CO-MOVEMENT TOWARDS A CURRENCY OR MONETARY UNION? AN EMPIRICAL STUDY FOR NEW ZEALAND

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This paper analyses whether New Zealand would be ready to form a currency or monetary union with either Australia, the 11 EU countries that are members of the EMU, Japan, or the US, if the criteria that have been used by researchers for the EMU are applied. The analysis is an empirical study with data from the mid 1980s to 1998, using cointegration techniques to search for co-movement and convergence in key economic variables: interest rates, inflation rates, exchange rates, real GDP, and current-account/GDP ratios.

I. Introduction

Recently, New Zealand politicians have been debating the issue of forming a currency or a monetary union between New Zealand and one or more of the major trading partners. A monetary union refers usually to a union using the same currency, and a true currency union to a union that irrevocably fixes exchange rates among members but allows for different currencies within the union. Compared to a currency union, a monetary union may be preferable because it does not face a potential credibility problem as to whether currencies are fixed irrevocably or adjustments will eventually be made.

Some economists have argued that a currency or monetary union promotes trade because it eliminates exchange rate volatility (see, e.g., Mundell, 1997). However, there is no hard empirical evidence that shows that exchange rate volatility has a significant negative effect on trade flows (see, e.g., Gagnon, 1992, and the critical comments to a paper of Rose (2000, pp. 34–46) by Lockwood, Quah, and others). The decision to form a monetary or currency union is often dominated by political reasons.

Traditional theory on optimal currency areas suggests that the degree of factor mobility (Mundell, 1961), of trade integration (McKinnon, 1963), and the similarity of regional production patterns (Kenen, 1969) should be the relevant criteria to assess the readiness to form a currency or monetary area. However, data at disaggregated levels are not readily available and an empirical analysis is therefore difficult. Instead, the 1991 Maastricht Treaty

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(1992) spelled out the criteria for membership of EU countries in the Economic and Monetary Union (EMU), which started in January of 1999: Long term interest rates and inflation rates not more than 2 per cent and 1.5 per cent, respectively, above the average of the three countries with the lowest inflation rates; no devaluation of its currency in the two years preceding the entrance into the union; and government deficits and debts not exceeding 3 per cent and 60 per cent of the GDP, respectively.

These criteria are easily understandable and verifiable. However, it is debatable whether these criteria are meaningful in an economic sense. The answer depends on the underlying macroeconomic model that one has in mind. In a related paper (Haug, MacKinnon, and Michelis, 2000), we explored the question of an EMU among the 12 original EU members, taking the above criteria as given and applying cointegration techniques. The EMU is part of a gradual approach to a monetary union. In 1979, the European Monetary System (EMS) with an Exchange Rate Mechanism (ERM) to tie exchange rates within certain bands was put in place. The idea was to progressively increase coordination of monetary and fiscal policies before the start of the EMU. This gradual approach to a monetary union faced several crises. In September of 1992, for example, Italy and the UK were forced out of the ERM.

In this paper, I explore the possibility of New Zealand forming a currency or monetary union from an empirical point of view. On a theoretical level, it is debatable whether a currency or monetary union is desirable. Hargreaves and McDermott (1999) have provided a discussion of the advantages and disadvantages of a union for New Zealand. I try to answer instead the empirical question of whether New Zealand would be ready for a union based on the criteria that several researchers have applied to the EU countries to assess readiness for the EMU. I explore the degree of co-movement in economic variables among potential partner countries. Karfakis and Moschos (1990) have studied interest rate co-movements for European countries with cointegration techniques, whereas Hafer, Kutan, and Zhou (1997) have applied these techniques to the term spread of interest rates of EMS countries. Artis and Nachane (1990) have studied co-movements (cointegration) of inflation rates across EMS and non-EMS countries. MacDonald and Taylor (1991) have tested for cointegration among three European countries for nominal and real exchange rates and also for money supplies. Hafer and Kutan (1994) have also performed similar cointegration tests for European countries and in addition analysed their data for policy convergence, i.e., the degree of co-movement. Serletis and Krichel (1992) have studied convergence by testing for cointegration of real output among EU countries. However, there is no consensus as to which criteria are to be used, and I therefore apply a broad range of them. For this range of criteria, I study four potential currency or monetary unions: New Zealand with Australia, New Zealand with the 11 EMU member countries, New Zealand with Japan, and New Zealand with the US. These are major trading partners of New Zealand. The political debate has focused mainly on a union with Australia, but it has also been debated to adopt the US dollar, the Euro or possibly some third currency (see Brash, 1999 and 2000). Currencies other than the Australian dollar would presumably involve simply adopting the currency without a true union that allows for participation in monetary policy decisions.

