An Examination of the Purchasing Power Parity Hypothesis in a Low Inflation Environment

By

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Abstract
The paper explores the presence of PPP in a low inflation, fixed exchange rate unified currency area of the Eastern Caribbean Central Bank territories. The PPP hypothesis was examined using two standard approaches; testing of unit roots and testing for a cointegrating vector between the nominal exchange rate and relative prices on monthly and quarterly data. The null hypothesis of a unit root in the real exchange rate could not be rejected in any of the countries irrespective of data frequency. A cointegrating vector was found in only two countries using monthly data and in three countries using quarterly data. Length of the data series (1980-97) may have influenced the results as well as the omission of real factors. The general results suggest the need to search for models with greater explanatory power, which may use panel data to extend the length of the series.

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Introduction

The relationship between relative prices and the exchange rate has been an area of intensive research. Most studies focus on the empirical validity of the purchasing power parity hypothesis (PPP) as investigators attempt to establish whether there is co-movement of exchange rates and relative prices in the long run. The PPP hypothesis can be traced to the work of classical economists including Alfred Marshall, John Stuart Mill and Viscount Goschen, however the modern interpretation is associated with the work of Cassel (1921, 1920)\(^1\). Apart from being considered, as a theory of exchange rate determination by modern scholar’s, the interest in the hypothesis partly reflects its importance as a fundamental building block of modern exchange rate theories\(^2\). In addition the theory has been utilized, in determining the most relevant exchange rate for a newly independent country and forecasting medium to long term exchange rates.

The growth in research in this particular area reflects the changes that occurred in the global monetary system in the mid-1970’s, along with developments in econometrics and in particular co-integration theory. The majority of researchers have not found evidence in support of the hypothesis. For instance Corbae and Ouliaris (1988), Park (1991) and Arderi and Lubin (1991) and Dornbusch (1988) using cointegration analysis all report evidence in favor of the rejection of PPP as a long run hypothesis, using cointegration techniques. However it must be noted that the majority of studies conducted to date have been on developed countries and a limited number on high inflation developing countries.

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\(^1\) Cassel’s ideas were very influential in informing the debate over Britain attempts to restore its pre-war mint parity with the dollar after 1925.
The main motivation for this paper is to examine the relevance of the PPP hypothesis in a sample of developing countries. The countries selected are those, which form part of the Eastern Caribbean Central Bank (ECCB) unified monetary area\(^3\). The sample was chosen for two reasons, because of the low inflation environment and the existence of a fixed nominal exchange rate for the group of countries since 1976.\(^4\) This is of particular importance as studies conducted in high inflation countries are more supportive of the hypothesis than under conditions of general price stability.

The structure of the paper is of the following order: In section I, the basic PPP theory will be examined and possible reasons for short term and long term deviation from the theory will be discussed. Section II examines econometric technique and in particular co-integration theory and its general applicability to the study being undertaken. Section III discusses the results obtained and related issues, which emerged.

**Purchasing Power Parity**

The purchasing power parity theory is used to determine prices and the exchange rate. If one assumes zero transaction cost or other impediments to trade, given that all goods are tradable effective arbitrage would result in the strongest version of PPP, namely absolute PPP which is stated as follows:

\[
E = \frac{P}{P^*} 
\]

\(^2\) The popular flexible, fixed and sticky price monetary model of the exchange rate, which evolved in the 1970’s to explain exchange rate behavior, uses the PPP hypothesis as an essential building block. See Dornbusch (1976) and Frenkel (1970).

