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The Role of Non-Parity Fundamentals in Exchange Rate Determination: Australia and the Asia Pacific Region

Abstract

This paper extends the literature by looking at the contribution of non-parity variables after extracting the impact of parity variables on exchange rates of Australia and the Asia Pacific countries. Exchange rates are examined using high- and low-frequency multi-country panel time series data for a group of *trade-related* nations in the Asia Pacific, including Japan. Our findings suggest that exchange rate is affected by growth rate, and trade and capital flows: other less significant variables include sovereign debt; balance of payments; money supply; and trade openness. It also confirms that interest rate has significant effect on exchange rates while price effect is not significant in short run regressions. These key findings are robust across different time intervals, thus showing new findings on the exchange rate dynamics consistent with theories.

Keywords: exchange rates, parity theorems, trade and capital flows, foreign debt and reserves, growth, monetary and fiscal policy.

JEL classifications: F31; F32; G15

1 Introduction

The motivation of this paper is to present findings on exchange rate behaviour by including *new* theory/empirically-verified factors as well as other main theory-suggested ones to investigate exchange rate determination in a trade-related multi-country context using new research tools. One particular unexplored factor in international finance is the role of capital flows in recent decades in the determination of exchange rates: see Harvey (2001). There is a need to go beyond the traditional price and interest parity factors employed to study exchange rates of small to medium-size economies. Secondly, after

much effort at studying bilateral (two-country) exchange rate determination, which has yet provided consistent findings in a vast literature of this ilk, new approach using multi-country framework and improved research design is needed to understand exchange rate equilibrium. That is what this paper does.

Researchers have expressed increasing frustration over their failures to explain exchange rate movements (Dornbusch, 1987; MacDonald and Taylor, 1992). With rapid growth in trade and capital flows across national boundaries, newer key factors are becoming noticed as affecting the value of foreign currency (Harvey, 2001). These factors are many and include current account deterioration, excessive foreign debt accumulation, capital flows, foreign currency reserves and fiscal imbalances. Additional factors that are viewed and verified in some studies as affecting exchange rate are: economic growth; exchange rate regimes; and uncontrolled monetary expansion.

This study extends exchange literature by looking at the contributions of non-parity variables after extracting the impact of parity variables in a first step: for this we use a two-step regression popularised in the 1990s, and widely used in Finance. The resulting findings provide improved understanding of the dynamics of how exchange rates are determined in trade-related multi-country context by using control factors beyond the traditional parity conditions. We include countries in a trade-related group if that country has a majority of trade with the other countries in the grouping.[1] We also provide a single country study of Australia as well.

For the multi-country Asia Pacific region as a whole, we find that the interest rate parity holds well and this study concludes that increases in nominal interest rates lead to downward movements in exchange rates, that is exchange rate improves as Fisher Effect kicks in. Faster economic growth rate

in the region significantly facilitates the strengthening of currency values. In addition, monetary expansions are positively related to domestic exchange rates and this might be a reflection of faster growth rates driving monetary expansion. From the separate findings for Australia as a comparison with a developed country in the region, economic growth rate is the major determinant of exchange rate movements; accumulation of international reserves and the domestic monetary stance are also important factors in the shorter term.

The remainder of this paper is divided into five sections. The next section contains a brief overview of the current literature, which assisted in identifying fundamentals relevant to this study. Section three illustrates the methodology involved, followed by report of significant findings and robustness testing in section four and five respectively. This paper ends with a conclusion in section six.

2 Literature on Exchange Rate Determination

The currency exchange market is the world's largest market in terms of daily trading volume - in excess of US$ 2.3 trillion in 2007 - no comparison to even the world's combined bond or stock markets.[2] The imports and exports of goods and services, coupled with international capital flows could account for only part of this huge currency transaction: speculative trades in currency is a major part of this transaction. The primary function of the foreign exchange market is to facilitate international trade and investment as well as to permit transfers of purchasing power denominated in one currency to another.

The two parity theorems of exchange rates include the Purchasing Power Parity (PPP of Cassel, 1918) as well as the Interest Rate Parity (IRP of Fisher, 1930). These theorems have been extensively tested by renowned

scholars all over the world. Interest in currency behaviour is rekindled because of the incompleteness of our knowledge on exchange rate determination in the face of periodic currency crises, and by the availability of newer statistical tools, as well as the accumulation of data over lengthy periods.

2.1 Purchasing Power Parity

PPP has been viewed by many as a basis for international comparison of income and expenditures, an equilibrium condition; and efficient arbitrage condition in goods as a theory of exchange rate determination. PPP established a common ground for cross-country comparison by linking currencies of different countries to price levels - or more precisely, price differences across countries - as the base. The underlying theory is based on a simple goods market arbitrage argument: ignoring tariffs, transportation costs, and assuming common goods consumed that should ensure identical prices across countries, under the *law of one price*. While this notion appears simple enough, specifying comparative prices between two countries in the short run is difficult. This has led to a majority of empirical literature failing to verify that PPP holds.[3]

The relative version of PPP suggests that if a country's inflation rate is relatively higher than its trading partner's, that country will find its currency value falling in proportion to its relative price level increases. The exchange rate E adjusts by k as a function of P^d domestic prices and P^f foreign prices.

$$E = k\left(\frac{P^d}{P^f}\right) \tag{1}$$

Taking the log on both sides to study changes in exchange rates, arriving at a testable proposition, where j represents country, t represents time period, P represents prices, d domestic and f foreign as stated below:

$$\ln E_{jt} = a_j + b_j \ln\left(\frac{P_t^d}{P_t^f}\right)_j + \mu_{jt} \qquad (2)$$

In order to allow for constant price differential between baskets, the bulk of empirical tests focused on testing relative consumption based PPP which require that changes in the relative price levels between countries be offset by changes in their bilateral exchange rates.

Evidence on short run PPP holding is lacking. It seems that the theory of PPP had failed to hold.[4] The apparent lack of evidence even under mostly the current floating regimes provides researchers opportunity to revisit this theme. It is also the same urge that led to the development of the sticky price model of Dornbusch (1976). In the last two decades, after a number of studies using unit root tests, researchers have still failed to reject the null hypothesis of the random walk.[5] Froot and Rogoff (1994) concluded that PPP is *not a short-run relationship*: this is the basis of our research design to be explained later to use different time intervals. Prices do not offset exchange rate swings on a monthly or even annual basis. Frankel and Rose (1996a) examined PPP using a panel data set of 150 countries over forty-five years and confirmed that PPP holds and their estimate implied a half-life of PPP deviations of four years, i.e. it is long term.

2.2 Interest Rate Parity

Interest rate parity, IRP, is the law of one price in the asset market for securities.[6] In theory, the foreign exchange market should be in equilibrium when deposits of all currencies offer the same rate of return. A rise in interest rates will attract more investment into the country resulting in an appreciation of the currency in the short run and exchange rates should fall in the long run to restore equilibrium. According to the uncovered interest rate parity, the

ratio of changes in exchange rate *E*, within a time period *t*, is a function of domestic interest rate i^d, and foreign interest rate i^f.

$$\frac{E_{t+1}}{E_t} = \left(\frac{1 + i_t^d}{1 + i_t^f} \right) \tag{3}$$

While PPP implies that exchange rates will adjust to changes in inflation differentials; International Fisher Effect (IFE) implies that relative interest rate differentials will give rise to similar final results in exchange rates. The ability of exchange rate markets to anticipate interest differentials is supported by several empirical studies that indicated the long run tendency for these differentials to offset exchange rate changes.[7]

2.3 Non-Parity Variables

Some researchers point out, over the last two decades, that there are other variables which are correlated with exchange rate movements.[8] These variables could shed fresh light, and assist in identifying other-than-parity explanations for understanding exchange rate behaviour. Despite the fact that parity explanations have gained a centre stage up until about the 1980s for exchange rate behaviour research, recent years have witnessed interests in other explanations, given the conflicting empirical evidence on parity theories. The evidence in theory and in empirical studies on these non-parity variables are systematically examined here.