II. Choice of Variables and the Concept of Policy Convergence

Based on previous research on European countries, I consider long term interest rates, the spread between short term and long term interest rates, inflation rates, nominal and real exchange rates, and real GDP. I also consider the current-account/GDP ratio.

I analyse each of the above variables in turn. For each variable, I test whether there is co-movement between New Zealand and the potential other currency or monetary union member(s). I apply the concept of unit roots and of cointegration in this context. If variables are integrated of order one, then the existence of cointegration among these variables indicates that they move together over time and do not drift apart as we move through time. This indicates that monetary and fiscal policies have been aligned. This is a necessary condition for a union. If cointegration does not exist, then variables do not move together over time. Furthermore, the number of cointegrating vectors indicates the degree of co-movement or of convergence, as proposed by Hafer and Kutan (1994). The number of variables in the system minus the number of cointegrating vectors is equal to the number of common stochastic trends. If there is one common shared stochastic trend, then convergence is complete. If there is more than one common stochastic trend, but there is cointegration in the system, then there is co-movement without complete convergence.

I consider interest rates first. The long term interest rate reflects monetary policy and possibly fiscal policy. The slope of the term structure of interest rates is measured here by the spread between a money market and a long term interest rate. Plosser and Rouwenhorst (1994) have uncovered empirical evidence that the spread reflects not only monetary policy (inflation), but also expectations of real economic activity. They point out that this is consistent with real business cycle models that link the slope of the real term structure to real output or consumption growth differentials between the 'near and distant future' (p. 138). The term spread has a component orthogonal to monetary policy that reflects other domestic policies, such as fiscal policy. Hafer, Kutan, and Zhou (1997) interpret therefore the spread as a summary measure of monetary and fiscal policy in each country. Stationarity of the spread is implied by the theory of the term structure of interest rates, however, the empirical evidence has been mixed across countries. The finding of a stationary process for all potential union members would indicate policy convergence in the sense that the term structure process is similar. If the spread were instead non-stationary, the theory of the term structure would be rejected, however, one could still look for co-movement of spreads across countries in this case.

I take inflation as an indicator of the stance of monetary policy. It might be preferable here to take the monetary base or another measure of money. However, data are not readily available for the set of countries considered and definitions of other money measures, like M1, that could be used instead, vary considerably across countries. In addition, I look at nominal exchange rates that would reflect monetary policy as well. Of course, uncovered interest rate parity implies that interest rates reflect the (expected) changes in nominal exchange rates. In addition, the theory of relative purchasing power parity (PPP) implies a link between nominal exchange rates and inflation and that real exchange rates should be stationary in levels. (The consumer price index might not be appropriate for deriving real exchange rates when testing parity). However, I am not testing here these two theories in detail.

Differences in movements of real exchange rates across counties reflect changes in terms of trade, in relative prices of traded and non-traded goods, and differences in trade restrictions and tax policies. If real exchange rates are not stationary but have a unit root, co-movements of real exchange rates across countries would imply that these differences do not play a dominant role and would therefore indicate in a way readiness for a currency or monetary union and no need to adjust fiscal (tax) and trade policies further. On the other hand, stationarity would imply that PPP holds and that the time series process of real exchange rates across countries is similar because the above factors do not lead to deviations

from PPP, i.e., the assumptions used in deriving PPP hold up across countries, and, for example, tax policies are similar.

An alternative view is to see monetary policy as a tool to change real exchange rates in order to compensate for asymmetric shocks between regions if one assumes sticky goods and/or factor prices that adjust only slowly compared to exchange rates. This view is expressed, for example, by von Hagen and Neumann (1994). These authors also point out the difficulty of identifying asymmetric shocks and therefore of testing for a decline in the asymmetry of the shocks. Focusing on cointegration instead avoids this problem. Under this view of the role of monetary policy, cointegration of real exchange rates across countries would indicate that asymmetric shocks are not important and that the costs from losing this tool in a currency or monetary union would therefore likely be small. Whether monetary policy is at all an effective tool to manipulate real exchange rates is, however, questionable.