\(^3\) The Eastern Caribbean Central Bank is the monetary authority for the six independent islands of the Eastern Caribbean, namely St Lucia, Dominica, Grenada, St Kitts and Nevis, Antigua and Barbuda and St Vincent, in addition too the British dependent territories of Montserrat and Anguilla. To our Knowledge only one such study has been conducted using data from this area. However the study was based on low frequency data and tested the relationship for data on the entire group. See Rambarran (1995)

\(^4\) The predecessors to the ECCB were the British Caribbean Currency Board in 1950 serving the current membership, plus Trinidad and Tobago, Barbados and Guyana. This was succeeded by the Eastern Caribbean Currency Authority in 1965 with the withdrawal of Trinidad and Tobago and Guyana at political independence. By 1976 the peg to sterling was delinked and the 100 percent sterling backing was changed to 60 percent of US dollars or SDRs.
where \( E \) is the exchange rate and represents the number of units of domestic currency required for purchasing one unit of foreign currency. \( P \) and \( P^* \) are the domestic and the foreign price indices respectively. This version of the PPP is premised on the law of one price, which states that once converted into a common currency, national price levels should be equal.

In reality the equilibrium price of a good may not be the same when converted into a common currency. The reasons for this include the wedge created because of transport cost, quotas, tariffs and informational asymmetry, which reduces the effectiveness of arbitrators. In addition the presence of non-traded goods can prevent arbitrators from responding to profitable investment opportunities. Furthermore the non-neutral of money in the short run can generate price differences in similar goods across countries.

To account for the shortcomings of the absolute version of PPP an alternative referred to as relative PPP is often specified. According to this version the change in the exchange rate is equivalent to the difference in inflation rates and is given by the following:

\[
\Delta E = \Delta P - \Delta P^* \tag{2}
\]

where \( \Delta E \) is the percentage change in the exchange rate, while \( \Delta P \) and \( \Delta P^* \) represents the rate of change of the domestic and foreign price level. The above equation states that the rate of change of the exchange rate approximates the domestic rate of inflation minus the foreign rate of inflation. Due to the fact that the PPP hypothesis is regarded as a theory of exchange rate determination one may erroneously conclude that the validity of the theory may be dependent on the degree of flexibility of the exchange rate. However despite the fact that most developing countries have shown preference for the maintenance of a fixed peg to a major currency, it is however impossible to avoid fluctuations in the effective exchange rate as long as major currencies are allowed to float against each other.

*Deviations from Purchasing Power Parity*
An obvious reason for deviations of the exchange rate from its PPP value in the long run is if a substantial amount of the goods cannot be traded. Thus with the existence of non-traded goods, arbitrage condition is not satisfied for all internationally produced goods but only for tradable goods. Deviations from PPP caused by the existence of non-tradable goods is likely to be more acute in developing countries where the typical consumption basket usually consist of more non-tradable items. There are two possible methods, which could be utilized to address this issue. Rogers and Jenkins (1995) disaggregated the data and tested for a long run relationship between relative prices of certain commodities across different countries. Kim (1990) used wholesale prices rather than the consumer price indices based on the assumption that wholesale prices is a better indicator of the general price of tradable goods.

Over the last two decades the debate on PPP has resulted in a number of theories which seek to explain deviations from PPP whether they be transitory or permanent. A factor, which is commonly identified, is the role of ‘news’ and in particular the response of exchange rates to new developments. The reaction of exchange rates to news formed the basis of the Dornbusch (1976) model of overshooting exchange rates. Daniel (1986) contends that the response of exchange rates to news is a crucial determinant of short-term deviations from PPP. The basis of the theory is that news is processed faster in exchange rates than in prices. The rationale has been that prices are determined in the commodity markets, where signals tend to be digested very slowly. This is compared to exchange rates, which are determined in the auction markets where news is quickly assimilated.

Based on the above hypothesis deviations from PPP are largely the result of price stickiness. Hence it is logical to conclude that such deviations should disappear overtime as prices adjust to a new equilibrium given nominal disturbances. In the case where a real disturbance occur and the price indices contain different goods and weights in various countries, the PPP deviations may decline but might not disappear altogether. The role of news as a source of deviation from PPP is likely to be more relevant in the developed countries. This is related to the fact that in developed countries with
sophisticated financial markets, exchange rate movements are usually influenced by developments in the asset markets.

