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Exchange Rate Volatility and Choice of Anchor Currency - Prospects for a Melanesian Currency Union*

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Abstract
This paper investigates an appropriate choice of anchor currency for a proposed Melanesian currency union under various hypothetical currency union arrangements. Drawing from the optimal currency area (OCA) theory and related extensions, the analysis focuses on the effects of a currency union on exchange rate volatility following similar approach by Scrimgeour (2002). Counterfactual exchange rate series are constructed for alternative scenarios for Melanesia with the following major trading partners: Australia, New Zealand, USA and Japan. The main findings showed that both short-term and cyclical exchange rate volatility are generally lower in a currency union with either Australia or New Zealand. However, the results vary under varying weights and currency baskets. Choosing a single common anchor currency based solely on exchange rate volatility may not be conclusive. Hence, further research is required, for example, in considering the effects of a currency union on volatility in output, inflation or interest rates.

JEL Classification: F15, F31, F33

Key words: Exchange Rate Volatility, Currency Union, Melanesian Countries

1. INTRODUCTION

This paper investigates an appropriate choice of anchor currency for the proposed Melanesian currency or monetary union.[1] The analysis focuses on analysing the effect of the currency union on exchange rate volatility. Determining an appropriate currency anchor is dependent on assessing the exchange rate volatilities of the Melanesian countries and their important (weighted by trade or trade and GDP) trading partners in a hypothetical currency union arrangement. In such arrangement where relatively low exchange rate volatility is observed between a Melanesian country and any one of its predominant trading partner, than the concerned trading partner's currency is the choice of anchor for the Melanesian country. This analysis follows a similar approach by Scrimgeour (2001, 2002), and draws from Grimes et al. (2000) but applied in the context of Pacific Island (Melanesia) countries. The Melanesian countries in this analysis include Fiji, Papua New Guinea, Solomon Islands and Vanuatu.[2] The focus on Melanesia comes amidst the backdrop of a lack of evidence for a Pacific Islands currency union as a regional group (see, e.g., Fichera, 2006, Creane et al., 2006), and the growing debate in favour for a Melanesian sub-union (see, e.g., Jayaraman et al. (2007); Lahari, 2010). The findings of this study will contribute new insights to the on-going debate on currency and monetary unions in the Pacific region. This analysis is further motivated by the lack of research in this area.

The rest of the paper begins in section 1.1 with a discussion of the basic theoretical framework within the scope of optimal currency area (OCA) theory. This is followed by a review of selected empirical studies in section 2. In section 3, the data and methodology are discussed, which includes a discussion on the construction of a trade-weighted exchange rate and measures of exchange rate volatility. Section 4 presents the empirical results and tests conducted in determining the extent of exchange volatility under alternative currency union arrangements. Lastly, section 5 summarises and concludes this analysis.

[1] A currency union refers to a zone consisting of several countries or regions where a single exchange rate regime prevails, a single currency circulates, and where a single monetary authority implements a common monetary policy. A monetary union refers to a group of countries that agree to permanently fix their exchange rates under centralisation of monetary authority. A monetary union may not necessarily be fully centralised or have formal integration but there are commitments for monetary policy coordination among members through arrangements such as currency boards. In this analysis, the term currency union will be used to also refer to a monetary union, unless otherwise stated.

[2] Apart from the only two fully independent Polynesian countries (Samoa and Tonga), many other Polynesian and Micronesian nations are not fully independent and exist under free associated states (e.g., Guam) while some still remain colonies such as Tahiti under French. Hence, they are not the focus of this analysis. Melanesia consists of relatively the larger sub-regional group of fully independent countries.

1.1 Theoretical Background

The theoretical arguments are connected to the OCA theory and related extensions, particularly in connection to exchange rate volatility and trade flows, and the choice of anchor currency. The arguments are also connected to the cost and benefits approach.[3] Generally, the theoretical argument postulates that currency unions can minimise transactions costs associated with exchange rates. In terms of deciding on an appropriate choice of anchor currency, if a country adopts a given currency in a currency or monetary union, transaction costs associated with exchanging currencies should be reduced across possible anchor currencies of major trading partners.[4] Given that transaction costs affect exchange rate volatility, it would be optimal, *ceteris paribus*, for a country to adopt the anchor currency of the country that is the most important (e.g., weighted by trade or output).[5] This is because the effective bilateral exchange rate volatility affects the choice of an anchor currency among a country's trading partners. Eliminating or reducing exchange rate volatility can generate microeconomic gains such as enabling international arbitrage that enhances efficiency and productivity, thus contributing to exchange rate stability.

Eliminating Exchange Rate Volatility

If the world consisted of only two countries, for example, Papua New Guinea (PNG) and Australia, with their own respective currencies used for trade between each other, then nominal exchange rate volatility would be eliminated if the two countries adopt only one currency. This can be done by either accepting a new currency, or, in the case, PNG, a relatively smaller 'developing' country, irrevocably fixing its exchange rate to the Australian dollar (anchor currency). Effectively, this would be a one-currency world. Such a world would also be an 'optimal' currency area if the two countries faced similar shocks, had strong trade relations and factors of production (e.g., labour and capital) flowed freely. When two countries fully meet the criteria for the OCA, this implies that they are likely to have limited or removed exchange rate

[3] For a discussion on the OCA theory, see, e.g., Mundell (1961), McKinnon (1963) and Kenen (1969). For exchange rate volatility and trade flows, see, e.g., Krugman (1993) and Tavlas (1993. For a discussion on choice of anchor currency, see Meissner and Oomes (2008). Ishiyama (1975) discusses the costs and benefits approach.

[4] Examples of such transactions costs are the loss of receipts from international trade due to exchange rate uncertainty, and costs related to hedging due to exchange rate risks.

[5] Although there is some debate, studies show that transaction costs increase with exchange rate volatility (see, e.g., Clark et al. 2004). Also, Scrimgeour (2001, 2002) suggest that weights based on other criteria, such as capital flows or equity denominated in each currency, may be meaningful alternatives. However, this may be suitable for developed industrialised countries with more integrated financial markets and mobility of large capital flows, unlike the developing economies such as the Melanesian countries.

fluctuations against each other. However, such a two-country world arrangement is far from realistic.

Reducing Exchange Rate Volatility

Exchange rate volatility may not be removed entirely in a currency union if trade exits among members of the union and non-union countries. This would reduce exchange rate volatility but not eliminate it.[6] Thus, in terms of the relationship between exchange rate volatility and the choice of an anchor currency, how we determine the appropriate anchor currency among the possibility of three, four or more anchor currencies, depends on the importance of the anchor country (major trading partner) and its bilateral exchange rate volatility among other countries. Extending from our earlier example, one argument would be that PNG should opt to choose another currency (anchor) apart from Australia, if Australia's exchange rate volatility with another country, say the United States, is relatively high or more volatile. However, the volatility of exchange rates is the same irrespective of which side we take if there were only these three countries. This is because we still have to trade and buy another country's currency. Thus, given that the bilateral exchange rate volatility is affected by the relative weight (importance) of another country, PNG (or any Melanesian country) should opt to choose the currency (anchor) of its most important partner. Hence, exchange rates measured in terms of the trade weighted exchange rates (TWI) have lower volatility when one country enters into a union with another country that is the most important in terms of trade.

Forming a union based on the lower volatility of another country's exchange rate is premature if one's trade, *ceteris paribus*, with the other country is relatively small. Accordingly, when entering into a union with more countries that are less important, the more one gains from currency union in terms of reduction in volatility (Scrimgeour, 2002). Thus, in a world of three or more countries, a currency union consisting of several trading countries would mean that volatility would be lower overall from the point of view of the independent currency. This would imply that the exchange rates may be less volatile and/or that not all of them move in similar directions. Thus, a two-country world would mean exchange rate volatility would be eliminated

[6] During the Bretton-Woods period, individual industrialised countries did not envisage major differences when pegging to a reserve currency since their exchange rates were fixed and only infrequently re-aligned. However, when the Bretton-Woods system collapsed in 1973, this caused difficulties in efforts to stabilise exchange rates especially when the US dollar and the German Deutsche Mark (DM) started floating against each other. Pegging one's currency to either the US dollar or the DM meant floating against either one of the two currencies, hence inevitably contributing to fluctuations in exchange rates.

but in a three, four or more country world, volatility could be reduced but not eliminated. The latter case is more realistic.

This analysis is limited to exchange rate volatility alone as a condition for determining the choice of an anchor currency. The effects of currency union on other important volatilities such as volatility in output, inflation and interest rates that enter the system are beyond the scope of this analysis. In addition, choosing an anchor currency also implies choosing an exchange rate regime (e.g., fixed or floating regime). This work does not extend towards determining the costs and benefits of choosing a particular regime, nor analysing the determinants of a particular exchange rate regime.

2. SELECTED EMPIRICAL STUDIES

To date, there has been no study undertaken involving Pacific Island Countries (PICs) including Melanesian countries on the effect of currency union on exchange rate volatility and its implications of an appropriate choice of currency anchor.[7] This review draws from selected studies in regions such as Africa, Asia, Europe, and lastly looks at related studies within the Pacific Island region.

