New Zealand's Exchange Rate Cycles: Evidence and Drivers

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Foreword

The Treasury's vision statement focuses on higher living standards for New Zealanders. While a range of factors underpin well-being, raising New Zealand's economic performance is a central driver of permanently higher standards of living. New Zealand faces two key economic challenges that need to be addressed if our economic performance is to lift. These are:

- accelerating productivity growth to raise average incomes per person and to close the income gap with other wealthier countries; and

- reducing imbalances in order to better position us to weather the inevitable economic or financial shocks that will impact our economy in the future.

This paper is one of a suite of four papers that examine key elements of New Zealand's economic performance and the macro- and micro-economic factors that are inhibiting productivity growth and contributing to economic imbalances.

These papers follow on from Treasury's earlier suite of papers examining New Zealand's productivity performance.[1]

The four papers in the series are:

- *Why are Real Interest Rates in New Zealand so High? Evidence and Drivers* — examining interest rates in New Zealand, the apparent premium relative to overseas rates, potential drivers of this interest rate differential and the impact this might be having on investment;

- *New Zealand's Exchange Rate Cycles: Evidence and Drivers* — with a key focus on examining the nature of New Zealand's exchange rate cycle over the medium term and possible drivers for this cycle;

- *Economic Imbalances: New Zealand's Structural Challenge* — examining the imbalances in New Zealand's economy and their implications for resilience; and

- *New Zealand's Exchange Rate Cycles: Impacts and Policy* — focusing on the impact that New Zealand's exchange rate cycle has on the tradable sector and wider economic performance and possible policy responses.

The papers are being published to articulate the Treasury's current thinking on these issues. Our hope is that these papers will spark further debate on these important topics and stimulate further research that further advances our collective understanding of New Zealand's economic performance and possible policy change that may lift it.

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[1] http://www.treasury.govt.nz/publications/research-policy/tprp

Abstract

This paper seeks to understand the extent of New Zealand's exchange rate fluctuations compared to others, and what drives New Zealand's exchange rate.

New Zealand has only experienced a limited number of exchange rate cycles since the dollar was floated. On a trade-weighted basis this paper finds that New Zealand has large exchange rate cycles, but that some other relevant economies (e.g. Australia, the Euro Area, Japan and South Korea) also have similarly large cycles. By comparing the short-term (i.e. month-to-month) volatility of New Zealand's exchange rate to other economies, on a trade-weighted basis New Zealand's exchange rate fluctuates greatly. New Zealand, Australia and Japan face the highest levels of short-term volatility out of the economies included in the analysis.

Factors that affect the expected relative return on New Zealand dollar assets are found to explain a significant part of exchange rate cycles. These include interest rate differentials between New Zealand and other countries, relative growth performance and attitudes to risk. More fundamental drivers such as export commodity prices and the terms of trade, and productivity growth also drive New Zealand dollar returns. The main driver of the exchange rate changes over time in response to developments in the domestic and global economy.

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New Zealand's Exchange Rate Cycles: Evidence and Drivers

1   Introduction

Both the level of the exchange rate and exchange rate cycles receive much attention in public discussion. This paper seeks to understand the extent of New Zealand's exchange rate fluctuations relative to other economies, and what drives these. This paper is aimed at a non-technical but interested audience. It aims to facilitate informed discussion and greater transparency around a complex issue of interest to all New Zealanders.

A companion paper *New Zealand's Exchange Rate Cycles: Impacts and Policy* (Mabin, forthcoming) discusses the impact of New Zealand's exchange rate cycles on exporters and the wider tradable sector, and potential policy options for mitigating exchange rate variability.

2   Framework

Figure 1 presents New Zealand's real trade-weighted index (TWI) over time. Notably, the real exchange rate has fluctuated around a relatively stable mean over this 40 year period. The post-1985 average (the period over which the dollar has been freely floating) is only slightly above the average in the preceding 15 year period. The peaks and troughs of the cycles have not differed greatly, despite the wide range of exchange rate regimes, the two exceptions being the time of the 20% devaluation in 1984 and the early 2000s. The post-2003 period is the longest episode of the real exchange rate being above its long-run average.