2.3.1 Current and Capital Account Deterioration

Studies of financial crises in Latin America and East Asia have been motivated by an interest in the roles of banking, and balance of payments. The trade and capital balances are known to be most sensitive to exchange rate changes. For countries affected by the 1997/8 Asian financial crisis, the

reversal of capital flows, and current account deficits (together with high foreign debt) have been suggested as common factors surrounding that crisis.[9]

Karfakis and Kim (1995) using Australian exchange rate data found that unexpected current account deficit is associated with a depreciation of exchange rates and a rise in interest rates. Evidence that current account deficits reduced domestic wealth and may thus lead to overshooting of the exchange rates thus a fall in the real value of the currency were also reported by Obstfeld and Rogoff (1995a), Engel and Flood (1985), and Dornbusch and Fisher (1980). There has also been a surge in international capital flows into developing countries in the recent decades.[10] These capital flows affect domestic output, real exchange rates, capital and current account balances for years thereafter.[11]

Portfolio investment has also increased in recent years due to greater access to capital markets via newer regulations, reduced capital controls and the overall globalisation of financial services.[12] Calvo, Izquierdo and Talvi (2003) blamed the fall of Argentina's currency programme on their country's vulnerability to sudden stops in capital flows. A recent study by Kim (2000) on four countries that faced currency crises found that reversal of capital flows as well as current account deficits are significantly related to currency crises in these countries.[13] Rivera-Batiz and Rivera-Batiz (2001) concluded that explosion of capital flows resulted in higher interest rates and depreciation of exchange rates in the long run.

2.3.2 Loss of International Reserves and Excessive Foreign Currency Debt

The amount of international reserves held by the central authority is another factor affecting exchange rate determination.[14] Due to the usage of

reserves as a means to defend a country's currency, it provides credibility to the value of the currency: this suggests that reserves and the type of currency exchange regime in this case (managed float as a camouflage for trade advantage) are likely to affect exchange rates.[15]

Calvo, Leiderman and Reinhart (1994) showed that increase in capital inflows increase total reserves and real exchange rates of Lain American countries. Marini and Piersanti's (2003) study covering Asian countries found that a rise in current and expected future budget deficits generated appreciation in exchange rates and a decumulation of external assets, resulting in a currency crisis when foreign reserves fell to a critical level. Hsiao and Hsiao (2001) found a unidirectional causality from short-term external debt/international reserves ratio to exchange rates in Korea. Similar to Martinez (1999) on Mexico, Frankel and Rose (1996b) studied a large group of developing countries and found that the level of debt, foreign direct investment, foreign interest rates, foreign reserves and growth rates affect exchange rates significantly.

2.3.3 Trade Openness, Slow Growth, Fiscal Imbalances, and Excessive Monetary Expansion

Globalisation has resulted in domestic financial markets being slowly more integrated with international financial markets: see Edward and Khan (1985) and Ariff (1996). Open economies facing capital flows, competitive interest rates and trade competition from others must lead to a defined relationship between openness and the rate of growth in some countries.[16] Similar to Karras (1999), Papell and Theodoridis's (1998) study on openness, exchange rates and prices found stronger evidence of PPP for countries with

less exchange rate volatility, and shorter distance from other countries but not for countries with greater openness to trade.

Among the many models found in the literature to explain long-term deviations in PPP, the most popular one is from Balassa (1964) and Samuelson (1964). Both agued that technological progress has historically been faster in the traded goods sector than in non-traded goods sector and therefore traded goods productivity bias is more obvious in higher income countries. Froot and Rogoff (1994) and Rogoff (1999) further showed that faster growing countries would tend to experience exchange rate appreciation relative to their slower growing partners when technological changes happen more often in trading goods sector as a result of intense international competition. Add to these the following: Canzoneri, Cumby and Diba (1999); Chinn (2000); Duval (2002); and Cheung, Chinn and Pascual (2003).

MacDonald and Wojcik's (2003) study on EU accession countries found that productivity, as well as private and government consumption significantly affect exchange rate behaviour. In contrast with Edwards and Savastano (1999), Bailey, Millard and Wells (2001) found that increased labour productivity in the US resulted in current account deficits that are financed by large capital inflows, which appreciated the dollar exchange rates.

2.3.4 Exchange Rate Regimes

Since the breakdown of the fixed Bretton Woods system, exchange volatility has drastically increased to levels that are beyond the explanation of fundamentals.[17] Grilli and Kaminsky (1991) concluded that real exchange rate behaviour changes substantially across historical periods but not necessarily across exchange rate regimes. Calvo and Reinhart (2002) examined thirty-nine countries around the world and found that moderate to

large exchange rate fluctuations are very rare in managed float systems. Other studies that found similar results includes Hasan and Wallace's (1996), Moosa and Al-Loughani (2003) and Edwards (2002) who explained that super-fixed regimes were highly inflexible and inhibited adjustment process.

Hence there is literature support for checking these many non-parity factors' role in exchange rate determination.

3 Data, Methodology and Summary Statistics

3.1 Data

The data used relate to exchange rates between individual countries, and the United States (U.S.) dollar (IFS line rf) as the foreign unit as observed at the end of observation periods.[18] Quarterly bilateral exchange rates for Australia as well as nine other Asia Pacific countries are from 1974:4 to 2006:1. The *International Financial Statistics* (IFS) CD-ROM is the major source for these data. Price variables include CPI (IFS line 64) and PPI (IFS line 63) of individual countries; T-Bill and Money market rates (IFS line 60) are used to arrive at the interest differentials between countries. Changes in exchange rates, prices and interest differentials are calculated using natural logarithm.

The non-parity current and capital flow variables include: trade balance (Trade) from imports and exports of goods, and current account balance (Cur); balance of payments (BOP) from overall balance; capital flows include both inflows and outflows of foreign direct investment (FDI) and portfolio investments (PT); and total reserves (TR) as well as foreign debt (FD). Monetary expansion data is broader money[19] (M2) which includes both money and quasi-money. Growth rate (PROD) is measured by change in Gross Domestic Product (GDP) per capita. The set of dummy variables includes exchange regimes which are grouped into three categories: free-float,

exchange band/managed, and fixed regime.[20] Trade openness is measured by total trade (TTrade), that is, the sum of total imports and exports, as a proportion of GDP: this is used to form trade-related groupings. Incomplete data are sourced from Datastream, World Bank as well as individual country's Central Banks and Statistical Departments. The independent variables are categorised into parity and non-parity variables.[21] A summary of variable definitions and their expected signs are found in Table 1.

Insert Table 1 here.