Another explanation for deviations from PPP, which is gaining increasing popularity, is the idea of partial pass-through of exchange rates. This hypothesis has been analyzed and developed by a number of theorists including Froot and Rogoff (1995) and Freenstra and Kendall (1997). The basic tenet of the proposition is that under conditions of imperfect competition, firms involved in the export of goods and services may adjust prices by less than the complete change in the exchange rate. A firm, which wants to maintain market share, may decrease profit margins in order to absorb some of the price increases associated with a currency appreciation. Hence, only a certain percentage of the price increase associated with the currency change is passed through to the importer price.

Freenstra and Kendall (1997) argue that the change in price relative to domestic substitutes, due to the pass through behavior, should be taken into account when measuring parity between prices in the exporting and importing countries. To account for the pass through effect a weighted average of import relative to domestic prices and export prices relative to the cost of production is recommended.

The above discussion mainly highlights the explanations for short-term deviations from PPP, however in the long run such deviations should diminish significantly. In contrast empirical studies indicate that in a number of cases this deviation persist in the long run and are likely to be accounted for by real factors. Balassa (1964) and Samuelson (1964) provided the first possible explanation for these occurrences, they stated that when prices are converted into a common currency at prevailing exchange rates, prices in richer countries will be higher than that of poor countries. A closely related theory is associated with the work of Kravis and Lipsey (1983) and Bhagwati (1984). They argue that the existence of higher capital-labor ratios in developed countries results in higher wages. Given the assumptions of (a) low labor cost in developing countries and (b) non-traded goods are labor intensive, when measured in common currency price levels are higher in rich countries. Other factors that may
account for persistent deviations from PPP include developments with relation to the current account balance and government behavior\textsuperscript{5}.

**Co-integration and PPP**

Co-integration theory is especially useful when there is need to determine whether two or more time series have a stationary relationship over the long run. This theory is particularly useful in testing the PPP hypothesis, which is essentially a long run relationship. Many earlier empirical studies of PPP indicate a high level of short run violations from the theory. Although most studies allude to the poor performance of the theory in the short run\textsuperscript{6}, many economists still hold the view that over the long run, relative price may move in proportion to the change in the nominal exchange rate, so that the real exchange rate will revert to parity. As indicated in section I, the relative PPP version can be expressed statistically in the following form:

\[
\ln E_t = \eta + \gamma \ln \left( \frac{P_t}{P_t^*} \right) + \epsilon_t \tag{3}
\]

If \( E_t \) changes over time but is a stationary ARIMA \((p, q)\) process, then deviations from parity is largely temporary and is expected to disappear through time. Previous studies have tested for long run PPP via two methods. The first approach is to test for a unit root in the real exchange rate, while the second involves a test for cointegration between the nominal exchange rate and relative prices. For the existence of long run PPP, \( \epsilon_t \) should be stationary or the variables in equation (3) should be co-integrated. Rejection of the existence of a cointegrating vector implies that the PP hypothesis is not relevant for the data. The use of cointegration technique when linked with the error correction Framework allows for the separation of long run relationships and produces superconsistent estimates. Following Engle and Granger (1987) given the presence of a co-integrating relationship amongst the variables in equation (3) an error correction

\textsuperscript{5} For further exposition of these arguments, see Rogoff (1986).
\textsuperscript{6} See Lehmann (1983), Frenkel(1981)
representation which caters for flexibility in the short run dynamic process while the model is constrained to return to the long run equilibrium can be specified.

**Data and empirical findings**

The data utilized in this paper were obtained from the international financial statistics of the international monetary fund. The preferred price index is the Wholesale Price Index (WPI), however the countries under investigation do not calculate this index; thus the Consumer Price Index (CPI) was utilized. The exchange rate was the end of period effective real and nominal rate measured in terms of units of domestic currency per US dollar. The estimates are performed using both quarterly and monthly data extending from 1980-1997, although the nominal exchange rate for the countries under investigation has remained pegged to the US dollar for the entire period at a fixed rate there is considerable variability in the effective exchange rate index.