The movement of real GDP over the business cycle can be seen as a measure of the effects of shocks and of the stance of government policy. If countries have a common business cycle, the costs of fixing exchange rates are likely to be smaller the more similar the cycles are. I follow here the approach of Serletis and Krichel (1992) and use cointegration methods in order to assess the degree of convergence of business cycles, avoiding the difficult task of identifying asymmetric shock and their nature (see, e.g., Bayoumi and Taylor (1995) for an alternative approach).

The last variable that I analyse is the current-account/GDP ratio. The intertemporal approach to the current account suggests that international capital flows act as a buffer to smooth out aggregate consumption when shocks hit economic fundamentals (see, e.g., Milbourne and Otto, 1992). Such shocks alter intertemporal consumption and indirectly also national savings. The degree to which current account movements reflect fiscal policies is somewhat controversial (see Seater (1993) on Ricardian equivalence). Regardless, co-movement and a high degree of convergence of current accounts indicate similarities in economic conditions that would facilitate a union.

III. The Data

The starting date chosen for this study is 1985 or later if data are not available. The reason is that New Zealand abolished capital controls at the end of 1984. The end date is the last month or quarter of 1998. Data are collected for New Zealand, Australia, the 11 EMU countries, Japan, and the US. The 11 original EMU countries are: Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Portugal, and Spain. Greece joined the EMU in January 2001 and is not considered here.

Monthly average interest rates for long-term government bonds are from the International Monetary Fund's June 1999 International Financial Statistics (IFS) CD-ROM, line 61. I exclude Finland due to lack of data on a monthly basis. All long term interest rates are expressed in natural logarithms. Monthly averages of day-to-day money rates for short-term borrowing among financial institutions are from the September 1999 IFS CD-ROM, line 60b. This series was also used by Hafer *et al*. to represent short term interest rates. Here, data for France are not available and for Ireland and Luxembourg are available only for a small part of the sample period used in this study. For the US, the federal funds rate is recorded. For New Zealand and several other countries, short-term rates are the call money market rates. New Zealand call rates are from Statistics New Zealand's (1999) PC-Infos data base. New Zealand data are available from April 1987 on, which is, therefore, the starting

date for the term spread study. In summary, among the 11 EMU countries, Finland, France, Ireland, and Luxembourg are excluded for the analysis of the interest rate differentials.

Quarterly inflation rates are calculated from the first differences of the logarithms of the Consumer Price Index (CPI) from the June 1999 IFS CD-ROM. Monthly end-of-period exchange rates based on the European Currency Unit (ECU) are from the June 1999 IFS CD-ROM, line ea or ec, if ea is unavailable. Line ec is the inverse of line ea. Portugal's data do not start until July, 1985. I therefore chose 1985:07 as the starting date for the exchange rate analysis. Among the 11 EMU countries, Spain is excluded due to missing data and Luxembourg because the currency was fixed to the Belgian Franc over the entire sample period. ECU exchange rates are available for the US dollar but not for Australian and New Zealand dollar. Hence, I use the spot US dollar exchange rate for these two countries to calculate the implied ECU rates for Australia and New Zealand. The US dollar exchange rates are from the IFS CD-ROM, monthly, end-of period, line ag, or line ae, if line ag is unavailable; line ae is the inverse of line ag. All exchange rates in the regressions are expressed in natural logarithms.

Quarterly real exchange rates are calculated with the CPI from end-of-period nominal exchange rates. The real exchange rate is derived for German Mark (DM) based exchange rates and for US dollar based exchange rates and they cover the period 1985:3 to 1998:4 to overlap with the period for the nominal exchange rates. Luxembourg and Spain are excluded. All real exchange rates are expressed in natural logarithms.

Quarterly and seasonally adjusted GDP data are from the IFS CD-ROM, line 99b. The associated GDP deflator is from the same source and is used to calculate real GDP. All real GDP data are transformed to natural logarithms. The New Zealand data are not available from the IFS CD-ROM prior to 1988:3 and I therefore retrieved these data from PC-Infos instead. Data for Ireland and Luxembourg are either not available or available only for a very short sub-period.