Figure 1: New Zealand's real trade-weighted exchange rate

Index = Q2 2010 real TWI = 66.8
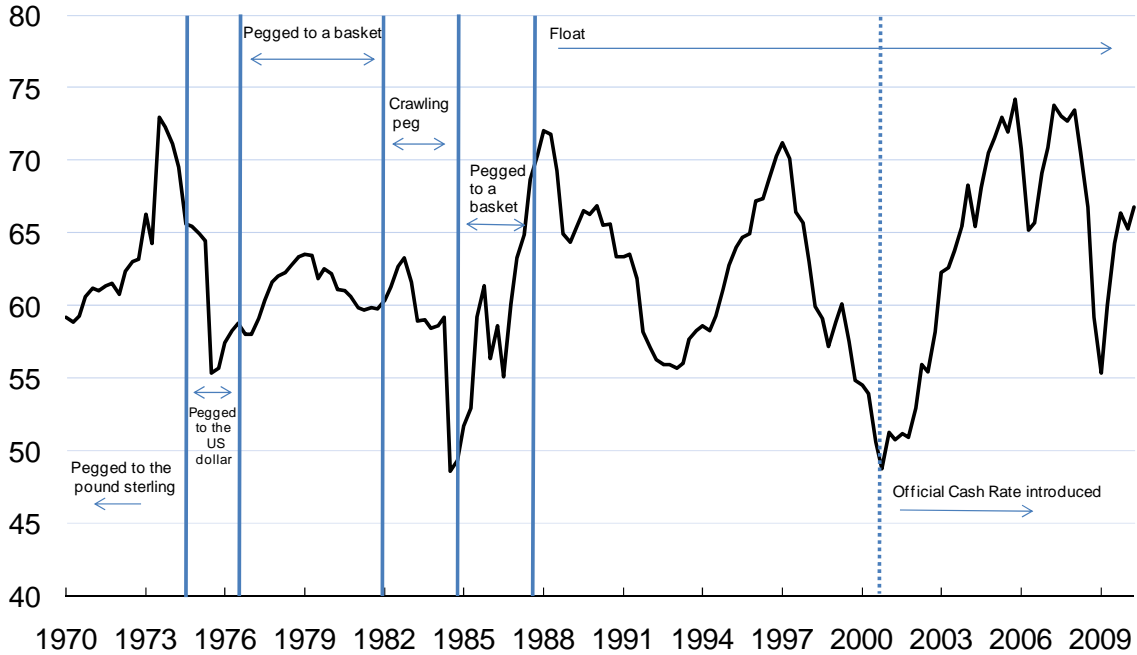
Note: Solid vertical lines indicate nominal exchange rate regimes. The dotted line indicates the year when the Official Cash Rate was introduced as the monetary policy lever under the floating regime. The average for the period is 62.2.