In Bayoumi and Eichengreen (1998), the authors analysed the link between the OCA variables to explain exchange rate volatility and intervention for industrialised countries using regression analysis. They argued that exchange rate volatility could be explained by the relevant OCA variables (e.g., economic shocks). However, their findings showed that OCA factors affected exchange rate and intervention in different ways. A currency union (where OCA conditions hold) can affect exchange rate volatility in varying degrees through the dynamic interactions of the OCA variables. Bangake (2008) followed a similar approach to that of Bayoumi and Eichengreen (1998) and arrived at similar findings. Bangake's study involved only African countries. Using simultaneous equations and the generalised method of moments (GMM), evidence from the study showed that OCA variables explained the behaviour of bilateral exchange rates. Hence, the results are likely to have policy implications for the proposed monetary union of Africa. In other related studies, Bedhora (1990) analysed the impact of exchange rates and imports for the period

[7] The literature on exchange rate regimes looks at two closely interrelated fields of study. This includes studies regarding the determinants of the exchange rate regime (choice of regime) and studies on the choice of anchor currency. Although this review focuses on the latter, there may be some interrelationships.

1976 to 1982 on members of the six-country West African Monetary Union (WAMU).[8] Applying the nominal effective exchange rate index within an import demand function, the findings from the study showed that exchange rate variability did not affect the Union's real imports. This finding contradicted arguments that since the common currency of the members of the WAMU had been pegged to the French franc since 1948, their nominal exchange rate variability would have been affected by movements of the French franc (now euro).[9] Moreover, Savvides (1996) applied formal tests to determine the degree of variability of nominal and real exchange rates of the members of the 'Communaute Financiere Africaine' (CFA) Franc Zone with those of other African countries. Findings from the study showed that both nominal and real exchange rate variability increased during the flexible exchange rate period for all countries, although CFA Franc Zone members experienced lower nominal variability than real variability. The study also found that membership of the CFA Franc Zone results in lower nominal exchange rate variability.

Regarding the Asia region, Kawai and Tagaki (2000) argued that exchange rate volatility among developing countries harmed trade and investment. Hence, it was inadvisable to adopt an anchor currency based on a freely floating exchange rate regime. This argument was extended by Kawai (2007) who proposed that East Asia's emerging economies initiate attempts to utilise a currency basket system based on the G3 (US, Euro area and Japanese) or G3-plus (G3 and emerging East Asian) currencies as a monetary policy anchor. Such a system would initiate progress towards an East Asian monetary zone. In Europe, studies such Fidrmuc and Horvath's (2008) analysed a number of selected new European Union member states.[10] Employing generalised autoregressive conditional heteroskedasticity (GARCH) and threshold autoregressive conditional heteroskedasticity (TARCH) models, they found that low credibility of exchange rate management led to higher volatility of exchange rates. Their study also showed that volatility of exchange rates had significant asymmetric effects among the countries.

While there are no studies directly involving PICs, there are also few studies within the South Pacific region involving Australia and New Zealand. The two most important this analysis are the works of Grimes et al. (2000) and Scrimgeour (2001, 2002). Grimes et al. (2000) investigated whether it was feasible for New Zealand to establish a currency union with Australia and adopt

[8] The six countries include Benin, Burkina Faso, Côte d'Ivoire, Niger, Senegal, and Togo.

[9] Since members of the WAMZ plan to have a common currency in the future, the choice of anchor currency is likely to be the US dollar. This is not only because most of the member countries' currencies are quoted in US dollars, but that their reserves are also held in US dollars (Meissner and Oomes, 2008). Hence, the future integration of WAMU and WAMZ will have implications on the common choice of a currency anchor.

[10] These member states included the Czech Republic, Hungary, Poland, Romania, and Slovakia.

the Australian dollar or a hybrid currency such as a combined ANZAC dollar. Among other issues considered, the study analysed the effect of a currency union on exchange rate volatility in a hypothetical currency union for New Zealand with Australia, New Zealand with the United States or even with a three-way currency union block. Using newly constructed trade-weighted counterfactual exchange rates, and applying standard volatility measures, they found that in a three-way currency union with both Australia and the United States, New Zealand would face lower exchange rate volatility. Following from Grimes et al. (2000), Scrimgeour (2001, 2002) extended the analysis on similar hypothetical currency unions with New Zealand. Scrimgeour applied a simple theoretical framework, used newly constructed counterfactual exchange rate series based on varying weighting structures, and derived measures of short-term exchange rate volatility based on quarter-on-quarter changes in the nominal exchange rate and cyclical volatility based on a band-pass filter (Baxter and King, 1999). Findings from his study showed that if New Zealand was to have formed a currency union with the United States or Australia in the mid-1980s, exchange rate volatility would not have been reduced. However, cyclical volatility would have been relatively lower if New Zealand entered a currency union with the United States.

In summary, whilst there is the argument that nominal exchange rate volatility is higher under anchor currencies based on flexible exchange rate regimes than those based on fixed exchange rate regimes (see, e.g., Coleman 1999), the implications of a currency union on exchange rate volatility remains inconclusive. However, it is rarely disputed that entering into a currency union would reduce exchange rate volatility.[11] It is inevitable that analyses of the interactions between currency unions and volatility of exchange rates are, in part, sensitive to the decisions of data and sample requirements, countries (developed/developing), measures of volatility, and specification of models considered. It is also noted that many other factors (e.g., similar output shocks), apart from exchange rate volatility alone, are related to anchor currency choice.

3. DATA AND METHODOLOGY

3.1 DATA

The exchange rate variable used is based on a trade-weighted nominal exchange rate index (TWI). This measure is used by countries to compare their exchange rates against the exchange

[11] When the Bretton-Woods system collapsed in 1973, the anchor currency choices among developed economies changed considerably. During the pre-Bretton Woods period, anchor currencies for many developing countries were the U.S. dollar, the British pound, and the French franc. The popularity of the U.S dollar and particularly the British pound has since declined. The latter is no longer a choice of anchor (Meissner and Oomes, 2008).

rates of their major trading partners. It is a preferred instrument for capturing the effects of exchange rate changes on a country's economy and inflation. The choice of applying nominal exchange rates is based on the concept of currency unions. The theoretical arguments postulate that currency unions reduce exchange rate volatility. Conceptually, this means that entering into a currency union removes nominal exchange rate fluctuations between member countries. On this basis, studies such as Scrimgeour (2001, 2002) have used nominal exchange rates. This analysis follows similar arguments.

Given that there are no published time series data on TWIs for most of the Melanesian countries, the indices are newly constructed. Alternatively, a weighted nominal exchange rate index calculated on a 50:50 weighted basis based on both trade and output (nominal GDP) is derived. This is denoted as CTWI. The nominal exchange rate (line RH..ZF) and GDP (line 99B..ZF) data are obtained from the International Monetary Fund's International Financial Statistics (IFS). The trade data are obtained from the United Nations Commodity Trade database (COMTRADE). The sample period is 1980:1 to 2006:4. All indices are expressed in natural logarithms. The weights measured by total merchandise trade (imports plus exports) and nominal GDP are similar to the measures applied by the Australian Reserve Bank and Statistics New Zealand. Scrimgeour (2001, 2002) and Grimes et al. (2000) also apply similar measures. Other measures of weights can also be used such as capital flows or equity denominated in each currency.[12] Apart from differences in countries analysed, other different features include differences in sample period of study, different weighting schemes and different basket of currencies in the weighted exchange rate indices.

Exchange rate volatility based on trade alone or both trade and GDP may have implications on the decision to form a currency union. Hence, to assess the robustness of the exchange rate indices, different weights and different currency baskets have been considered. These consist of a basket of six and twelve currencies, denoted as TWI6 and TWI12, respectively. The six countries are Australia, China, Japan, New Zealand, Singapore and the United States (US). These six countries are Melanesia's most important trading partners, accounting for slightly over 80% of total imports and about 40% to 60% of their exports.[13]

[12] This may have implications given that most equities are quoted in the US dollar. Nonetheless, in choosing an anchor currency, what is crucial is which foreign currency (trading partner) is important and not the variability of the bilateral exchange rate (Scrimgeour, 2001, 2002).

[13] Since the 1997 Asian financial crisis, growth in the East Asia region was the fastest in the world. Trade among East Asian countries, particularly China and Japan, and the Melanesian countries continue to increase. Although China is now an important world/regional player, the Chinese yuan has been subject to much

In a hypothetical currency union arrangement, the four chosen anchor currencies are AUD (Australia), NZD (New Zealand), USD (United States) and JYP (Japan). In addition, the twelve trading partners are Denmark, France, Germany, India, Republic of Korea and the United Kingdom plus the six major trading countries already stated above. Accordingly, in representing a given series, the label for each series begins with the weighting scheme used, followed by the number indicating the basket of currencies used and the anchor currency. For example, in the series associated with the Australian dollar (AUD), this is labelled as TWI6-AUD or TWI12-AUD. Similarly, in the case of the combined trade and GDP weighted indices, this is labelled as CTWI6-AUD or CTWI12-AUD, respectively. Further, it is important to note that in terms of calculating exchange rate volatility involving New Zealand dollar as the anchor currency, the sample starts from 1985:2, immediately after the period the NZD was floated in March 1985. Similarly, for Australia, the calculation starts from 1984:1 since the AUD was floated in December 1983. For PNG, the calculation starts from 1995:1 onwards, following the floating of the currency in November, 1994. Lastly, the weights in this analysis are fixed given the lack of consensus on the impact of currency unions on trade and the controversies surrounding Rose's (2000) claims. This follows similar arguments by Scrimgeour (2001, 2002) and also by Grimes et al. (2000).[14] In our case, the weights are calculated based on the average of total merchandise trade (imports and exports) or combined trade and nominal GDP from 1980 to 2006 to avert any bias from the selection of single-year weights.