Quarterly current account data are form line 78 on the IFS CD-ROM. The figures are in US dollars and I converted them to national currencies in order to form the current-account/GDP ratios that I will analyse below. I used the above mentioned US dollar exchange rates for the conversions. Again, data for Ireland and Luxembourg are either not available or available only for a very short sub-period.

IV. Empirical Methods and Results

This paper will analyse cointegration among variables that are integrated of order one (I(1)), i.e., have one unit root. It would also be possible to test for cointegration among variables that are integrated of order two. I therefore use the augmented Dickey-Fuller (ADF) test in order to test first for a unit root in each variable used in the cointegration analysis. I also test for two unit roots with the ADF test. I use critical values calculated with the program form MacKinnon (1996). The lag augmentations for the ADF test are chosen with Akaike's information criterion (see Agiakloglou and Newbold (1996), and also Ng and Perron (1995)). Results are reported in Table I and discussed below. The software package EViews 3.1. is used for all tests in this paper.

Once I establish empirical evidence for one unit root for each variable, I apply the Johansen (1995) framework to test for cointegration and use the critical values from MacKinnon, Haug, and Michelis (1999). Chao and Phillips (1999) pointed out a problem with Johansen's method of performing sequential tests to determine the number of co-

Table I P Values for augmented Dickey-Fuller tests for a unit root

Country	*Interest rate*	*Interest rate spread*	*Inflation*	*ECU nom. exchange rate*	*DM real exchange rate*	*Real GDP*	*Curr. acc./ GDP ratio*
Australia	0.94	0.39	0.27	0.04	0.15	0.87	0.001
Austria	0.99	0.42	0.84	0.15	0.02	0.84	0.85
Belgium	0.96	0.43	0.71	0.41	0.08	0.99	0.55
Finland			0.80	0.58	0.69	0.66	0.72
France	0.98		0.99	0.77	0.30	0.24	0.99
Germany	0.95	0.34	0.0001	0.12		0.72	0.50
Ireland	0.91		0.23	0.05	0.46		
Italy	0.97	0.05	0.78	0.79	0.59	0.99	0.48
Japan	0.94	0.33	0.26	0.27	0.11	0.99	0.03
Luxembg.	0.82		0.19				
Netherl.	0.93	0.56	0.046	0.25	0.23	0.51	0.41
New Zeal.	0.82	0.06	0.001	0.07	0.04	0.01	0.004
Portugal	0.99	0.57	0.68	0.14	0.21	0.25	0.97
Spain	0.99	0.009	0.22			0.99	0.17
US	0.54	0.37	0.87	0.005	0.007	0.99	0.27

Note: *P* values have been calculated with the programme of MacKinnon (1996). Akaike's criterion was used to select the optimal lag length for the augmentations. The *P* values for nominal US dollar exchange rates and the US dollar real exchange rates for Australia, Japan, and New Zealand are 0.60, 0.01, 0.54 and 0.047, 0.001, 0.04, respectively. I also tested the null hypothesis of two unit roots, which was rejected in all cases, with the exception of a few countries in the last two columns.

integrating vectors in the system, i.e, the cointegration rank. The probability of overestimating the rank remains positive in the limit; therefore, the cointegration rank is not estimated consistently with the sequential procedure. They suggested an alternative procedure that gives consistent estimates. They proposed to apply the posterior information criterion of Phillips and Ploberger (1996) to VECMs. It consistently estimates the cointegration rank and in addition also the lag order of the VECM. I do not apply this procedure here, because the evidence in favour of cointegration is quite sparse anyway and the results with the Johansen test form an upper bound on the number of cointegrating vectors. Furthermore, the VECM of Johansen requires to choose an appropriate lag order. I use the Schwarz Bayesian Information Criterion for this purpose (see Reimers, 1993). In contrast to Akaike's criterion, the Schwarz criterion estimates the lag length consistently. I use a VECM specification throughout the paper where the constant term is only in the cointegrating vector. This VECM specification implies that there are no deterministic time trends in the process driving the variables. It is possible to test for a deterministic trend specification in a VECM, however, theoretically it would not be appealing, except for real GDP which though is I(0) for New Zealand so that cointegration tests cannot be applied.