<table>
<thead>
<tr>
<th></th>
<th>ADF(q)</th>
<th>1&lt;sup&gt;st&lt;/sup&gt; diff</th>
<th>P-P(q)</th>
<th>1&lt;sup&gt;st&lt;/sup&gt; diff</th>
<th>ADF(m)</th>
<th>1&lt;sup&gt;st&lt;/sup&gt; diff</th>
<th>P-P(m)</th>
<th>1&lt;sup&gt;st&lt;/sup&gt; diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>St Kitts/Nevis</td>
<td>-1.161</td>
<td>-3.230*</td>
<td>-1.330</td>
<td>-6.482*</td>
<td>-1.258</td>
<td>-6.262*</td>
<td>-2.167</td>
<td>-12.09*</td>
</tr>
<tr>
<td>St Lucia</td>
<td>-1.620</td>
<td>-4.345*</td>
<td>-2.137</td>
<td>5.815*</td>
<td>-2.153</td>
<td>-6.986*</td>
<td>-2.256</td>
<td>-10.32*</td>
</tr>
<tr>
<td>St Vincent</td>
<td>-1.659</td>
<td>-5.734*</td>
<td>-1.603</td>
<td>-6.310*</td>
<td>-1.514</td>
<td>-6.072*</td>
<td>-1.489</td>
<td>-13.09*</td>
</tr>
</tbody>
</table>

95% critical value -2.904 for quarterly series and -2.875 for monthly data

The first method of testing for PPP was based on testing for stationarity in the real effective exchange rate. The results of the unit root test for both quarterly and monthly data are reported in Table 1. The results indicate that both the augmented Dickey-Fuller and Phillips-Peron test statistics fail to reject, the null hypothesis of a unit root for the monthly and quarterly series of the six countries at the 5 per cent confidence level.
However the null hypothesis is rejected when the first differences of the series are taken, that is, all series of the six countries are I (1) as is shown in table 1. Thus based on the non-stationarity of the real exchange rate variable in levels it can be deduced that the PPP relationship is invalid in the sample of countries over the time period under consideration.

Table 2. Unit root test for nominal exchange rate in levels and first differences of quarterly and monthly series.

<table>
<thead>
<tr>
<th></th>
<th>ADF(q)</th>
<th>1st diff</th>
<th>P-P(q)</th>
<th>1st diff</th>
<th>ADF(m)</th>
<th>1st diff</th>
<th>P-P(m)</th>
<th>1st diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dominica</td>
<td>-2.112</td>
<td>-3.055*</td>
<td>-1.562</td>
<td>-5.832*</td>
<td>-0.281</td>
<td>-4.108*</td>
<td>-0.908</td>
<td>-7.273*</td>
</tr>
<tr>
<td>Grenada</td>
<td>-0.638</td>
<td>-2.807*</td>
<td>-0.183</td>
<td>-5.949*</td>
<td>-0.182</td>
<td>-5.778*</td>
<td>-0.039</td>
<td>-10.07*</td>
</tr>
<tr>
<td>St Kitts/Nevis</td>
<td>-1.454</td>
<td>-3.281*</td>
<td>-1.500</td>
<td>-5.892*</td>
<td>-1.287</td>
<td>-5.842*</td>
<td>-1.326</td>
<td>-10.43*</td>
</tr>
<tr>
<td>St Lucia</td>
<td>-1.566</td>
<td>-4.021*</td>
<td>-1.175</td>
<td>-6.580*</td>
<td>-1.195</td>
<td>-6.517*</td>
<td>-1.106</td>
<td>-9.957*</td>
</tr>
<tr>
<td>St Vincent</td>
<td>-1.876</td>
<td>-3.563*</td>
<td>-1.528</td>
<td>-6.033*</td>
<td>-1.795</td>
<td>-5.892*</td>
<td>-1.655</td>
<td>-10.48*</td>
</tr>
</tbody>
</table>

The symbols * and ** denotes rejection of the null-hypothesis of non-stationarity at the 1% and 5% significance levels.