3.2 METHODOLOGY

Trade-Weighted Exchange Rate Index (TWI)

The TWI is constructed as a weighted geometric average of the exchange rates for the currencies of the selected major trading partner countries. Following similar approaches by the New Zealand Reserve Bank and Scrimgeour (2001, 2002), the calculation of the TWI is,

controversy (see e.g., Sirono, 2009). However, Japan is still a leading and dominant economy in East Asia and among the Pacific Islands (Melanesian) economies.

[14] Scrimgeour (2001, 2002) argues that due to the controversy of Rose's (2000) findings that currency unions had a dramatic effect on bilateral trade flows, the assumption that trade patterns are invariant to a monetary union holds. Until such time there is consensus in support of Rose's claims, then weight drift can be considered.

$$TWI = \prod_{i=1}^{k} \left(\frac{e_{it}}{e_{io}}\right)^{w_i} A \quad (1)$$

where Π is the product of the bilateral nominal exchange rate at time t, e_{it}, divided by the exchange rate in the base period, e_{io}, adjusted by weights, w_i. The weights sum up to one. The number of trading partners is represented by k. A represents a scaling factor that is applied to ensure continuity in the series so that each TWI does not change from the initial base period (March quarter, 1980), during re-weighting.[15] This measure is constructed for the independent country as well as in the case of a hypothetical or counterfactual currency union. In the latter case, the cross-rates are used as exchange rates following the approach of Scrimgeour (2001, 2002). For instance, bilateral exchange rates (cross-rates) for the New Zealand dollar or the Japanese yen calculated to represent Fiji in a currency union with Australia would have applied as AUD/NZ and AUD/JPY. This depends on which country is the anchor, in this case Australia, in a currency union setting.[16]

Short-Term Exchange Rate Volatility

Although there are various measures of exchange rate volatility as noted in the literature review, there is no preferred statistically accepted measure (see e.g., McKenzie, 1999 and Rigobon, 2008). We adopt the approach taken by Scrimgeour (2001, 2002) as the study relates to the Pacific region involving two of our countries of interest (Australia and New Zealand) and is connected to the focus of this study. If, for instance, Australia and New Zealand decide to form a currency union, this will have implications on the choice of anchor currency for PICs.[17] The focus on nominal exchange rate volatility is also because of the lack of short-term hedging markets such as the bond and derivatives markets among Melanesian countries, as well as the focus on quarterly measures of volatility over cyclical measures. Thus, our measure of exchange rate (TWI) volatility is the variance (Var) of the quarter-to-quarter percentage change in the exchange rates calculated as follows,

[15] This is applied in adjusting for the introduction of the euro in 1999, replacing the currencies of France and Germany in the twelve-currency basket by the euro.

[16] In such a currency union scenario, the TWI is based on the assertion that is the same as permanently fixing an independent country's exchange rate with the exchange rate of the anchor country.

[17] Given that exchange rate volatility is seen as the deviation from a predictable path, the random walk hypothesis postulates that any change in the exchange rate can be seen as volatility (Scrimgeour, 2001, 2002).

$$Var\ (\Delta TWI) = var\left(\sum_{i=1}^{k} w_i\, \Delta x_i\right) \tag{2}$$

where Δx_{i} is quarter-to-quarter percentage change in the individual exchange rate of the *i-th* currency in the TWI basket. The form in which the variance in equation (2) is estimated initiates from an arithmetic-weighted average of the TWI. This ensures that the assumption of fixed weights over time is invoked in a less complex and in an inclusively coherent derivation process. In this way, there is equality from equation (2) to (3) below,[18]

$$Var\ (\Delta TWI) = \sum_{i=1}^{k} var(w_i\, \Delta x_i) + \sum_{i \neq j}^{k} cov\left(w_i \Delta \mathrm{x}_i, w_j \Delta \mathrm{x}_j\right) \tag{3}$$

From equation (3) to (4) below, the weights are separated from the parenthesis given the fixed weight assumption.[19] The covariance (*cov*) term is included between exchange rates of country *i* and country *j*,

$$Var\ (\Delta TWI) = \sum_{i=1}^{k} w_i^2 var(\Delta x_i)\ + \sum_{i \neq j}^{k} w_i w_j cov\left(\Delta \mathrm{x}_i, \Delta \mathrm{x}_j\right) \tag{4}$$

In the derivation of the independent currency case, the above equation (4) can be applied. The argument is that the extent of exchange rate (TWI) volatility is determined by volatility encountered in the individual exchange rates' time series and the correlation of volatility among the exchange rates.[20] In the case of a currency union where there are four or more countries, then equation (4) is expanded as equation (5) below,

$$Var\ (\Delta TWI) = \sum_{i=1}^{k} w_i^2 var(\Delta x_i^* - \Delta x_1^*) + \sum_{i \neq j}^{k} w_i w_j cov\left(\Delta x_i^* - \Delta x_1^*, \Delta x_j^* - \Delta x_1^*\right) \tag{5}$$

[18] See also footnote 16 in Scrimgeour (2001).

[19] In effect, during weight drift, the weights affect the variance in a non-static manner and are included in the bracket term. See footnote 16 in Scrimgeour (2001).

[20] This implies that the TWI would experience low (or high) volatility, *ceteris paribus*, if one of the bilateral exchange rates has low (or high) volatility. Similarly, the extent of exchange rate (TWI) volatility would be low (or high), *ceteris paribus*, if one of the exchange rates showed low (or high) covariance.

where x_i^* represents the cross-rates as exchange rates. Equation (5) is appropriate for a currency union setup, where even after the union there remain four or more countries in the world to trade with. This suits our context. In our case, we consider a currency union with six and twelve major trading partners. As discussed earlier in the theoretical section, a currency union comprising of several major trading countries could lead to lower exchange rate volatility from the point of view of the independent currency. This is likely to occur when the covariances of the exchange rate series (cross-rates) are negative or closer to zero. If the world consisted of only a two-country currency union, then the TWI basket will consist of only one currency. Hence, $var(\Delta TWI) = var(\Delta x) = 0$, which implies that exchange rate volatility would be eliminated as the exchange rate is assumed to be constant.

A limitation of the above measure of volatility is implied by the following argument by Scrimgeour (2001, 2002). Take for example the Fijian dollar. In the case of the independent currency case without a currency union, the Fijian dollar can appreciate against, say, the Australian dollar while at the same time it depreciates against say the US dollar. This would not affect the TWI, which remains constant. Hence, this implies that the volatility of the TWI would be smaller than the trade-weighted volatility in an independent TWI. In practise, the Fijian dollar can appreciate against the Australian or US dollar simultaneously. This implies a converse effect in that volatility of the TWI would be greater than trade-weighted volatility in an independent TWI. An alternative measure should consider the trade-weighted sum of volatilities in individual exchange rates, instead of including covariances (Scrimgeour 2001, 2002), although this is beyond this analysis.

Cyclical Exchange Rate Volatility

Another measure of exchange rate volatility considered is the variance of the cyclical component of the exchange rate index extracted using the band-pass filter of Baxter and King (1999).[21] Although the business cycles for the Melanesian countries were about 8 to 16 quarters, this analysis adopts the 6 to 32 quarters proposed by Baxter and King (1999) because this analysis under different currency union scenarios includes developed countries (trading partners) that have varying business cycles.[22] This analysis used $K = 12$ for the order of the moving average to show some similarity with the cycles generated for similar advanced economies using a similar order

[21] See Baxter and King (1999) for further discussion.

[22] It should be noted that arguments about the duration of the business cycle or preferred filtering methods and so forth, is beyond this analysis.

(Scrimgeour, 2001, 2002). These specifications may have implications for our results. The use of the Baxter and King (1990) filter removes exchange rate variability at business cycle frequency by removing higher and lower frequency fluctuations.[23] In addition, it is noted that the differences in means in the different exchange rate series are likely to affect the variance of the band-pass filter's measure of the exchange rate cycle that could result in spurious differences in variances (Scrimgeour, 2001, 2002). Hence, prior to filtering the TWIs, each currency union based series is rescaled to arrive at similar means to that of the independent currency (base series). This adjustment is done by multiplying a constant to the series. The constant factor is equal to the mean of the base series divided by the mean of any one currency union based series.

4. EMPIRICAL RESULTS

This section presents evidence on whether short-term exchange rate volatility would be lower in a currency union under alternative currency union arrangements. While the focus is on the short-term volatility measure, cyclical volatility is also analysed. The analysis begins with the six-country trade weighted exchange rate indices (TWI6s). Further investigation is undertaken to evaluate whether changes in the calculation of the exchange rate series under different weighting structures and different baskets of currencies have implications on the initial findings. In addition, unit root tests (see Appendix A.2) based on the ADF test conducted shows that all the series in levels contained unit roots. The test shows that all the series are integrated of order one. The test was important in determining the extent of non-stationarity among the series, given our considerations for the quarter-to-quarter deviations in exchange rates, and de-trending the data using the band-pass filter.

