0.8029)		[0.1988]	[0.0051]
p(*)=LWPI(*)	s=LEO	1.1516	-1.6973	5.7443	9.9508	15.2905
		(0.4282)	(0.5346)		[0.0016]	[0.0005]
		***	***			
	s=LEB	1.2842	-1.7946	5.6356	8.7406	15.0714
		(0.4489)	(0.5543)		[0.0031]	[0.0005]
Turkey		***	***			
p(*)=LCPI(*)	s=LEO	0.7381	-2.9597	21.0752	3.0145	37.0344
		(0.1556)	(1.2285)		[0.0825]	[0.0000]
		***	***			
	s=LEB	0.7810	-2.3222	18.7534	1.6427	21.2948
		(0.1088)	(0.8929)		[0.2000]	[0.0000]
		***	***			
p(*)=LWPI(*)	s=LEO	1.0770	-4.0550	27.5777	3.5741	5.6908
		(0.0334)	(0.8579)		[0.0587]	[0.0581]
		***	***			
	s=LEB	1.0982	-2.3222	28.8316	14.4706	3.4123
		(0.1088)	(0.8929)		[0.0001]	[0.1816]
		***	***			

*** denotes rejecting the null hypothesis of unit root at 1% level,** denotes rejecting the null hypothesis of unit root at 5%level, *denotes rejecting the null hypothesis of unit root at 10% level.

The findings from the Asian group, generally speaking, are less supportive of the long-run PPP validity comparing to the two former groups. Out of the 14 countries examined, the cointegrating coefficients for Nepal and Turkey solely are reported to be both significant

and correctly signed. For the remaining countries, the results display a relatively clearer pattern comparing to the formerly discussed groups that the parallel market rate and wholesale price index are more favorable in validating the weak-form PPP. The use of parallel market, instead of the official rate, provides significant and meaningful cointegrating coefficients for India, Iran, Korea, Kuwait, and Philippines. Besides, while using the consumer price index produces insignificant or (and) wrongly signed coefficients, positive estimations have been obtained for Kuwait, Singapore and Thailand when the wholesale price index are employed instead. This finding has also been advocated in the literature we reviewed in the second chapter.

The test results for the binding restrictions are again, not as positive as the African and Latin American groups. Evidences of strong PPP are reported under the combination of parallel exchange rate and wholesale price index for India and Iran whilst only the official exchange rates of Iran receives support in the validity of strong-form PPP. The symmetry condition for the domestic and foreign prices holds for more cases. Specifically, the parallel rate for Korea, Philippines, and Singapore, as well as the official exchange rate for Thailand and Turkey are found to support the symmetry condition.

Table 4.9: VECM Estimation for Western Developed Economies

	$s_t = \alpha + \beta_1 p_t + \beta_2 p_t^* + \varepsilon_t$				Hypothesis tests	
	Normalized cointegrating coefficients				chi-square statistics ,probability in [ ]	
	standard error in ( )				$\beta_1 = -\beta_2$	$\beta_1 = -\beta_2 = 1, \alpha = 0$
Belgium		β_1	β_2	α		
p(*)=LCPI(*)	s=LEO	13.194	-8.369	-17.139	33.725	30.625
		-3.114	-2.592		[0]	[0]
		***	***			
	s=LEB	9.667	-6.576	-9.825	3.595	32.496
		-1.989	-1.657		[0.058]	[0]
		***	***			

*** denotes rejecting the null hypothesis of unit root at 1% level,** denotes rejecting the null hypothesis of unit root at 5%level, *denotes rejecting the null hypothesis of unit root at 10% level.

The last group and also the last country to be discussed for this model is Belgium. As shown in table 4.9, the coefficients are significant and correctly signed for both exchange

rates while the symmetry condition holds for the parallel exchange rate only. It is also evident that the strong-form PPP does not hold for Belgium.

4.5. Empirical Results Analysis for Model Two

In the preceding section we have discussed the findings from estimating the traditional PPP model and the following section presents the analysis of an alternative PPP model which incorporates the dynamic interaction between the official and parallel exchange rate markets. The formulation of this model was explained in section 3.3.

4.5.1 Cointegration test

In accordance to the procedure we undertook for analyzing model one, we initiate the analysis by investigating the stochastic properties of the variables concerned. Since the same range of series used in model 1 are employed in this model, we move forward to present the cointegrating rank of the VAR models estimated for each country.

The results from cointegration test are displayed in table A.17 to A.20 in the appendix. At least 1 cointegrating vector is detected for all of the estimates and around half of the countries have been reported to contain 2 cointegrating vectors. This finding is consistent with Diamandis (2003) who reports 2 cointegrating vectors for Argentina, Bolivia and Chile.

The details are discussed on basis of regional categories as before. Table A.17 presents the cointegration ranks for Latin American economies. Two cointegrating vectors have been reported for 5 countries, namely, Argentina, Bolivia, Mexico, Peru and Suriname regardless of the price index choices. One cointegrating vector is indicated for Brazil, Colombia, El Salvador, Honduras and Venezuela no matter which price index is employed. Differing results appear for Peru and Chile in the sense that two cointegrating vectors are suggested using the consumer price index and 1 cointegrating vector is found using the wholesale price index. It is noteworthy that the adjusted trace statistics we have evidently rectified the cointegration ranks for 2 countries. Specifically, the trace statistics has reported 4 cointegrating vectors for Costa Rica and El Salvador which obviously cannot hold as there should not be more than 3 cointegrationg relationships amongst 4

nonstationary series. The adjusted trace statistics, however, has reported 2 and cointegrating vectors for Costa Rica and El Salvador, respectively, leading to improvement of the test results.

Turning to the African group as illustrated in table A.18, the VAR models for 4 out of 6 countries are found to contain 2 cointegrating vectors, namely, Egypt, Kenya, Morocco and South Africa whilst 1 cointegrating vector is indicated for Algeria and Nigeria. The choice between wholesale and consumer price indices has caused no difference in the determination of the cointegration ranks. Table A.19 indicates that the cointegration rank for Belgium is 2.

When it comes to the findings for the Asian economies as displayed in table A.20, around half of the economies are suggested to contain one cointegrating vector and 2 for the remaining one. Inconsistent results obtained when differential price index is in use for Sri Lanka and Turkey. For both countries, the model using consumer price index displays 2 cointegrating vectors whilst 1 cointegrating vector while using wholesale price index. It is interesting that similar findings have been observed for the Latin American group as we discussed earlier.

Based on the cointegration rank we have determined, the long-run VEC models are obtained for countries containing one cointegrating vector with the cointegrating coefficients presented. For the 2 cointegrating vectors case we follow the methodology of Diamandis (2003) by imposing identification restrictions as discussed in section 3.3.2 and test the validity of the restrictions. Our investigation limits to the hypothesis testing of the restrictions instead of the estimates of the models when 2 cointegration relationships are present. The main reason for this is that in the two cointegration equations case, most of the tentative estimates of the VEC models tend to report the 2 cointegration vectors as the two PPP relationships for the parallel exchange rate and official exchange rate respectively, which will be a repetition of our investigation in model 1. Our results will shed light on both the validity of the parallel PPP relationship as well as the long run relationship between the two exchange rates.

Table 4.10: Model 2 VECM Estimation for African Economies (a)

Countries	$e_b = b_0 + b_1 e_o + b_2\, p + b_3 p^*$ Expected sign of coefficients: b_0>0, b_1>0, b_2 > 0, and b_3<0.				
	Normalized cointegrating coefficients				
	(standard error in parentheses)				
		b_1	b_2	b_3	b_0
Algeria	p(*)=LCPI(*)	-4.104	14.654	-48.989	170.639
		(-3.50408)	(-5.5685)	(-9.28506)	
		***	**	***	
Nigeria	p(*)=LCPI(*)	0.3459	0.7919	-1.3062	5.8918
		(0.1303)	(0.1733)	(0.4921)	
		***	***	***	

Table 4.10: Model 2 VECM Estimation for African Economies (b)

Tests for overidentifying restrictions of Countries with 2 cointegrating vectors					
	Restrictions on cointegrating vectors $\beta = \begin{bmatrix} 1 & 0 & -1 & 1 & \alpha \\ 1 & -1 & 0 & 0 & 0 \end{bmatrix}$			Restrictions on cointegrating vectors $\beta = \begin{bmatrix} 1 & 0 & -1 & 1 & \alpha \\ 1 & -1 & 0 & 0 & 0 \end{bmatrix}$	
Countries	α	Likelihood Ratio Test statistics (p-value in brackets)	Countries	α	Likelihood Ratio Test statistics (p-value in brackets)
Egypt			Kenya		
p(*)=LCPI(*)	-4.4031	27.7468 (0.0000)	p(*)=LCPI(*)	-4.5961	6.2163(0.1836)
p(*)=LWPI(*)	-1.7523	41.8702 (0.0000)			
Morocco			South Africa		
p(*)=LCPI(*)	-2.0700	18.1039(0.0012)	p(*)=LCPI(*)	-1.7311	22.2153(0.0002)
p(*)=LWPI(*)	-2.1145	21.4717 (0.0003)	p(*)=LWPI(*)	-1.7888	17.2609(0.0017)

Table 4.10 (a) and (b) demonstrate the VEC model estimation and test results of overidentifying restrictions for the African economies. As shown in 4.10 (a), for the countries with 1 cointegrating relationship, the cointegrating coefficients are significant and correctly signed for Nigeria. Statistically significant coefficients have also been obtained for Algeria but the coefficient for the official exchange rate is wrongly signed.

As regard to countries for which one cointegrating vector exists, only the restrictions for Kenya cannot be rejected.

The results for Asian Economies are displayed in table 4.11(a) and (b). Amongst the countries with 1 cointegrating vector, the estimated coefficients for Korea, Malaysia and Turkey are significant and correctly signed. Indonesia, Iran and Kuwait have also received significant estimates but wrongly signed. It is worth mentioning that for Korea, the significant and meaningful coefficients can only be obtained when the wholesale instead of consumer price index is in use. For the countries with 2

Table 4.11: Model 2 VECM Estimation for Asian Economies (a)

Countries	$e_b = b_0 + b_1 e_o + b_2\, p + b_3 p^*$ Expected sign of coefficients: b_0>0, b_1>0, b_2 > 0, and b_3<0.				
	Normalized cointegrating coefficients				
	(standard error in parentheses)				
		b_1	b_2	b_3	b_0
Indonesia	p(*)=LCPI(*)	1.9335	-0.4576	-1.1202	-0.9442
		(0.1501)	(0.3394)	(0.5628)	
		***		**	
	p(*)=LWPI(*)	4.3158	−7.7193	11.9386	-57.5245
		(0.72694)	(1.64484)	(2.81342)	
		***	***	***	
Iran	p(*)=LCPI(*)	-0.9839	2.3598	-6.5484	34.2703
		(0.5035)	(1.1689)	(3.1607)	
		***	***	***	
Korea	p(*)=LCPI(*)	1.2434	0.0316	-0.0815	−1.3910
		(0.1137)	(0.2212)	(0.4565)	
		***			
	p(*)=LWPI(*)	0.8924	0.7476	-1.0258	2.0415
		(0.1557)	(0.2286)	(0.3517)	
		***	***	***	
Kuwait	p(*)=LCPI(*)	0.9841	-0.1048	0.0362	0.2794
		(0.0804)	(0.0270)	(0.0138)	
		***	***	***	
	p(*)=LWPI(*)	2.3433	-0.3579	0.4292	1.3967
		(0.3003)	(0.1059)	(0.0971)	
		***	***	***	

Malaysia	p(*)=LCPI(*)	1.5111	1.8488	-0.6542	-4.4838
		(0.2034)	(0.3503)	(0.1846)	
		***	***	***	
	p(*)=LWPI(*)	1.0507	0.1696	-0.2567	0.3599
		(0.0498)	(0.1137)	(0.1690)	
		***			
Sri Lanka	p(*)=LWPI(*)	0.0443	0.6473	0.7814	-1.8541
		(0.4323)	(0.3312)	(0.7488)	
			***		
Turkey	p(*)=LWPI(*)	0.9215	0.0867	-0.6879	3.8094
		(0.1282)	(0.1402)	(0.5381)	
		***	***	***	

Table 4.11: Model 2 VECM Estimation for Asian Economies (b)

Tests for overidentifying restrictions of Countries with 2 cointegrating vectors					
Countries	Restrictions on cointegrating vectors $\beta = \begin{bmatrix} 1 & 0 & -1 & 1 & \alpha \\ 1 & -1 & 0 & 0 & 0 \end{bmatrix}$		**Countries**	Restrictions on cointegrating vectors $\beta = \begin{bmatrix} 1 & 0 & -1 & 1 & \alpha \\ 1 & -1 & 0 & 0 & 0 \end{bmatrix}$	
	α	Likelihood Ratio Test statistics (p-value in brackets)		α	Likelihood Ratio Test statistics (p-value in brackets)
India			**Nepal**		
p(*)=LCPI(*)	-0.3456	15.08193(0.0045)	p(*)=LCPI(*)	-4.0664	4.1743(0.3829)
p(*)=LWPI(*)	-3.5555	18.8292(0.0008)			
Pakistan			**Philippines**		
p(*)=LCPI(*)	-3.6944	20.4364(0.0004)	p(*)=LCPI(*)	-3.7203	11.3978(0.0224)
p(*)=LWPI(*)	-3.9841	17.7598(0.0014)			
			Sri Lanka		
Singapore			p(*)=LCPI(*)	-1.8541	9.6766(0.0462)
p(*)=LCPI(*)	-0.3332	23.03796(0.0001)			
p(*)=LWPI(*)	-0.3274	11.2495(0.0239)	**Thailand**		
Turkey			p(*)=LCPI(*)	-0.0925	9.3853(0.0522)
p(*)=LCPI(*)	-18.6372	8.9959(0.0612)	p(*)=LWPI(*)	-3.467428	17.3058(0.0017)

cointegrating vectors , the restrictions hypothesis cannot be rejected for a considerable number of countries, namely, Nepal, Philippines, Sri Lanka ,Singapore, Thailand and Turkey.

Table 4.12 (a) and (b) demonstrate the VEC model estimation and test results of overidentifying restrictions for the Latin American economies. As shown in 4.12(a), for the countries with 1 cointegrating relationship, the cointegrating coefficients are significant and correctly signed for Brazil, Colombia and Dominican Republic. Statistically significant coefficients have also been obtained for El Salvador and Honduras but the signs of these coefficients are not entirely correct. For the countries with 2 cointegrating vectors, the results are a bit discouraging as only the VEC model for Mexico validates the identifying restrictions. As regard to Belgium, the overidentifying restrictions are rejected.

The overall findings for the second model are less positive as opposed to the traditional PPP model we estimated (model one). On the other hand, the parallel market version of PPP does hold for a number of economies, and the joint hypothesis indicating the long-run strong-form PPP for parallel exchange rate as well as the informational efficiency in the parallel market is validated for Kenya, Nepal, Mexico, Philippines, Sri Lanka, Thailand, Singapore and Turkey.

Table 4.12: **Model 2 VECM Estimation for Latin American Economies (a)**

Countries	$e_b = b_0 + b_1 e_o + b_2\, p + b_3 p^*$ Expected sign of coefficients: b_0>0, b_1>0, b_2 > 0, and b_3<0.				
	Normalized cointegrating coefficients				
	(standard error in parentheses)				
		b_1	b_2	b_3	b_0
Brazil	p(*)=LCPI(*)	0.2244	0.7083	-4.7818	10.4227
		(0.1959)	(0.1860)	(1.5751)	
		***	***	***	
	p(*)=LWPI(*)	2.7708	-1.8864	17.8880	-71.4861
		(0.8600)	(0.8463)	(3.1465)	
		***	***	***	
Colombia	p(*)=LCPI(*)	0.8176	0.3336	-0.9064	4.0874
		(0.0938)	(0.1190)	(0.2448)	
		***	***	***	
	p(*)=LWPI(*)	0.7054	0.4150	-1.0812	5.3217
		(0.1638)	(0.1942)	(0.3218)	
		***	***	***	
Dominican Republic	p(*)=LCPI(*)	0.2426	0.6635	-0.4268	1.6397
		(0.1038)	(0.1275)	(0.1728)	
		***	***	***	
Ecuador	p(*)=LCPI(*)	0.4710	0.4128	-0.0642	3.5196
		(0.1190)	(0.1395)	(0.2116)	
		***	***		
El Salvador	p(*)=LCPI(*)	-1.3829	1.7361	-2.2419	7.8234
		(0.6345)	(0.6429)	(1.1079)	
		***	***	***	
Honduras	p(*)=LCPI(*)	-2.7636	11.1988	-14.2379	39.3329
		(0.8077)	(0.9723)	(3.5139)	
		***	***	***	

Peru	p(*)=LWPI(*)	1.3715	-0.3724	-10.7555	40.4995
		(0.4297)	(0.4222)	(2.5000)	
		***		***	
Venezuela	p(*)=LCPI(*)	-0.5307	0.9192	-1.6762	11.9125
		(0.5806)	(0.5976)	(0.7536)	
				***	
	p(*)=LWPI(*)	0.8626	-0.1316	-2.6340	11.2900
		(0.9978)	(1.0561)	(1.3301)	
				*	

Table 4.12: **Model 2 VECM Estimation for Latin American Economies (b)**

Tests for overidentifying restrictions of Countries with 2 cointegrating vectors					
	Restrictions on cointegrating vectors $\beta = \begin{bmatrix} 1 & 0 & -1 & 1 & \alpha \\ 1 & -1 & 0 & 0 & 0 \end{bmatrix}$			Restrictions on cointegrating vectors $\beta = \begin{bmatrix} 1 & 0 & -1 & 1 & \alpha \\ 1 & -1 & 0 & 0 & 0 \end{bmatrix}$	
Countries	α	Likelihood Ratio Test statistics (p-value in brackets)	**Countries**	α	Likelihood Ratio Test statistics (p-value in brackets)
Argentina			**Bolivia**		
p(*)=LCPI(*)	-0.906	38.1627(0.000)	p(*)=LCPI(*)	-3.582	43.59036(0.000)
Costa Rica			**Chile**		
p(*)=LCPI(*)	-3.8145	51.2477（0.0000）	p(*)=LCPI(*)	6.2629	91.2084（0.0000）
p(*)=LWPI(*)	6.1528	40.6690（0.0000）	p(*)=LWPI(*)	6.5624	49.0613（0.0000）
			Peru		
Mexico			p(*)=LCPI(*)	0.0443	19.9552(0.0005)
p(*)=LCPI(*)	-2.5920	11.4742（0.0217）	**Suriname**		
p(*)=LWPI(*)	2.7109	15.5033（0.0038）	p(*)=LCPI(*)	8.2377	19.3901(0.0007)

Table 4.13: **Model 2 VECM Estimation for Western Developed Economies**

Tests for overidentifying restrictions of Countries with 2 cointegrating vectors		
	Restrictions on cointegrating vectors	
	$\beta = \begin{bmatrix} 1 & 0 & -1 & 1 & \alpha \\ 1 & -1 & 0 & 0 & 0 \end{bmatrix}$	
Countries	α	Likelihood Ratio Test statistics (p-value in brackets)
Belgium		
p(*)=LCPI(*)	13.176	15.3744(0.0040)

Notes for Table 4.9 to 4.13:
p(*)=LCPI(*) indicates CPI is used for both domestic and U.S price levels while p(*)=LWPI(*) indicates CPI is used for both domestic and U.S price levels

4.6. Discussion of Results and Resultant Policy Implications

The previous econometric investigation reveals some very interesting aspects of the way international finance and, particularly, the exchange rates management intertwines with countries' economic performance. The most striking feature extracted from this research is the solid existence of a long run relationship between the exchange rates of the countries under investigation and the price levels of those economies. In other words, the PPP doctrine is evident, either to its weak or its strong form case. Then, depending on the case, the importance or not of the parallel markets is emerged.