The sample in this study includes Australia as an individual country and a selection of nine countries in the Asia Pacific region: Australia, Indonesia, Japan, Korea, Malaysia, New Zealand, the Philippines, Singapore and Thailand. The developed nations include Australia, Japan, New Zealand and Singapore and the rest are emerging economies with relatively high growth rates. The reason behind the choice of these nine countries is the high level of inter-trade between these countries in the same geographical region as shown in Table 2 and the availability of information with regards to these nations. We include these countries as each of the countries included has a majority trade relation, that is import and exports to other countries in the grouping is well above 50 percent of total trade. We present this as the trade-relatedness for selecting countries to be included in a regional grouping (and thus we had five such groups made of 54 countries across the world, although this paper is on Asian Pacific grouping only). For related data, see Table 2: for example, Hong Kong has a majority of its trade with the chosen group.

Insert Table 2 here

3.2 Methodology

The regression analysis tests the price and interest parity theorems and then includes other non-parity fundamentals with appropriate tests to check the robustness and validity of results. The one-step ordinary least squares model has its limitations and hence a two-step regression is used to explain the unexplained effects captured in the residuals from the first regression using parity variables. Ball, Brown and Officer (1990) is a paper collected in Ball, Brown, Finn and Officer (1990) and they popularized this procedure of extracting theory suggested variables in the first step regression, and then taking the residual to test further proposition. This procedure of first running a regression, and then using the residuals from the first regression as dependent variable on further independent variables is thus followed. We follow this procedure as it is well-established in Finance studies. This overcomes the problem of estimating the parity relations which have significant pair-wise correlations with non-parity variables. Stepwise parsimonious regression approach using the well established AIC statistics allows an examination of each independent variable's contribution to the model, which will be useful in selecting a narrower set of variable. The parity and non-parity models include different tests of the price and interest parities individually as well as jointly in a multi-country framework.

Combined Price and Interest Parity Test

Investigating both price and interest parities should yield results that could explain the extent to which parity hypotheses could explain changes in exchange rates:

$$\ln\left(\frac{E_{t+1}}{E_t}\right)_{jt} = \alpha'_{0j} + \alpha'_{1j}\ln\left(\frac{P}{P^*}\right)_{jt} + \beta'_{1j}\ln\left(\frac{1+i}{1+i^*}\right)_{jt} + e_{jt} \qquad (4)$$

Non-Parity Models

Exchange rates are also dependent, as argued in this paper, on changes in non-parity variables especially in the short run. This section describes the tests aimed at estimating the individual effect such variables have on exchange rates. These variables will also be tested together, first in a general model, and subsequently eliminating uncorrelated variables by using the Akaike Information Criterion (AIC) that will result in a stepwise approach.

Step 1:

Parity:
$$\ln\left(\frac{E_{t+1}}{E_t}\right)_{jt} = \alpha'_{0j} + \alpha'_{1j}\ln\left(\frac{P}{P^*}\right)_{jt} + \beta'_{1j}\ln\left(\frac{1+i}{1+i^*}\right)_{jt} + \gamma_{jt} \qquad (5)$$

Step 2:

Non-Parity:

$$\gamma_{jt} = a'_{0j} + b'_{1j}\left(Trade/GDP\right)_{jt} + b'_{2j}\left(Cur/GDP\right)_{jt} + b'_{3j}\left(BOP/GDP\right)_{jt} + b'_{4j}(InFDI/GDP)_{jt} +$$
$$b'_{5j}\left(OtFDI/GDP\right)_{jt} + b'_{6j}\left(InPt/GDP\right)_{jt} + b'_{7j}\left(OtPt/GDP\right)_{jt} + b'_{8j}(FD/GDP)_{jt} +$$
$$b'_{9j}\left(T\,\mathrm{Re}\,s/\mathrm{Im}\right)_{jt} + b'_{10j}\left(\mathrm{Pr}\,odty\right)_{jt} + b'_{11j}\left(Bdgt/GDP\right)_{jt} +$$
$$b'_{12j}\left(TTrade/GDP\right)_{jt} + b'_{13j}(TMy/GDP)_{jt} + b'_{14j}(\mathrm{Re}\,gime)_{jt} + \nu'_{ij} \qquad (6)$$

where, the dependent variable takes the residual value from the first regression. The first regression includes the effect of the parity relations, and the residual as the dependent variable for the second regression contains the potential effects from non-parity relations. Thus, this two-step regression popularized by Ball, Brown and Officer (1990) may be applied to investigate the parity and non-parity relations both in time series – as depicted in the above – or in cross-sectional tests.

Most researchers use monthly or annual interval data to test parity theorems. Given the price stickiness and the evidence of long-run equilibrium on price parity, there is need to test the relations using longer intervals of data.

Therefore, we tested the regression by increasing the interval period and observing the variables across one-, two-, three- and further years so that the tests may be conducted over longer interval data to detect the impact of variables which has long run impacts beyond one or more years. Thus, a 2-year window means that the variables are observed over a two-year period, and so forth.

Common problems faced in cross-sectional and time series analysis are non-normality of variables, non-stationarity of time series data, multicollinearity among criterion factors, autocorrelation and heteroscedasticity. The descriptive statistics of the variables are given in the Appendix 1 to this paper: although not shown in the appendix, the variables were found to be normally distributed, given the transformation. The impact of multicollinearity is to reduce any single independent variable's predictive power by the extent to which it is associated with the other independent variables. It can be detected using Variance Inflation Factor (VIF) that shows how the variance of an estimator is inflated by the presence of multicollinearity (Hair *et al.*, 1998).[22] Variables with larger VIF values or low tolerance level are excluded: alternatively highly collinear variables may be joined in some transformation of the series. Our VIF statistics show that multicollinearity is not present in the regression: see Endnote 21 and the Appendix 2 to this paper. As may be verified, the VIF statistics are below the critical values, thus indicating that the multicollinearity is not likely to affect the test statistics in the regression.

The normality of all the variables will be tested to ensure multivariate normality and this is further ensured by specifying the variables in natural logarithms while stationarity of the series will be tested and confirmed by

Augmented Dickey-Fuller (ADF) unit root test and the Kwiatkowski, Philips, Schmidt and Shin (KPSS) Test: see Appendix 3 and also Endnote 21. The presence of heteroscedasticity is detected by White's test using Eviews software: thought the test results are not reported here, we used appropriate corrections for heteroscedasticity problem. To ensure that the assumption of constant variance is not violated, the heteroscedasticity and autocorrelation problems are tested and corrected using the Eviews process for this.

4. Findings

This section reports the quarterly as well as other interval results on both Australia and the Asia Pacific region. Since the exchange rate used in this model is against the foreign currency, a negative coefficient corresponds to an increase in the value of domestic currency and a positive coefficient indicates otherwise.

4.1 Short Term - Australia

From the quarterly results in Table 3, it is important to note that higher growth rate stands out clearly as the major determinant of exchange rates in Australia. This model however, cannot find any indication of the purchasing power and interest parity in the short term which is consistent with the current empirical literature. Although statistically insignificant, the coefficient for trade has the right sign where increase in trade leads to appreciation of the domestic currency. The coefficient for foreign debt is insignificant and in the opposite direction to theoretical prediction: it cannot be explained. Capital and portfolio flows are insignificant but the short run coefficients have the expected signs. It appears that for a developed country, capital and debt flows

do not have a significant impact on its economy and therefore its exchange rates. That is the short-run story.

Insert Table 3 here.