Analysis based on the six-country basket

Figure 1 shows the TWI6s for the independent Melanesian countries in alternative currency union arrangements. It is widely known in the Pacific region that exchange rates of Pacific Island economies (Melanesia) are highly unstable and prone to shocks which have implications on exchange rate volatility. Figure 1 illustrates a gradual depreciation of most of the independent

[23] It is known that the effect of exchange rate volatility on international trade can be minimised if exchange rate uncertainty is mitigated or resolved by hedging exposures (Scrimgeour, 2001, 2002). Since business trading contracts are generally long-term, businesses are often uncertain about the timing of their foreign exchange rate transactions (McKenzie, 1999, Brookes et al. 2000). This has implications on the longer-term volatility and thus hedging may be less effective. Hence, applying a filtering method such as the Baxter and King (1999) filter can do away with variability at business cycle frequency by eradicating high frequency fluctuations outside the business cycle, i.e., at higher frequencies than the business cycle. It also removes low frequency components of the cycle beyond the business cycle, i.e., at frequencies lower than the business cycle.

currencies of the Melanesian countries since 1980. Only Fiji's currency shows imminent signs of revaluations towards 1984 but showed subsequent devaluation during the coups of 1987, followed by a currency devaluation in 1998.[24] PNG floated its currency in late 1994 and had since seen general depreciation in its currency which stabilises towards 2002.[25] Figure 1 also shows that the general trend in depreciation would have been similar had the Melanesian countries, particularly Solomon Islands and Vanuatu, formed a monetary union with Japan.[26] However, under the Japanese union, the yen would have appreciated towards 2000.

According to the weights of our six-currency basket based on trade flows, Australia is the most important trading partner, except for Vanuatu, where Japan holds the highest weight.[27] Japan is the second largest trading partner for most of the other Melanesian countries. Ideally, this implies that the Australian dollar and the Japanese yen are the preferable currencies to adopt. Bowman (2005) argued that Asia is likely to be a dominant trading partner besides Australia for PICs and thus a currency union in the Pacific should consider the US dollar as a possible anchor rather than the Australian dollar. Our findings for short-term exchange rate and cyclical volatility for the TWI6s are presented in Table 1. Although lower volatility was observed for the independent currencies of Fiji and Vanuatu, their volatility would have been relatively high if their respective currency devaluations were unadjusted. This points to an important argument of the OCA theory; when countries enter into a currency union, a stable and competitive currency anchor can act as a buffer against the effects of shocks on the exchange rate, and thus reduce exchange rate volatility. The outcome shows that lower exchange rate volatility is highly predominant in a currency union with either Australia or New Zealand for the TW16s, apart from the United States in Vanuatu's case. The same can be said for the TWI12s and cyclical volatility. More specifically, evidence shows that for PNG and Solomon Islands, short-term exchange rate volatility is relatively low in a currency union with New Zealand under the TWI16s. This is despite the fact that Australia is

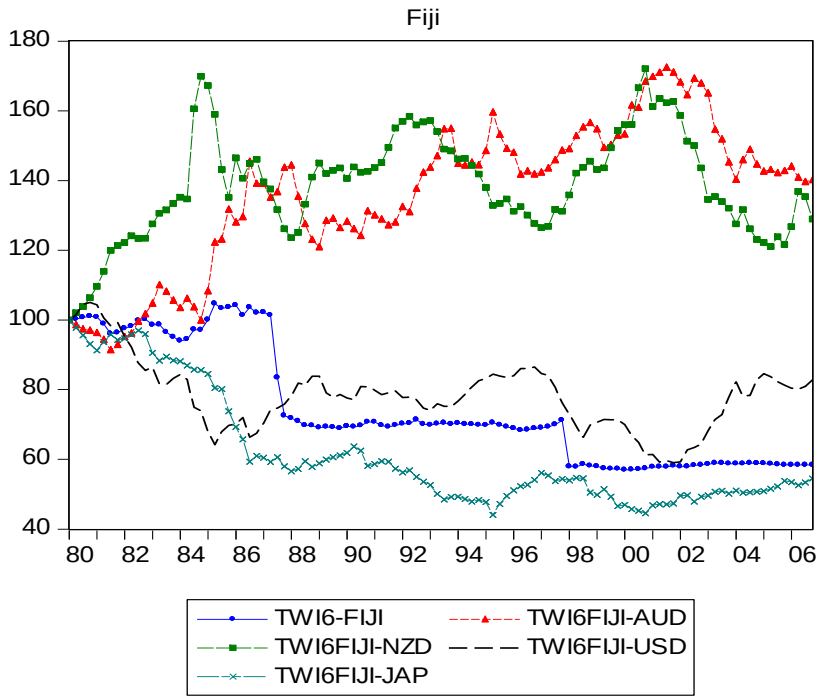
[24] The Fiji exchange rate series showed drastic devaluations in 1987 (third and fourth quarters) as a result of the coups, and also in 1998 (first quarter). To mitigate the effects on overall exchange rate volatility, the series for the specific periods were omitted.

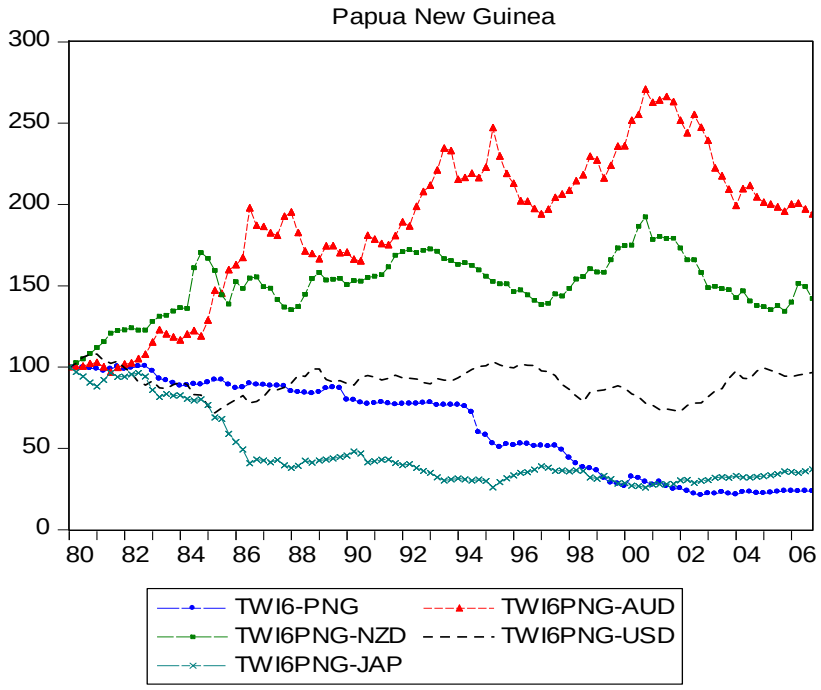
[25] As noted earlier, calculation of exchange rate volatility for PNG starts from 1995:1 onwards, the period immediately after the currency was floated in late 1994.

[26] In the case of the Solomon Islands, calculation of exchange rate volatility started from 1983:1 after the country introduction a currency basket. The effect of the currency devaluation in 1998:1 was also omitted. In Vanuatu's case, the periods 1985 to 1986, and 1998 were omitted as several devaluations were undertaken during these periods.

[27] Since the weights are based on the average of 1980 to 2006 total trade flows, the relative importance of each country could vary depending on the selected period for calculating the weights. For example, choosing the average of 1980 to1990 trade flows, or more recently 2000 to 2006 weights could mean that the relative importance of each country could vary.

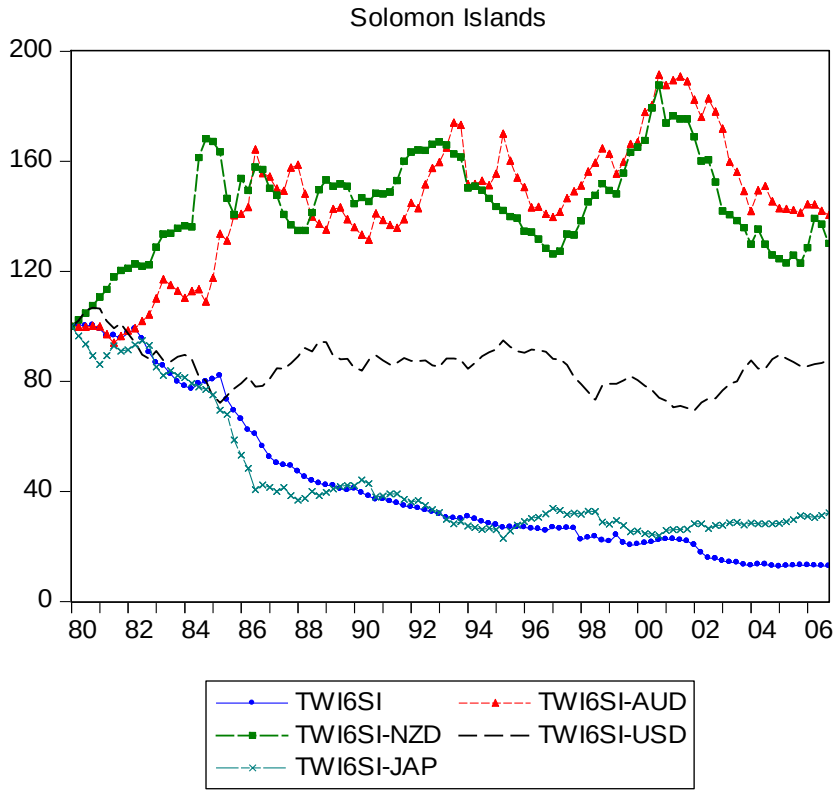
Figure 1: Independent and Hypothetical TWI6s under Alternative Currency Unions - Level Series