Taking into account the baseline taxonomy (into regions), it is easy to infer that the parallel market exchange rates are quite important for the less developed economies. For most of the countries from the African and the South American continents, as well as from Asia, the role of the black market pricing of the local currencies is substantial. On top of that, it is important to notice the importance of the wholesale price index in the PPP modelling for a number of African economies which share a common characteristic. They are all producers and exporters of raw materials and natural resources, such as gas and oil. This

holds true for the Gulf countries, as well. This is a major finding, compared to previous work done on this area. It indicates that countries open and vulnerable to international trade should reconsider the way they formulate their exchange rate policies. Most of these economies present the so called “fear of floating”, in the sense that they usually fix their currencies value vis-à-vis one of the most important global currencies (in most cases, US dollar). In this way, they anticipate to protect the value of their exports and, on the same time, to avoid dangerous fluctuations in their international financial positions. Nevertheless, the fact that the long-run equilibrium examination underlines the role of parallel market rates for these economies indicates that it might be in their favour to alterate the following macroeconomic policies. Keeping their currencies undervalued (in most cases) compared to US dollar, is not a sustainable policy. It would probably be in their interest to adopt a more flexible exchange rate policy.

A similar argument holds for the crisis-prone economies. As it is obvious from the results’ discussion, the parallel market rate is more useful, in order to provided clear validation of the PPP doctrine. This finding can be evidence of the underlined reason that these economies are more susceptible to abrupt macroeconomic and financial conditions. Since their policies are based on de jure exchange rate system and, also, the fact that they do not formulate their policies based on the most appropriate measures (in the examined case here, the parallel market rates), these economies turn out to be more vulnerable and succumbed to financial and currency crises episodes. Additionally, this econometric outcome indicates that these economies should follow less restrictive policies for their currencies and adopt more flexible exchange rate regimes. The past crisis episodes dictate the inability of fixed regimes to be sustainable in the long run. It is not by accident that countries that used to keep their currencies into inflexible exchange rate regimes (for instance, the EU countries in the past) soon abandoned such policies (most of them after 1994). Liberalization of exchange rates seems like a fruitful policy for such type of economies.

Turning now to the case of the developed economies, there is no strong evidence for the necessity to use parallel market rates whatsoever. As previously implied, there are a number of reasons for this to happen. First of all, the previously mentioned market liberalization and integration worked well for these economies. The openness verified the ability of these economies to satisfy their funding needs not only from natural sources but also from foreign capital inflows. Moreover, the period I examine in this thesis covers the

so called “Great Moderation” era. This period is characterized by steady growth path and reasonably low inflationary pressures for these economies. On top of these, many central banks adopted inflation targeting policies, which are an additional important effect on the ability of these monetary authorities to control inflation, growth prospects and managing (up to a certain extent) the value of their currencies. Thus, these active macro-financial policies, which do not include strong interventions into the foreign exchange market, contributed to the gradual elimination of the parallel exchange rate markets. At least, they rendered them obsolete. This is another strong argument in favour of capital mobility liberalization, together with the necessity to adopt more flexible exchange rate regimes. Of course, it is reasonable to assume that, based on the special features of each economy, a somehow different exchange rate system may be appropriate. In any case, the evidence is strongly in favour of macroeconomic policies, like those mentioned above. It is not by chance that this is the tendency observed in the last 2 decades in the economies around the world.

Chapter 5: Conclusion

The thesis conducts an empirical analysis of the parallel market exchange rate behavior in the post Bretton-Woods era based on monthly data spanning the period January 1973 to December 1998 for a heterogeneous group of 56 countries across the globe. The main objective of the study is to examine the validity of long-run PPP across the countries under examination and to identify whether the market-determined parallel rates are more supportive of the long run PPP as opposed to the official rate. I also investigated the nexus between the two rates based on a parallel market version of PPP, by means of standard cointegration techniques. The variables of interest, as suggested by standard PPP formulations, include the official and parallel nominal exchange rates, the price indices of domestic countries and those of the United States as U.S dollar is used as the numeraire currency. For the price indices we employ both Consumer Price index (CPI) and Wholesale Price index (WPI).Besides, a binary probit model is estimated as a preliminary

The empirical analysis is carried out in the following way:
As a preliminary investigation, we follow Reinhart& Rogoff (2004) and regress a currency crash dummy on the 12-month parallel market premium for 37 countries across the globe during the period 1973 M01 to 1998 M12 based on Monthly data. We first examined the time series properties of the parallel market premium we constructed and preclude the countries with non-stationary premia for further analysis. What follows is the regression estimated using the Binary Probit model as the dependant variable is a binary one. Our findings are consistent with Reinhart& Rogoff (2004), who report 97 percent cases of positive coefficient and 81 percent both positive and significant, especially in the case of Latin American economies. On the other hand, the weakest results come from the developed world, while the results for the African and Asian region are, in general, consistent. The overall findings validate the hypothesis that the parallel market premium is indicative of the currency crashes hence might systematically predict official rate realignment in the long run.

The main empirical analysis is concentrated on testing the long-run validity of PPP based on Johansen cointegration analysis. The monthly data is used for the nominal and official exchange rates, the domestic price indices (both wholesale and consumer price indices) during the sample period mentioned above. Two alternative models are investigated: the

traditional weak-form and strong form PPP framework as well as a version of PPP model proposed by Diamandis(2003) accountable for the presence of both official and parallel exchange rate markets. The econometric methodology is consistent for the examination using both models, i.e., the Johansen cointegration approach.

The results from the traditional PPP model (denoted as model 1 alternatively) are rather positive as regard to the acceptance of weak-form PPP. Above all, the existence of at least one cointegrating vector is found for almost all the estimated VAR models with only few exceptions. These findings are encouraging for our further analysis as for most countries; the evidences of long run relationship within the variable set are supported, which enables us to test the PPP framework as established in the former chapter. In general, similar findings are obtained by using either exchange rate in terms of the determination to the cointegration rank. Differing results have been reported more frequently only in the Asian group when the magnitude of price and exchange rate vary in the sense that the results display a relatively clearer pattern comparing to the other groups that the parallel market rate and wholesale price index are more favorable in validating the weak-form PPP. The most positive results are reported for the Latin American economies. When it comes to the validity of weak-form PPP, a majority of countries in the group have received positive results in favour of the weak-form PPP validity, the strong-form PPP is also supported for a few countries. Colombia, Ecuador and Peru have received positive result when the parallel market rate is under examination. As for Suriname and Venezuela, strong-form PPP is confirmed by using both exchange rates. In the Latin American group, the parallel market exchange rate seems to be favoring the strong-form PPP hypothesis more than the official exchange rate. The overall findings for the second model are less positive as opposed to the traditional PPP model we estimated (model one) but the parallel market version of PPP does hold for a few economies, and the joint of hypothesis indicating the long-run strong-form PPP for parallel exchange rate as well as the informational efficiency in the parallel market is validated for Kenya, Nepal, Mexico, Philippines, Sri Lanka, Thailand, Singapore and Turkey.

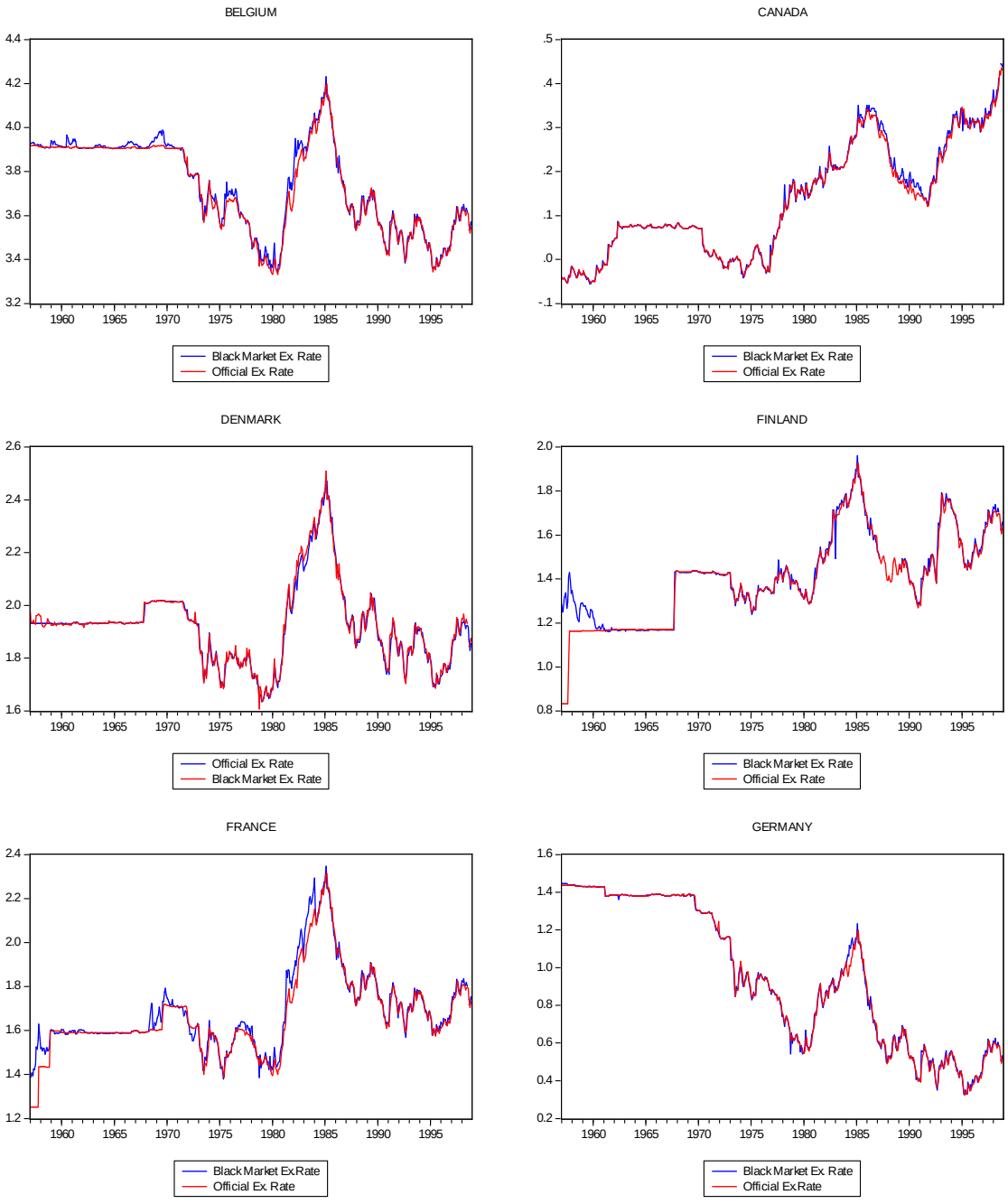
To sum up, it is obvious that the weak-form PPP models receives stronger support than the alternative model especially for the Latin American economies .Relatively speaking, the alternative model fit better for the Asian group where 7 out of 14 countries have been reported to support the second model. The strong-form PPP is best received for African

economies but mostly for the parallel exchange rate solely. Also, long-run cointegrating relationships amongst the nominal exchange rate, the domestic price as well as the foreign price have been strongly supported regardless of the choice between official and parallel exchange rate. Although evidence has demonstrated itself that, the use of parallel exchange rate can improve the validity of meaningful and significant cointegrating relationships implied by PPP, this is true for both variants of models. Similar comparative findings have been obtained for the wholesale price index as opposed to the consumer price index. This is true for all 3 groups of economies. Our empirical analysis is consistent with the panel unit root based test of PPP carried out by Cerrato and Sanrantis (2007) as regard to the positive results regarding weak-form PPP .The purpose to identify if the parallel market exchange rates is more favorable in validating PPP is positively, although not definitely, confirmed.

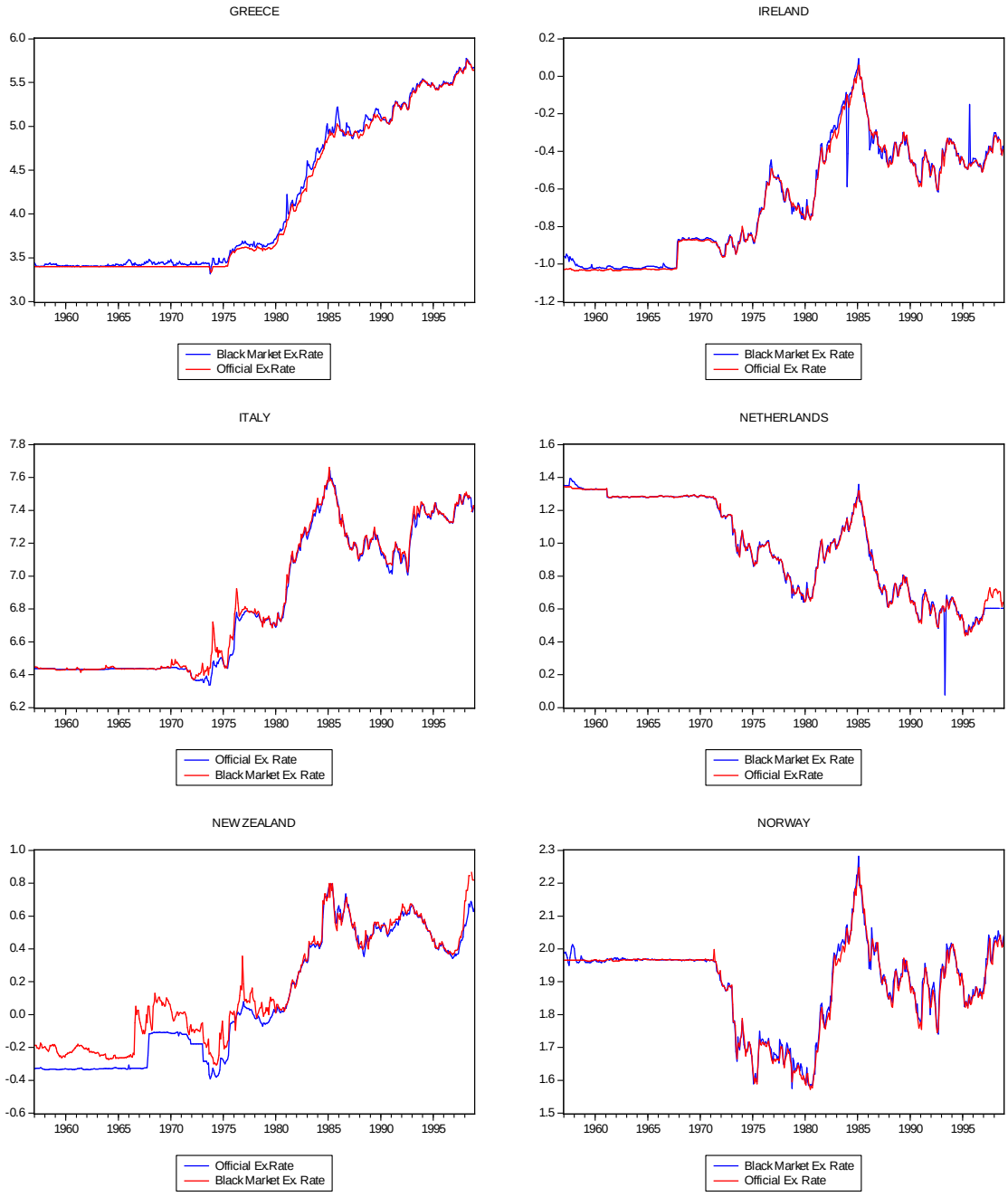
In any case, a number of policy prescriptions can be underlined, based on the previous econometric analysis. First of all, it is evident the superiority of floating exchange rate regimes, compared to restrictive policies adopted from many crisis-prone economies. This is reasonable to assume, given that parallel market rate provides somehow improved results for the PPP validity. Then, the fact that countries rich in resources tend to fix their currencies value instead of letting them float, does not seem to be the wisest economic policy choice. Countries that desisted such restrictive policies, experienced steady growth rates and stable conditions for their currencies value. The lack of data until the recent period is an obstacle, in order to examine the PPP model validity in periods of fully fledged, financial meltdowns. This would be an interesting extension in the relevant economic literature.

APPENDIX

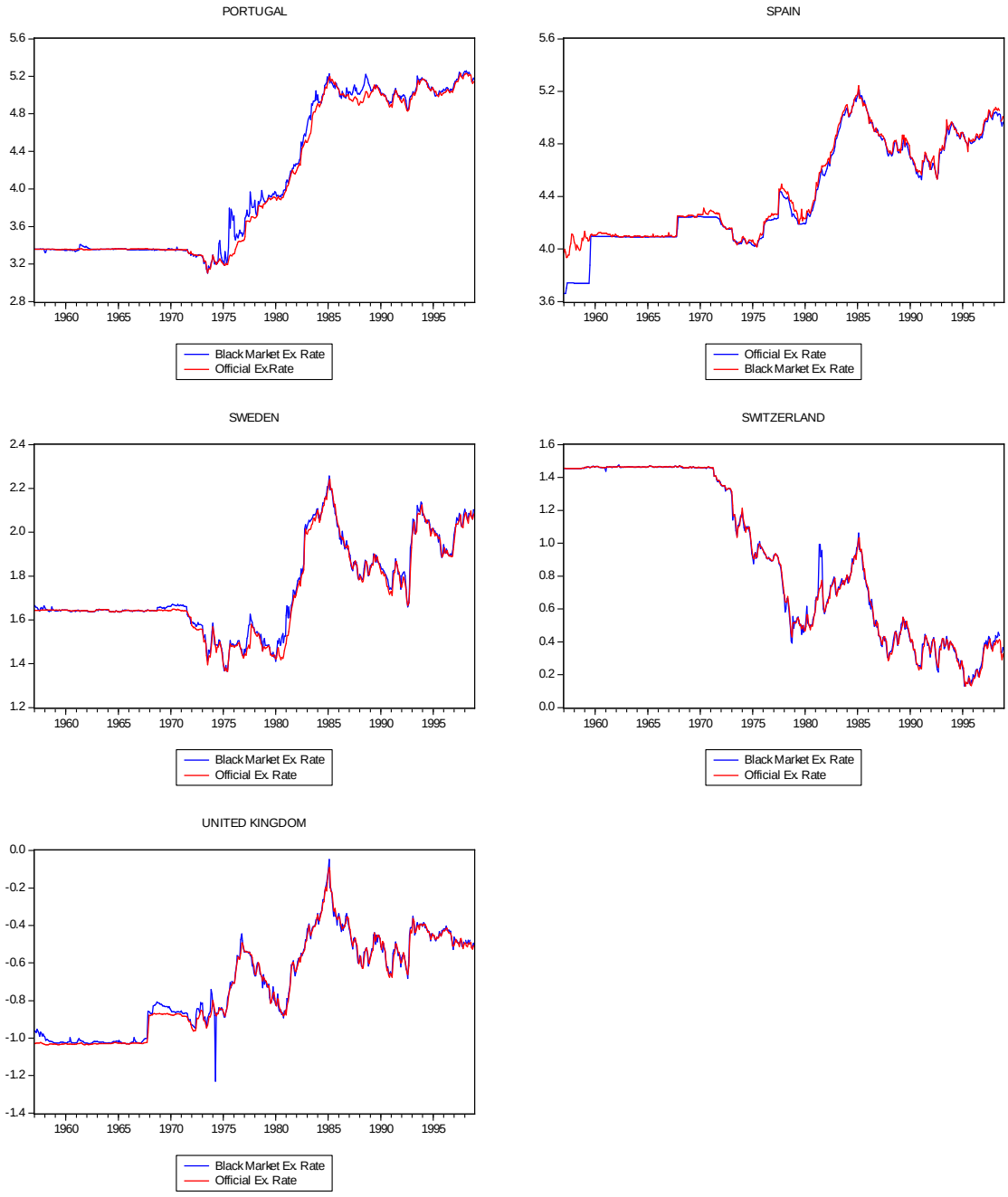
Figures A.1: Developed Economies Official and Parallel Ex. Rates - 1