First, I consider monthly long term interest rates. For all countries analysed, the ADF test does not reject the null hypothesis of a unit root. To test for two unit roots, I apply the ADF test and two unit roots are rejected in all cases at the 1 per cent level. The next step is to apply cointegration tests. I look in turn at cointegration between New Zealand and Australia, New Zealand and the EMU countries, New Zealand and Japan, and New Zealand and the US. The null hypothesis of no cointegration is not rejected in all but one case: New Zealand and the EMU countries (10 countries because Finnish data were unavailable). Results are reported in Table II. There is one cointegrating vector among these 11 countries. The parameter estimates of the VECM model are reasonable. Therefore, New Zealand's interest

Table II Cointegration tests for long term interest rates: EMU countries

Original sample: 1985:01 to 1998:12
Test assumption: No deterministic trend in data
Series: New Zealand and 10 EMU member countries (Finland excluded)
Lags interval: No lags

Eigenvalue	*Likelihood ratio test*	*P values*	*Hypothesised no. coint. vect.*
0.482271	346.2651	0.001	None
0.301430	236.9867	0.18	At most 1
0.210072	177.4393	0.55	At most 2
0.196043	138.2943	0.64	At most 3
0.163998	102.0716	0.77	At most 4
0.152302	72.33694	0.85	At most 5
0.098045	44.90859	0.95	At most 6
0.066538	27.77893	0.96	At most 7
0.041790	16.34901	0.91	At most 8
0.032916	9.262778	0.71	At most 9
0.022082	3.706749	0.46	At most 10

Note: P values have been calculated with the programme of MacKinnon *et al*. (1999).

rates have been moving with those of the EMU countries over time. However, there is no complete convergence of policies as there are 10 stochastic trends. Instead, the finding of 10 cointegrating vectors would have indicated one common shared stochastic trend. This would have implied that there is complete convergence of policies.

Second, I consider the monthly spread between money market interest rates and long term government bond rates. The ADF test rejects the null at the 10 per cent significance level but not at the 5 per cent level. In addition, I analyse autocorrelation and partial autocorrelation functions (Box-Jenkins methods) and do not find support for a unit root. Two unit roots are rejected. I conclude that the interest spread is stationary in levels and is not I(1). This is consistent with empirical results for New Zealand in Guthrie, Wright and Yu (1999). On the other hand, the spreads for Australia, most of the EMU countries, for Japan, and for the US are I(1). On account of the interest rate spreads alone, fiscal and monetary policies of New Zealand and of all the potential partners for a currency or monetary union have not been aligned sufficiently. New Zealand spreads have been following a process different from that of the others.

Third, I consider quarterly inflation rates derived from the CPI. The ADF test clearly rejects the null hypothesis of a unit root for New Zealand. Two unit roots are rejected as well. Therefore, the inflation rate seems to be stationary in levels. Inflation rates for other countries are mostly I(1), in particular for Australia, Japan, and the US they are I(1). The evidence for a currency or monetary union is not favourable either if one looks only at inflation rates.

Fourth, I consider monthly nominal exchange rates. I study first exchange rates per ECU. The unit root test result for New Zealand is not clear with a *P* value of 0.07. The series might be I(1). I used again autocorrelation and partial autocorrelation function analysis which lends support for I(1). For other countries, the ADF test indicates a unit root with the exception of Australia, the US, and possibly Ireland. The evidence suggests that nominal exchange rates between New Zealand and Australia towards the ECU have not been showing

the same type of time series behaviour. In addition, autocorrelation analysis for the two countries supports this conclusion. On this criterion alone, a currency or monetary union would not seem advisable for these two countries. However, I also take exchange rates per US dollar instead of per ECU. Both countries' US dollar exchange rates are I(1). I find no evidence for cointegration. This means that the New Zealand and the Australian dollar also followed a different time path in relation to the US dollar. There is evidence for cointegration between New Zealand and the ECU rates of EMU countries. Luxembourg and Spain were excluded as pointed out in the data section.