Total reserves have an insignificant coefficient though the sing is consistent with theoretical expectation that an increase in reserves raises the confidence level others have on its currency value. Government' fiscal budget is insignificant but of the correct sign. This reflects that fiscal budget condition does not drive the value of the currency. Monetary policy of the government is also not significant (t-statistics of 1.22) where excessive monetary expansion leads to deterioration of currency value. The total trade or trade openness coefficient is insignificant and the relationship is negative. The sign reflects that openness to trade resulted in huge imports that send the currency value falling. The F-probability of 0.000 shows that the model is statistically significant and that growth rate is the major driving force behind exchange rate movements. The adjusted R-squared of 0.873 also indicates that more than 80 per cent of the movement in exchange rates can be explained by this model.

4.2 Short Term – Asia Pacific

For the region as a whole in Table 3, interest and price parities do not hold in the short run as these are statistically insignificant in the short run consistent with current literature. The coefficient for growth rate of -57.30 is highly statistically significant (t-stats -13.06) with major effect on exchange rates as well as in the expected direction. Improvement in the balance of payments leads to an increase in the value of domestic currency in the region; nonetheless it is only marginally significant with t-statistics of -1.77. It is most interesting to note that domestic monetary expansion is significant and directly

related to the value of the currency. This is not consistent with the monetarists' model and might be a reflection of rapid growth of the region driving monetary expansion. The coefficient for foreign debt of 0.162 is statistically significant (t-statistics 1.83) and shows that increase in sovereign debt negatively impacting domestic exchange rates. Government's fiscal budget is another significant determinant of exchange rates for Asia Pacific countries in the short term where improvement in the budget balance improves the exchange rate performance too.

The capital, portfolio flows, and monetary regime are generally insignificant and this shows that short run quarterly changes in these variables do not have a strong impact on exchange rates. Total trade of the region is also significant but is inversely related to exchange rates. This might be explained by the large amount of imports absorbed into the region when these countries accumulated wealth through rapid growth which is supported by huge exports too. Thus trade openness allows these countries to import more productive technologies and it facilities to enable them to sustain higher and continuous growth. With adjusted R-squared of 0.738 for a region of nine countries, the model can explain more than 70 per cent of changes in exchange rates.

Short Term - Parsimonious Model

The parsimonious model in Table 4 indicates similar findings for the region and confirms the significance of growth rates and others have on exchange rates. These results are more reliable. Sensitivity analysis of the tests is conducted with no substantial differences to the reported results. Parsimonious model indicates that the coefficients for the five major factors for the region of Asia Pacific countries are namely (1) growth rates, (2) balance of payment, (3) budget balance, (4) foreign debt accumulation and (5)

total money, continue to be statistically significant which is consistent with theories and some studies. The other variables are not significant and some of them have incorrect sign.

Insert Table 4 here

4.3 Longer Term - Australia

The longer term results are shown in Table 5 as a comparison from short to longer period of time. It is crucial to note that purchasing power parity is achieved at two years for Australia, which is not only statistically significant (t-statistics 3.71) and of correct sign. Sample sizes are too small to allow reliable use of parity fundamentals to predict changes in exchange rates, even when these fundamentals do determine exchange rates. Further study with longer time series in the future would obtain more significant results.

Insert Table 5 here

There is without doubt growth rate is the major determinant of exchange rates in Australia from the results obtained here for quarterly as well as all subsequent time periods. Fiscal stance is also an important longer term variable, as fiscal expansion is inversely associated with the movement of exchange rates and is statistically significant in both one- and three- yearly regressions. Monetary expansion is becoming more important in the longer term and the results correspond to theory; it is indirectly related to exchange rates. It is important to note that exchange rate appreciation of a certain magnitude always become more worrisome if coupled with excessive monetary expansion.

The coefficients of foreign debt of 2.219 and 1.951 are significant (t-statistics 2.90 and 3.73 respectively) and of the correct direction for one, and two year intervals. This shows that in the longer-term, persistent accumulation

of foreign debt decreases the value of the currency when investors lose confidence in the ability of the country to repay its foreign debt. Moreover, high foreign debt leads to further deterioration of the economy if accompanied by high world interest rates.

Non-parity variables which are marginally significant in affecting exchange rates in the shorter time period also include inflow of foreign direct and portfolio investments which are positively related to exchange rates in the one yearly interval. This shows that in the longer term, inflows of investment increase the value of the Australian currency and likewise for accumulation of balance in the current account. The R-squared for the all the period intervals are above 80 per cent and this shows that the models can explain a large portion of exchange rate movements. In summary, the key driving force behind the Australian currency is still growth rates in the domestic economy. Other variables that affect exchange rates include inflow of foreign direct and portfolio investments, foreign debt accumulation, total trade, and monetary and fiscal stance of the government.

Parsimonious Model

The results from a parsimonious model given in Table 6 clearly show that growth rate is the major determinant of exchange rates in Australia. It is interesting to note that accumulation of reserves and portfolio outflows are also significant determinants for one and two yearly interval, respectively.

Insert Table 6 here.

4.4 Longer Term - Asia Pacific

Consistent with theoretical position, interest parity theory is consistently holding in the region as a whole as it is statistically significant in

all the yearly intervals in Table 7. Price parity however, is not being explained in the model here. It might be, since these countries are relatively new with data of only about thirty years, longer time period and longer series of data once available in the future, would enable more significant results to be determined using our intervalling method to control sticky price.

Insert Table 7 here

The coefficient for growth rates, interest rates and total money are statistically significant in four year interval and are the major forces behind exchange rates in the region. The growth of countries in this region helps to explain the increase in currency value throughout the thirty years of the study. The balance of payment is only a shorter term variable in determining exchange rates in the region as accumulation of the balance is reflected in an improvement in exchange rates as predicted. Monetary expansion in the region is positively related to exchange rates and trade openness is negatively related to exchange rates as explained in the earlier section.

Although significant only in the shorter term, the coefficient on foreign debt of 0.262 at four year interval is in the expected direction in the longer term. Other capital and portfolio flows, current account, and trade flows are insignificant in affecting exchange rates which is surprising because it is believed that they are the major reasons for the financial crisis in the region in 1997. This might be due to the insufficient length of time series available from these countries when some of them only started recording these flows in the late nineties.

The parsimonious result in Table 8 reinforces the findings from Table 7. Overall, the adjusted R-squared are all above 75 per cent which shows that

the models can explain a high proportion of changes in exchange rate in the region. On top of that, the F- probabilities for the models are very significant.

Insert Table 8 here

5 Robustness Testing

This paper undertakes robustness tests to reaffirm the results. We first remove statistically insignificant variables from the model to form the parsimonious model. The results are robust to the removal of these variables, with all explanatory variables and significance of coefficient persisting. On top of that, using stepwise approach reconfirms the existing results, as seen above.

We also removed relatively highly correlated variables from the model (despite the VIF tests) and re-ran the analysis. The results largely persisted. The outflows of capital and portfolio figures are generally not significant anyway and when they are removed, the number of observations increases and adjusted R-squared also increases. Overall, the F- statistics of the models improved and the models are statistically significant.