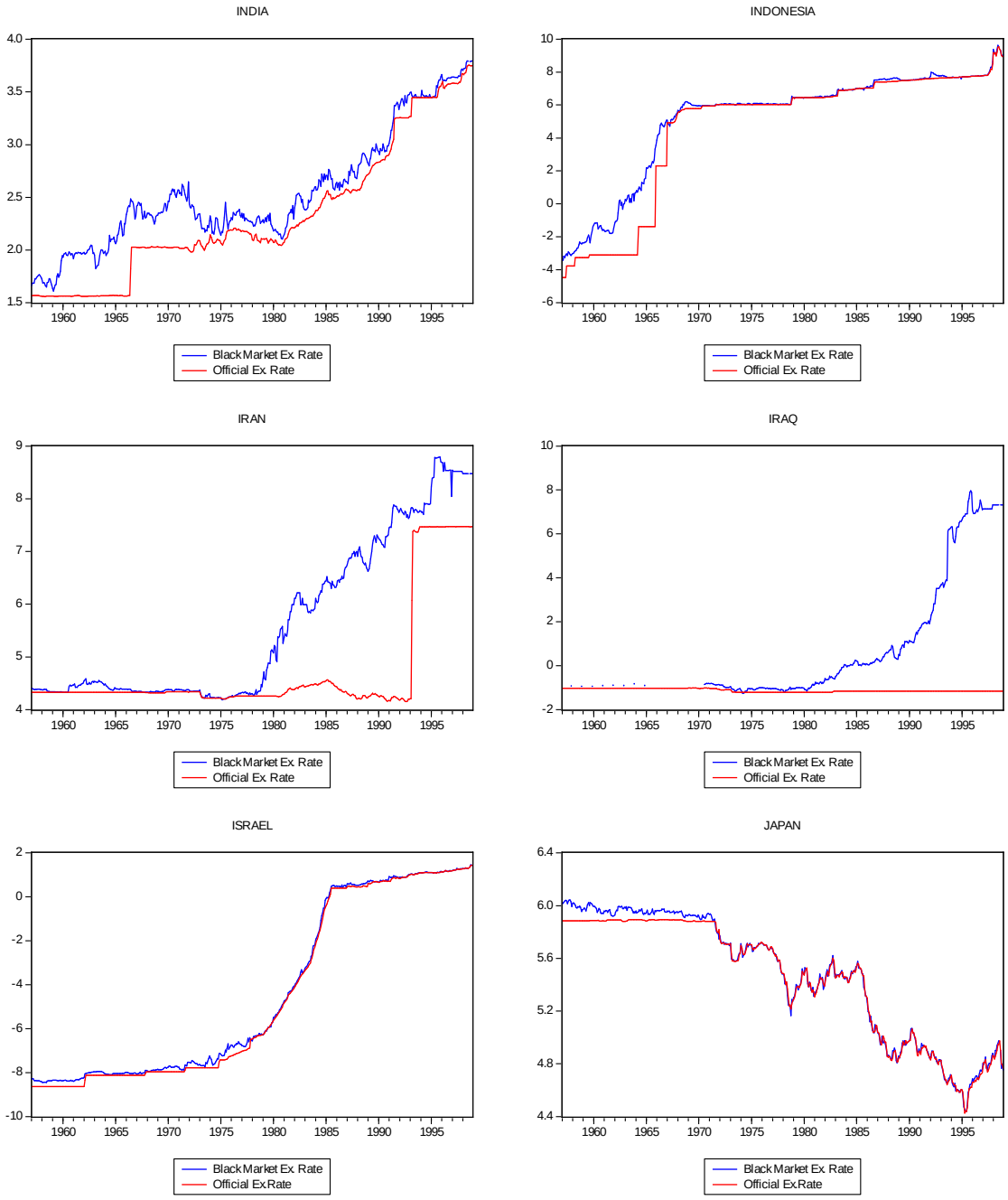
Figures A.2: Developed Economies Official and Parallel Ex. Rates - 2



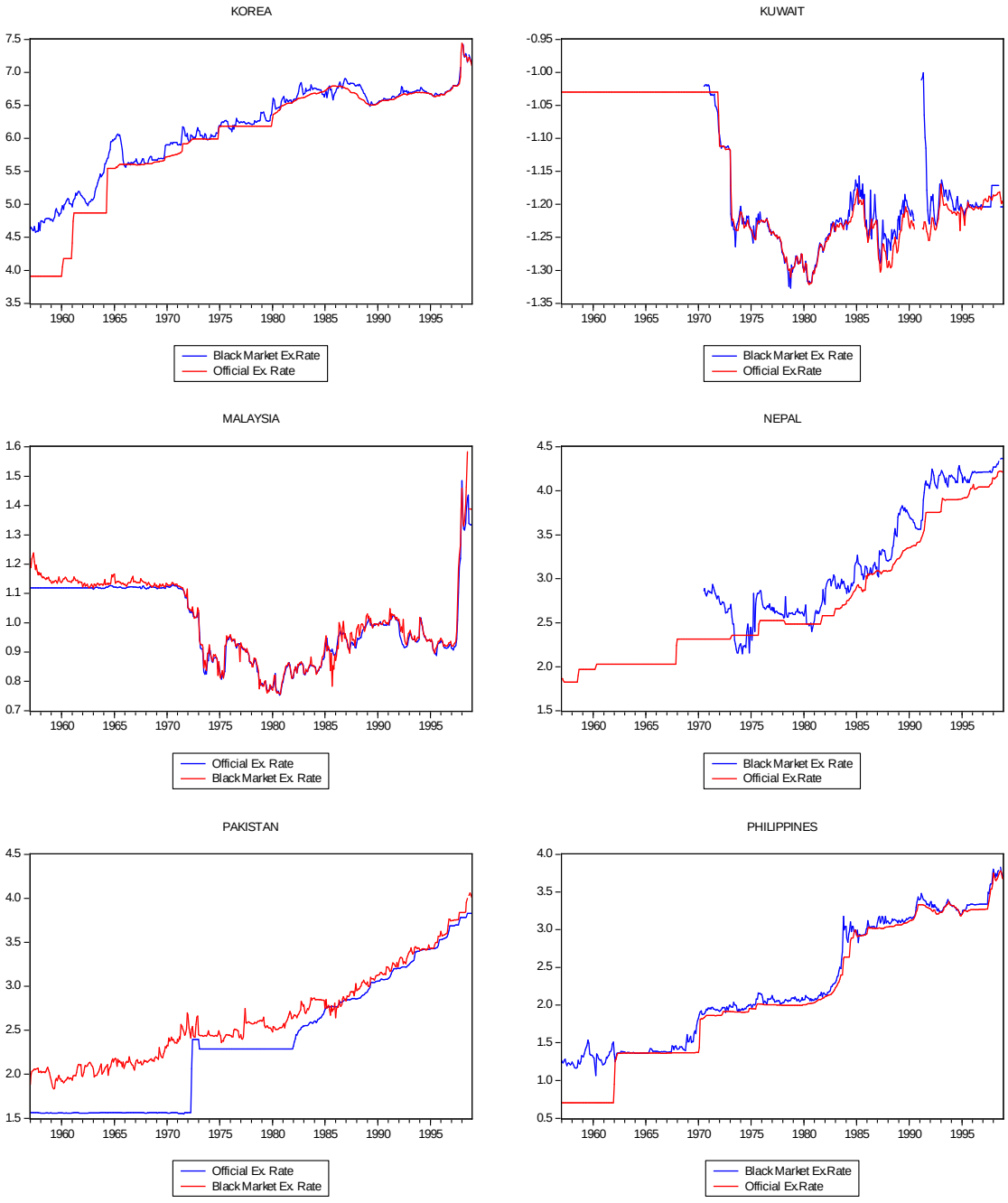
Figures A.3: Developed Economies Official and Parallel Ex. Rates - 3



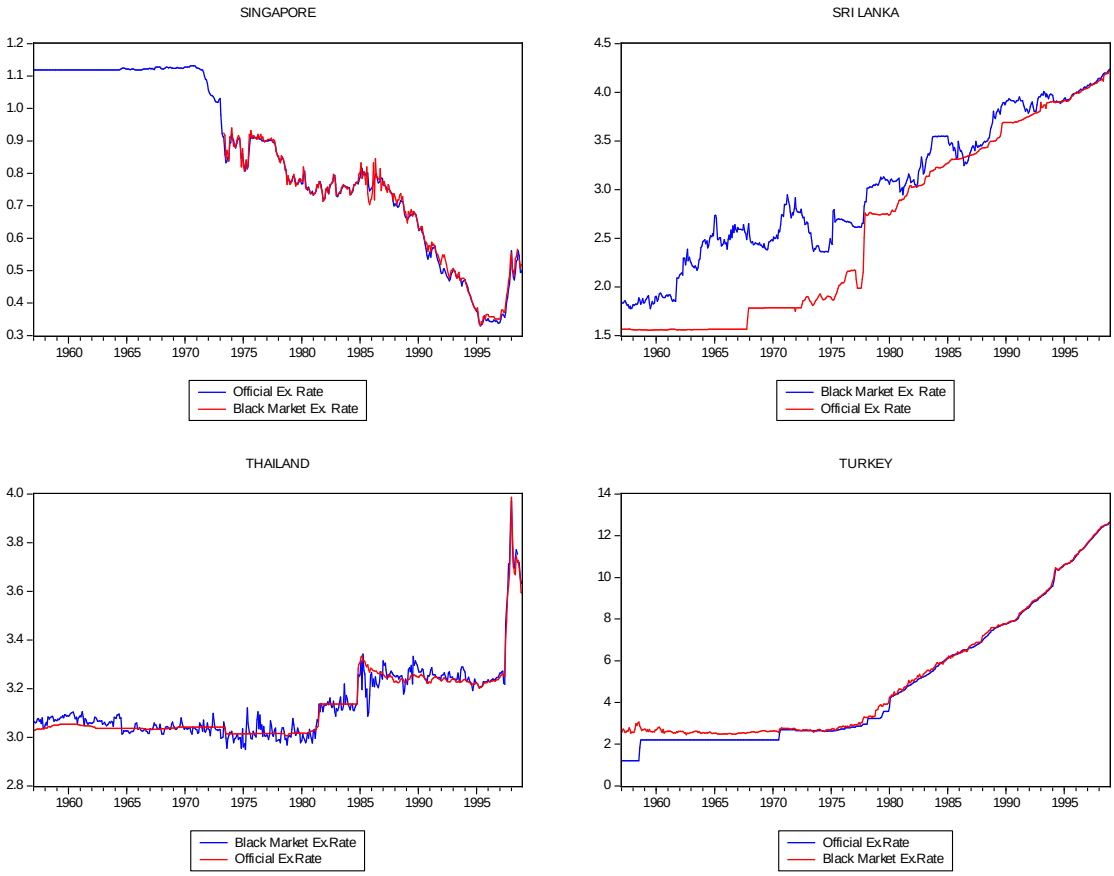
Figures A.4: Asian Economies Official and Parallel Ex. Rates - 1



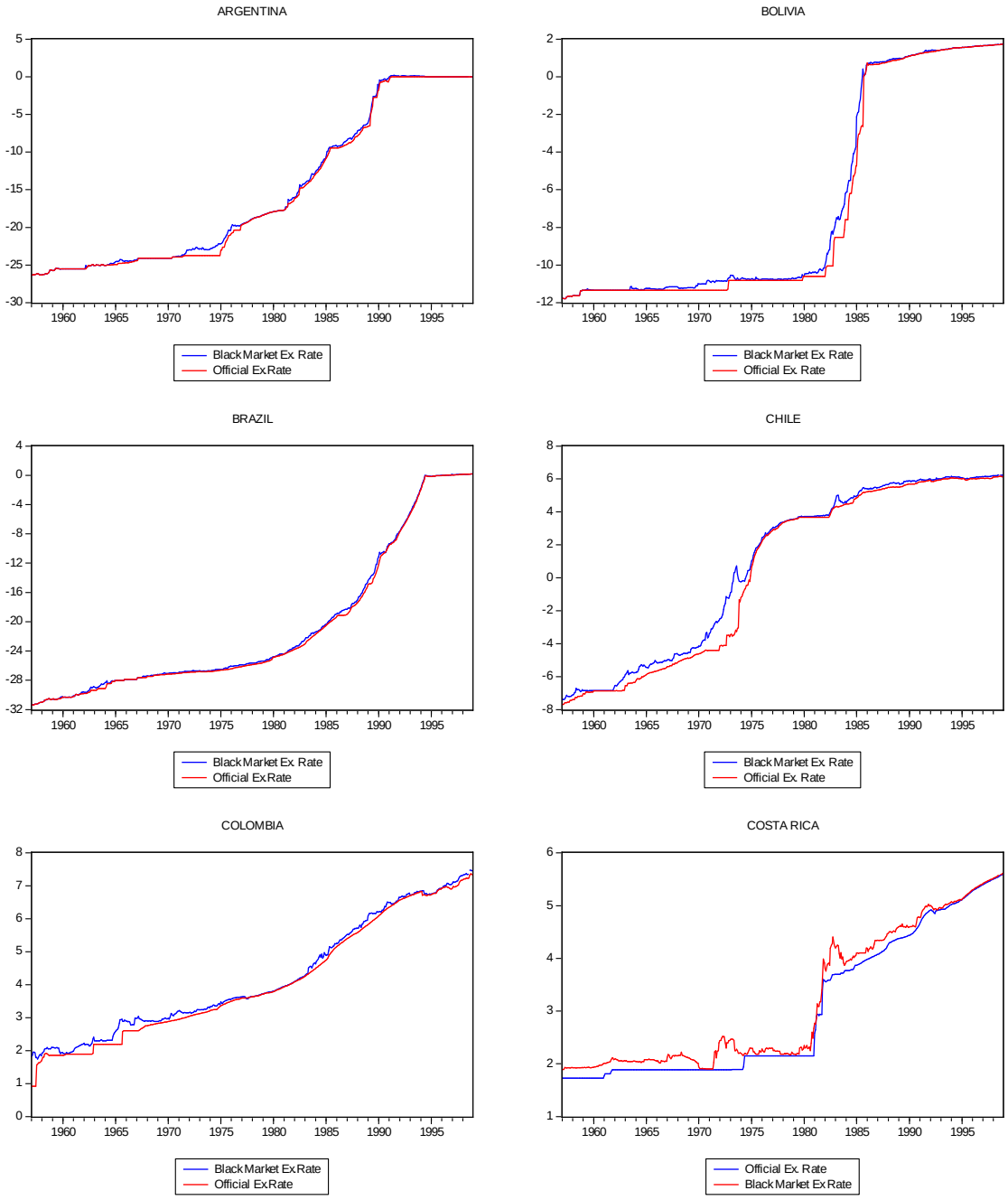
Figures A.5: Asian Economies Official and Parallel Ex. Rates - 2



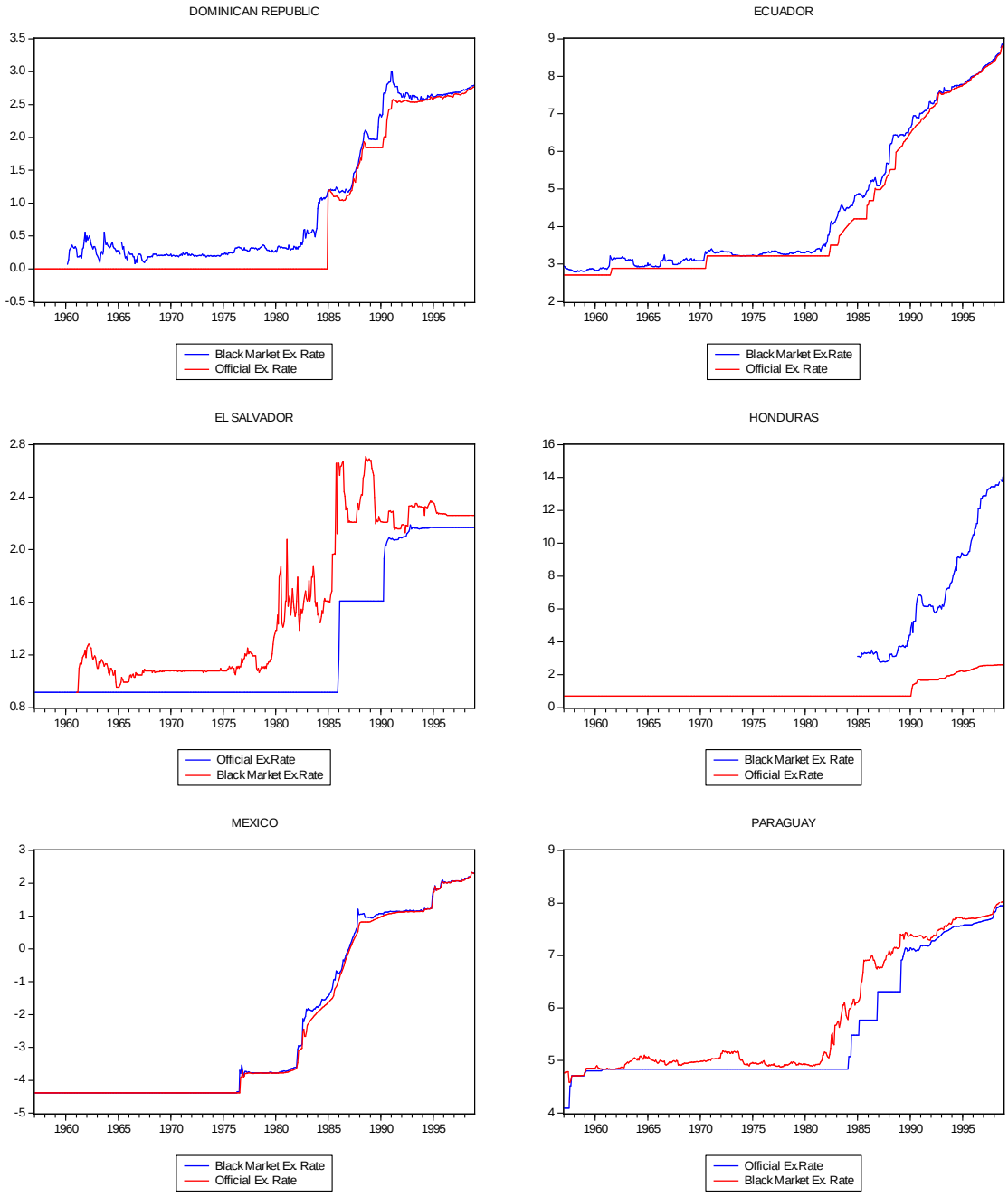
Figures A.6: Asian Economies Official and Parallel Ex. Rates - 3



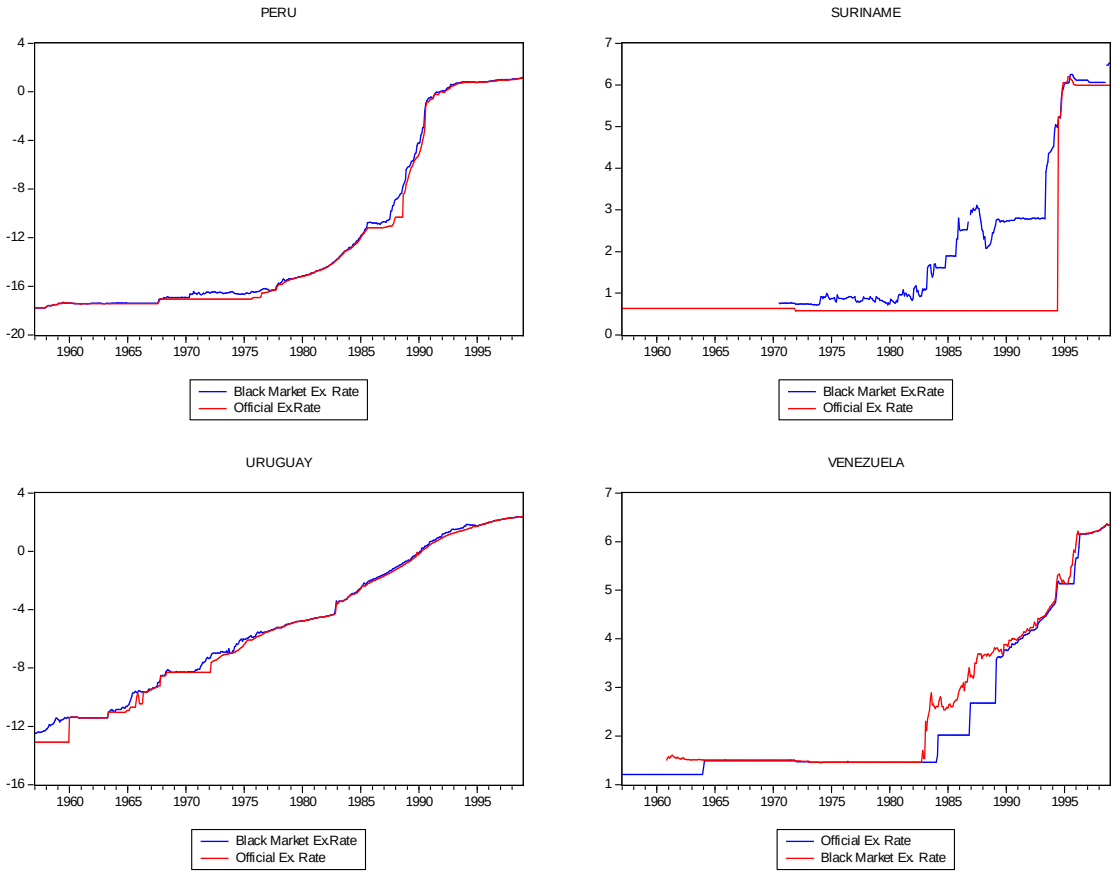
Figures A.7: Latin American Economies Official and Parallel Ex. Rates - 1