Table III reports 3 cointegrating vectors at a 5 per cent significance level. (The parameter estimates of the VECM model are reasonable.) Therefore, convergence is not complete because there is more than one stochastic trend in the model. A currency or monetary union would be feasible based on ECU rates alone, however, further policy alignment would be needed. The ECU rate for the Japanese yen is I(1), however, no cointegration is detected between New Zealand and Japanese ECU exchange rates. In addition, the US dollar exchange rate for the Japanese yen is I(0), whereas New Zealand's US dollar exchange rate is I(1). Based on these nominal exchange rate results, a currency or monetary union between New Zealand and Japan or between New Zealand and the US seems not desirable.

Fifth, I consider real exchange rates calculated with the CPI. I examine DM based and US dollar based exchange rates. The New Zealand DM exchange rate is stationary in levels. The null hypothesis of a unit root is rejected. Results for the New Zealand US dollar real exchange rates are similar and a unit root is strongly rejected. According to the ADF test, Austrian, possibly Belgian, and US DM-rates, and Australian and Japanese US dollar rates are I(0). For all other cases, the ADF test cannot reject a unit root. The empirical evidence from real exchange rates suggests that the processes driving these variables are similar for New Zealand and the US. Also, a currency or monetary union with the EMU countries seems not advisable. For Australia and Japan, the processes are similar to that of New Zealand only when US dollar real exchange rates are used but are dissimilar when DM exchange rates are used.

Table III Cointegration tests for ECU exchange rates: EMU countries

Original sample: 1985:07 to 1998:12
Test assumption: No deterministic trend in the data
Series: New Zealand and 9 EMU member countries (excl. Luxembg. and Spain)
Lags interval: No lags

Eigenvalue	*Likelihood ratio test*	*P value*	*Hypothesised no coint. vect.*
0.547659	406.3545	0.001	None
0.443878	278.6300	0.001	At most 1
0.274265	184.1604	0.007	At most 2
0.242066	132.5486	0.07	At most 3
0.154127	87.92596	0.35	At most 4
0.135317	60.97680	0.44	At most 5
0.103001	37.56871	0.59	At most 6
0.077135	20.06794	0.72	At most 7
0.029710	7.144162	0.89	At most 8
0.014113	2.288302	0.72	At most 9

Note: see Table II

Sixth, I consider quarterly real GDP series. A unit root is clearly rejected for New Zealand but is clearly not rejected for all the other countries considered. The time series behaviour of real GDP of New Zealand is evidently different from that of its potential partner countries. This finding is consistent with Hargreaves and McDermott's (1999) who have found that New Zealand has had shorter expansions and longer and deeper contractions than Australia and the US.

Seventh, and last, I consider quarterly current-account/GDP ratios. A unit root is rejected for New Zealand, Australia and Japan. On the other hand, a unit root cannot be rejected for the EMU countries. This means that the time series behaviour of the current-account/GDP ratio is similar for the former countries only in the sense that the series are I(0). This is neither a necessary nor a sufficient condition for a union. On this criterion alone, there is no evidence against a currency or monetary union. It is not possible to assess readiness for a union with cointegration analysis in this case.

V. Conclusion

This paper investigated whether New Zealand would be ready for a currency or monetary union with either Australia, the European EMU member countries, Japan, or with the US. The empirical evidence, using data from 1985 to 1998, suggests that this is not the case. I analysed several macroeconomic variables for co-movement over time, which is a necessary condition for a union. I included variables that have been the focus of empirical studies looking at EU countries in light of the EMU.

Interest rate movements did not show any co-movement between New Zealand and Australia or Japan. There was co-movement with EMU countries but not complete convergence, which indicates differences in fiscal and monetary policies. The interest rate spread revealed time series behaviour for New Zealand that is significantly different from that of potential partner countries. The same picture emerged for inflation rates. Nominal exchange rates for New Zealand and Australia and for New Zealand and the US have not been co-moving either. There has been co-movement between New Zealand and the EMU countries but again there is no complete convergence. Real exchange rates provided mixed evidence and real GDP movements in New Zealand have been distinctly different form those of potential partner countries, whereas current-account/GDP ratios do not provide evidence for a union either. In summary, the empirical results in this paper suggest that New Zealand is not ready for a currency or monetary union with its major trading partners.

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