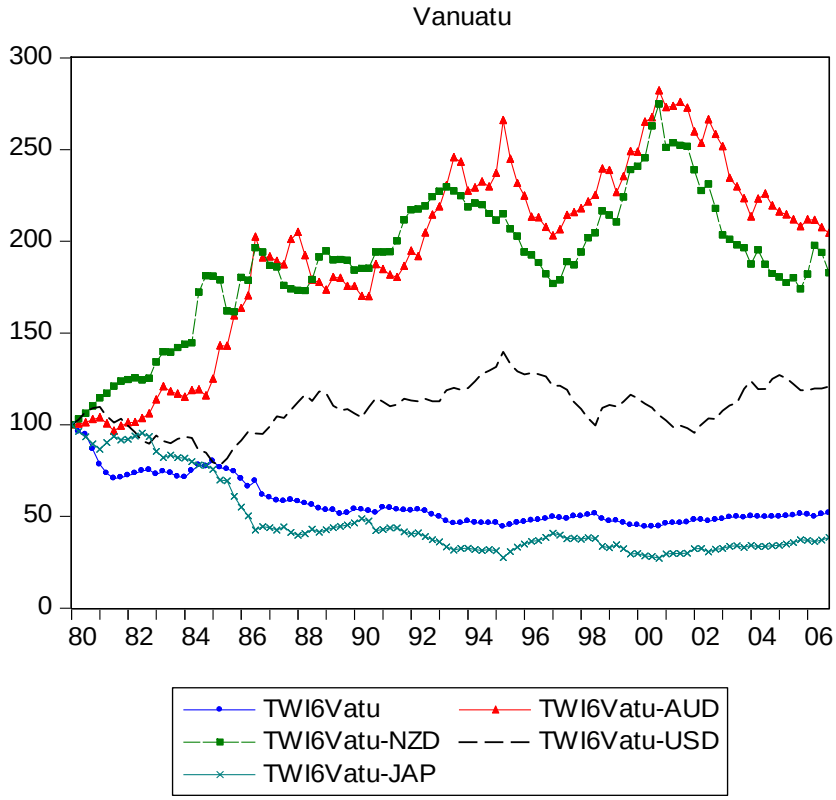




the most important trading partner for both PNG and the Solomon Islands. Further investigation shows that the estimate for the weighted variance between AUD/USD and AUD/JYP cross-rates is slightly higher when the PNG and the Solomon Islands are in a union with Australia. This contributes to an increase in the overall volatility. A similar case can be said for Vanuatu

Cont…Figure 1





whose main trading partner is Japan but, in terms of lower volatility, the US dollar is the preferred anchor currency. In addition, the findings for cyclical volatility are shown in Table 1, while the business cycle component of the exchange rate is illustrated in Appendix A.5. Table 1 shows that lower cyclical volatility for TWI6s is evident for Fiji and PNG in a currency union with Australia. This is the same for TWI12s.

The results also show that volatility is relatively low under the independent currency in the case of Vanuatu, during the business cycle fluctuations. This holds even under different baskets of currencies. It is unclear whether the approach taken in de-trending the series based on the band-pass filter specifications has implications on the results. Moreover, the sample generalised variance test (Anderson, 1957; see Appendices A.1, A.3) is applied to determine whether the variance of the independent TWI6 series versus the series under alternative anchor currencies with Australia, New Zealand, Japan and United States are the same. One of the main results is the rejection of the null of equal variance for the independent cases for all Melanesian countries against being in a currency union with Australia, respectively. Based on the outcomes in Table 1, only the Solomon Islands estimate appears significantly different.

Sensitivity Analysis - Different Weighting Schemes, Different Baskets of Currencies

To assess the robustness of our earlier findings based on the series with the six-country basket, further analysis was conducted considering different weights and different basket of currencies. This part of analysis drew from the twelve-country trade-weighted series, TWI12. In addition, both the CTWI6 and CTWI12 series, composed of both the trade and nominal GDP weights, under the six and twelve country baskets are analysed. Initial results based on the TWI12 series were briefly mentioned earlier to highlight similar outcomes with those based on the TWI6 series. From the weights of the CTWI6 and CTW12 series, the United States becomes the most important partner for most of the countries except Vanuatu, where Japan continues to hold the highest weight, even in the CTWI12 series. PNG's weight shifts to Australia as the most important partner only in the CTW12 series. Hence, the analysis for the CTWI6 and CTWI12 series would have implications on the previous findings, especially where there are shifts in the relative importance of trading partners. The correlation coefficients between the independent TWI6s and the CTWI6s, and between the TWI12s and the CTWI12s, were between 0.98 to 0.99[28] indicating almost perfect linear relationships respectively.

[28] On the basis of the earlier findings, similar correlation coefficients were found between Fiji and PNG under a currency union with Australia amongst all the indices. This was the same when compared under a currency

Table 1: Short-Term and Cyclical Exchange Rate Volatility under Alternative Currency Union Arrangements - TWI6s and TWI12s

Alternative Currency Unions	Short-term Volatility		Cyclical Volatility	
	TWI6	TWI12	TWI6	TWI12
Independent Currency				
FIJI	2.10*	1.44*	29.69	29.72
PNG[a]	14.26	10.26	55.19	57.80
S.I.	6.61	5.33	32.45	34.00
Vatu.	4.77	3.41	12.86*	7.38*
Currency Union with Australia[b]				
FIJI	4.41	3.38	15.38*	16.95*
PNG[a]	6.68	4.22*	21.38*	18.20*
S.I.	5.29	3.94	16.22	15.41
Vatu.	9.62	6.98	23.68	22.55
Currency Union with New Zealand[c]				
FIJI	2.36	3.61	16.46	18.79
PNG[a]	3.66*	4.33	46.30	18.23
S.I.	3.67*	3.46	14.86	13.25*
Vatu.	7.09	5.62	19.98	20.47
Currency Union with USA				
FIJI	13.98	7.95	26.53	27.02
PNG[a]	10.23	7.15	27.20	26.75
S.I.	7.58	3.67	12.09*	18.05
Vatu.	4.41*	3.07*	16.02	17.65
Currency Union with Japan				
FIJI	6.62	3.87	29.35	81.31
PNG[a]	7.28	4.64	71.80	64.97
S.I.	4.92	3.19*	65.42	61.00
Vatu.	8.70	3.22	65.97	68.59

Notes

* Represents the lowest volatility point estimates; PNG = Papua New Guinea; S.I. = Solomon Islands; Vatu = Vanuatu.

[a] The sample for PNG under independent and alternate currency unions starts from 1995:1. This represents the period immediately after the currency was floated in November, 1994.

[b] The sample under Australian dollar as anchor currency, begins from 1984:1, the period immediately after the currency was floated.

[c] The sample for NZ starts from 1985:2 immediately after the NZ dollar was floated in March 1985.

Figures in Appendix A.6 and A.7 illustrate the associations between TWI6 and TWI2, and TWI6 and CTWI6. For clarity, a number of alternative currency unions have been omitted.

union with Japan. Likewise, the Solomon Islands and Vanuatu under a union with Japan had same correlations. In Vanuatu's case, the correlation was 0.98 under a currency union with the United States.

Table 2: Short-Term and Cyclical Exchange Rate Volatility under Alternative Currency Union Arrangements - CTWI6s and CTWI12s

Proposed Monetary Unions	Short-term Volatility		Cyclical Volatility	
	CTWI6	CTWI12	CTWI6	CTWI12
Independent Currency				
FIJI	2.11	1.29*	26.98	26.82
PNG[a]	13.97	8.46	60.46	61.50
S.I.	5.90	4.31	28.64	36.49
Vatu.	4.41	2.44	11.69	7.63
Currency Union with Australia[b]				
FIJI	2.46	2.27	19.31*	19.95
PNG[a]	4.08	2.72	23.08	16.68*
S.I.	3.59	2.74	16.15	15.32
Vatu.	5.35	3.99	23.22	23.02
Currency Union with New Zealand[c]				
FIJI	1.71*	2.08	22.17	19.69*
PNG[a]	2.42	2.39	17.10*	22.17
S.I.	2.73	2.38	17.51	14.08*
Vatu.	4.30	3.40	10.79*	6.03*
Currency Union with USA				
FIJI	5.58	3.82	22.53	24.70
PNG[a]	4.20	3.73	22.11	22.06
S.I.	4.07	4.41	14.04*	16.54
Vatu.	2.57*	2.63	17.29	19.71
Currency Union with Japan				
FIJI	2.02	2.07	72.87	72.23
PNG[a]	2.06*	2.02*	60.80	66.24
S.I.	1.73*	1.97*	56.10	52.31
Vatu.	4.85	2.25*	59.29	60.05

Notes: See Table 1.

As shown in Tables 1 and 2, increasing the basket of currencies from six to twelve results in lower exchange rate volatility, in particular, short-term volatility. This is because all the Melanesian countries have very few important trading partners; most of them are reflected in the six-currency basket. As noted earlier, as more currencies become less important, the likelihood for volatility reduction increases in a currency union. Further inspection of the data shows that in the twelve-country cases, weighted variances among the bilateral exchange rates between the respective Melanesian countries and their important trading partners are lower than in the six-country analysis. It is also apparent that the effect of the covariances on volatility appears relatively low in all cases. In the overall analysis for the TWI12 indices, lower volatility appears

predominant in a union with Australia or New Zealand, although the US dollar anchor resulted in low volatility in Vanuatu's case. A similar outcome is evident in the six-country basket analysis. However, the specific differences relate to PNG and the Solomon Islands, whose lowest volatility estimates are evident in a union with Australia and Japan respectively. For PNG, this was consistent with the findings for cyclical volatility in both TWI6s and TWI12s.