Figures A.8: Latin American Economies Official and Parallel Ex. Rates - 2



Figures A.9: Latin American Economies Official and Parallel Ex. Rates - 3



Figures A.10: African Economies Official and Parallel Ex. Rates

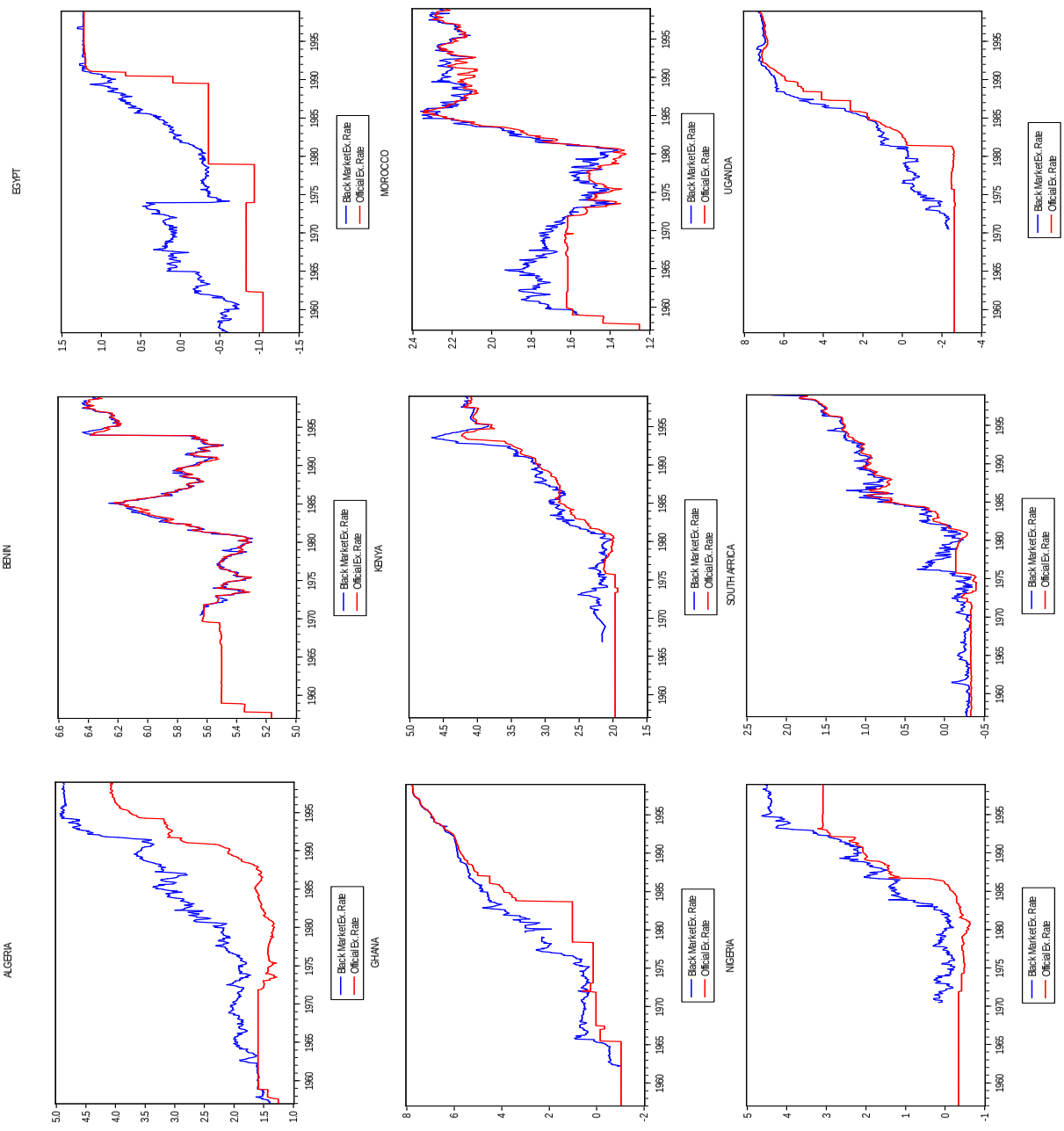


Table A.1: Unit Root Test for 12-m Parallel Market Premium

－Western Developed Economies

Countries	leads/lags		ADF-statistics		MacKinnon(1996)\p-values	
	Const.	Con/Trend	Constant	Constant, Trend	Const.	Con/Trend
BELGIUM	12	12	-2.571880*	-3.989048	0.0916	0.2988
CANADA	12	12	-2.870996**	-3.135554*	0.0197	0.0849
DENMARK	12	12	-2.571880*	-3.135554	0.0955	0.2832
FINLAND	12	12	-2.872765	-3.137183	0.1176	0.3340
FRANCE	12	12	-2.571880	-3.135554	0.1761	0.4297
GREMANY	12	12	-2.571880*	-3.135554	0.0586	0.1935
GREECE	12	1	-2.870996**	-3.424387**	0.0358	0.0385
IRELAND	12	12	-3.452066***	-3.424926**	0.0035	0.0135
ITALY	12	4	-2.870996**	-3.424530**	0.0411	0.0132
NETHERLAND	12	12	-3.452066***	-3.424926**	0.0025	0.0142
NEW ZEALAND	12	12	-2.571880*	-3.135554	0.0552	0.1865
NORWAY	4	8	-3.451491***	-3.988635***	0.0009	0.0005
PORTUGAL	12	6	-3.451491***	-3.988433***	0.0057	0.0003
SPAIN	12	12	-3.451632***	-3.135321*	0.0080	0.0563
SWEDEN	13	4	-2.871029**	-3.424530**	0.0492	0.0224
SWITZERLAND	12	4	-2.870996**	-3.988233***	0.0419	0.0066

Table A.2: Unit Root Test for 12-m Parallel Market Premium – Latin America

Countries	leads/lags		ADF-statistics		MacKinnon(1996)\p-values	
	Const.	Con/Trend	Constant	Constant, Trend	Const.	Con/Trend
ARGENTINA	10	12	-3.451920***	-3.424926**	0.0035	0.0339
BOLIVIA	10	10	-2.870931**	-3.135494*	0.0148	0.0647
BRAZIL	14	14	-2.871061**	-3.135614*	0.0407	0.0877
CHILE	12	12	-2.571880*	-3.135554*	0.0886	0.0853
COLOMBIA	12	12	-2.571880	-3.135554	0.2898	0.6138
COSTA RICA	12	12	-2.870996**	-3.424926**	0.0018	0.0104
DOMINICAN REP.	12	12	-2.571880*	-3.135554	0.0814	0.2665
ECUADOR	12	12	-2.571880*	-3.135554	0.0755	0.1779
EL SALVADO	12	12	-3.452066***	-3.989048	0.0005	0.0028
MEXICO	4	6	-3.451491***	-3.988433***	0.0038	0.0063
PARAGUAY	12	7	-2.571880*	-3.988534***	0.0757	0.0041
PERU	1	1	-3.451283***	-3.987938***	0.0002	0.0011
SURINAME	12	13	-3.454353**	-3.136480*	0.0366	0.0725
URAGUAY	4	7	-3.451491***	-3.424676**	0.0072	0.0144
VENEZUELA	12	12	-2.870996**	-3.135554*	0.0288	0.0771

Table A.3: Unit Root Test for 12-m Parallel Market Premium – Asian Econ.

Countries	leads/lags		ADF-statistics		MacKinnon(1996)\p-values	
	Const.	Con/Trend	Constant	Constant, Trend	Const.	Con/Trend
INDIA	12	12	-3.452066***	-3.989048***	0.0020	0.0053
INDONESIA	4	6	-3.451491***	-3.988433***	0.0026	0.0000
IRAN	12	12	-3.452066***	-3.424926**	0.0093	0.0469
IRAQ	4	4	-3.451491***	-3.988233***	0.0020	0.0053
ISRAEL	12	6	-2.571880*	-3.424627**	0.0802	0.0106
JAPAN	4	6	-3.451491***	-3.988433***	0.0012	0.0038
KOREA	4	6	-3.452066***	-3.989472***	0.0000	0.0051
KUWAIT	12	12	-3.452066***	-3.989048***	0.0002	0.0017
MALASIA	4	8	-3.451491***	-3.988635***	0.0005	0.0000
NEPAL	12	12	-3.452066***	-3.989048***	0.0000	0.0003
PAKISTAN	4	6	-3.451491***	-3.424627**	0.0075	0.0107
PHILIPPINES	12	12	-3.452066***	-3.424926**	0.0047	0.0253
SINGAPORE	8	6	-3.452991***	-3.425451**	0.0024	0.0305
SRI LANKA	12	12	-3.452066***	-3.989048***	0.0019	0.0093
THAILAND	4	8	-3.451491***	-3.988635***	0.0005	0.0000
TURKEY	6	4	-3.451632***	-3.424530**	0.0062	0.0132

Table A.4: Unit Root Test for 12-m Parallel Market Premium– African Econ.

Countries	leads/lags		ADF-statistics		MacKinnon(1996)\p-values	
	Const.	Con/Trend	Constant	Constant, Trend	Const.	Con/Trend
ALGERIA	12	12	-3.452066***	-3.424926**	0.0069	0.0339
BENIN	12	12	-2.571880*	-3.989048	0.0507	0.1618
EGYPT	12	12	-2.870996**	-3.135554*	0.0130	0.0829
GHANA	12	12	-3.452066***	-3.989048***	0.0004	0.0007
KENYA	12	12	-2.870996**	-3.135554*	0.0177	0.0737
MOROCCO	12	6	-2.870996**	-3.424627**	0.0400	0.0358
NIGERIA	4	6	-3.451491***	-3.988433***	0.0039	0.0019
SOUTH AFRICA	12	12	-3.452066***	-3.989048***	0.0014	0.0069
UGANDA	4	13	-2.870743**	-3.135584	0.0400	0.3534

Table A.5: Probit Model for Western Developed Economies

	Equation: $D_{ot} = \alpha + \beta\Delta P_{t-i} + u_t$			
	α		**β**	
Country	**Coefficient (stand errors in brackets)**	**Z-statistics (p-values in brackets)**	**Coefficient (stand errors in brackets)**	**Z-statistics (p-values in brackets)**
Greece	-5.932297(2.596527)	-2.284705**(0.0223)	0.097097(0.052220)	1.859374* (0.0630)
New Zealand	-3.224428(0.685896)	-4.701043***(0.0000)	0.032261(0.023201)	1.390497 (0.1644)
Portugal	-3.061142(0.572213)	-5.349656***(0.0000)	0.018356(0.017234)	1.065065 (0.2868)
Spain	-3.153737(0.664208)	-4.748120***(0.0000)	0.031019(0.026540)	1.168795 (0.2425)

Table A.6: Probit Model for Asian Economies

	Equation: $D_{ot} = \alpha + \beta\Delta P_{t-i} + u_t$			
	α		**β**	
Country	**Coefficient (stand errors in brackets)**	**Z-statistics (p-values in brackets)**	**Coefficient (stand errors in brackets)**	**Z-statistics (p-values in brackets)**
India	-2.847259(0.396872)	-7.174242***(0.0000)	0.026661(0.015255)	1.747666* (0.0805)
Indonesia	-2.311749(0.205369)	-11.25658***(0.0000)	0.007413(0.001568)	4.726803***(0.0000)
Iran	-2.410733(0.265067)	-9.094807***(0.0000)	-0.005619(0.009479)	-0.592781 (0.5533)
Israel	-0.012200(0.010110)	-1.206722 (0.2285)	0.000726(7.94E-05)	9.146644***(0.0000)
Korea	-2.922725(0.442621)	-6.603221***(0.0000)	0.017143(0.015684)	1.093043 (0.2744)
Malaysia	-4.777911(3.303545)	-1.446298 (0.1481)	0.054666(0.047966)	1.139691 (0.2544)
Nepal	-2.705612(0.341204)	-7.929607***(0.0000)	-0.011262(0.020497)	-0.549455 (0.5827)
Philippines	-4.141246(1.329569)	-3.114728***(0.0018)	0.033285(0.014164)	2.349985** (0.0188)
Sri Lanka	-2.834092(0.431417)	-6.569267***(0.0000)	0.022237(0.015057)	1.476851 (0.1397)
Thailand	-2.756704(0.331449)	-8.317123***(0.0000)	0.031904(0.008191)	3.895061***(0.0001)
Turkey	-2.785495(0.322680)	-8.632368***(0.0000)	0.011277(0.003338)	3.378158***(0.0007)

Table A.7: Probit Model for Latin American Economies

	Equation: $D_{ot} = \alpha + \beta\Delta P_{t-i} + u_t$			
	α		**β**	
Country	**Coefficient (stand errors in brackets)**	**Z-statistics (p-values in brackets)**	**Coefficient (stand errors in brackets)**	**Z-statistics (p-values in brackets)**
Argentina	-1.144925(0.095111)	-12.03776***(0.0000)	0.000229(6.53E-05)	3.500405***(0.0005)
Bolivia	-1.776622(0.134094)	0.000243***(4.88E-05)	0.000243(4.88E-05)	4.987134***(0.0000)
Brazil	-1.420162(0.117796)	-12.05610***(0.0000)	0.001298(0.000146)	8.897778***(0.0000)
Chile	-1.948561(0.156679)	-12.43667***(0.0000)	0.002659(0.000654)	4.065303***(0.0000)
Costa Rica	-2.507664(0.251540)	-9.969235***(0.0000)	0.008340(0.002489)	3.351188***(0.0008)
Dominican Republic	-3.075569(0.487479)	-6.309131***(0.0000)	0.018806(0.006576)	2.859924***(0.0042)
Ecuador	-2.414266(0.240870)	-10.02312***(0.0000)	0.009349(0.003035)	3.080661***(0.0021)
El Salvador	-2.684052(0.309769)	-8.664690***(0.0000)	0.010199(0.003428)	2.975097***(0.0029)
Mexico	-2.301352(0.208656)	-11.02939***(0.0000)	0.005816(0.001381)	4.210988***(0.0000)
Paraguay	-2.200739(0.209061)	-10.52679***(0.0000)	0.003300(0.005586)	0.590801 (0.5547)
Peru	-1.543147(0.116475)	-13.24875***(0.0000)	0.000462(8.74E-05)	5.291132***(0.0000)
Suriname	-2.591251(0.282861)	-9.160856***(0.0000)	0.002984(0.000936)	3.188881***(0.0014)
Uruguay	-3.383675(0.610157)	-5.545579***(0.0000)	0.011581(0.005271)	2.197048***(0.0280)
Venezuela	-2.303581(0.215251)	-10.70185***(0.0000)	0.007219(0.002139)	3.374945***(0.0007)

Table A.8: Probit Model for African Economies

	Equation: $D_{ot} = \alpha + \beta \Delta P_{t-i} + u_t$			
	α		**β**	
Country	**Coefficient (stand errors in brackets)**	**Z-statistics (p-values in brackets)**	**Coefficient (stand errors in brackets)**	**Z-statistics (p-values in brackets)**
Algeria	-2.134825 (0.194401)	-10.98157***(0.0000)	-0.000618(0.005665)	-0.109081 (0.9131)
Benin	-0.000229(0.003182)	-0.072092 (0.9426)	0.000613(0.000129)	4.758931***(0.0000)
Egypt	-2.391247(0.263211)	-9.084891***(0.0000)	0.016178(0.014193)	1.139827 (0.2544)
Ghana	-1.771678(0.190483)	-9.300975***(0.0000)	-0.017913(0.007983)	-2.243970** (0.0248)
Kenya	-2.539757(0.260620)	-9.745040***(0.0000)	0.012228(0.003388)	3.609001***(0.0003)
Nigeria	-2.659580(0.326447)	-8.147058***(0.0000)	0.006632(0.003521)	1.883318***(0.0597)
South Africa	-2.919981(0.417376)	-6.996047***(0.0000)	0.024658(0.009540)	2.584790***(0.0097)
Uganda	-1.936192(0.166528)	-11.62680***(0.0000)	0.001458(0.000944)	1.543995 (0.1226)

Table A.9: Additional Unit Root Testing for Western Developed Economies

Unit roots and stationarity tests	Series	leads/lags		ADF-statistics		MacKinnon (1996)one-sided p-values		leads/lags		DF-GLS statistics	
Country		**C**	**C,T**	**C**	**C,T**	**C**	**C,T**	**C**	**C,T**	**C**	**C,T**
Belgium	LBMER	8	8	-2.03683	-2.568915	0.271	0.2949	8	8	-1.330009	-2.564391
1980M01-1998M12	ΔLBMER	7	7	-6.615949***	-6.610827***	0	0	7	12	-6.523850***	-4.156095***
	LOER	1	1	-1.69196	-2.212355	0.4348	0.4811	1	1	-0.947426	-2.202561
	ΔLOER	2	1	-10.40788***	-10.39735***	0	0	2	2	-10.39079***	-10.39079***
	LCPI	12	12	-1.103148	-2.012612	0.716	0.5925	12	12	-0.03592	-1.93621
	ΔLCPI	12	12	-2.168949	-2.19389	0.2181	0.4914	12	12	-2.043711**	-2.084904
	PMP	4	5	-4.565738***	-3.782838**	0.0002	0.0182	4	4	-4.601466***	-4.603417***
	ΔPMP	4	4	-15.81771***	-15.83859***	0	0	4	4	-15.40184***	-15.86088***
Portugal	LBMER	1	1	0.076717	-1.742366	0.9637	0.7309	1	1	1.420299	-1.014441
1973M01-1998 M12	ΔLBMER	6	6	-9.563883***	-9.607817***	0	0	5	5	-9.134175***	-9.157446***
	LOER	1	1	0.161062	-1.569014	0.9699	0.8039	1	1	1.672876	-0.835247
	ΔDLOER	2	2	-10.25427***	-10.28361***	0	0	2	2	-9.998089***	-10.28354***
	LCPI	12	12	-0.529801	-1.803595	0.8824	0.7018	12	12	0.479154	-1.30288
	ΔDLCPI	11	11	-2.547349	-2.440261	0.105	0.3582	11	11	-2.535997**	-2.55714
	PMP	2	2	-6.388699***	-6.432064***	0	0	2	2	-5.955750***	-6.411783***
Spain	LBMER	3	3	-0.856592	-1.993095	0.8014	0.6032	3	3	0.58844	-1.968855
1973M01-1998M12	ΔLBMER	2	2	-11.40270***	-11.39123***	0	0	9	7	-2.532964**	-4.476782***
	LOER	3	3	-1.391471	-2.180173	0.5873	0.4991	3	3	0.599785	-1.950619
	ΔDLOER	1	1	-14.06460***	-14.06758***	0	0	2	2	-10.53514***	-10.58067***
	LCPI	12	12	-0.719631	-1.759835	0.8393	0.7228	12	12	0.497124	-1.69973
	ΔDLCPI	11	11	-2.231723	-2.270096	0.1954	0.4491	11	11	-2.256770**	-2.269087
United	LWPI	12	12	-1.09023	-1.731799	0.7211	0.7358	12	12	0.100859	-1.708564

States	ΔlWPI	12	11	-2.700807*	-4.631508***	0.0746	0	11	11	-2.312369**	-4.412244***
	LCPI	5	5	-0.126322	-1.668116	0.9445	0.764	9	5	0.50336	-1.014718
	ΔDLCPI	4	4	-4.061250***	-4.053350***	0.0012	0.0078	4	4	-3.964117***	-3.988491***

Notes: LCPI and LWPI denote the log consumer price index and log wholesale price index respectively. LBMER and LOER represent the log parallel (black) market exchange rate and the log official exchange rate. The observation period for each country is recorded under the country name based on a commonly availability of all the variables under examination..