Table 3 Unit root test for relative prices in levels and first differences based on quarterly and monthly data.

<table>
<thead>
<tr>
<th></th>
<th>ADF(q)</th>
<th>1st diff</th>
<th>P-P(q)</th>
<th>1st diff</th>
<th>ADF(m)</th>
<th>1st diff</th>
<th>P-P(m)</th>
<th>1st diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antigua</td>
<td>-2.492</td>
<td>-3.629*</td>
<td>-2.045</td>
<td>-15.917*</td>
<td>-5.278</td>
<td>-11.01*</td>
<td>-6.017</td>
<td>-79.41*</td>
</tr>
<tr>
<td>Dominica</td>
<td>-0.809</td>
<td>-4.693*</td>
<td>-0.024</td>
<td>-6.824*</td>
<td>-0.279</td>
<td>-6.860*</td>
<td>-0.155</td>
<td>-17.549*</td>
</tr>
<tr>
<td>Grenada</td>
<td>-0.027</td>
<td>-3.031**</td>
<td>-0.600</td>
<td>-3.215**</td>
<td>-1.165</td>
<td>-3.546**</td>
<td>1.048</td>
<td>-11.740*</td>
</tr>
<tr>
<td>St Kitts \ Nevis</td>
<td>-2.016</td>
<td>-1.168</td>
<td>-1.694</td>
<td>-7.285*</td>
<td>-2.252</td>
<td>-5.576*</td>
<td>-1.673</td>
<td>-14.369*</td>
</tr>
<tr>
<td>St Lucia</td>
<td>-1.308</td>
<td>-7.849*</td>
<td>-3.456</td>
<td>-41.78*</td>
<td>-2.720</td>
<td>-11.00*</td>
<td>-1.869</td>
<td>-238.51*</td>
</tr>
<tr>
<td>St Vincent</td>
<td>-0.308</td>
<td>-4.359*</td>
<td>-0.083</td>
<td>-7.528*</td>
<td>-0.070</td>
<td>-6.048*</td>
<td>-0.237</td>
<td>-17.137*</td>
</tr>
</tbody>
</table>

The symbol * and ** denotes rejection of the null hypothesis of non-stationarity at the 1% and 5% level respectively.

The next step in evaluating the relevance of the PPP theory in this sample of countries involves testing for the existence of a cointegrating vector between relative prices and the nominal effective exchange rate (see eqn.3). The first step in this process is to test for the presence of a unit root in the two series under consideration, namely the
nominal effective exchange rate and relative prices for monthly data and quarterly data. The results test for unit roots in the variables using the augmented Dickey-Fuller test and the Peron-Phillips test are presented in table 2 and 3. The results indicate that for monthly and quarterly data the nominal effective exchange rate and the price level are both I (1), meaning that they are first difference stationary. Since both of the variables, which would enter the PPP formulation, are integrated of the same order, then it is possible to test for the presence of a cointegrating vector.

The test for the presence of a cointegrating vector is performed using the Johansen method. The Johansen test is performed in the VAR framework and different values of the lag length K=1 to 8 was considered. In most cases a lag of K=4 is required to remove serial correlation in the residuals, so statistical results based on a VAR (4) model are reported. The results of the cointegrating test are reported in Table 4 for the monthly and quarterly time series data. The test results indicate that for both the quarterly and monthly series a cointegrating vector was identified in St Lucia and St Kitts and Nevis, while the presence of a cointegrating vector was confirmed in the case of Dominica based on the quarterly data set.