Moreover, according to the analysis of the CTWI6 and CTWI12 indices, adopting the Japanese yen as anchor currency results in relatively lower short-term volatility for most of the countries, especially regarding the CTWI12s. This may point to Bowman's (2005) arguments that Asia, comprising Japan, is likely to overtake Australia as the predominant trading partner for PICs. However, this is in contrast to the higher cyclical volatility for the corresponding indices. As noted earlier, due to shifts in relative importance of trading partners because of changes in the weights, the findings are inconsistent with the earlier results for most of the countries. However, as observed in the earlier analysis, it is apparent that cyclical volatility is relatively lower in a currency union with either Australia or New Zealand.

Appendix A.3 presents the results for the sample generalised variance test following from the outcome of the volatility estimates in Table 2. The tests are performed to ascertain whether the variability of the exchange rates of independent member countries of Melanesia weighted by trade and GDP, and based on a basket of currencies of 6 trading partners, is the same as the variability of the exchange rate under similar weights but based on a currency basket of 16 trading partners, and an anchor currency - New Zealand, Japan or USA. A similar test is conducted under a 12 currency basket for the independent countries against similar weights and currency basket, but on the basis of the Japan as the anchor currency. The test results were not significant suggesting that there are differences in the variances of the exchange rates for the independent cases of Fiji, PNG and the Solomon Islands against the Japanese yen as the anchor currency, and the New Zealand dollar in the case for Fiji. This reaffirms the earlier findings that short-term volatility is lower in a currency union with Japan, especially for PNG, the Solomon Islands and Vanuatu in terms of the CTWI12 series, and PNG and Solomon Islands pertaining to the CTWI6 series.

5. CONCLUSION

This paper analyses an appropriate choice of anchor currency for the Melanesian countries under alternative currency union arrangements. Drawing from the OCA theory in connection to

exchange rate volatility and trade flows, the choice of anchor currency and the cost and benefits of a currency union, the analysis focuses on the effects of a currency union on exchange rate volatility. The analysis follows a similar approach by Scrimgeour (2001, 2002). While the focus is on the short-term exchange rate volatility, cyclical volatility is also analysed. Newly constructed trade-weighted nominal exchange rate indices based on six major trading partners are initially analysed. Further investigation was undertaken using different weighting structures and different baskets of currencies to assess implications on the initial findings. The overall findings suggests that, both short-term and cyclical exchange rate volatility are generally lower in a currency union with either Australia or New Zealand for the majority of the Melanesian countries. However, the results vary to some extent from the individual country perspective when analysed under varying weights and currency baskets. Under a combined trade and GDP weighted basket of currencies, particularly the twelve-currency basket, entering into a currency union with Japan would have resulted in low volatility. However, this contrasts with higher cyclical volatility. Lastly, this study notes that choosing a single common anchor currency based solely on exchange rate volatility may not be conclusive. Further research is required, for example, in analysing the effects of currency union on volatility in output, inflation and interest rates.

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Appendix A.1

Sample Generalised Variance Test

The sample generalised test (Anderson, 1957) is appropriate for our purpose given that the assumptions underlying most standard tests for two variances (e.g., F-test) are not likely to hold (Scrimgeour (2001, 2002). For instance, our samples are unlikely to be independent and neither are they likely to be drawn from populations that are normally distributed. The sample generalised test is applied to determine the equality of the two variances based on the samples drawn from the quarter-to-quarter percentage change and the cyclical series. Scrimgeour (2001, 2002) has also applied this test. Thus, the null and alternative hypothesis where σ is the population variance is given as,

$$H_0: \sigma_1^2 = \sigma_2^2 \quad \text{against} \quad H_a: \sigma_1^2 \neq \sigma_2^2$$

The test-statistic for H_0 is,

$$2(N-1)\sqrt{\frac{S_1^2 S_2^2 - S_{12}^2}{\sigma_1^2 \sigma_2^2 - \sigma_{12}^2}} \qquad (A1.1)$$

with a chi-square distribution, $\chi^2_{(2N-4)}$, under the null hypothesis. *N* represents the sample size, S_1 and S_2 are the respective variances for the two samples and S_{12}^2 is the sample covariance. Given that the population variances and the covariance are unknown, the approximation approach of Scrimgeour (2001, 2002) is applied. This procedure approximates the parameters for the population variance and the covariance by the following procedures,

$$\sigma_i^2 = \bar{S}_i^2 = (1/N-m)\sum_{k=1}^{m}(n_k - 1)S_{i,k}^2 \qquad (A1.2)$$

$$\sigma_{12}^2 = \bar{S}_{12}^2 = (1/N-m)\sum_{k=1}^{m}(n_k - 1)S_{12,k}^2 \qquad (A1.3)$$

Initially, the sample is divided into *m* subsamples of *k = 1…m* with size n_k. In our case, *m* is six when *N* is 108. Although it is unclear how *m* was derived by Scrimgeour (2001), *m* was chosen by adjusting the corresponding weight based on *N* = 65 and *m* = 8 by Scrimgeour (2001) so that each subsamples had equal length.

Appendix A.2 - ADF Unit Root Test Results

ln(TWIs): N=1980:1 to 2006:4				
Series by Country	ADF [a] (p-value)		Conclusion	Decision on Order of Integration at levels
	Levels -(Constant & Trend)	1st-Diff - (Constant)		
TWI6				
FIJI	0.45	0.00	Do not reject H_o	*I(1)*
PNG[b]	0.66	0.00	Do not reject H_o	*I(1)*
S.I	0.29	0.00	Do not reject H_o	*I(1)*
Vatu.	0.58	0.00	Do not reject H_o	*I(1)*
TWI12				
Fiji	0.43	0.00	Do not reject H_o	*I(1)*
PNG[b]	0.58	0.00	Do not reject H_o	*I(1)*
S.I	0.29	0.00	Do not reject H_o	*I(1)*
Vatu	0.15	0.00	Do not reject H_o	*I(1)*
CTWI6				
Fiji	0.73	0.00	Do not reject H_o	*I(1)*
PNG[b]	0.75	0.00	Do not reject H_o	*I(1)*
S.I	0.45	0.00	Do not reject H_o	*I(1)*
Vatu	0.45	0.00	Do not reject H_o	*I(1)*
CTWI12				
Fiji	0.62	0.00	Do not reject H_o	*I(1)*
PNG[b]	0.60	0.00	Do not reject H_o	*I(1)*
S.I	0.35	0.00	Do not reject H_o	*I(1)*
Vatu.	0.25	0.00	Do not reject H_o	*I(1)*
TWI6-AUD[c]				
Fiji	0.72	0.00	Do not reject H_o	*I(1)*
PNG	0.96	0.00	Do not reject H_o	*I(1)*
S.I	0.87	0.00	Do not reject H_o	*I(1)*
Vatu.	0.97	0.00	Do not reject H_o	*I(1)*
TWI12-AUD[c]				
Fiji	0.56	0.00	Do not reject H_o	*I(1)*
PNG	0.94	0.00	Do not reject H_o	*I(1)*
S.I	0.84	0.00	Do not reject H_o	*I(1)*
Vatu	0.96	0.00	Do not reject H_o	*I(1)*
CTWI6-AUD[c]				
Fiji	0.82	0.00	Do not reject H_o	*I(1)*
PNG	0.95	0.00	Do not reject H_o	*I(1)*
S.I	0.81	0.00	Do not reject H_o	*I(1)*
Vatu	0.96	0.00	Do not reject H_o	*I(1)*
CTWI12-AUD[c]				
Fiji	0.68	0.00	Do not reject H_o	*I(1)*
PNG	0.92	0.00	Do not reject H_o	*I(1)*
S.I	0.73	0.00	Do not reject H_o	*I(1)*
Vatu.	0.32	0.00	Do not reject H_o	*I(1)*
TWI6-NZD[d]				
Fiji	0.15	0.00	Do not reject H_o	*I(1)*
PNG	0.24	0.00	Do not reject H_o	*I(1)*
S.I	0.30	0.00	Do not reject H_o	*I(1)*
Vatu.	0.63	0.00	Do not reject H_o	*I(1)*
TWI12-NZD[d]				
Fiji	0.13	0.00	Do not reject H_o	*I(1)*
PNG	0.23	0.00	Do not reject H_o	*I(1)*
S.I	0.64	0.00	Do not reject H_o	*I(1)*
Vatu	0.90	0.00	Do not reject H_o	*I(1)*