*** denotes rejecting the null hypothesis of unit root at 1% level,** denotes rejecting the null hypothesis of unit root at 5%level, *denotes rejecting the null hypothesis of unit root at 10% level.

Table A.10: Additional Unit Root Testing for Asian Economies

Unit roots and stationarity tests	Series	leads/lags		ADF-statistics		MacKinnon (1996)one-sided p-values		leads/lags		DF-GLS statistics	
Country		**C**	**C,T**	**C**	**C,T**	**C**	**C,T**	**C**	**C,T**	**C**	**C,T**
India	LBMER	6	6	0.47524	-1.063042	0.9858	0.9327	6	6	2.484428	-1.258063
1973M01-1998M12	ΔLBMER	6	6	-9.494179***	-9.553146***	0	0	11	11	-2.597856***	-3.858771***
	LOER	1	1	1.127677	-1.432212	0.9977	0.8506	1	1	2.996452	-0.858466
	ΔDLOER	2	2	-11.06737***	-11.22246***	0	0	2	2	-10.63228***	-11.23786***
	LCPI	10	10	1.006922	-3.281987*	0.9967	0.0704	10	10	2.943013	-1.644024
	ΔDLCPI	9	9	-4.863400***	-5.040654***	0	0	11	9	-2.259069**	-3.973230***
	LWPI	1	1	0.303085	-3.469116**	0.9783	0.0439	1	1	5.081469	-1.794362
	ΔlWPI	11	11	-4.344568***	-4.317143***	0.0004	0.0032	11	10	-1.867361*	-3.368531**
	PMP	1	1	-3.260857**	-4.468086***	0.0173	0.0018	1	1	-2.745033***	-2.883236*
Indonesia	LBMER	5	5	-2.569351	-2.009973	0.1001	0.5939	6	5	1.60133	-0.656517
1973M01-1998M12	ΔLBMER	4	4	-7.429453***	-7.643982***	0	0	12	12	-3.570962***	-3.295310**
	LOER	6	6	-2.032463	-1.335096	0.2729	0.8779	6	6	1.360806	-0.681629
	ΔDLOER	12	12	-4.099116***	-4.216850***	0.0011	0.0045	12	12	-3.811251***	-3.933724***
	LCPI	1	1	-0.576762	-1.407599	0.8724	0.8575	1	1	6.33703	-0.871938
	ΔDLCPI	5	5	-5.733441***	-5.710711***	0	0	5	5	-0.747901	-1.755554
	LWPI	1	1	-1.065861	-1.878621	0.73	0.6634	3	1	2.636164	-1.089912
	ΔlWPI	4	4	-5.486705***	-5.505087***	0	0	2	2	-7.560889***	-7.571219***
	PMP	2	2	-4.301476***	-4.738906***	0.0005	0.0007	2	2	-4.267568***	-4.336533***
Iran	LBMER	4	4	0.759812	-1.694783	0.9933	0.7524	4	4	1.879462	-0.741752
1973M01-1986M12	ΔLBMER	3	3	-9.170086***	-9.342329***	0	0	3	3	-8.651057***	-9.335128***
	LOER	3	3	-0.595662	-1.575095	0.8686	0.8016	3	3	-0.306418	-1.426776
	ΔDLOER	2	2	-10.62076***	-10.68945***	0	0	2	2	-10.59038***	-10.68919***

	LCPI	12	12	1.812006	-0.84075	0.9998	0.96	12	12	2.078456	-0.408898
	ΔDLCPI	11	11	-2.231597	-3.279608*	0.1954	0.071	11	11	-1.695405*	-1.923211
	LWPI	12	12	1.372095	-0.996608	0.999	0.9421	12	12	1.405494	-0.474442
	ΔlWPI	11	11	-2.699281*	-3.371828*	0.0749	0.0565	11	11	-1.435366	-3.176099***
	PMP	6	6	-2.556067	-2.81741	0.103	0.1916	6	6	-2.296902**	-2.803659**
	ΔPMP	5	5	-7.994337***	-7.990983***	0	0	5	5	-8.002051***	-8.002898***
Iraq	LBMER	6	6	1.831422	-1.104126	0.9998	0.9257	6	6	2.879961	0.20937
1973M01-1998M12	ΔLBMER	6	6	-7.943649***	-8.562271***	0	0	6		-7.824391***	-8.323660***
	LOER	1	1	-1.294174	-1.106429	0.6337	0.9258	1	1	-0.119273	-1.174502
	ΔDLOER	12	12	-4.918490***	-4.961689***	0	0.0003	12	12	-4.866397***	-4.885505***
	LCPI	4	4	2.064899	-0.926873	0.9999	0.9475	4	4	1.468966	-0.620949
	ΔDLCPI	3	3	-3.128124**	-4.420887***	0.0283	0.0035	3	3	-2.724743***	-4.147947***
	LWPI	1	1	0.379477	-1.488886	0.9816	0.8301	1	1	1.671511	-1.375975
	ΔlWPI	1	1	-8.882929***	-8.999408***	0	0	6	6	-4.081450***	-5.480405***
	PMP	9	9	0.25797	-0.973916	0.9758	0.9448	9	9	0.619787	-0.879158
	ΔPMP	8	8	-9.802943***	-9.956795***	0	0	8	8	-9.734661***	-9.950770***
Japan	LBMER	12	12	-1.168259	-3.043918	0.6894	0.1214	12	12	-0.141135	-2.433869
1973M01-1986M12	ΔLBMER	12	12	-4.98855***	-4.973593***	0	0	11	11	-3.261251***	-2.676028*
	LOER	1	1	-0.416372	-2.638069	0.9036	0.2635	1	1	0.674678	-1.780964
	ΔDLOER	2	2	-10.87991***	-10.88624***	0	0	2	2	-10.81015***	-10.78162***
	LCPI	12	12	-1.980713	-0.972558	0.2955	0.9453	12	12	0.286801	-1.385387
	ΔDLCPI	11	11	-2.482146	-2.977935	0.1205	0.1395	11	11	-1.146795	-1.548695
	LWPI	4	1	-1.507738	-0.168165	0.529	0.9936	4	4	0.248986	-1.038949
	ΔlWPI	3	3	-5.240020***	-5.396016***	0	0	3	3	-5.067174***	-5.125253***
	PMP	6	6	-2.127155	-3.546710**	0.2341	0.0356	6	6	0.336346	-2.579411*
	ΔPMP	5	5	-15.25965***	-15.24210***	0	0	11	3	-1.931434*	-15.55776***

Korea	LBMER	1	1	-2.007063	-2.475782	0.2839	0.3401	1	1	1.211905	-1.49533
1973M01-1998m12	ΔLBMER	6	6	-8.088644***	-8.153640***	0	0	2	9	-7.597271***	-2.615248*
	LOER	1	1	-2.18091	-2.227216	0.2137	0.4729	1	1	1.323609	-1.09557
	ΔDLOER	6	6	-8.766273***	-8.934180***	0	0	6	6	-8.202438***	-7.898211***
	LCPI	1	1	-3.296936**	-0.69347	0.0158	0.9721	1	1	3.277141	0.072134
	ΔDLCPI	12	12	-2.553535	-3.125824	0.1039	0.102	5	12	-2.870944***	-3.040371**
	LWPI	1	1	-1.803153	0.025496	0.379	0.9965	1	1	3.456146	-0.297154
	ΔlWPI	11	11	-3.673192***	-4.050379***	0.0048	0.0079	11	11	-2.673027***	-2.987020**
	PMP	9	9	-2.282428	-2.487493	0.1781	0.3343	9	9	-0.370601	-1.950845
	ΔPMP	8	8	-9.173471***	-9.189575***	0	0	11	9	-2.269640**	-4.769046***
Kuwait	LBMER	1	1	-4.618914***	-4.565419***	0.0001	0.0014	1	1	-0.191826	-1.966119
1973M01-1998M12	ΔLBMER	6	6	-9.246427***	-9.491612***	0	0	6	6	-9.188103***	-9.042155***
	LOER	2	2	-1.28654	-1.187627	0.6372	0.9111	1	1	-0.300623	-1.492434
	ΔDLOER	1	1	-14.61550***	-14.62221***	0	0	1	1	-14.57618***	-14.38321***
	LCPI	6	6	-1.782203	-3.251539*	0.389	0.0767	6	6	0.805449	-1.89088
	ΔDLCPI	6	6	-6.425349***	-6.460810***	0	0	2	6	-7.769768***	-5.672824***
	LWPI	12	12	-1.361379	-2.148929	0.6004	0.5148	12	12	2.352998	-0.454409
	ΔlWPI	11	11	-4.014554***	-3.973457**	0.0017	0.0111	12	12	-1.928780*	-3.247224**
	PMP	6	6	-3.879985***	-3.879985***	0.0025	0.0025	6	6	-3.334108***	-3.048021**
Nepal	LBMER	1	1	-0.058288	-3.022196	0.9515	0.1277	1	1	0.477407	-1.288962
1973M01-1998M12	ΔLBMER	4	4	-8.285628***	-8.376377***	0	0	3	3	-6.557761***	-7.461421***
	LOER	1	1	1.627182	-1.039127	0.9996	0.9363	1	1	4.104111	-0.495652
	ΔDLOER	6	6	-8.341679***	-8.611447***	0	0	6	6	-7.362422***	-8.560380***
	LCPI	12	12	0.766161	-2.786013	0.9934	0.2033	12	12	2.757297	-1.843632
	ΔDLCPI	11	11	-4.705024***	-4.817083***	0.0001	0.0005	11	11	-2.412593**	-3.534448***
	PMP	1	1	-4.371107***	-4.344578***	0.0004	0.003	2	2	-1.263946	-2.347814
Malaysia	LBMER	6	6	-0.052183	1.668744	0.9523	1	2	6	-0.563278	0.084776

1986M01-1998M12	ΔLBMER	6	6	-6.418793***	-6.791397***	0	0	12	12	0.210122	-1.781821
	LOER	1	1	-1.214736	-0.598019	0.6695	0.9784	1	1	-1.189473	-1.018194
	ΔDLOER	6	6	-7.154934***	-7.300795***	0	0	6	6	-7.153886***	-7.242013***
	LCPI	1	1	1.820068	-2.813497	0.9998	0.193	1	1	5.684977	-0.435068
	ΔDLCPI	11	5	-3.506246***	-6.040993***	0.0082	0	11	11	-2.665823***	-3.563082***
	LWPI	1	1	-0.319312	-3.158759*	0.9181	0.0968	1	1	1.316857	-2.651677
	ΔlWPI	6	6	-5.464553***	-5.405870***	0	0.0001	1	1	-4.044230***	-5.713561***
	PMP	6	6	-3.444837**	-3.152877*	0.0108	0.0979	4	3	-0.738346	-5.270921***
Pakistan	LBMER	3	3	1.546856	-1.411283	0.9994	0.8568	3	3	3.347421	-1.266175
1973M01-1998M12	ΔLBMER	2	2	-16.78763***	-16.94909***	0	0	11	11	-0.666785	-1.54936
	LOER	3	3	0.500799	-2.740499	0.9867	0.2207	3	3	1.970408	-1.451185
	ΔDLOER	2	2	-10.82944***	-10.90895***	0	0	2	2	-10.30242***	-10.89445***
	LCPI	1	1	1.998337	-2.307228	0.9999	0.4287	2	1	6.046064	-0.428072
	ΔDLCPI	11	11	-3.910995***	-4.142219***	0.0021	0.0058	11	11	-1.329559	-2.869524*
	LWPI	1	12	1.059676	-2.831639	0.9972	0.1867	12	12	1.791017	-1.56026
	ΔlWPI	12	12	-4.501271**	-4.526341***	0.0002	0.0015	11	11	-1.074698	-2.3609
	PMP	1	1	-2.669182*	-3.658300**	0.0802	0.0261	1	1	-2.674070***	-2.935674**
Philippines	LBMER	9	9	0.298229	-2.424636	0.9781	0.3662	9	9	2.153113	-1.60623
1973M01-1998mM12	ΔLBMER	8	8	-7.687490***	-7.738721***	0	0	12	12	-1.990451**	-3.622401***
	LOER	1	1	-0.459976	-2.717435	0.8958	0.2299	3	3	1.985994	-2.780528*
	ΔDLOER	2	2	-10.69295***	-10.68046***	0	0	2	2	-10.27882***	-10.47772***
	LCPI	5	5	0.566387	-2.540442	0.9887	0.3084	5	5	2.960992	-1.003785
	ΔDLCPI	4	4	-6.143414***	-6.210053***	0	0	5	5	-1.795371*	-3.417363**
	PMP	1	1	-3.784710***	-4.183567***	0.0033	20.0051	2	2	-1.071641	-2.779773*
Singapore	LBMER	1	1	-1.261381	-1.529089	0.6482	0.8177	1	1	0.135412	-1.733381
1974M01-	ΔLBMER	7	7	-6.616198***	-6.640450***	0	0	12	12	-2.216268**	-2.403749

1998M12	LOER	1	1	-0.49027	-2.587906	0.8902	0.2861	1	1	0.812449	-1.751167
	ΔDLOER	1	1	-14.56162***	-14.55229***	0	0	1	1	-14.40406***	-14.41966***
	LCPI	6	6	-1.017674	-1.796424	0.7482	0.7051	6	6	1.126379	-1.883298
	ΔDLCPI	5	5	-4.873425***	-4.901517***	0	0	5	5	-4.336760***	-4.618663***
	LWPI	3	3	-1.717785	-1.70181	0.4212	0.7483	3	3	-0.826266	-0.887992
	ΔlWPI	8	8	-4.482537***	-4.770760***	0.0003	0.0006	8	2	-2.284132**	-7.350839***
	PMP	8	7	-2.925415**	-2.363064	0.0436	0.3982	7	7	-1.859392*	-2.713667*
Sri-Lanka	LBMER	3	3	-0.529661	-2.992651	0.8824	0.1353	3	3	1.678986	-2.962288**
1976M01-1998M12	ΔLBMER	2	2	-12.97092***	-12.95883***	0	0	8	2	-9.270091***	-12.56348***
	LOER	2	2	0.568109	-2.547899	0.9888	0.3048	2	2	2.53712	-1.104057
	ΔDLOER	1	1	-12.88968***	-12.95477***	0	0	1	1	-12.49071***	-12.96739***
	LCPI	6	6	1.024156	-4.255281***	0.9969	0.004	6	6	1.144392	-0.421925
	ΔDLCPI	6	6	-7.711737***	-8.217724***	0	0	6	6	-7.562099***	-8.096793***
	LWPI	1	1	-1.684683	-2.616317	0.4379	0.2734	1	1	2.938218	-1.418606
	ΔlWPI	6	6	-6.167377***	-6.288534***	0	0	6	6	-6.177653***	-6.243806***
	PMP	1	1	-1.83745	-2.855916	0.3622	0.1781	1	1	-1.752731*	-1.823155
	ΔPMP	6	6	-8.678710***	-8.701242***	0	0	6	6	-8.383589***	-8.541931***
Thailand	LBMER	8	1	1.422887	-1.711953	0.9991	0.7448	1	1	0.338022	-1.465164
1973M01-1998M12	ΔLBMER	6	6	-9.049510***	-9.254357***	0	0	6	6	-8.730310***	-7.893059***
	LOER	1	1	-0.864265	-2.429571	0.7991	0.3637	1	1	-0.279863	-2.206124
	ΔDLOER	11	11	-6.726151***	-6.846117***	0	0	11	11	-6.645699***	-6.788033***
	LCPI	3	3	-0.638747	-1.154692	0.8588	0.9171	5	3	2.117069	-1.217841
	ΔDLCPI	2	2	-7.392440***	-7.393327***	0	0	2	2	-7.059191***	-7.207585***
	LWPI	1	1	0.04358	-1.755156	0.961	0.725	1	1	3.202608	-1.16411
	ΔlWPI	10	10	-4.720838***	-4.696685***	0.0001	0.0008	10	3	-1.994854**	-7.470493**
	PMP	11	11	-3.667958***	-3.921785**	0.0049	0.0119	10	11	-1.393025	-3.311545**
Turkey	LBMER	2	6	6.13787	0.512473	1	0.9993	2	12	8.180504	0.157104

1986M01-1998M12	ΔLBMER	11	5	-3.711521***	-10.69380***	0.0042	0	11	11	-2.407721***	-2.764449*
	LOER	1	1	3.862485	0.37324	1	0.9989	1	1	6.702515	0.675459
	ΔDLOER	1	1	-13.16274***	-14.10995***	0	0	7	1	-4.662541***	-14.13363***
	LCPI	1	1	6.405835	-1.468449	1	0.8387	6	6	3.129884	0.006843
	ΔDLCPI	5	12	-4.023591***	-3.753840**	0.0015	0.0202	12	12	-1.299785	-3.681612***
	LWPI	1	1	1.591568	-2.586901	0.9995	0.287	3	1	1.862404	-0.893768
	ΔlWPI	3	3	-6.096943***	-6.421303***	0	0	8	3	-1.783695*	-6.112913***
	PMP	5	5	-4.339492***	-4.393580***	0.0004	0.0024	5	5	-0.228877	-1.501627
	ΔPMP	4	4	-13.98652***	-14.03900***	0	0	8	8	-2.185258**	-3.974070***

Notes:
LCPI and LWPI denote the log consumer price index and log wholesale price index respectively. LBMER and LOER represent the log parallel (black) market exchange rate and the log official exchange rate. The observation period for each country is recorded under the country name based on a commonly availability of all the variables under examination..
*** denotes rejecting the null hypothesis of unit root at 1% level,** denotes rejecting the null hypothesis of unit root at 5%level, *denotes rejecting the null hypothesis of unit root at 10% level.