Table 4. Results of the Johansen test for cointegration for the monthly and quarterly series

<table>
<thead>
<tr>
<th></th>
<th>Monthly At most one</th>
<th>Quarterly None</th>
<th>Monthly At most one</th>
<th>Quarterly None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antigua</td>
<td>1.203</td>
<td>0.458</td>
<td>7.621</td>
<td>8.152</td>
</tr>
<tr>
<td>Dominica</td>
<td>0.007</td>
<td>7.425</td>
<td>6.739</td>
<td>8.236</td>
</tr>
<tr>
<td>Grenada</td>
<td>0.060</td>
<td>0.067</td>
<td>7.350</td>
<td>8.859</td>
</tr>
<tr>
<td>St Kitts \Nevis</td>
<td>7.505</td>
<td>9.268</td>
<td>19.442</td>
<td>26.173</td>
</tr>
<tr>
<td>St Lucia</td>
<td>4.521</td>
<td>4.528</td>
<td>10.21</td>
<td>28.260</td>
</tr>
<tr>
<td>St Vincent</td>
<td>0.098</td>
<td>0.0416</td>
<td>7.296</td>
<td>7.675</td>
</tr>
</tbody>
</table>

Notes:
(1) Critical values for monthly and quarterly data are as follows: At most one vector at 5 % and 1%, 3.76 and 6.65 respectively, no vectors at 5% and 1% 15.41 and 20.04.
(2) * Indicates significance at the 5% level.

The lack of cointegration or evidence of PPP in a number of countries can be said to deviate from apriori expectations. Indeed the dominant convention is that the more significant the share of non-tradable in GDP, the greater the possibility of the exchange
rate diverging from its PPP value. In general when price parity is calculated from a general price this may induce systematic bias for countries where the non-traded sector is dominant. The countries, which form part of the ECCB monetary union posses weak domestic production, thus by extension non-tradable share of income is relatively low. A crude measure of the contribution of the traded sector to GDP is the share of external trade to GDP, which is relatively high across the sample of countries in this study.

The literature on the PPP suggest that trade restrictions and specifically, asymmetric restrictions on import compared to exports is a probable cause of deviations from PPP especially among developing countries. However there is limited conclusive evidence to support this view in the ECCB as trade restrictions have been gradually reduced over the past two decades. Furthermore where restrictions have been imposed it is usually as a revenue generating measure and has not been prohibitive. In addition the large import content of consumption and production limits the degree to which imports can be discriminated against.

McNown and Wallace (1989) illustrated that the exchange rate in high inflation countries tended to follow PPP more closely than low inflation countries. In a high inflation environment monetary growth is likely to overshadow real factors, hence the exchange rate is likely to converge to its PPP value. Thus it is quite plausible that the reason for the very weak evidence in support of PPP in this sample of countries is due to the generally low inflation environment which obtains. The nature of the monetary arrangement in the sample of countries restricts the ability of the governments to engineer bouts of inflation via excessive monetary accommodation of fiscal expansions. Prices in the countries are largely determined by developments in the main trading partner countries. The rate of inflation in the group of countries is on average approximately 5.0 per cent.

Another probable cause of the weak evidence of PPP in this group of developing countries relates to the use of the effective exchange rate in this study. This rate of exchange depends heavily on the structure of commodity trade as the weights applied to
the prices are based mainly on trade data. The deficiency of this approach is that service trade and financial flows tend to exert a strong influence on the exchange rate in developing countries.

**Short run impact of inflation on exchange rates**

For the countries where the null hypothesis of non-co-integration is rejected, an error correction model can be estimated, utilizing the residuals of the equilibrium regression. The theory underlying the estimation of such a model is that a proportion of the deviation from PPP in the initial period is corrected in the following period. Thus an error correction model of the following form can be specified:

\[
\Delta \ln E_t = \sum_{i=1}^{n} \pi_i \Delta \ln E_{t-i} + \sum_{i=1}^{n} \beta_i \Delta \ln \left( \frac{p^{d}_{t-i}}{p^{f}_{t-i}} \right) + Z \{ \ln E_{t-1} - \mu - \chi \ln \left( \frac{p^{d}_{t-1}}{p^{f}_{t-1}} \right) \} + \zeta, 
\]

where \( Z \) is the error correction term, which shows the departure of the exchange rate from its PPP value, that is corrected in the subsequent periods. The coefficient \( \zeta \) measures the single period response of the exchange rate shock. If the coefficient is significantly different from zero and is negative this implies that the exchange rate will adjust to the long run PPP relationship. Therefore an increase in the relative domestic inflation rate compared with the foreign country would reduce the value of domestic currency but the currency would eventually converge to its long run equilibrium.