6 Conclusion

This study reports new findings, if accepted, may extend the existing currency literature by considering the extent to which both parity and non-parity variables influence exchange rates in Australia and also in a region of nine closely-trading countries in the Asia Pacific. We find that of the non-parity variables for Australia, three have extensive explanatory power in the models investigated in this paper: (1) growth rates, (2) foreign debt and (3) fiscal expansion. Collectively, these variables explain about 80 per cent of the changes in exchange rates in Australia. The parity variables, on the other hand, are generally statistically insignificant. Two other non-parity variables which

are marginal, thus are not significant, include (4) monetary expansion and (5) inflow of foreign capital.

The major driving forces behind exchange rates in the Asia Pacific region as a whole are (1) interest rates, (2) growth rates and (3) monetary expansion. (4) Interest parity is consistently holding in the region for all intervals of time periods. (5) Price parity however, needs further extension of data and tests in a future study due to insufficient data available for these relatively new countries: as mentioned earlier, we could not extend the tests beyond 4-year intervals, which is too short to reveal the price parity equilibrium given sticky prices. Other minor non-parity variables that appear to be statistically borne out are identified: (6) balance of payments, (7) government's fiscal balance and trade openness as these factors are not always significant in all regressions. The explanatory power of models is also large.

It is important to note that different countries face different set of parity and non-parity variables which are significant in driving their exchange rates. The results for parity and non-parity variables are robust to alternative specifications of the model. We believe the tests developed in this study has led to improved results, and help identify new variables that are related to exchange rates while the puzzle of short-term versus long term behaviour is made obvious by applying different interval period. It is to be noted that the use of different intervalling periods beyond the monthly and quarterly intervals used by most researchers enabled us to bring in the impact of long-cycle sticky price effect. Finally, this study ventured to include factors suggested by theories/empirical reports to identify non-parity variables, which appear to be very significant contributors to the exchange rate determination.

Notes:

[1] We grouped 54 countries into 5 trade-related groupings, the Asia pacific countries is one of the five groupings thus formed.

[2] The Economist. April, 2001. Forex is 50 times larger by volume than the equity market as stated by Euromoney.com. Resnick, Bruce G. Business Horizons, Nov/Dec 89, Vol 32, Issue 6 and updated by others.

[3] Empirical work that has led to conflicting empirical findings for PPP includes MacDonald (1993), Rogoff (1996), Edison, Gragnon and Melick (1997), Cheng (1999) and Bayoumi and MacDonald (1999). They have all found no clear evidence or at best, very weak relationship between inflation and exchange rates.

[4] Henry and Olekaln's (2002) study on Australia found little evidence for long run equilibrium between exchange rate and prices. In a similar view, Adler and Lehman (1983) found that the deviations from PPP follow a random walk without reverting back to PPP for 43 countries.

[5] MacDonald and Ricci (2001), Kuo and Mikkola (2001), Lothian and Taylor (2000), Mark and Sul (2001), Schnabl and Baur (2002) found considerable evidence for long run relation and concluded that fundamentals paly a significant role in determining exchange rates.

[6] The interest rate theory was first developed by Keynes (1923) and Fisher (1930) through the introduction of Fisher effect for domestic interest rate theory.

[7] Studies that provided evidence include Mark (1995), Chortareas and Driver (2001), Chinn and Meredith (2002), Hoffman and MacDonald (2003) which found measures of long run expected changes in exchange rates highly correlated with interest rate differentials.

[8] Frankel and Rose (1996b) on current account and government budget deficits; Calvo, Leiderman and Reinhart (1994) on capital flows, inflation and current account deficits; and Aizenman and Marion (2002) on reserve and credibility; and many others.

[9] It is documented that the recent currency crises were due to vast changes in these variables, including Kim (2000).

[10] Gross foreign direct investment as a percentage of GDP increased more than 100 percent for Korea, the Philippines and Indonesia for the period 1990-2001.Net private capital flows into six developing regions in the world totalled US$167.976 millions in 2001. Source: *2003 World Development Indicators*, database, World Bank, 13 April 2003.

[11] Studies on capital flows that affect output, exchange rates and balance of payments include Kim (2000) and Calvo and Reinhart (1999).

[12] Portfolio investment inflows have increased from RM19,346 millions in 1991 to a peak of RM238,454 millions in 1994 for Malaysia. Source: Bank Negara Malaysia and Department of Statistics, Malaysia. Portfolio investment averaged US102 billion for 1995-96 and US26 billion for 1997-2000 according to World Economic Outlook, 2003, IMF.

[13] Using annual data for 21 OECD countries, Krol (1996) found that capital flows have significant effect on current accounts as well as exchange rates and this is reinforced by Kim (2000).

[14] Korea's usable reserve fell from US$28 billion to a mere US$6 billion when their currency went on a free fall in December 1997: Aizerman and Marion (2002). Brazil's reserves fell from US$75 billion to less than half of that before the currency collapsed in 1998: Dornbusch and Fisher (2003).

[15] Total external debt for six developing regions in the world according to World Bank classification amounted to US$2,332,621 millions for 2001. Source: *2003 World Development Indicators*, World Bank.

[16] Karras and Song (1996) investigated 24 OECD countries for thirty years and found positive relationship between output volatility, economy's trade openness and exchange rate flexibility.

[17] Reviewing the US experience with flexible exchange rates, Dornbusch (1987b) found that changes in exchange rates in the last fifteen years are inconsistent with any explanations in theory and may not be related to fundamentals.

[18] These exchange rate quotations can be expressed in either a unit of foreign currency (Direct quote) or a local unit expressed in foreign equivalent (Indirect quote). A direct exchange rate quotation gives the home currency price of in terms of foreign currency whereas the indirect quote gives the one unit home currency equivalent in foreign currency. They are actually the reciprocal of each other. In order to avoid confusion, direct quotations are used, as is the practice in the literature, in this study unless stated otherwise.

[19] IFS defined money as the sum of currency outside deposit money banks and demand deposits, and quasi money as the sum of time, savings and foreign currency deposits of resident sector.

[20] Exchange regimes are according to Reinhart and Rogoff (2002).

[21] In order to minimize multicollinearity effects, all parity variables were transformed as first difference and specified in the models as natural logarithm. Further investigation of the variables indicated that there is no significant correlation among the independent variables using VIF tests.

[22] These test results are shown in this paper in the Appendix 2 on more than the variables included in this study: we did the tests with the methods described in this paper and other methods used to study the other four regions.

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Table 1: Summary of Variables and Definitions

No.	Variable	Definition	Expected Sign
1.	LnER	Log difference of Exchange Rate over time periods	
2.	LnP	Log difference of Prices over time periods	+
3.	LnI	Log difference of Interest Rate over time periods	+
4.	Trade/GDP	Trade Balance / Gross Domestic Product (GDP)	-
5.	Cur/GDP	Current balance / GDP	-
6.	BOP/GDP	Balance of Payment / GDP	-
7.	TRes/M	Total Reserve / Total Import	-
8.	FD/GDP	Foreign Debt / GDP	+
9.	InFDI/GDP	Inflows of Foreign Direct Investment / GDP	-
10.	OutFDI/GDP	Outflows of Foreign Direct Investment / GDP	-
11.	InPt/GDP	Inflows of Portfolio Investment / GDP	-
12.	OutPt/GDP	Outflows of Portfolio Investment / GDP	-
13.	Bdgt/GDP	Budget Deficit or Surplus /GDP	-
14.	TMy/GDP	Total Money (M2) / GDP	+
15.	Prodty	Gross Domestic Product / Total Population	-
16.	TTrade/GDP	Total Exports and Imports / GDP	-
17.	Regime	Exchange Regime	+/-

Table 2: Proportion of trade between countries in the Asia Pacific Region

Country	ASEAN	Japan	EU & UK	US	Korea	China	Hong Kong and Taiwan	Australia/ New Zealand
Australia	14%	19%	12%	10%	8%	7%	4%	7%
Indonesia	14%	21%		13%	7%	5%	4%	5%
Japan	6%			30%	7%	10%	12%	5%
Korea		10%		20%		15%	6%	19%
Malaysia	25%	11%		21%	5%	7%	5%	7%
New Zealand		12%	10%	16%	5%	5%		20%
Philippines	12%	15%	10%	26%	4%	7%	12%	2%
Singapore	25%	7%	6%	15%	4%	6%	15%	3%
Thailand	15%	15%		20%	12%	5%	5%	9%

Source: CIA Factbook 2005.