Table A.11: Additional Unit Root Testing for Latin American Economies

Unit roots and stationarity tests	Series	leads/lags		ADF-statistics		MacKinnon (1996)one-sided p-values		leads/lags		DF-GLS statistics	
Country		**C**	**C,T**	**C**	**C,T**	**C**	**C,T**	**C**	**C,T**	**C**	**C,T**
Argentina	LBMER	3	3	0.773943	-1.74559	0.9936	0.7294	3	3	3.033672	-0.684689
1973M01-1998M12	ΔLBMER	2	2	-8.273709***	-8.396172***	0	0	6	2	-3.692991***	-8.169370***
	LOER	8	8	0.032865	-1.979968	0.9601	0.6103	8	8	1.297277	-1.17239
	ΔLOER	7	7	-4.125284***	-4.073886***	0.0062	0.0012	7	7	-3.169359***	-4.000760***
	LCPI	8	8	-0.281247	-2.142391	0.9248	0.5203	8	8	0.837583	-1.482281
	ΔLCPI	12	12	-3.373076**	-3.382427*	0.0124	0.0549	12	12	-2.787287***	-3.332042**
	PMP	1	1	-4.353589***	-4.344074***	0.0004	0.0029	4	1	-2.572694***	-4.165592***
	ΔPMP	3	3	-15.45053***	-15.44322***	0	0	3	3	-15.46619***	-15.46927***
Bolivia	LBMER	10	10	-0.410767	-1.954476	0.9045	0.6241	10	10	0.423561	-1.417261
1973M01-1998	ΔLBMER	12	12	-3.247383**	-3.268268*	0.018	0.0728	12	12	-2.947654***	-3.260361**
	LOER	9	9	-0.472974	-1.99774	0.8934	0.6007	9	9	0.312641	-1.467583
	ΔLOER	8	8	-3.880972***	-3.920337***	0.0024	0.0119	8	8	-3.614976***	-3.918396***
	LCPI	4	5	-0.507056	-2.087192	0.8869	0.5512	4	5	0.50755	-1.607391
	ΔLCPI	3	3	-4.103491***	-4.096481***	0.0011	0.0068	1	4	-1.925460*	-2.984332**
	PMP	7	7	-4.753574***	-4.768636***	0.0001	0.0006	7	7	-4.464936***	-4.750818***
	ΔPMP	8	8	-10.85425***	-10.84559***	0	0	8	8	-10.86545***	-10.86628***
Brazil	LBMER	4	4	1.919026	-0.746103	0.9999	0.9684	4	4	3.234659	-0.312172
1973M01-1998M12	ΔLBMER	3	3	-5.478895***	-6.086126***	0	0	4	3	-4.123437***	-5.997544***
	LOER	1	1	2.297937	-0.662176	1	0.9744	3	3	2.850275	-0.425521
	ΔLOER	2	10	-5.133135***	-3.163263*	0	0.0932	2	10	-4.246156***	-3.186955**
	LCPI	2	2	-0.635824	-1.382706	0.8587	0.8636	1	2	0.696583	-1.24111
	ΔLCPI	1	1	-3.640388***	-3.628828**	0.0057	0.0296	1	1	-3.388151***	-3.538914***

	LWPI	1	6	1.385116	-1.086382	0.999	0.9291	1	1	2.594728	-0.523298
	ΔlWPI	6		-3.642423***	-3.984882***	0.0053	0.0097	11	6	-1.976721**	-3.982772***
	PMP	3	3	-3.975258***	-4.003076***	0.0017	0.0092	3	3	-3.179855***	-3.898093***
Chile	LBMER	2	2	-1.580538	0.083259	0.4918	0.9971	2	2	2.563297	-0.394025
1973M01-1998M12	ΔLBMER	1	1	-11.2056***	-11.35012***	0	0	1	1	-11.17544***	-11.31134***
	LOER	2	2	-1.412813	0.085698	0.5768	0.9971	4	2	1.96824	-0.356296
	ΔLOER	1	1	-12.14058***	-12.14058***	0	0	4	3	-5.984637***	-7.442939***
	LCPI	12	12	-1.546757	-2.471587	0.5091	0.3422	12	12	-0.123144	-2.649009*
	ΔLCPI	6	6	-3.443254***	-3.418870**	0.0076	0.0283	4	4	-1.9414**	-2.8900**
	LWPI	5	5	-1.384645	-0.602613	0.5905	0.9781	5	5	1.092339	-0.923874
	ΔlWPI	4	4	-4.811031***	-4.970335***	0.0001	0.0003	4	4	-4.085690***	-4.401893***
	PMP	6	6	-4.099550***	-4.144907***	0.0011	0.0058	6	6	-4.024198***	-4.052959***
Colombia	LBMER	6	6	1.047351	-1.396023	0.9971	0.8613	6	6	3.879284	-0.80822
1973M01-1998M12	ΔLBMER	5	5	-7.724991***	-7.849400***	0	0	5	5	-4.731349***	-6.175170***
	LOER	1	1	-0.067729	-1.290028	0.9507	0.889	1	1	5.496753	-1.292532
	ΔLOER	6	6	-9.326761***	-9.449367***	0	0	3	6	-8.849945***	-8.936791***
	LCPI	1	1	2.874094	-1.984347	1	0.608	12	1	1.388879	-0.155651
	ΔLCPI	11	11	-2.991580**	-3.630879**	0.0364	0.0282	11	11	-2.949618***	-3.243192**
	LWPI	2	2	1.881915	-2.458728	0.9998	0.3487	12	2	0.624087	-0.538833
	ΔlWPI	1	1	-9.307440***	-9.606867***	0	0	1	12	-9.260378***	-2.768801*
	PMP	4	4	5.432961	3.105868	1	1	4	9	6.070835	0.809895
	ΔPMP	8	3	-4.095975***	-8.344615***	0.0011	0	7	7	-2.937891***	-2.581340*
Costa Rica	LBMER	1	1	0.919825	-1.581546	0.9958	0.7992	1	1	2.685825	-0.738757
1973M01-1998M12	ΔLBMER	11	11	-4.088907***	-4.169298***	0.0011	0.0053	10	11	-3.666880***	-4.175676***
	LOER	9	9	0.246694	-2.101428	0.9752	0.5432	9	9	1.254833	-1.258519
	ΔLOER	8	8	-4.095077***	-4.247402***	0.0011	0.0041	8	8	-3.700089***	-4.254816***
	LCPI	6	6	1.112143	-1.770917	0.9976	0.7175	6	6	1.922617	-0.440418

	ΔLCPI	5	5	-3.368554**	-3.794515**	0.0126	0.0176	5	5	-2.457746**	-3.771149***
	LWPI	6	6	0.209277	-2.343198	0.973	0.4092	6	6	1.310151	-1.205305
	Δ|WPI	5	5	-3.494728***	-3.576495**	0.0085	0.0328	5	5	-2.717409***	-3.535538***
	PMP	1	1	8.424705	4.350433	1	1	1	9	9.470711	0.194286
	ΔPMP	8	8	-2.367654	-4.110598***	0.1516	0.0065	8	8	-1.812727*	-3.639650***
Dominican Republic	LBMER	3	3	0.586973	-1.639372	0.9893	0.776	3	3	1.786956	-0.920346
1973M01-1998M12	ΔLBMER	2	2	-10.98389***	-11.12624***	0	0	5	5	-2.058935**	-3.529304***
	LOER	6	6	0.618928	-1.37681	0.9902	0.8667	6	6	1.469022	-0.698808
	ΔLOER	6	6	-7.984666***	-8.169711***	0	0	6	6	-7.768611***	-8.147177***
	LCPI	2	2	2.358045	-1.895064	1	0.6556	2	2	4.516166	-0.12607
	ΔLCPI	1	1	-10.23467***	-10.82407***	0	0	3	1	-4.422855***	-10.36275***
	PMP	1	1	-4.364669***	-4.439491***	0.0004	0.0021	1	1	-3.676730***	-4.012353***
Ecuador	LBMER	4	4	2.126524	-0.860388	0.9999	0.9581	4	4	3.434751	-0.108037
1973M01-1998M12	ΔLBMER	3		-7.961960***	-8.533355***	0	0	3	3	-6.416997**	-8.156341**
	LOER	1	1	4.334295	-0.135464	1	0.9942	6	1	6.654836	0.822939
	ΔDLOER	8	6	-4.580827***	-7.730492***	0.0002	0	10	6	-3.038437***	-7.638230***
	LCPI	6	2	3.128625	-0.763685	1	0.9669	6	6	3.324045	-0.029685
	ΔDLCPI	5	1	-3.602532***	-10.96416***	0.006	0	5	5	-3.237213***	-4.590784***
	PMP	1	1	-3.749913***	-3.754194**	0.0037	0.0198	1	1	-3.703860***	-3.724516***
El Salvador	LBMER	1	1	-1.065334	-2.238276	0.7306	0.4666	1	1	0.096621	-2.132222
1973M01-1998M12	ΔLBMER	6	6	-7.429598***	-7.426515***	0	0	6	6	-7.402651***	-7.444428***
	LOER	2	2	0.216064	-1.505085	0.9734	0.8269	2	2	0.958461	-0.918519
	ΔDLOER	1	1	-14.75701***	-14.83264***	0	0	1	1	-14.66564***	-14.84844***
	LCPI	6	2	1.682306	-2.714401	0.9996	0.2312	6	6	2.598031	-0.416044
	ΔDLCPI	5	5	-4.639031***	-5.344138***	0.0001	0	5	5	-3.150888***	-5.171306***
	PMP	1	1	-3.267952**	-3.254934*	0.017	0.0753	1	1	-2.599745***	-3.156185**

Honduras	LBMER	3	3	0.744791	-2.012251	0.9928	0.5898	3	3	1.790902	-1.139847
1973M01-1998M12	ΔLBMER	2	2	-5.066343***	-5.283793***	0	0.0001	2	2	-4.915025***	-4.892868***
	LOER	6	6	0.784281	-0.692418	0.9937	0.9724	6	6	1.215723	-0.618001
	ΔDLOER	5	6	-5.834537***	-6.172537***	0	0	5	5	-5.667451***	-6.116283***
	LCPI	3	3	4.881832	0.280075	1	0.9985	3	3	6.50747	0.800939
	ΔDLCPI	2	2	-7.845896***	-9.551047***	0	0	11	2	-1.108091	-8.987096***
	PMP	1	1	-2.110304	-3.517263**	0.241	0.0408	1	1	-1.628243*	-3.290401**
Mexico	LBMER	6	6	0.825199	-1.679561	0.9944	0.7591	6	6	1.933232	-0.677857
1981M01-1998M12	ΔLBMER	5	5	-6.251220***	-6.508050***	0	0	5	5	-5.807419***	-6.495368***
	LOER	5	5	1.060851	-1.621996	0.9972	0.7832	5	5	2.14745	-0.562738
	ΔDLOER	4	4	-5.790983***	-6.149044***	0	0	4	4	-5.236007***	-6.082622***
	LCPI	4	4	1.175392	-2.006788	0.998	0.5957	4	4	2.140347	-0.735141
	ΔDLCPI	3	3	-3.852341***	-4.385244***	0.0026	0.0025	3	3	-0.767171	-1.664527
	LWPI	1	3	-3.025680**	-1.411847	0.0341	0.855	3	3	0.753335	-0.804167
	ΔlWPI	2	12	-3.347850**	-3.248951*	0.014	0.078	2	2	-3.287293***	-3.470374***
	PMP	1	1	-6.077522***	-6.278396***	0	0	1	1	-5.584968***	-6.274488***
Peru	LBMER	4	4	0.924675	-1.371014	0.9958	0.8683	4	4	1.994203	-0.62366
1973M01-1998mM12	ΔLBMER	3	3	-5.610551***	-5.920045***	0	0	3	3	-5.155290***	-5.895680***
	LOER	3	3	1.335248	-1.274369	0.9988	0.8927	3	3	2.674534	-0.398266
	ΔDLOER	2	2	-8.426710***	-8.763107***	0	0	3	2	-6.672188***	-8.743372***
	LCPI	5	5	0.373587	-1.639544	0.9817	0.776	5	5	1.256642	-0.965079
	ΔDLCPI	4	4	-4.085410***	-4.289455***	0.0011	0.0035	4	4	-3.730313***	-4.287602***
	LWPI	4	4	-1.051384	-1.1691	0.7348	0.9135	4	4	0.651975	-1.369365
	ΔlWPI	3	3	-3.665281***	-3.727818**	0.0053	0.0225	3	3	-3.536838***	-3.603191***
	PMP	1	1	-5.190895***	-5.250176***	0	0.0001	1	1	-4.817139***	-5.239425***
Suriname	LBMER	6	6	0.537254	-1.638017	0.9878	0.7759	6	6	1.41668	-0.962372
1973m01-1998m12	ΔLBMER	6	6	-5.370856***	-5.527797***	0	0	6	6	-4.677403***	-5.503917***
	LOER	6	6	-0.439634	-1.295196	0.8995	0.8878	6	6	-0.215775	-1.304862
	ΔDLOER	6	6	-7.691043***	-7.817318***	0	0	6	6	-7.642143***	-7.794758***

	LCPI	4	5	0.164366	-2.056392	0.9701	0.5683	5	5	1.356697	-1.246939
	ΔDLCPI	5	3	-5.136430***	-5.193498***	0	0.0001	4	3	-3.721125***	-5.096563***
	PMP	5	5	-3.887232***	-4.109377***	0.0024	0.0067	4	5	-3.421604***	-4.103221***
Venezuela	LBMER	3	3	2.082488	-0.781564	0.9999	0.9654	3	3	3.10267	-0.094549
1973M01-1998M12	ΔLBMER	2	2	-9.268782***	-9.804134***	0	0	2	2	-7.859700***	-8.395128***
	LOER	1	1	2.63354	-0.003539	1	0.9962	1	1	3.920701	0.310092
	ΔDLOER	6	6	-7.779213***	-8.492771***	0	0	6	6	-7.101758***	-8.361661***
	LCPI	1	1	8.310245	3.014388	1	1	2	5	7.705786	0.25218
	ΔDLCPI	4	1	-4.102287***	-10.20385***	0.0011	0	4	4	-3.153679***	-5.769043***
	LWPI	2	2	4.453042	0.634661	1	0.9996	2	2	5.803383	0.754563
	ΔlWPI	1	1	-7.935120***	-9.417331***	0	0	3	1	-4.436334***	-9.320324***
	PMP	7	7	-3.080826**	-3.146235*	0.0287	0.097	7	7	-3.070868***	-3.073312**

Notes: LCPI and LWPI denote the log consumer price index and log wholesale price index respectively. LBMER and LOER represent the log parallel (black) market exchange rate and the log official exchange rate. The observation period for each country is recorded under the country name based on a commonly availability of all the variables under examination..

*** denotes rejecting the null hypothesis of unit root at 1% level,** denotes rejecting the null hypothesis of unit root at 5%level, *denotes rejecting the null hypothesis of unit root at 10% level.

Table A.12: Additional Unit Root Testing for African Economies

Unit roots and stationarity tests	Series	leads/lags		ADF-statistics		MacKinnon (1996)one-sided p-values		leads/lags		DF-GLS statistics	
Country		**C**	**C,T**	**C**	**C,T**	**C**	**C,T**	**C**	**C,T**	**C**	**C,T**
Algeria	LBMER	11	11	0.659671	-1.589814	0.9912	0.7959	11	11	2.078671	-1.132065
1974M01-1998M12	ΔLBMER	10		-6.405779***	-6.566283***	0	0	6	6	-8.678894***	-9.491608***
	LOER	1	1	2.32887	0.429238	1	0.9991	1	1	3.683674	0.243768
	ΔLOER	7	6	-5.604517***	-7.117665***	0	0	7	6	5.318023***	-7.092339***
	LCPI	12	12	-3.861924	-1.806839	0.9184	0.6989	12	12	0.511059	-1.667019
	ΔLCPI	11	12	-2.440574	-2.665574	0.252	0.1317	11	11	-2.35128**	-2.395465
	PMP	1	1	3.488836	1.387574	1	1	1	1	4.300224	0.926658
	ΔPMP	9	7	-4.409153***	-5.545844***	0.0003	0	9	7	-4.196499***	-5.276940***
Egypt	LBMER	3	3	-0.661631	-1.770367	0.8536	0.7178	3	3	0.73655	-1.752212
1973M01-1998M12	ΔLBMER	2	2	-14.26850***	-14.25947***	0	0	4	2	-7.988716***	-13.61013***
	LOER	11	11	-0.441828	-2.095848	0.8991	0.5463	11	11	0.381412	-1.685909
	ΔDLOER	10	10	-4.416207***	-4.477433***	0.0003	0.0018	10	10	-4.255831***	-4.481486***
	LCPI	1	1	3.81319	-2.791079	1	0.2013	1	1	8.749692	0.182398
	ΔDLCPI	12	12	-3.485798***	-4.019183***	0.0088	0.0087	12	12	-3.183208***	-3.850726***
	LWPI	12	12	0.730712	-2.151126	0.9927	0.5153	12	12	1.497384	-0.773612
	ΔlWPI	11	11	-3.020025**	-3.315512***	0.0338	0.0649	11	11	-2.482846**	-2.225864
	PMP	6	6	-2.018483	-2.346839	0.2789	0.4073	6	6	-1.926059*	-1.958523
	ΔPMP	2	2	-14.84099***	-14.84285***	0	0	6	6	-7.776735***	-8.853289***
Ghana	LBMER	10	10	0.181098	-1.904478	0.9712	0.6503	10	10	2.522285	-1.526497
1973M01-1998M12	ΔLBMER	9	9	-6.198259***	-6.219470***	0	0	10	9	-1.2626	-2.952639**
	LOER	1	1	0.847059	-1.788233	0.9948	0.7093	1	1	2.647147	-0.836296
	ΔDLOER	6	6	-8.293644***	-8.457829***	0	0	6	6	-7.782096***	-8.449518***

	LCPI	1	1	0.751482	-1.970309	0.9931	0.6154	2	2	3.911851	-0.922849
	ΔDLCPI	1	10	-9.534197***	-4.096294***	0	0.0069	1	1	-9.538758***	-9.534976***
	PMP	10	10	-4.073509***	-4.069735***	0.0012	0.0075	10	10	-3.778610***	-3.972818***
Kenya	LBMER	5	9	-0.344557	-2.637481	0.9152	0.2639	5	5	0.546063	-1.657375
1973M01-1998M12	ΔLBMER	4	3	-6.795267***	-6.830264***	0	0	4	4	-6.711705***	-6.825071***
	LOER	1	1	1.253727	-1.288415	0.9985	0.8894	1	1	2.379764	-0.461365
	ΔDLOER	6	6	-7.211128***	-7.502308***	0	0	6	6	-6.960915***	-7.364469***
	LCPI	3	3	0.802978	-2.575416	0.994	0.2919	3	3	3.455666	-1.035001
	ΔDLCPI	2	2	-7.102045***	-7.194438***	0	0	5	2	-2.386650**	-5.815429***
	PMP	1	1	-4.221011***	-4.407628***	0.0007	0.0024	1	1	-4.183275***	-4.363608***
Nigeria	LBMER	1	1	0.589106	-2.153071	0.9893	0.5138	1	1	1.834785	-0.891855
1973M01-1998M12	ΔLBMER	6	6	-6.910741***	-7.114263***	0	0	12	4	-1.42633	-6.292583***
	LOER	3	3	0.988881	-1.125216	0.9965	0.9226	3	3	1.866845	-0.430625
	ΔDLOER	2	2	-11.43319***	-11.66991***	0	0	2	2	-11.20554***	-11.65027***
	LCPI	2	2	3.102932	-1.247934	1	0.8986	2	2	5.546785	0.139802
	ΔDLCPI	1	1	-9.701803***	-10.47362***	0	0	11	1	-1.945203**	-10.37338***
	PMP	2	2	-1.741604	-2.34836	0.4094	0.4062	2	2	-1.361051	-2.308838
	ΔPMP	1	1	-18.69747***	-18.68354***	0	0	10	1	-2.317507**	-17.71480***
Morocco	LBMER	9	9	-0.673205	-1.543852	0.8508	0.8131	9	9	0.132754	-1.498287
1973M01-1998M12	ΔLBMER	8	8	-6.808471***	-6.829620***	0	0	12	12	-3.698435***	-3.961442***
	LOER	1	1	-1.151096	-1.543839	0.6966	0.8132	3	3	0.589622	-1.53657
	ΔDLOER	2	2	-10.64698***	-10.64059***	0	0	12	2	-4.243667***	-10.58496***
	LCPI	12	12	0.344751	-2.16661	0.9804	0.5067	12	12	1.863032	-1.064766
	ΔDLCPI	11	11	-4.005842***	-4.073945***	0.0015	0.0073	11	11	-1.944399**	-2.954721***
	LWPI	10	10	-3.342484**	-0.619605	0.014	0.9768	12	11	2.822177	0.162298
	ΔlWPI	4	9	-8.720002***	-7.350906***	0	0	12	12	-1.942621**	-3.685083***
	PMP	4	2	-3.114789**	-6.977213**	0.0262	0	4	4	-1.940875*	-2.105843

South Africa	LBMER	2	2	1.504991	-1.107192	0.9993	0.9256	2	1	1.839095	-0.800283
1980M01-1998M12	ΔLBMER	1	1	-18.01651***	-18.19740***	0	0	1	12	-18.61336***	-0.264678
	LOER	1	1	1.430112	0.9991	-1.28822	0.8895	8	8	2.601462	-0.36688
	ΔDLOER	11	11	-4.424105***	-4.853371***	0.0003	0.0004	11	11	-3.921644***	-4.567156***
	LCPI	12	12	0.410782	-2.90103	0.9833	0.1631	12	12	0.393687	-1.254632
	ΔDLCPI	2	11	-3.4511***	-3.9878***	0	0	2	2	-2.5724***	-3.4712***
	LWPI	12	12	-1.657942	0.105231	0.4512	0.9972	6	6	0.775741	-0.070239
	ΔlWPI	5	5	-3.4599***	-4.0001***	0	0	5	5	-1.201455	-3.630365***
	PMP	12	12	-3.079179**	-3.108117	0.0288	0.1055	12	12	-2.880337***	-2.241785

Notes: LCPI and LWPI denote the log consumer price index and log wholesale price index respectively. LBMER and LOER represent the log parallel (black) market exchange rate and the log official exchange rate. The observation period for each country is recorded under the country name based on a commonly availability of all the variables under examination..