The results of the Vector Error Correction Model for the countries in which the presence of a cointegrating vector was confirmed are reported in table 5. The VEC model is estimated for both quarterly and annual data series. The modeling approach is based on the general to specific approach associated with the work of Hendry (1987). The procedure involves the estimation of a VAR with all the variables entering the model being I(1). The equation is initially estimated with dependent variables with lags of four quarters for quarterly data and twelve lags for monthly data. Variable deletion test was performed to determine the joint significance of the lagged variables. The final
parsimonious equation for the various countries are presented, these equations were subjected to a battery of diagnostic test.

Table 5. Error correction models (Variables in first differences)
<table>
<thead>
<tr>
<th>Variables</th>
<th>Monthly Data</th>
<th>Quarterly Data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>St Lucia</td>
<td>St Kitts</td>
</tr>
<tr>
<td>E&lt;sub&gt;t-1&lt;/sub&gt;</td>
<td>0.408*+ (0.069)</td>
<td>0.3177*+ (0.063)</td>
</tr>
<tr>
<td>E&lt;sub&gt;t-2&lt;/sub&gt;</td>
<td>-0.159* (0.074)</td>
<td></td>
</tr>
<tr>
<td>E&lt;sub&gt;t-3&lt;/sub&gt;</td>
<td>0.114** (0.069)</td>
<td>0.327* (0.120)</td>
</tr>
<tr>
<td>E&lt;sub&gt;t-4&lt;/sub&gt;</td>
<td></td>
<td>0.236** (0.120)</td>
</tr>
<tr>
<td>RP&lt;sub&gt;t-1&lt;/sub&gt;</td>
<td>0.005 (0.005)</td>
<td>0.246* (0.122)</td>
</tr>
<tr>
<td>RP&lt;sub&gt;t-2&lt;/sub&gt;</td>
<td>0.0096** (0.005)</td>
<td>0.240** (0.123)</td>
</tr>
<tr>
<td>RP&lt;sub&gt;t-3&lt;/sub&gt;</td>
<td>0.010** (0.005)</td>
<td>1.201** (0.683)</td>
</tr>
<tr>
<td>RP&lt;sub&gt;t-4&lt;/sub&gt;</td>
<td>0.008** (0.004)</td>
<td>1.086 (0.659)</td>
</tr>
<tr>
<td>ECR&lt;sub&gt;t-1&lt;/sub&gt;</td>
<td>-0.016** (0.009)</td>
<td>-0.0005+ (0.0001)</td>
</tr>
<tr>
<td>R2</td>
<td>0.17</td>
<td>0.15</td>
</tr>
<tr>
<td>DW</td>
<td>1.97</td>
<td>1.96</td>
</tr>
<tr>
<td>SER</td>
<td>0.010</td>
<td>0.026</td>
</tr>
<tr>
<td>LM</td>
<td>0.555</td>
<td>1.431</td>
</tr>
</tbody>
</table>

Notes: A constant was estimated but is not reported. * And ** denotes significance at the 5% and 10% confidence interval, while + denotes significance at the 1% confidence level. DW is the Durbin Watson Statistic, SER is the Standard error of the regression and LM is the test statistic for the Breusch-Godfrey Serial Correlation LM test for higher order correlation. ECR is the error correction term, RP is relative prices and E is the nominal effective exchange rate.

In general although the models pass the battery of diagnostic test, the ability of the error correction model to explain exchange rate movements was limited as can be interpreted via the adjusted R<sup>2</sup> statistic. Based on the results obtained, the estimated coefficients of the error correction term was significant and correctly signed in all the countries and suggest a relatively slow reaction to correct deviations from PPP. This suggests considerable inertial in the adjustment to the desired exchange rate. However the
adjustment of the exchange rate to inflation difference between the United States and the respective countries was under 10%, which can be regarded as relatively small.