Table 3: Quarterly One and Two-Step Results

Region		Australia		Asia Pacific	
			2 Step		2 Step
Intercept		-.002	.002	.019	.008
		(-0.16)	(0.30)	(4.20)*	(2.59)*
Parity	Price	-.035	-.036	-.005	-.018
		(-2.59)*	(-1.15)	(-0.76)	(-2.50)*
	Interest	.001	-.111	.054	.163
		(0.01)	(-0.81)	(1.21)	(1.22)
Non-Parity	Trade/GDP	-1.927	-1.234	.066	.076
		(-1.42)	(-0.94)	(0.47)	(0.54)
	BOP/GDP	.086	.035	-.139	-.154
		(0.26)	(0.11)	(-1.77)***	(-1.91)***
	Cur/GDP	1.341	1.009	.073	.059
		(1.22)	(0.94)	(0.62)	(0.52)
	InFDI/GDP	.220	.202	-.001	.007
		(0.71)	(0.64)	(-0.01)	(0.14)
	OtFDI/GDP	-.070	-.130	.003	.017
		(-0.17)	(-0.29)	(0.03)	(0.17)
	InPt/GDP	-.015	.019	-.037	-.029
		(-0.07)	(0.09)	(-0.61)	(-0.47)
	OtPt/GDP	-.504	-.580	.007	.014
		(-1.34)	(-1.58)	(0.04)	(0.07)
	TRes/Im	-.033	-.030	.001	.003
		(-1.61)	(-1.53)	(0.03)	(0.12)
	ForDt/GDP	-14.372	133.894	.162	.159
		(-0.08)	(0.79)	(1.83)***	(1.75)***
	Prodty	-.060	-.061	-57.30	-56.10
		(-16.87)*	(-17.19)*	(-13.06)*	(-13.45)*
	Bdgt/GDP	16.227	-12.793	-.112	-.102
		(0.14)	(-0.10)	(-3.17)*	(-2.81)*
	TMy/GDP	.144	.149	-.261	-.257
		(1.22)	(1.23)	(-10.17)*	(-9.99)*
	Regime	.007	.004	-.001	.001
		(1.26)	(1.34)	(-0.29)	(0.32)
	TTrade/GDP	.249	.124	.056	.071
		(0.40)	(0.20)	(1.43)	(1.65)
	Adj R^2	.873	.867	.738	.729
	F-prob	0.000	0.000	0.000	0.000

*, ** and *** denote statistical significance at 1, 5 and 10% levels. t-statistics are in parentheses. The results were corrected for heteroscedasticity and autocorrelation using Newey-West HAC matrix.

Table 4: Quarterly One and Two-Step Parsimonious Results

Variables:	Australia	2 Step	Asia Pacific	2 Step
Prodty	-.061	-.061	-57.275	-55.637
	(-28.52)*	(-27.66)	(-14.80)*	(-13.83)*
TMy/GDP			-.265	-.259
			(-25.91)*	(-24.64)*
Bdgt/GDP			-.141	-.136
			(-3.86)*	(-3.53)*
ForDebt/GDP			.172	.167
			(2.74)*	(2.58)*
BOP/GDP			-.138	-.159
			(-4.44)*	(-4.94)*
LNPPI	-.018			
	(-2.39)*			
Adjusted R^2	.878	.870	.738	.730
F-Probability	0.000	0.000	0.000	0.000

*, ** and *** denote statistical significance at 1, 5 and 10% levels. t-statistics are in parentheses.

Table 5: Results from Quarter, One to Four Yearly - Australia

Australia		Quarterly	One Yearly	Two Yearly	Three Yearly	Four Yearly
Intercept		-.002	.055	.165	.284	.202
		(-0.16)	(0.77)	(5.90)**	(5.39)**	(2.22)
Parity	Price	-.035	.041	.256	-.089	-.214
		(-2.59)*	(0.50)	(3.71)*	(-1.24)	(-1.68)
	Interest	.001	-1.631	-2.785	-.966	1.196
		(0.01)	(-3.75)**	(-2.32)	(-1.37)	(0.53)
Non-Parity	Trade/GDP	-1.927	1.501		5.339	
		(-1.42)	(0.72)		(1.72)	
	BOP/GDP	.086	.680			
		(0.26)	(0.63)			
	Cur/GDP	1.341	-2.277			
		(1.22)	(-1.38)			
	InFDI/GDP	.220	-3.647			
		(0.71)	(-2.78)***			
	OtFDI/GDP	-.070	.038			
		(-0.17)	(0.03)			
	InPt/GDP	-.015	-1.412			
		(-0.07)	(-1.04)			
	OtPt/GDP	-.504	.130			.736
		(-1.34)	(0.09)			(0.12)
	TRes/Im	-.033	-.022	1.687		
		(-1.61)	(-0.12)	(5.59)**		
	ForDt/GDP	-14.372	2.219	1.951		
		(-0.08)	(2.90)***	(3.73)***		
	Prodty	-.060	-103.681	-130.013	-70.821	-57.880
		(-16.87)*	(-4.23)*	(-6.64)**	(-5.54)**	(-6.30)***
	Bdgt/GDP	16.227	2.472	-1.088	2.657	
		(0.14)	(3.73)**	(-1.90)	(3.31)***	
	TMy/GDP	.144	.537	.917		
		(1.22)	(1.01)	(1.96)		
	Regime	.007	.021			
		(1.26)	(0.80)			
	TTrade/GDP	.249	-.169			
		(0.40)	(-0.54)			
	Adj R^2	.873	.903	.973	.810	.947
	F-prob	0.000	0.031	0.021	0.130	0.158

*, ** and *** denote statistical significance at 1, 5 and 10% levels. t-statistics are in parentheses. The results were corrected for heteroscedasticity and autocorrelation using Newey-West HAC matrix. [a]With the length of time period increasing to three and four yearly intervals, one shortcoming of the data set is that the number of observations falls. However, with longer time period available in the future, this problem can be eliminated.

Table 6: 1 – 4 Yearly Parsimonious Result - Australia

	Quarterly	One Yearly	Two Yearly	Three Yearly	Four Yearly

Prodty	-.061	-60.190	-83.356	-84.503	-55.487
	(-28.52)*	(-10.33)*	(-14.38)*	(-20.54)*	(-4.47)*
LNPPI	-.018				
	(-2.39)*				
TRes/Im			1.220		
			(5.52)*		
Regime			.086		
			(3.54)*		
PtOt				17.021	
				(9.59)*	
Adj R^2	.878	.848	.966	.991	.776
F-prob	0.000	0.000	0.000	0.000	.005

*, ** and *** denote statistical significance at 1, 5 and 10% levels. t-statistics are in parentheses.