*** denotes rejecting the null hypothesis of unit root at 1% level,** denotes rejecting the null hypothesis of unit root at 5%level, *denotes rejecting the null hypothesis of unit root at 10% level.

Table A.13: Johansen Cointegration Test for model 1– Latin American Economies

Argentina	Series: e_o p p*			
p(*)=LCPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	52.7642	49.7201	24.2760
	1	10.1381	9.5532	12.3209
	2	0.0130	0.0122	4.1299
No.of Cointegrating eqn(s):1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	40.8046	38.4121	24.2760
	1	11.5961	10.9162	12.3209
	2	0.0842	0.0792	4.1299
No.of Cointegrating eqn(s):1				
Bolivia	Series: e_o p p*			
p(*)=LCPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	34.39163	27.71124	29.79707
	1	14.58899	11.75516	15.49471
	2	5.604942	4.516212	3.841466
No.of Cointegrating eqn(s):1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	62.5716	58.23972	42.91525
	1	22.03684	20.51121	25.87211
	2	5.695545	5.301238	12.51798
No.of Cointegrating eqn(s):1				
Brazil	Series: e_o p p*			
p(*)=LCPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	42.1358	41.0171	29.7971
	1	9.5215	9.2687	15.4947
	2	1.4124	1.3749	3.8415
No.of Cointegrating eqn(s):1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	49.1307	47.8028	29.7971
	1	15.1823	14.7720	15.4947
	2	2.2474	2.1867	3.8415
No.of Cointegrating eqn(s):1				
	Series: e_o p p*			
p(*)=LWPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	49.3075	47.9984	29.7971
	1	12.5144	12.1822	15.4947
	2	1.0798	1.0512	3.8415
No.of Cointegrating eqn(s):1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	58.2702	57.1350	29.7971
	1	19.6318	19.2493	15.4947
	2	1.1704	1.1476	3.8415
No.of Cointegrating eqn(s):1				
Colombia	Series: e_o p p*			
p(*)=LCPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	30.4459	28.6894	29.7971
	1	14.8936	14.0344	15.4947
	2	7.0059	6.6018	3.8415

No.of Cointegrating eqn(s):1 / 0				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	45.8066	44.6168	29.7971
	1	13.9634	13.6007	15.4947
	2	4.8042	4.6795	3.8415
No.of Cointegrating eqn(s):1				
	Series: e_o p p*			
p(*)=LWPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	56.45319	55.065	24.27596
	1	9.623032	9.3864	12.3209
	2	1.305562	1.273458	4.129906
No.of Cointegrating eqn(s): 1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	42.91525	46.76226	0.0055
	1	25.87211	19.69181	0.1514
	2	12.51798	2.429452	0.9124
No.of Cointegrating eqn(s):1				
Dominican Republic	Series: e_o p p*			
	$H_0: r$	Trace	Atrace	Trace95
p(*)=LCPI(*)	0	40.5112	29.7971	39.7322
	1	13.6575	15.4947	13.3948
	2	2.6549	3.8415	2.6038
No.of Cointegrating eqn(s):1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	44.5476	41.5004	29.7971
	1	16.0428	14.9454	15.4947
	2	4.5803	4.2670	3.8415
No.of Cointegrating eqn(s):1				
Ecuador	Series: e_o p p*			
p(*)=LCPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	79.9670	78.4292	29.7971
	1	20.4859	20.0919	15.4947
	2	3.8546	3.7805	3.8415
No.of Cointegrating eqn(s):2				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	130.2004	127.6722	42.91525
	1	25.06514	24.57844	25.87211
	2	9.509868	9.32521	12.51798
No.of Cointegrating eqn(s):1				
El Salvador	Series: e_o p p*			
	$H_0: r$	Trace	Atrace	Trace95
p(*)=LCPI(*)	0	30.8907	29.1085	24.2760
	1	11.7598	11.0814	12.3209
	2	1.8831	1.7744	4.1299
No.of Cointegrating eqn(s):1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	76.5037	75.0134	24.2760
	1	22.6869	22.2449	12.3209
	2	0.8370	0.8207	4.1299
No.of Cointegrating eqn(s):2				

Honduras	Series: e_o p p*			
p(*)=LCPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	64.15026	62.9166	29.79707
	1	14.34762	14.0717	15.49471
	2	0.559464	0.548705	3.841466
No.of Cointegrating eqn(s):1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	51.0898	50.1495	29.79707
	1	14.27315	14.01045	15.49471
	2	2.498802	2.452812	3.841466
No.of Cointegrating eqn(s):1				

Mexico	Series: e_o p p*			
p(*)=LCPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	38.13474	32.32742	29.79707
	1	14.97834	12.69737	15.49471
	2	4.615687	3.912791	3.841466
No.of Cointegrating eqn(s):1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	45.14092	38.26667	35.19275
	1	19.66875	16.67351	20.26184
	2	4.733394	4.012573	9.164546
No.of Cointegrating eqn(s):1				
	Series: e_o p p*			
p(*)=LWPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	42.3962	41.2019	24.2760
	1	10.8914	10.5846	12.3209
	2	0.4157	0.4040	4.1299
No.of Cointegrating eqn(s):1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	38.3029	37.5567	29.7971
	1	14.7178	14.4311	15.4947
	2	4.5475	4.4589	3.8415
No.of Cointegrating eqn(s):1				

Peru	Series: e_o p p*			
p(*)=LCPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	64.9853	64.3604	29.7971
	1	27.1751	26.9138	15.4947
	2	2.6021	2.5771	3.8415
No.of Cointegrating eqn(s):2				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	32.8873	31.2804	29.7971
	1	14.2057	13.5116	15.4947
	2	4.3358	4.1240	3.8415
No.of Cointegrating eqn(s):1				
	Series: e_o p p*			
p(*)=LWPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	52.6962	51.2909	29.7971
	1	19.2621	18.7485	15.4947
	2	1.2770	1.2430	3.8415
No.of Cointegrating eqn(s):2				
	Series: e_b p p*			

	$H_0: r$	Trace	Atrace	Trace95
	0	30.5726	29.9770	29.7971
	1	11.0779	10.8621	15.4947
	2	1.7929	1.7580	3.8415
No.of Cointegrating eqn(s):1				

Suriname	Series: e_o p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	74.47722	69.46433	29.79707
	1	15.45525	14.41499	15.49471
	2	1.916948	1.787923	3.841466
No.of Cointegrating eqn(s):1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	39.6848	38.9015	29.7971
	1	9.3142	9.1304	15.4947
	2	0.0133	0.0131	3.8415
No.of Cointegrating eqn(s):1				

Venezuela	Series: e_o p p*			
p(*)=LCPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	56.0452	54.9674	29.7971
	1	8.9863	8.8135	15.4947
	2	0.0905	0.0887	3.8415
No.of Cointegrating eqn(s):1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	57.8166	56.6903	29.7971
	1	7.3929	7.2488	15.4947
	2	0.2550	0.2501	3.8415
No.of Cointegrating eqn(s):1				
	Series: e_o p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	52.8147	51.7991	29.7971
	1	11.6498	11.4257	15.4947
	2	1.4161	1.3888	3.8415
No.of Cointegrating eqn(s):1				
p(*)=LWPI(*)	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	50.2560	49.2770	29.7971
	1	7.7731	7.6217	15.4947
	2	0.0028	0.0028	3.8415
No.of Cointegrating eqn(s):1				

Chile		Series: e_o p p*		
p(*)=LCPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	60.9770	56.8728	29.7971
	1	15.0819	14.0667	15.4947
	2	5.2130	4.8622	3.8415
No.of Cointegrating eqn(s):1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	65.9365	59.4932	24.2760
	1	18.7035	16.8758	12.3209
	2	1.5877	1.4326	4.1299
No.of Cointegrating eqn(s):2				
	Series: e_o p p*			
p(*)=LWPI(*)	$H_0: r$	Trace	Atrace	Trace95

	0	41.4016	37.8188	24.2760
	1	5.7534	5.2555	12.3209
	2	1.1025	1.0071	4.1299
No.of Cointegrating eqn(s):1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	65.8128	61.9541	24.2760
	1	19.0242	17.9087	12.3209
	2	1.5755	1.4831	4.1299
No.of Cointegrating eqn(s):2				
Costa Rica	Series: e_o p p*			
p(*)=LCPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	52.0700	48.2062	24.2760
	1	10.3292	9.5628	12.3209
	2	1.8693	1.7306	4.1299
No.of Cointegrating eqn(s):1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	48.7951	44.0217	29.7971
	1	16.2732	14.6812	15.4947
	2	4.3981	3.9678	3.8415
No.of Cointegrating eqn(s):1				
	Series: e_o p p*			
p(*)=LWPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	51.10346	46.68105	42.91525
	1	25.46593	23.26215	25.87211
	2	8.396484	7.669865	12.51798
No.of Cointegrating eqn(s):1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	61.51122	56.10144	42.91525
	1	31.40266	28.64086	25.87211
	2	10.4353	9.517537	12.51798
No.of Cointegrating eqn(s):1				

Table A.14: Johansen Cointegration Test for model 1 – African Economies

Algeria	Series: e_o p p*			
p(*)=LCPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	41.0430	40.1697	29.7971
	1	8.9531	8.7626	15.4947
	2	0.7959	0.7790	3.8415
No.of Cointegrating eqn(s): 1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	36.8821	36.0918	29.7971
	1	9.6560	9.4491	15.4947
	2	0.5718	0.5596	3.8415
No.of Cointegrating eqn(s):1				
Egypt	Series: e_o p p*			
p(*)=LCPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	38.1365	37.4031	29.7971
	1	12.2705	12.0345	15.4947
	2	3.3952	3.3299	3.8415
No.of Cointegrating eqn(s):1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	44.66206	41.17056	42.91525
	1	21.78777	20.08449	25.87211
	2	7.859145	7.244749	12.51798
No.of Cointegrating eqn(s):1				
	Series: e_o p p*			
p(*)=LWPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	68.25671	67.59402	42.91525
	1	23.31918	23.09278	25.87211
	2	4.451591	4.408372	12.51798
No.of Cointegrating eqn(s):1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	69.86237	69.17744	42.91525
	1	23.93703	23.70235	25.87211
	2	9.468157	9.375332	12.51798
No.of Cointegrating eqn(s):1				
Kenya	Series: e_o p p*			
p(*)=LCPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	51.6136	50.1247	29.7971
	1	14.0566	13.6511	15.4947
	2	1.5726	1.5272	3.8415
No.of Cointegrating eqn(s):1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	54.83145	53.22401	42.91525
	1	21.32434	20.6992	25.87211
	2	6.665539	6.470132	12.51798
No.of Cointegrating eqn(s):1				
Morocco	Series: e_o p p*			
p(*)=LCPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	72.1806	70.7925	24.2760
	1	13.3180	13.0619	12.3209
	2	0.0006	0.0006	4.1299

No.of Cointegrating eqn(s):2				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	70.9206	69.5390	24.2760
	1	12.6025	12.3570	12.3209
	2	0.0525	0.0515	4.1299
No.of Cointegrating eqn(s):2				
	Series: e_o p p*			
p(*)=LWPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	58.1297	53.18249	42.91525
	1	22.72591	20.79179	25.87211
	2	9.360104	8.563499	12.51798
No.of Cointegrating eqn(s):1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	74.1843	73.4247	24.2760
	1	9.6271	9.5286	12.3209
	2	0.3433	0.3398	4.1299
No.of Cointegrating eqn(s):1				
Nigeria	Series: e_o p p*			
p(*)=LCPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	61.4766	60.2944	24.2760
	1	14.1061	13.8349	12.3209
	2	0.8893	0.8722	4.1299
No.of Cointegrating eqn(s):2				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	38.1984	37.4543	29.7971
	1	12.9365	12.6845	15.4947
	2	1.9353	1.8976	3.8415
No.of Cointegrating eqn(s):1				
South Africa	Series: e_o p p*			
	$H_0: r$	Trace	Atrace	Trace95
p(*)=LCPI(*)	0	72.93897	67.32828	42.91525
	1	25.81377	23.8281	25.87211
	2	12.31155	11.36451	12.51798
No.of Cointegrating eqn(s):1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	65.65065	60.51835	42.91525
	1	23.50652	21.66888	25.87211
	2	9.128347	8.41473	12.51798
No.of Cointegrating eqn(s):1				
	Series: e_o p p*			
p(*)=LWPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	56.44521	50.25943	42.91525
	1	23.75159	21.14868	25.87211
	2	8.382462	7.463836	12.51798
No.of Cointegrating eqn(s):1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	52.53345	45.87428	42.91525
	1	23.02259	20.10423	25.87211
	2	6.823415	5.958475	12.51798
No.of Cointegrating eqn(s):1				

Table A.15: Johansen Cointegration Test for model 1 – Developed Economies

Belgium	Series: e_o p p*			
p(*)=LCPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	50.2421	46.8604	29.7971
	1	16.1649	15.0769	15.4947
	2	7.4062	6.9077	3.8415
No.of Cointegrating eqn(s):2/1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	46.4451	42.8142	29.7971
	1	15.5635	14.3468	15.4947
	2	6.7601	6.2317	3.8415
No.of Cointegrating eqn(s): 1				

Table A.16: Johansen Cointegration Test for model 2 – Asian Economies

India	Series: e_o p p*			
p(*)=LCPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	41.3777	40.5820	29.7971
	1	15.2364	14.9434	15.4947
	2	0.1180	0.1157	3.8415
No.of Cointegrating eqn(s):1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	42.8566	40.3439	29.7971
	1	15.1752	14.2854	15.4947
	2	1.1435	1.0765	3.8415
No.of Cointegrating eqn(s):1				
	Series: e_o p p*			
p(*)=LWPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	48.4839	47.5515	29.7971
	1	13.6450	13.3826	15.4947
	2	0.0119	0.0116	3.8415
No.of Cointegrating eqn(s):1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	71.2214	69.3533	47.8561
	1	36.0962	35.1494	29.7971
	2	12.8119	12.4759	15.4947
No.of Cointegrating eqn(s):2				
Indonesia	Series: e_o p p*			
p(*)=LCPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	83.57885	81.97156	42.91525
	1	24.14445	23.68013	25.87211
	2	3.885414	3.810695	12.51798
No.of Cointegrating eqn(s):1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	36.9819	35.17497	29.79707
	1	14.13412	13.44353	15.49471
	2	2.633874	2.505183	3.841466
No.of Cointegrating eqn(s):1				
	Series: e_o p p*			
p(*)=LWPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	38.76126	36.52503	29.79707
	1	15.48452	14.59118	15.49471
	2	0.518988	0.489046	3.841466
No.of Cointegrating eqn(s):1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95

	0	32.9805	31.0468	24.2760
	1	8.2038	7.7228	12.3209
	2	2.0919	1.9692	4.1299
No.of Cointegrating eqn(s):1				
Iran	Series: e_o p p*			
p(*)=LCPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	32.0736	31.0239	29.7971
	1	11.6912	11.3086	15.4947
	2	0.0711	0.0688	3.8415
No.of Cointegrating eqn(s):1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	34.7387	33.9724	29.7971
	1	14.4565	14.1376	15.4947
	2	0.4673	0.4570	3.8415
No.of Cointegrating eqn(s):1				
	Series: e_o p p*			
p(*)=LWPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	46.6457	45.1191	29.7971
	1	6.7678	6.5463	15.4947
	2	0.6869	0.6644	3.8415
No.of Cointegrating eqn(s):1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	65.8989	65.1774	29.7971
	1	15.8280	15.6547	15.4947
	2	0.1677	0.1658	3.8415
No.of Cointegrating eqn(s):2				
Kuwait	Series: e_o p p*			
p(*)=LCPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	54.8714	53.7515	24.2760
	1	4.5022	4.4103	12.3209
	2	0.0011	0.0011	4.1299
No.of Cointegrating eqn(s):1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	56.0733	54.9131	24.2760
	1	5.4285	5.3162	12.3209
	2	0.0060	0.0058	4.1299
No.of Cointegrating eqn(s):1				
	Series: e_o p p*			
p(*)=LWPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	87.7692	86.7243	24.2760
	1	2.6669	2.6352	12.3209
	2	0.0255	0.0252	4.1299

No.of Cointegrating eqn(s):1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	84.1093	83.0959	24.2760
	1	2.8596	2.8252	12.3209
	2	0.1629	0.1609	4.1299
No.of Cointegrating eqn(s):1				
korea	Series: e_o p p*			
p(*)=LCPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	40.3330	39.5573	29.7971
	1	10.0419	9.8487	15.4947
	2	3.7892	3.7164	3.8415
No.of Cointegrating eqn(s):1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	30.4469	28.6140	24.2760
	1	10.1540	9.5427	12.3209
	2	1.8086	1.6997	4.1299
No.of Cointegrating eqn(s):1				
	Series: e_o p p*			
p(*)=LWPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	47.5358	46.1646	29.7971
	1	15.6898	15.2372	15.4947
	2	5.9631	5.7911	3.8415
No.of Cointegrating eqn(s):3/2				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	33.7928	31.7585	29.7971
	1	14.2638	13.4051	15.4947
	2	4.4177	4.1517	3.8415
No.of Cointegrating eqn(s):1				
Malaysia	Series: e_o p p*			
p(*)=LCPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	47.9461	47.0241	24.2760
	1	11.8690	11.6408	12.3209
	2	2.2521	2.2088	4.1299
No.of Cointegrating eqn(s):1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	43.5610	42.7124	29.7971
	1	12.1769	11.9397	15.4947
	2	1.7898	1.7550	3.8415
No.of Cointegrating eqn(s):1				
	Series: e_o p p*			
p(*)=LWPI(*)	$H_0: r$	Trace	Atrace	Trace95

	0	13.3893	12.8642	29.7971
	1	3.7801	3.6318	15.4947
	2	0.4169	0.4005	3.8415
No.of Cointegrating eqn(s):0				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	16.4597	15.7969	29.7971
	1	6.1482	5.9006	15.4947
	2	0.4720	0.4530	3.8415
No.of Cointegrating eqn(s):0				
Nepal	Series: e_o p p*			
p(*)=LCPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	34.6888	34.0217	29.7971
	1	11.8717	11.6434	15.4947
	2	1.2094	1.1862	3.8415
No.of Cointegrating eqn(s):1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	40.4542	39.4035	29.7971
	1	17.5906	17.1337	15.4947
	2	0.9744	0.9491	3.8415
No.of Cointegrating eqn(s):2				
Pakistan	Series: e_o p p*			
p(*)=LCPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	41.7493	38.1363	29.7971
	1	8.9347	8.1615	15.4947
	2	0.6562	0.5994	3.8415
No.of Cointegrating eqn(s):1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	61.0195	56.8455	29.7971
	1	11.1525	10.3896	15.4947
	2	2.2064	2.0555	3.8415
No.of Cointegrating eqn(s):2				
	Series: e_o p p*			
p(*)=LWPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	49.7480	48.7913	29.7971
	1	15.5569	15.2577	15.4947
	2	0.0017	0.0017	3.8415
No.of Cointegrating eqn(s):2/1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	62.7905	61.5673	29.7971
	1	19.4315	19.0530	15.4947
	2	2.3687	2.3225	3.8415

No.of Cointegrating eqn(s):2				
Philippines	Series: e_o p p*			
p(*)=LCPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	55.9308	54.8552	24.2760
	1	13.6413	13.3790	12.3209
	2	1.8012	1.7665	4.1299
No.of Cointegrating eqn(s): 2				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	34.2562	31.2435	29.7971
	1	13.9989	12.7677	15.4947
	2	5.3957	4.9211	3.8415
No.of Cointegrating eqn(s):1				
Singapore	Series: e_o p p*			
p(*)=LCPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	69.8249	65.7965	29.7971
	1	12.6217	11.8936	15.4947
	2	3.7482	3.5319	3.8415
No.of Cointegrating eqn(s):1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	28.5785	26.8406	24.2760
	1	4.8536	4.5584	12.3209
	2	0.3976	0.3734	4.1299
No.of Cointegrating eqn(s):1				
	Series: e_o p p*			
p(*)=LWPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	39.8469	39.0419	29.7971
	1	5.4608	5.3505	15.4947
	2	1.2518	1.2265	3.8415
No.of Cointegrating eqn(s):1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	38.0076	37.2292	29.7971
	1	5.7675	5.6494	15.4947
	2	1.5748	1.5426	3.8415
No.of Cointegrating eqn(s):1				
Sri Lanka	Series: e_o p p*			
p(*)=LCPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	60.7916	59.6225	29.7971
	1	24.6355	24.1617	15.4947
	2	2.7658	2.7126	3.8415
No.of Cointegrating eqn(s):2				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95