Cont… Appendix A.2

CTWI6-NZD[d]				
Fiji	0.06	0.00	Do not reject H_o	*I(1)*
PNG	0.09	0.00	Do not reject H_o	*I(1)*
S.I	0.05	0.00	Do not reject H_o	*I(1)*
Vatu	0.12	0.00	Do not reject H_o	*I(1)*
CTWI12-NZD[d]				
Fiji	0.10	0.00	Do not reject H_o	*I(1)*
PNG	0.11	0.00	Do not reject H_o	*I(1)*
S.I	0.17	0.00	Do not reject H_o	*I(1)*
Vatu.	0.15	0.00	Do not reject H_o	*I(1)*
TWI6-USD				
Fiji	0.17	0.00	Do not reject H_o	*I(1)*
PNG	0.14	0.00	Do not reject H_o	*I(1)*
S.I	0.13	0.00	Do not reject H_o	*I(1)*
Vatu.	0.19	0.00	Do not reject H_o	*I(1)*
TWI12-USD				
Fiji	0.17	0.00	Do not reject H_o	*I(1)*
PNG	0.19	0.00	Do not reject H_o	*I(1)*
S.I	0.17	0.00	Do not reject H_o	*I(1)*
Vatu	0.20	0.00	Do not reject H_o	*I(1)*
CTWI6-USD				
Fiji	0.09	0.00	Do not reject H_o	*I(1)*
PNG	0.13	0.00	Do not reject H_o	*I(1)*
S.I	0.11	0.00	Do not reject H_o	*I(1)*
Vatu	0.21	0.00	Do not reject H_o	*I(1)*
CTWI12-USD				
Fiji	0.16	0.00	Do not reject H_o	*I(1)*
PNG	0.21	0.00	Do not reject H_o	*I(1)*
S.I	0.16	0.00	Do not reject H_o	*I(1)*
Vatu.	0.22	0.00	Do not reject H_o	*I(1)*
TWI6-JYP				
Fiji	0.91	0.00	Do not reject H_o	*I(1)*
PNG	0.89	0.00	Do not reject H_o	*I(1)*
S.I	0.91	0.00	Do not reject H_o	*I(1)*
Vatu.	0.89	0.00	Do not reject H_o	*I(1)*
TWI12-JYP				
Fiji	0.91	0.00	Do not reject H_o	*I(1)*
PNG	0.90	0.00	Do not reject H_o	*I(1)*
S.I	0.92	0.00	Do not reject H_o	*I(1)*
Vatu	0.71	0.00	Do not reject H_o	*I(1)*
CTWI6-JYP				
Fiji	0.88	0.00	Do not reject H_o	*I(1)*
PNG	0.87	0.00	Do not reject H_o	*I(1)*
S.I	0.87	0.00	Do not reject H_o	*I(1)*
Vatu	0.87	0.00	Do not reject H_o	*I(1)*
CTWI12-JYP				
Fiji	0.90	0.00	Do not reject H_o	*I(1)*
PNG	0.90	0.00	Do not reject H_o	*I(1)*
S.I	0.91	0.00	Do not reject H_o	*I(1)*
Vatu.	0.90	0.00	Do not reject H_o	*I(1)*

[a] ADF test is based on the Akaike Information Criteria; PNG = Papua New Guinea; S.I. = Solomon Islands; Vatu = Vanuatu; [b] Similar ADF test result for PNG based on sample 1995:1 to 2006:4 also show that the series is *I*(1) in levels; [c] ADF test result for the Australian sample from 1984:1 to 2006:4 also show that the series is *I*(1) in levels; [d] ADF test outcome for the sample for NZ starts from 1982:2 to 2006:4. The series is also *I*(1) in levels.

Appendix A.3: Sample Generalised Variance Test: Independent Currency (TWI6s) against Alternate Currency Union Arrangements (TWI6s)

$H_o: \sigma_1^2 = \sigma_2^2$	Test Statistic[1]	Conclusion
Fiji		
TWI6 vs TWI6-AUD	610.42**	*Reject H_o*
TWI6 vs TWI6-NZD	204.99	*Do not Reject H_o*
TWI6 vs TWI6-USD	183.92	*Do not Reject H_o*
TWI6 vs TWI6-JYP	388.66**	*Reject H_o*
PNG		
TWI6 vs TWI6-AUD	308.13**	*Reject H_o*
TWI6 vs TWI6-NZD	216.01	*Do not Reject H_o*
TWI6 vs TWI6-USD	241.47*	*Reject H_o*
TWI6 vs TWI6-JYP	303.03**	*Reject H_o*
S.I.		
TWI6 vs TWI6-AUD	365.48**	*Reject H_o*
TWI6 vs TWI6-NZD	803.78**	*Reject H_o*
TWI6 vs TWI6-USD	235.36	*Do not Reject H_o*
TWI6 vs TWI6-JYP	363.83**	*Reject H_o*
Vatu.		
TWI6 vs TWI6-AUD	242.75*	*Reject H_o*
TWI6 vs TWI6-NZD	237.45	*Do not Reject H_o*
TWI6 vs TWI6-USD	169.72	*Do not Reject H_o*
TWI6 vs TWI6-JYP	225.77	*Do not Reject H_o*

Appendix A.4: Sample Generalised Variance Test: Independent Currency (CTWI6s) against Alternate Currency Union Arrangement (CTWI12s)

$H_o: \sigma_1^2 = \sigma_2^2$	Test Statistic[1]	Conclusion
FIJI		
CTWI6 vs CTWI6-NZD	311.40**	*Reject H_o*
CTWI12 vs CTWI12-JYP	322.49**	*Reject H_o*
PNG		
CTWI6 vs CTWI6-JYP	302.65**	*Reject H_o*
CTWI12 vs CTWI12-JYP	584.83**	*Reject H_o*
S.I.		
CTWI6 vs CTWI6-JYP	343.34**	*Reject H_o*
CTWI12 vs CTWI12-JYP	374.36**	*Reject H_o*
Vatu.		
CTWI6 vs CTWI6-USD	165.25	*Do not Reject H_o*
CTWI12 vs CTWI12-JYP	227.55	*Do not Reject H_o*

Notes for Appendix A.3 and A.4

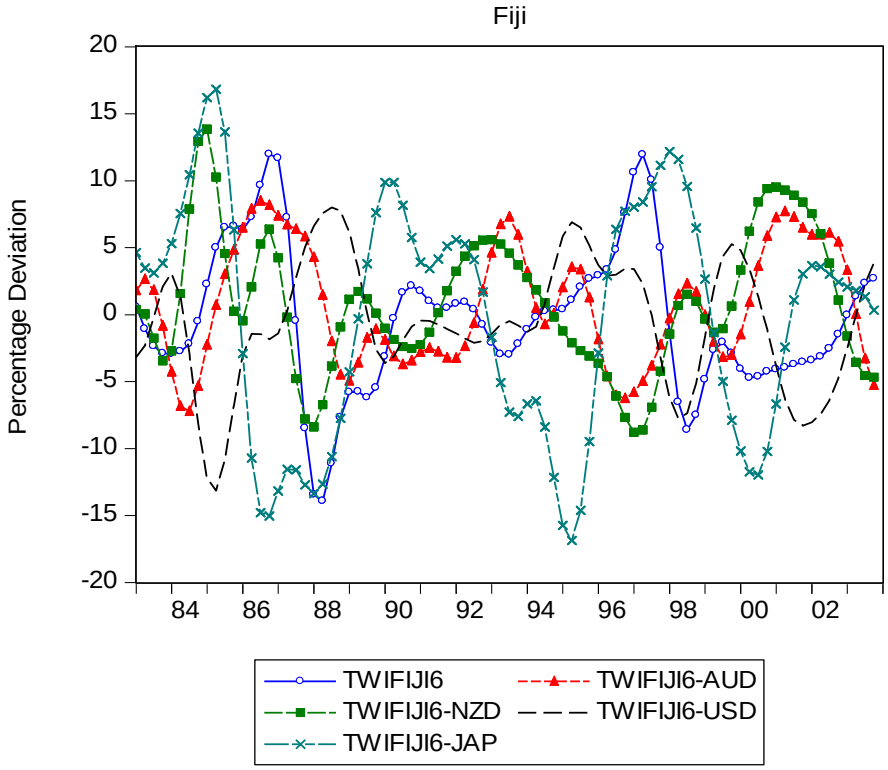
.$\chi^2_{(212)}$ critical values are 246.968 @ 5% and 238.78 @ 10% significance levels respectively

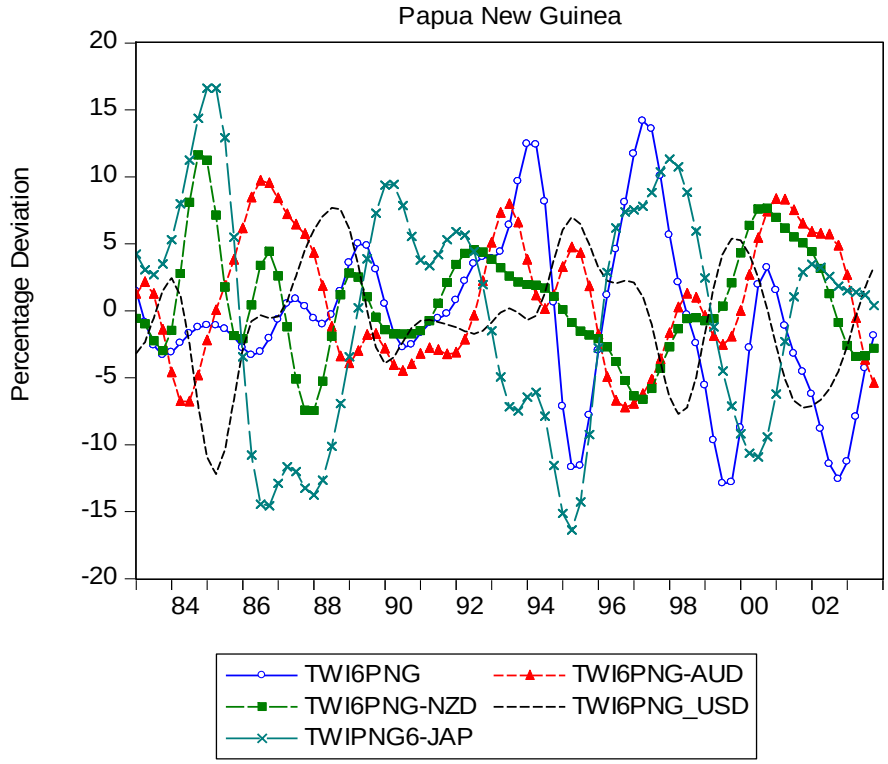
[1] ** and * denotes 5% and 10% significance levels respectively

PNG = Papua New Guinea; S.I. = Solomon Islands; Vatu = Vanuatu.