Source: Reserve Bank of New Zealand

Figure 2: New Zealand's real and nominal trade-weighted exchange rate

Index = Q2 2010 real TWI = 66.8
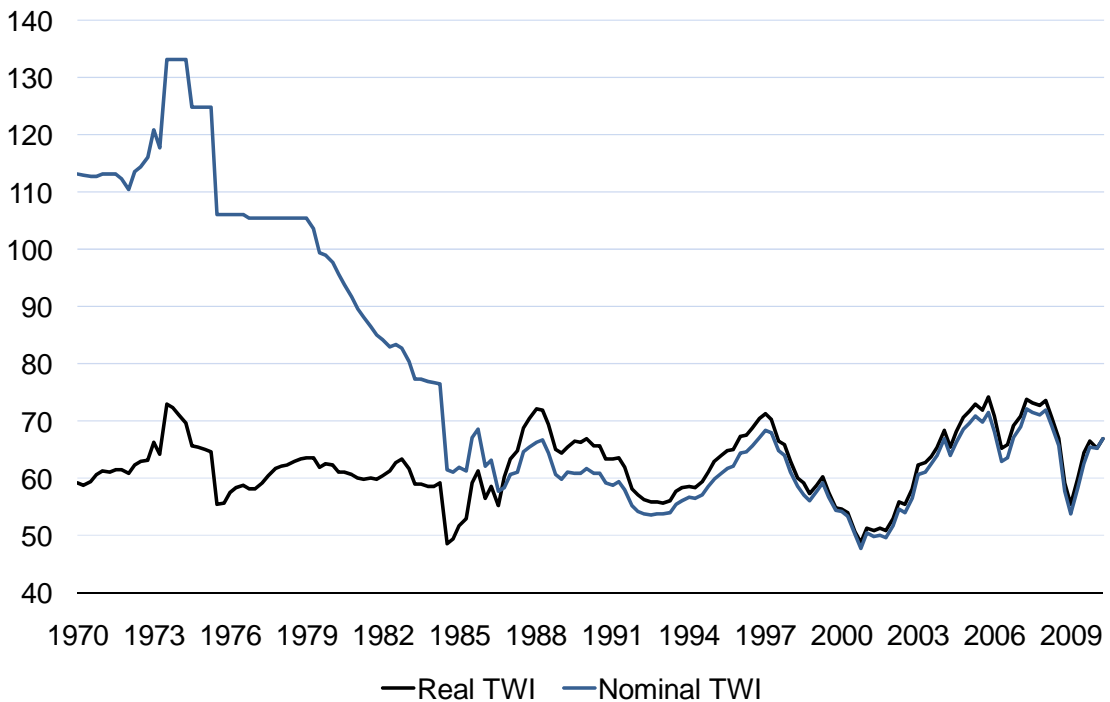
Source: Reserve Bank of New Zealand

Since the floating of the dollar in 1985, the real exchange rate has closely followed the nominal exchange rate. This is because of both New Zealand's and New Zealand's trading partners' generally low rates of inflation (figure 2). More weight will be given to the real exchange rate in the evidence section of this paper for the sake of international comparisons. In addition, the real exchange rate provides a better measure of international competitiveness, particularly when countries experience variable price levels. Box 1 sets out some of the common exchange rate definitions.

It is useful to discuss the behaviour of exchange rates over three time horizons. Distinguishing between them is important as they all have different characteristics, drivers and implications for the economy and policy. Figure 3 presents a stylised path for the real exchange rate that helps frame some of the issues:

- Long-run level – reflecting some notion of the average or equilibrium real exchange rate;

- Medium-term cycles or swings – reflecting deviations from the long-run level of the real exchange rate. These medium-term cycles are referred to as exchange rate **variability** and they are seen over a multi-year horizon; and

- Short-term **volatility** (not plotted) – largely reflecting fluctuations in the nominal exchange rate at say day-to-day or month-to-month, up to a one-year horizon that see the real exchange rate move around the cyclical real exchange rate. In figure 3 these would be plotted as fluctuations around the blue line.

Figure 3: Stylised path for the real exchange rate
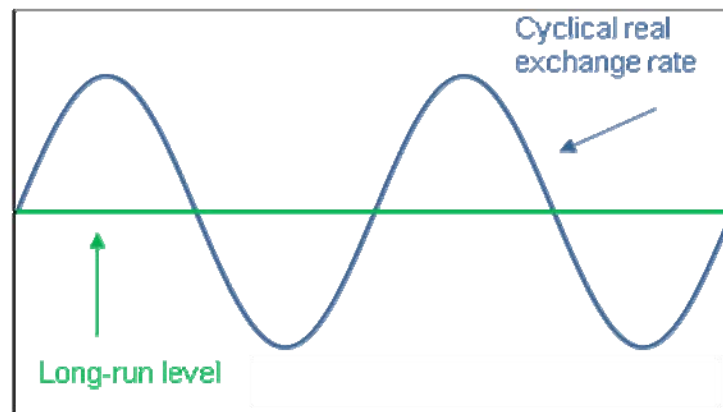
Source: The Treasury

Box 1: Definitions

Nominal exchange rate: The nominal exchange rate specifies how much one currency is worth in terms of another. It is the value of the home nation's currency in terms of a foreign nation's currency. For example, the average for November 2010 was for one New Zealand dollar to buy around 0.78 Australian dollars.