Table 7: Results from Quarter, One to Four Year – Asia Pacific

Asia Pacific		Quarterly	One Yearly	Two Yearly	Three Yearly	Four Yearly
Intercept		.019	.077	.062	.118	.048
		(4.20)*	(6.39)*	(1.72)***	(1.59)	(0.53)
Parity	Price	-.005	-.002	-.006	-.064	-.198
		(-0.76)	(-0.18)	(-0.20)	(-1.21)	(-2.65)**
	Interest	.054	.169	.763	.681	2.190
		(1.21)	(1.87)***	(4.06)*	(1.76)***	(5.40)*
Non-Parity	Trade/GDP	.066	-.003	-.011	.708	.811
		(0.47)	(-0.02)	(-0.05)	(1.56)	(2.33)**
	BOP/GDP	-.139	-.389	-.043	-.183	-.201
		(-1.77)***	(-1.87)***	(-0.18)	(-0.28)	(-0.32)
	Cur/GDP	.073	-.010	.288	-.065	.052
		(0.62)	(-0.07)	(1.44)	(-0.16)	(0.12)
	InFDI/GDP	-.001	.235	.238	1.688	.372
		(-0.01)	(1.00)	(0.37)	(2.22)**	(0.37)
	OtFDI/GDP	.003	.507	0.420	.431	1.608
		(0.03)	(1.33)	(0.61)	(0.51)	(0.75)
	InPt/GDP	-.037	.048	-.384	.906	1.276
		(-0.61)	(0.30)	(-0.95)	(1.13)	(0.81)
	OtPt/GDP	.007	.210	-.071	-.507	.103
		(0.04)	(0.76)	(-0.09)	(-0.55)	(0.05)
	TRes/Im	.001	.017	-.035	-.033	-.005
		(0.03)	(0.21)	(-0.22)	(-0.11)	(-0.03)
	ForDt/GDP	.162	-.205	-.128	-.310	.262
		(1.83)***	(-1.18)	(-0.56)	(-1.77)***	(0.74)
	Prodty	-57.30	-29.099	-29.718	-30.728	-31.701
		(-13.06)*	(-4.62)*	(-5.33)*	(-5.82)*	(-3.06)*
	Bdgt/GDP	-.112	.313	.212	.561	-.385
		(-3.17)*	(1.45)	(0.43)	(0.72)	(-0.78)
	TMy/GDP	-.261	-.770	-.510	-.696	-.605
		(-10.17)*	(-10.60)*	(-3.78)*	(-3.08)*	(-3.48)*
	Regime	-.001	.001	.040	.058	.064
		(-0.29)	(0.10)	(1.79)***	(1.37)	(1.14)
	TTrade/GDP	..56	.047	.028	.017	.204
		(1.43)	(1.70)***	(0.79)	(0.38)	(4.06)*
	Adj R^2	.738	.873	.788	.793	.830
	F-prob	0.000	0.000	0.000	0.000	0.000

*, ** and *** denote statistical significance at 1, 5 and 10% levels. t-statistics are in parentheses. The results were corrected for heteroscedasticity and autocorrelation using Newey-West HAC matrix.

Table 8: 1 – 4 Yearly Parsimonious Result – Asia Pacific

	Quarterly	One Yearly	Two Yearly	Three Yearly	Four Yearly
Prodty	-57.275	-31.025	-28.062	-27.827	-33.709
	(-14.80)*	(-7.99)*	(-5.80)*	(-4.66)*	(-4.79)*
LnI			.708		1.886
			(3.23)*		(4.22)*

TTrade		.037 (2.13)**			
TMy	-.265 (-25.91)*	-.732 (-14.01)*	-.511 (-5.99)*	-.593 (-4.95)*	-.446 (-2.88)*
ForDebt/GDP	.172 (2.74)*				
BOP/GDP	-.138 (-4.44)*	-.419 (-4.26)*			
Bdgt/GDP	-.141 (-3.86)*	.435 (2.82)*			
Cur/GDP			.385 (2.63)*	.470 (2.25)**	.558 (2.53)**
Adj R^2	.738	.876	.808	.786	.823
F-prob	0.000	0.000	0.000	0.000	0.000

*, ** and *** denote statistical significance at 1, 5 and 10% levels. t-statistics are in parentheses.

Appendix 1a: Descriptive Statistics on Exchange Rates, Price and Interest Differences of Asia-Pacific Countries

Country	ln change in exchange rates			ln change in price differences			ln change in interest differences		
	Mean/ Median	Std Dev	Max/ Min	Mean/ Median	Std Dev	Max/ Min	Mean/ Median	Std Dev	Max/ Min
Australia	0.008/ 0.001	0.052	0.156/ -0.097	-0.079/ -0.045	0.111	0.051/ -0.385	0.033/ 0.024	0.029	0.097/ -0.002
Indonesia	0.035/ 0.011	0.132	0.582/ -0.331	-0.266/ -0.358	0.640	1.101/ -1.272	0.083/ 0.065	0.094	0.507/ -0.010
Japan	-0.004/ 0.007	0.066	0.150/ -0.169	0.018/ 0.018	0.053	0.154/ -0.124	-0.025/ -0.028	0.022	0.025/ -0.070
Korea	0.011/ 0.008	0.078	0.617/ -0.203	-0.005/ -0.027	0.084	0.191/ -0.223	0.050/ 0.044	0.036	0.165/ -0.008
Malaysia	0.008/ 0.000	0.044	0.236/ -0.063	-0.021/ -0.023	0.039	0.151/ -0.085	-0.007/ -0.004	0.036	0.058/ -0.097
Philippines	0.016/ 0.003	0.055	0.250/ -0.115	-0.092/ -0.072	0.243	0.287/ -0.523	0.082/ 0.074	0.035	0.168/ 0.028
Singapore	-0.002/ -0.005	0.027	0.094/ -0.068	-0.015/ -0.008	0.028	0.068/ -0.080	-0.016/ -0.017	0.011	0.013/ -0.049
Thailand	0.009/ -0.001	0.067	0.348/ -0.197	-0.031/ -0.045	0.114	0.199/ -0.215	0.028/ 0.028	0.038	0.138/ -0.041

Appendix 1b: Asia Pacific - Descriptive Statistics of Non-Parity Variables

Variables	N	Mean	Median	Std Dev	Max/Min

1	Trade/GDP	879	.0072	.0004	.0745	.6307/-.5523
2	Cur/GDP	794	.0009	.0002	.0306	.1391/-.1717
3	BOP/GDP	789	.0013	.0003	.0587	.4504/-.3229
4	InFDI/GDP	825	.0003	.0001	.0289	.4107/-.3096
5	OutFDI/GDP	686	.0001	.0000	.0099	.1376/-.0956
6	InPt/GDP	794	.0003	.0000	.0544	.4446/-.5504
7	OutPt/GDP	592	.0004	.0000	.0446	.3822/-.4805
8	TRes/M	934	.0351	.0278	.1200	.7341/-.5147
9	Bdgt/GDP	852	.0006	.0011	.0675	.3080/-.3067
10	TMy/GDP	997	.0429	.0395	.1505	1.2355/-1.2637
11	Prodty	994	.0001	.0001	.0006	.0052/-.0060
12	FD/GDP	753	.0035	.0002	.0265	.2123/-.2789
13	TTrade/GDP	903	.0177	.0043	.0887	.6307/-.5523