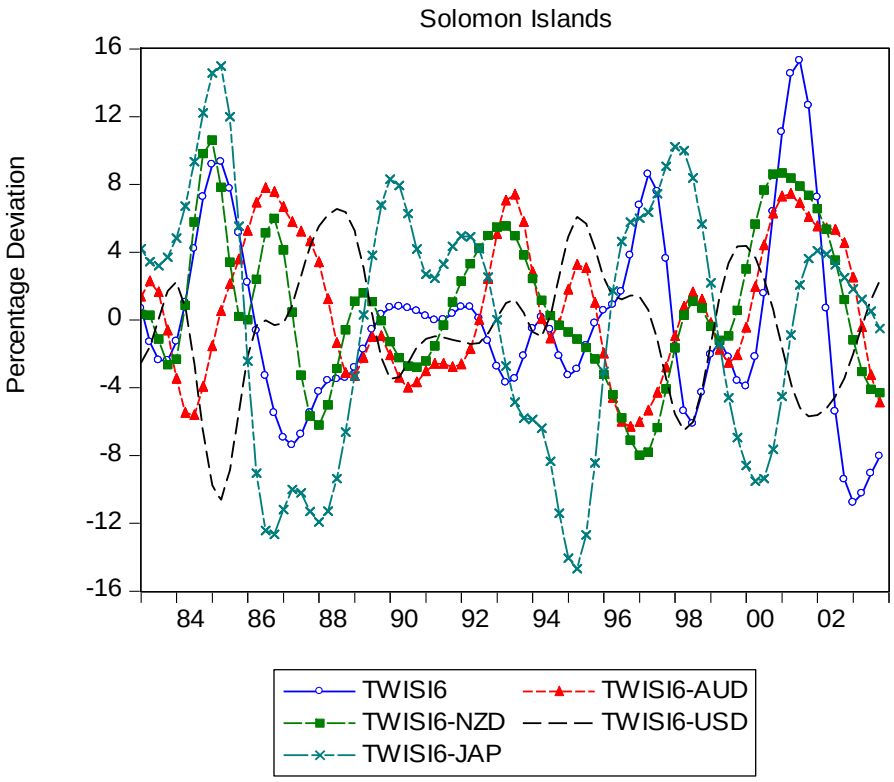
Appendix A.5

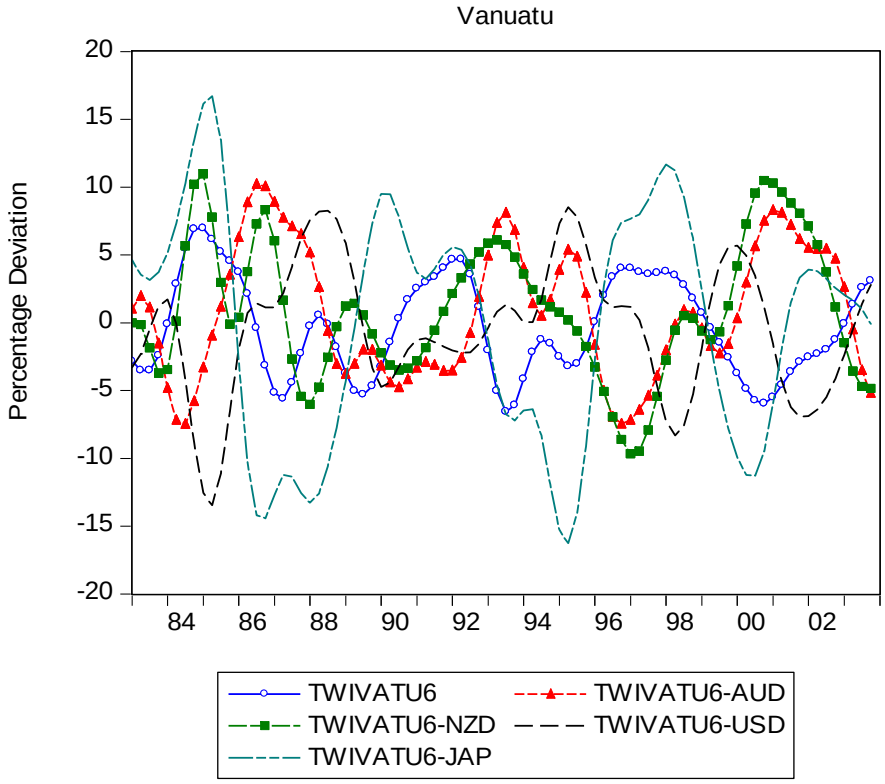
Business Cycle Component of the Independent and HypotheticalTWI6s under Alternative Currency Unions





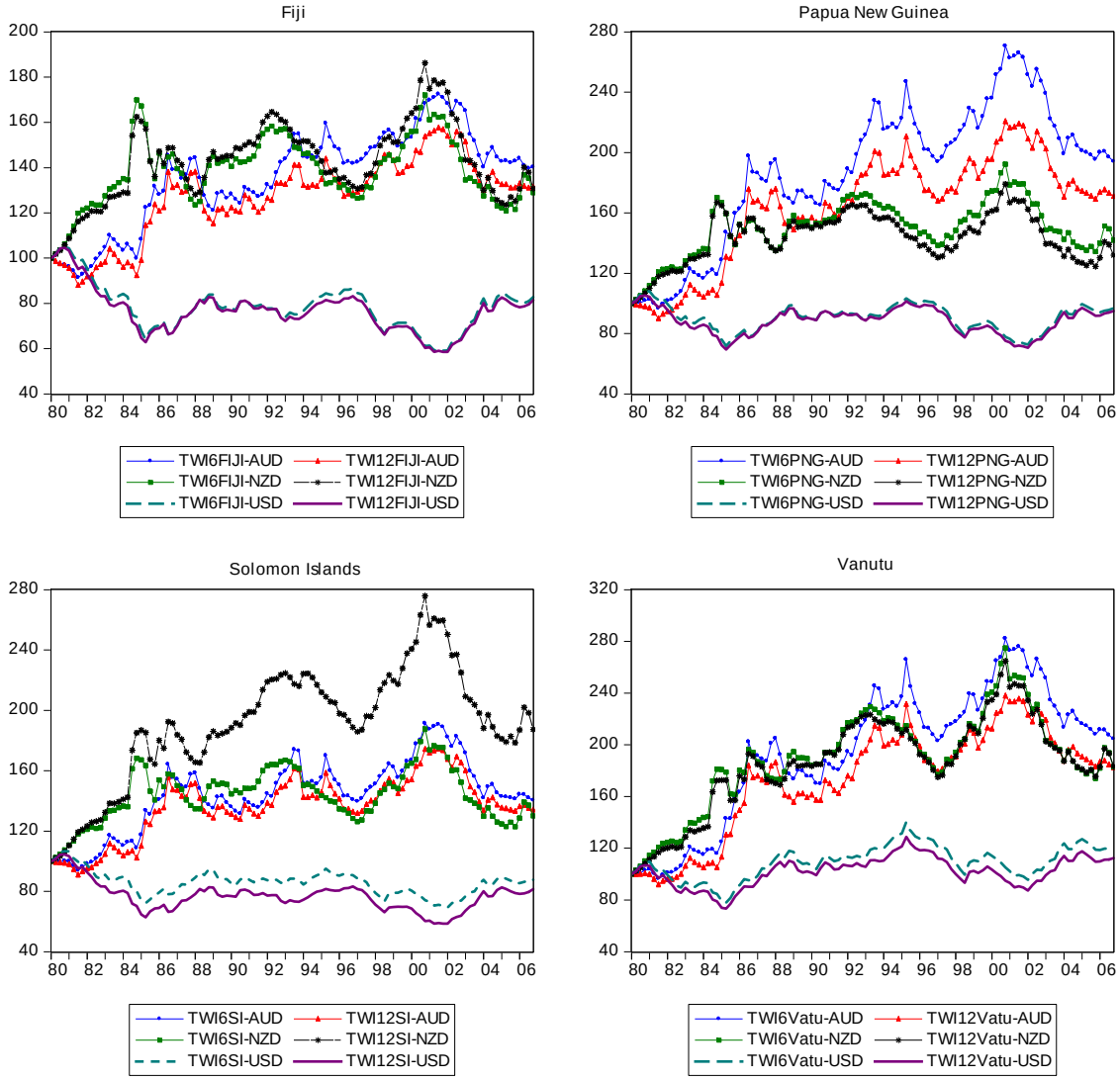
Cont… **Appendix A.5**





Appendix A.6

TWI6s and TWI12s in Independent and Selected Hypothetical Currency Unions



Appendix A.7

TWI6s and CTWI6s in Independent and Selected Hypothetical Currency Unions