**Is there an Alternative?**

In general the results of this study is consistent with other studies on the relevance of the PPP hypothesis. The rejection of the PPP hypothesis is generally invariant to the type of test conducted or the data frequency utilized. One major difficulty is that an investigator cannot easily determine whether the failure to reject the unit root hypothesis is reflective of the limited power of unit root test especially in small samples. In search of increased power a number of researchers have attempted to evaluate the theory using longer spans. Another method, which is becoming increasing popular, is the use of panel data in trying to confirm the PPP hypothesis. The use of this method to test for PPP was motivated by the work of Levin and Lin (1992)\(^7\). However although the results of such test are more conclusive it is not overwhelming, in addition a few investigators have questioned the efficiency of unit root test in panel data\(^8\).

The advantage of panel data based unit root test is that it compensates for insufficient time series variation by introducing cross section variation, thus resulting in an increase in the power of the test. This quality renders this test particularly useful in the Eastern Caribbean Central Bank area, indeed many previous studies on these economies have utilized the panel data approach to allow for increase degrees of freedom when the time series data span is relatively short\(^9\). However new research has questioned the efficacy of panel data based unit root test to prove the hypothesis? O’ Connell (1996) argues that wide sample panel studies are inaccurate as their fail to account for cross-sectional dependence in the real exchange rate. The underlying reasoning is that the real exchange rates of two closely linked countries are generally correlated. For example a

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\(^7\) It must be noted that critical values for unit roots in panel data based on this framework do not incorporate serial correlation in the disturbances.

\(^8\) Frenkel and Rose (1996) finds evidence of mean reversion using panel data, Papell (1997) finds considerable though not conclusive evidence against the unit root hypothesis. In contrast Abauf and Jorion (1990) can only find weak evidence in support of PPP using panel data in a sample of ten industrialized countries.

\(^9\) Example of studies which has used panel data series include Watson (1993) and Williams and Darius (1997)
shock to the countries of the Eastern Caribbean which affects prices or exchange rates will cause them to deviate together. If such cross sectional dependence is ignored the power and size of panel data unit root test is significantly reduced\(^{10}\). Thus the acceptance of the PPP hypothesis by some theorist using panel data is largely due to the fact that the cross sectional dependence is not controlled. O'Connell (1996) in his study illustrates that once this is controlled by using GLS to increase the efficiency of the test, the evidence in support of the PPP hypothesis in panel data is no more favorable than when time series data is used.

**Conclusion**

The main purpose of this study was to examine the relevance of the PPP hypothesis in a relatively stable and low inflation environment. The test procedure drew extensively from the recent developments in econometric theory and in particular the advances made in the area of cointegration. The PPP hypothesis was examined using two standard approaches: testing for unit roots in the real exchange rate and testing for a cointegrating vector amongst the nominal exchange rate and relative prices. These tests were conducted using both quarterly and monthly data.

From this study the evidence in support of the PPP hypothesis was generally weak. The null hypothesis of a unit root in the real exchange rate could not be rejected in any of the countries irrespective of the data frequency. Meanwhile a cointegrating vector was confirmed for only two countries when monthly data was used and three countries in the case of quarterly data.

The result of the study is consistent with other studies, which indicates that the theory is less likely to be relevant in countries experiencing relatively low rates of inflation. In addition the method of calculating the effective exchange rate along with the level of trade restrictions in these countries may have impacted on the results. The failure to find conclusive evidence in support of the hypothesis may also be due to the shortness of the time series utilised. To counter this problem a number of investigators have

\(^{10}\) For further elaboration See O'Connell (1996) pp. 4-6.
resorted to the use of panel, this method was not utilised in this paper partially because of the fact that if cross section independence is not accounted for the results using that method is likely to be inefficient. The general results of this study indicates the need to search for models with greater explanatory power to model exchange rate behavior, thus the need to develop and test models which incorporates the role of real factors in explaining exchange rate movements.
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