Appendix 2: Parity and Non-Parity Variables VIF and Tolerance Measure

	G-10		Asia Pacific		Latin America		Eastern Europe		ASEAN	
Variables	**VIF**	**Tolerance**	**VIF**	**Tolerance**	**VIF**	**Tolerance**	**VIF**	**Tolerance**	**VIF**	**Tolerance**
LNP	1.849	0.541	1.050	0.952	1.302	0.768	1.679	0.596	1.018	0.982
LNI	1.253	0.798	1.056	0.947	1.280	0.781	1.807	0.553	1.065	0.939
Trade/GDP	3.351	0.298	3.000	0.333	6.691	0.149	3.873	0.258	2.993	0.334
Cur/GDP	3.319	0.301	2.944	0.340	7.730	0.129	3.863	0.259	3.080	0.325
BOP/GDP	1.536	0.651	1.564	0.640	7.275	0.158	2.796	0.358	1.649	0.606
InFDI/GDP	1.629	0.614	1.350	0.741	1.088	0.919	1.184	0.845	1.100	0.909
OutFDI/GDP	1.660	0.603	1.593	0.628	1.097	0.911	1.096	0.912	1.140	0.877
InPt/GDP	1.154	0.867	1.841	0.543	5.838	0.163	1.992	0.502	0.327	0.754
OtPt/GDP	1.099	0.910	1.175	0.851	1.249	0.800	1.234	0.811	1.144	0.874
TRes/IM	1.570	0.637	1.445	0.692	1.245	0.803	2.061	0.485	1.474	0.678
Bgt/GDP	1.157	0.864	1.173	0.852	1.271	0.787	1.331	0.751	1.095	0.913
TMy/GDP	1.344	0.744	1.282	0.780	1.448	0.691	1.961	0.510	3.340	0.299
PROD	2.178	0.459	1.133	0.882	1.091	0.916	2.052	0.487	3.226	0.310
FD/GDP	1.230	0.813	1.143	0.875	1.197	0.836	1.382	0.724	1.205	0.830
TTrade/GDP	1.838	0.544	1.266	0.790	1.481	0.675	1.731	0.578	1.321	0.757
Regime	1.649	0.606	1.155	0.866	1.184	0.845	1.587	0.630	1.170	0.855

* VIF values of more than 10 shows significant multicollinearity.

Appendix 3a: Unit Root Tests for Parity Variables in Asia Pacific

	ADF Test	KPSS Test

	ln change in exchange rate		ln change in price differences		ln change in interest differences		ln change in exchange rate	ln change in price differences	ln change in interest differences
	t-stats	Model (lag)	t-stats	Model (lag)	t-stats	Model (lag)	KPSS statistic	KPSS statistic	KPSS statistic
Australia	-9.05***	C(0)	-4.60***	C(0)	-2.72	C&T(1)	0.103	0.903***	0.106
Indonesia	-8.13***	C(0)	-1.69	C&T(1)	-4.13***	C&T(2)	0.058	0.193**	0.054
Japan	-8.61***	C(0)	-2.24	C&T(0)	-1.80	C(6)	0.135	0.092	0.255
Korea	-11.41***	C(0)	-2.21	C&T(0)	-3.51**	C(1)	0.098	0.216***	0.173
Malaysia	-2.08	C(2)	-0.02	C(0)	-3.50**	C&T(0)	0.261	0.304	0.075
Philippines	-7.03***	C(0)	-2.60	C&T(1)	-2.76*	C(0)	0.108	0.112	0.343
Singapore	-9.98***	C(0)	-2.90**	C(0)	-4.56***	C(1)	0.306	0.448*	0.097
Thailand	-8.31***	C(0)	-3.22*	C&T(1)	-2.36	C(0)	0.109	0.079	0.150
Pooled	-22.8***	C(0)	-3.29	C(0)	-5.23**	C(0)	0.201	0.169	0.173

Critical values for ADF tests at 10,5 and 1% levels of significance are respectively, -2.59, -2.90 and –3.53 with a constant and –3.17, -3.48 and –4.09 with a constant and a deterministic trend. Critical values for KPSS tests at 10,5 and 1% levels of significance are respectively, 0.35, 0.46 and 0.74 with a constant and 0.12, 0.15 and 0.22 with a constant and a linear trend.

Note: For the ADF tests, the unit root null is rejected if the value of the DF t-statistics is less than the critical value. For the KPSS tests, the null of stationarity is rejected if the value of the KPSS statistic is greater than the critical value. *, ** and *** denote statistical significance at 10, 5 and 1% level. The critical values for the ADF tests are from MacKinnon (1991).

Appendix 3b: Unit Root Tests for Parity and Non-Parity Variables in (G-10 countries) and Asia Pacific Region

Variables	G-10			Asia Pacific		
	ADF Test		KPSS Test	ADF Test		KPSS Test
	t-stats	Model (lag)	KPSS statistic	t-stats	Model (lag)	KPSS statistic
lnER	-14.71***	C(13)	0.035	-6.72***	C(0)	0.772***
lnP	-3.53***	C(0)	0.114	-3.16***	None	0.119
lnI	-6.50***	C(0)	0.203	-7.26***	C(0)	0.111
Trade/GDP	-8.98***	C(11)	0.202	-6.31***	C(19)	0.494**
Cur/GDP	-14.68***	C(6)	0.099	-7.24***	C(15)	0.259
BOP/GDP	-22.25***	C(3)	0.205	-25.93***	C(2)	0.122
InFDI/GDP	-4.76***	C(12)	0.417*	-14.38***	C(10)	0.102
OutFDI/GDP	-20.70***	C(2)	0.594**	-10.12***	C(19)	0.038
InPt/GDP	-20.73***	C(3)	0.232	-6.81***	C(20)	0.029
OutPt/GDP	-4.13***	C(17)	0.359*	-4.13***	C(18)	0.015
TRes/IM	-8.47***	C(8)	0.208	-25.74***	C(0)	0.214
Bdgt/GDP	-14.88***	C(6)	0.241	-11.09***	C(7)	0.087
TMy/GDP	-10.57***	C(3)	1.407***	-28.54***	C(0)	0.069
Prodty	-3.83***	C(3)	0.293	-8.88***	C(11)	0.082
FD/GDP	-12.99***	C(7)	0.093	-7.19***	C(3)	0.098
TTrade/GDP	-10.14***	C(10)	0.334	-5.82***	C(11)	0.069

Critical values for ADF tests at 10,5 and 1% levels of significance are respectively, -2.59, -2.90 and –3.53 with a constant and –3.17, -3.48 and –4.09 with a constant and a deterministic trend. Critical values for KPSS tests at 10, 5 and 1% levels of significance are respectively, 0.35, 0.46 and 0.74 with a constant and 0.12, 0.15 and 0.22 with a constant and a linear trend.

Note: For the ADF tests, the unit root null is rejected if the value of the ADF t-statistics is less than the critical value. For the KPSS tests, the null of stationarity is rejected if the value of the KPSS statistic is greater than the critical value. *, ** and *** denote statistical significance at 10, 5 and 1% level. The critical values for the ADF tests are from MacKinnon (1991).