	0	48.3756	47.4332	29.7971
	1	15.5949	15.2911	15.4947
	2	2.5812	2.5309	3.8415
No.of Cointegrating eqn(s):2				
	Series: e_o p p*			
p(*)=LWPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	36.7306	35.9233	29.7971
	1	14.7972	14.4720	15.4947
	2	1.3052	1.2765	3.8415
No.of Cointegrating eqn(s):1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	28.9626	28.3166	29.7971
	1	7.6262	7.4561	15.4947
	2	0.6639	0.6491	3.8415
No.of Cointegrating eqn(s):0				
Thailand	Series: e_o p p*			
p(*)=LCPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	37.7046	36.9796	29.7971
	1	13.4324	13.1740	15.4947
	2	0.4849	0.4756	3.8415
No.of Cointegrating eqn(s):1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	38.2609	37.5156	29.7971
	1	14.3396	14.0602	15.4947
	2	0.0867	0.0850	3.8415
No.of Cointegrating eqn(s):1				
	Series: e_o p p*			
p(*)=LWPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	46.3140	45.4233	29.7971
	1	10.0608	9.8673	15.4947
	2	0.1261	0.1237	3.8415
No.of Cointegrating eqn(s):1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	47.2370	46.3168	29.7971
	1	12.2942	12.0547	15.4947
	2	0.2978	0.2920	3.8415
No.of Cointegrating eqn(s):1				
Turkey	Series: e_o p p*			
p(*)=LCPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	101.4180	100.4428	29.7971
	1	25.3744	25.1304	15.4947

	2	2.7590	2.7325	3.8415
No.of Cointegrating eqn(s):1				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	43.5317	40.9794	29.7971
	1	13.4619	12.6726	15.4947
	2	0.6432	0.6055	3.8415
No.of Cointegrating eqn(s):1				
	Series: e_o p p*			
p(*)=LWPI(*)	$H_0: r$	Trace	Atrace	Trace95
	0	28.2170	27.1105	29.7971
	1	12.0460	11.5736	15.4947
	2	0.0411	0.0395	3.8415
No.of Cointegrating eqn(s):0				
	Series: e_b p p*			
	$H_0: r$	Trace	Atrace	Trace95
	0	32.0393	30.7491	29.7971
	1	8.5432	8.1992	15.4947
	2	0.1528	0.1467	3.8415
No.of Cointegrating eqn(s):1				

Table A.17: Johansen Cointegration Test for model 2 – Latin American Economies

Series: e_b e_o p p*				
Argentina	$H_0: r$	Trace	Atrace	Trace95
p(*)=LCPI(*)	0	83.74918	78.72423	47.85613
	1	32.58986	30.63447	29.79707
	2	14.44817	13.58128	15.49471
	3	4.864055	4.572212	3.841466
No.of Cointegrating eqn(s):2				
Bolivia	$H_0: r$	Trace	Atrace	Trace95
p(*)=LCPI(*)	0	151.2124	148.2377	40.1749
	1	75.9160	74.4225	24.2760
	2	25.6640	25.1592	12.3209
	3	0.0209	0.0205	4.1299
No.of Cointegrating eqn(s):2				
Chile	$H_0: r$	Trace	Atrace	Trace95
p(*)=LCPI(*)	0	120.0013	115.2488	40.1749
	1	61.3903	58.9590	24.2760
	2	10.8216	10.3930	12.3209
	3	3.2395	3.1112	4.1299
No.of Cointegrating eqn(s):1				
Chile	$H_0: r$	Trace	Atrace	Trace95
p(*)=LWPI(*)	0	112.4828	108.0280	40.1749
	1	41.9306	40.2700	24.2760
	2	9.1135	8.7525	12.3209
	3	1.0782	1.0355	4.1299
No.of Cointegrating eqn(s):2				
Brazil	$H_0: r$	Trace	Atrace	Trace95
p(*)=LCPI(*)	0	87.1919	84.0498	63.8761
	1	38.1007	36.7277	42.9153
	2	11.1879	10.7848	25.8721
	3	2.0793	2.0043	12.5180
No.of Cointegrating eqn(s):1				
Brazil	$H_0: r$	Trace	Atrace	Trace95
p(*)=LWPI(*)	0	65.2480	57.0920	47.8561
	1	26.1387	22.8713	29.7971
	2	8.5712	7.4998	15.4947
	3	1.7563	1.5367	3.8415
No.of Cointegrating eqn(s):1				
Colombia	$H_0: r$	Trace	Atrace	Trace95
p(*)=LCPI(*)	0	50.1802	44.0977	47.8561
	1	21.9008	19.2462	29.7971
	2	11.3779	9.9988	15.4947
	3	3.0960	2.7207	3.8415
No.of Cointegrating eqn(s):1				
	$H_0: r$	Trace	Atrace	Trace95
p(*)=LWPI(*)	0	60.8480	59.2034	47.8561

	1	28.1726	27.4112	29.7971
	2	5.1640	5.0244	15.4947
	3	2.0701	2.0141	3.8415
No.of Cointegrating eqn(s):1				
Costa Rica	$H_0: r$	Trace	Atrace	Trace95
p(*)=LCPI(*)	0	102.8614	94.0131	47.8561
	1	53.4864	48.8854	29.7971
	2	16.1357	14.7477	15.4947
	3	3.9395	3.6006	3.8415
No.of Cointegrating eqn(s):4/2				
	$H_0: r$	Trace	Atrace	Trace95
p(*)=LWPI(*)	0	68.4619	62.5727	40.1749
	1	31.2885	28.5970	24.2760
	2	10.3667	9.4750	12.3209
	3	1.6973	1.5513	4.1299
No.of Cointegrating eqn(s):2				
Dominican Republic	$H_0: r$	Trace	Atrace	Trace95
	0	68.7266	65.0854	47.8561
p(*)=LCPI(*)	1	30.1182	28.5226	29.7971
	2	15.2170	14.4108	15.4947
	3	5.5200	5.2275	3.8415
No.of Cointegrating eqn(s): 2/1				
Ecuador	$H_0: r$	Trace	Atrace	Trace95
p(*)=LCPI(*)	0	64.8801	58.8044	47.8561
	1	30.4207	27.5719	29.7971
	2	13.1147	11.8866	9.4750
	3	5.1161	4.6370	3.8415
No.of Cointegrating eqn(s):1				
El Salvador	$H_0: r$	Trace	Atrace	Trace95
p(*)=LCPI(*)	0	52.9950	49.4738	47.8561
	1	31.1952	29.1224	29.7971
	2	16.3881	15.2992	15.4947
	3	4.8636	4.5404	3.8415
No.of Cointegrating eqn(s): 4/1				
Honduras	$H_0: r$	Trace	Atrace	Trace95
p(*)=LCPI(*)	0	51.6996	49.13068	47.85613
	1	23.77935	22.59777	29.79707
	2	8.688018	8.256315	15.49471
	3	0.490022	0.465673	3.841466
No.of Cointegrating eqn(s):1				
Mexico	$H_0: r$	Trace	Atrace	Trace95
p(*)=LCPI(*)	0	71.4266	60.1115	47.8561
	1	36.0935	30.3757	29.7971
	2	17.3874	14.6330	15.4947
	3	6.9486	5.8478	3.8415
No.of Cointegrating eqn(s):2				
Mexico	$H_0: r$	Trace	Atrace	Trace95

p(*)=LWPI(*)	0	67.5318	64.9468	47.8561
	1	37.3533	35.9235	29.7971
	2	14.2030	13.6593	15.4947
	3	4.7418	4.5603	3.8415
No.of Cointegrating eqn(s):2				
Peru	$H_0: r$	Trace	Atrace	Trace95
p(*)=LCPI(*)	0	74.2433	71.5558	40.1749
	1	33.2531	32.0494	24.2760
	2	11.2675	10.8597	12.3209
	3	0.1818	0.1753	4.1299
No.of Cointegrating eqn(s):2				
Peru	$H_0: r$	Trace	Atrace	Trace95
p(*)=LWPI(*)	0	60.5229	58.3320	40.1749
	1	23.7592	22.8991	24.2760
	2	6.6122	6.3728	12.3209
	3	0.2294	0.2211	4.1299
No.of Cointegrating eqn(s):1				
Suriname	$H_0: r$	Trace	Atrace	Trace95
p(*)=LCPI(*)	0	62.4165	60.7575	47.8561
	1	31.2689	30.4379	29.7971
	2	9.1135	8.8713	15.4947
	3	0.1460	0.1422	3.8415
No.of Cointegrating eqn(s):2				
Venezuela	$H_0: r$	Trace	Atrace	Trace95
p(*)=LCPI(*)	0	75.1083	73.1382	47.8561
	1	24.3512	23.7125	29.7971
	2	6.9931	6.8096	15.4947
	3	0.3535	0.3443	3.8415
No.of Cointegrating eqn(s):1				
Venezuela	$H_0: r$	Trace	Atrace	Trace95
p(*)=LWPI(*)	0	68.4411	66.6634	47.8561
	1	23.3843	22.7769	29.7971
	2	8.7786	8.5506	15.4947
	3	0.7671	0.7471	3.8415
No.of Cointegrating eqn(s):1				

Table A.18: Johansen Cointegration Test for model 2 – African Economies

Series: e_b e_o p p*				
Algeria	$H_0: r$	Trace	Atrace	Trace95
p(*)=LCPI(*)	0	60.1298	58.3995	47.8561
	1	27.8168	27.0163	29.7971
	2	10.8313	10.5196	15.4947
	3	0.2976	0.2890	3.8415
No.of Cointegrating eqn(s):1				
Egypt	$H_0: r$	Trace	Atrace	Trace95
p(*)=LCPI(*)	0	65.5947	63.8742	47.8561
	1	38.2427	37.2396	29.7971
	2	14.9200	14.5287	15.4947
	3	3.5583	3.4650	3.8415
No.of Cointegrating eqn(s):2				
Egypt	$H_0: r$	Trace	Atrace	Trace95
p(*)=LWPI(*)	0	108.6238	99.6958	47.8561
	1	50.3461	46.2081	29.7971
	2	15.2474	13.9942	15.4947
	3	5.5230	5.0690	3.8415
No.of Cointegrating eqn(s):2				
Kenya	$H_0: r$	Trace	Atrace	Trace95
p(*)=LCPI(*)	0	86.8027	82.2038	47.8561
	1	42.5279	40.2748	29.7971
	2	14.9460	14.1542	15.4947
	3	0.6599	0.6249	3.8415
No.of Cointegrating eqn(s):2				
Morocco	$H_0: r$	Trace	Atrace	Trace95
p(*)=LCPI(*)	0	65.8125	58.7454	47.8561
	1	36.3695	32.4640	29.7971
	2	17.4354	15.3632	15.4947
	3	5.8446	5.2170	3.8415
No.of Cointegrating eqn(s): 2				
Morocco	$H_0: r$	Trace	Atrace	Trace95
p(*)=LWPI(*)	0	110.5812	109.0716	40.1749
	1	44.3094	43.7045	24.2760
	2	10.2391	10.0993	12.3209
	3	0.1773	0.1749	4.1299
No.of Cointegrating eqn(s):2				
Nigeria	$H_0: r$	Trace	Atrace	Trace95
p(*)=LCPI(*)	0	51.8428	50.4830	47.8561
	1	24.7781	24.1281	29.7971
	2	11.6956	11.3888	15.4947
	3	4.8635	4.7359	3.8415
No.of Cointegrating eqn(s):1				
South Africa	$H_0: r$	Trace	Atrace	Trace95
p(*)=LCPI(*)	0	88.7346	81.7976	47.8561

	1	42.4554	39.1364	29.7971
	2	15.2428	14.0512	15.4947
	3	6.4126	5.9113	3.8415
No.of Cointegrating eqn(s):2				
South Africa	$H_0: r$	Trace	Atrace	Trace95
p(*)=LWPI(*)	0	92.8205	81.0545	63.8761
	1	46.4265	40.5414	42.9153
	2	21.4069	18.6933	25.8721
	3	7.8725	6.8746	12.5180
No.of Cointegrating eqn(s):2				

Table A.19: Johansen Cointegration Test for model 2 – Developed Economies

Series: e_b e_o p p*				
Belgium	$H_0: r$	Trace	Atrace	Trace95
p(*)=LCPI(*)	0	76.735	69.736	54.079
	1	39.751	36.125	35.193
	2	17.516	15.918	20.262
	3	7.727	7.022	9.165
No.of Cointegrating eqn(s):2				

Table A.20: Johansen Cointegration Test for model 2 – Asian Economies

Series: e_b e_o p p*				
India	$H_0: r$	Trace	Atrace	Trace95
p(*)=LCPI(*)	0	71.2214	69.3533	47.8561
	1	36.0962	35.1494	29.7971
	2	12.8119	12.4759	15.4947
	3	0.2195	0.2138	3.8415
No.of Cointegrating eqn(s):2				
India	$H_0: r$	Trace	Atrace	Trace95
p(*)=LWPI(*)	0	93.4961	92.2779	47.8561
	1	49.9732	49.3221	29.7971
	2	12.3389	12.1781	15.4947
	3	0.0523	0.0516	3.8415
No.of Cointegrating eqn(s):2				
Indonesia	$H_0: r$	Trace	Atrace	Trace95
p(*)=LCPI(*)	0	57.6204	53.7918	47.8561
	1	23.6212	22.0517	29.7971
	2	10.8792	10.1563	15.4947
	3	1.7353	1.6200	3.8415
No.of Cointegrating eqn(s):1				
Indonesia	$H_0: r$	Trace	Atrace	Trace95
p(*)=LWPI(*)	0	62.4528	59.1441	40.1749
	1	23.9635	22.6939	24.2760
	2	9.6853	9.1721	12.3209
	3	2.9892	2.8309	4.1299
No.of Cointegrating eqn(s):1				
Iran	$H_0: r$	Trace	Atrace	Trace95
p(*)=LCPI(*)	0	48.19169	45.32527	47.85613
	1	23.57031	22.16836	29.79707
	2	9.787238	9.205097	15.49471
	3	0.763872	0.718437	3.841466
No.of Cointegrating eqn(s):1				
Korea	$H_0: r$	Trace	Atrace	Trace95
p(*)=LCPI(*)	0	78.8269	77.2660	40.1749
	1	28.8308	28.2598	24.2760
	2	9.9732	9.7757	12.3209
	3	1.2040	1.1802	4.1299
No.of Cointegrating eqn(s): 1				
Korea	$H_0: r$	Trace	Atrace	Trace95
p(*)=LWPI(*)	0	55.4169	50.8621	47.8561
	1	24.7642	22.7288	29.7971
	2	8.7215	8.0047	15.4947
	3	3.7586	3.4497	3.8415
No.of Cointegrating eqn(s):1				
Kuwait	$H_0: r$	Trace	Atrace	Trace95
p(*)=LCPI(*)	0	65.0786	59.5202	47.8561

	1	29.6190	27.0893	29.7971
	2	14.8150	13.5496	15.4947
	3	5.0977	4.6623	3.8415
No.of Cointegrating eqn(s):1				
Kuwait	$H_0: r$	Trace	Atrace	Trace95
p(*)=LWPI(*)	0	51.3713	47.7504	40.1749
	1	18.9793	17.6416	24.2760
	2	3.1103	2.8911	12.3209
	3	0.0392	0.0365	4.1299
No.of Cointegrating eqn(s):1				
Malaysia	$H_0: r$	Trace	Atrace	Trace95
p(*)=LCPI(*)	0	77.0947	71.0678	63.8761
	1	35.0830	32.3404	42.9153
	2	9.9859	9.2052	25.8721
	3	3.3563	3.0939	12.5180
No.of Cointegrating eqn(s):1				
Malaysia	$H_0: r$	Trace	Atrace	Trace95
p(*)=LWPI(*)	0	48.6450	47.3564	47.8561
	1	16.8269	16.3811	29.7971
	2	4.1469	4.0371	15.4947
	3	0.2542	0.2475	3.8415
No.of Cointegrating eqn(s):1				
Nepal	$H_0: r$	Trace	Atrace	Trace95
p(*)=LCPI(*)	0	57.6432	56.1312	47.8561
	1	36.6657	35.7039	29.7971
	2	16.5893	15.1541	15.4947
	3	1.5470	1.5065	3.8415
No.of Cointegrating eqn(s):2				
Pakistan	$H_0: r$	Trace	Atrace	Trace95
p(*)=LCPI(*)	0	82.1217	79.9676	47.8561
	1	44.7983	43.6232	29.7971
	2	16.8299	15.3885	15.4947
	3	0.3554	0.3461	3.8415
No.of Cointegrating eqn(s):2				
Pakistan	$H_0: r$	Trace	Atrace	Trace95
p(*)=LWPI(*)	0	73.1435	71.2250	47.8561
	1	38.9075	37.8869	29.7971
	2	14.6545	14.2701	15.4947
	3	1.1479	1.1178	3.8415
No.of Cointegrating eqn(s):2				
Philippines	$H_0: r$	Trace	Atrace	Trace95
p(*)=LCPI(*)	0	77.8855	75.8426	47.8561
	1	35.1567	34.2345	29.7971
	2	12.7575	12.4229	15.4947
	3	4.9453	4.8155	3.8415
No.of Cointegrating eqn(s): 2				
Singapore	$H_0: r$	Trace	Atrace	Trace95

p(*)=LCPI(*)	0	67.3665	64.5885	47.8561
	1	40.8957	39.2092	29.7971
	2	15.3132	14.6818	15.4947
	3	3.3291	3.1918	3.8415
No.of Cointegrating eqn(s):2				
Singapore	$H_0: r$	Trace	Atrace	Trace95
p(*)=LWPI(*)	0	68.0194	66.1622	47.8561
	1	34.9108	33.9576	29.7971
	2	5.7660	5.6085	15.4947
	3	1.6567	1.6115	3.8415
No.of Cointegrating eqn(s):2				
Sri Lanka	$H_0: r$	Trace	Atrace	Trace95
p(*)=LCPI(*)	0	66.8481	64.8601	47.8561
	1	35.1429	34.0977	29.7971
	2	11.4111	11.0717	15.4947
	3	1.1261	1.0926	3.8415
No.of Cointegrating eqn(s):2				
Sri Lanka	$H_0: r$	Trace	Atrace	Trace95
p(*)=LWPI(*)	0	47.9236	46.4983	47.8561
	1	24.7252	23.9898	29.7971
	2	8.3638	8.1150	15.4947
	3	0.7406	0.7186	3.8415
No.of Cointegrating eqn(s):1				
Thailand	$H_0: r$	Trace	Atrace	Trace95
p(*)=LCPI(*)	0	64.3376	62.6501	40.1749
	1	29.4935	28.7199	24.2760
	2	6.0669	5.9078	12.3209
	3	0.0253	0.0247	4.1299
No.of Cointegrating eqn(s): 2				
Thailand	$H_0: r$	Trace	Atrace	Trace95
p(*)=LWPI(*)	0	83.9514	81.7494	47.8561
	1	41.6393	40.5471	29.7971
	2	8.1456	7.9320	15.4947
	3	0.2197	0.2139	3.8415
No.of Cointegrating eqn(s):2				
Turkey	$H_0: r$	Trace	Atrace	Trace95
p(*)=LCPI(*)	0	70.1462	66.9395	55.2458
	1	40.2229	38.3841	35.0109
	2	14.9190	14.2370	18.3977
	3	0.0336	0.0321	3.8415
No.of Cointegrating eqn(s):2				
Turkey	$H_0: r$	Trace	Atrace	Trace95
p(*)=LWPI(*)	0	59.1371	55.9620	47.8561
	1	27.7408	26.2513	29.7971
	2	7.4791	7.0775	15.4947
	3	0.0004	0.0004	3.8415
No.of Cointegrating eqn(s):1				

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