NZD/AUD: New Zealand dollar/Australian dollar cross rate

NZD/EUR: New Zealand dollar/euro cross rate

NZD/GBP: New Zealand dollar/British pound cross rate

NZD/JPY: New Zealand dollar/Japanese yen cross rate

NZD/USD: New Zealand dollar/US dollar cross rate

Real exchange rate: The real exchange rate differs from the nominal exchange rate because it is adjusted for the domestic price level relative to the foreign price level.

Effective exchange rate: A measure of one economy's currency against a basket of foreign currencies. Different weights apply to different economies and the weights are often based on trade patterns. The effective exchange rate can be calculated in nominal and real terms.

Trade-weighted index (TWI): This is an example of an effective exchange rate. It is a measure of movements in the New Zealand dollar against the currencies of New Zealand's major trading partners. The commonly cited measure of the TWI* comprises the US dollar, Australian dollar, the Japanese yen, the euro and the British pound.

* The RBNZ also publishes a broader measure of the TWI. See Kite (2007) for more details.

3   Evidence on exchange rate volatility and variability

There is a common perception that New Zealand's exchange rate is very volatile. This section examines the nature of New Zealand's exchange rate volatility and variability and how this compares with other economies, using different measures and frequencies.

The approach to the data

Alternative sources, measures, comparator economies and time periods all give a slightly different picture of movements in the New Zealand dollar. This paper uses four major sources for data:

- Reserve Bank of New Zealand (RBNZ) data on New Zealand's monthly bilateral exchange rates within New Zealand's trade-weighted index;[2]

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[2]   See Kite (2007) for the latest review of the TWI. The RBNZ calculate the TWI with 50% of the weight on the relative economic size of the economies and the other 50% on the economy's weight in trade with New Zealand.

- Bank of England data on monthly nominal effective exchange rates;

- Bank for International Settlements (BIS) data on monthly nominal and real effective exchange rates; and

- Organisation for Economic Co-operation and Development (OECD) data on monthly real effective exchange rates.

The BIS and OECD series provide the most detailed exchange rate series, by providing high frequency real time series which also take into account third country effects.[3] Effective exchange rates are used where possible as they are the most important from an economy-wide perspective.

Because no one measure can give a complete picture of New Zealand's exchange rate behaviour, different measures of exchange rate volatility and variability are used in this paper:

- In a short-term context the average absolute monthly percentage change is used; and

- In a medium-term context two measures are used to assess the typical amplitude of exchange rate cycles. The first is a high/low analysis[4] over the whole series, and the other is a peak/trough analysis[5] which takes into account all the major peaks and troughs over the sample. The first measure can sometimes be misleading as a measure of variability if a series exhibits a structural change. The second measure is subject to judgement about the timing of the major peaks and troughs of a cycle.

The choice of what economies to compare the variability of New Zealand's exchange rate cycles to and for what time period is ultimately a judgement call. To help avoid a potential bias, this paper includes as many economies as is considered practical. New Zealand's exchange rate is compared against nine economies that have had a floating exchange rate for most of the period analysed, and the focus is on OECD economies. It is worthwhile extending this analysis to a wider group of economies, e.g. South Africa, Chile, Hungary and Taiwan at some point in the future.

Much of the analysis is focused on medium-term variability from the period since 1992. This is the time where most of the economies in the analysis have had floating exchange rates and low and stable inflation.[6] However, for the section on short-term volatility the analysis begins from 1999 as this is when all economies in the sample have floating exchange rates and the Official Cash Rate was introduced in New Zealand.

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[3] Third country effects capture the competition that exporters face from competing suppliers in their export markets (Kite, 2007).

[4] This is calculated as the highest point in the series, minus the lowest point in the series, divided by the lowest point in the series, and multiplied by 100. This effectively gives the range, in percentage form, in which the exchange rate has moved over the series.

[5] The peak/trough analysis involves identifying all the peaks and troughs in the series. It takes the difference between each peak and trough, and divides each of these by the average of the peak and trough or trough and peak. The final result is the average of all of these numbers.

[6] In all of our analysis, data for South Korea is taken from mid-1998, shortly after it floated its exchange rate and for the Euro Area from 1999 when it was established.

3.1   Short-term (month-to-month) volatility

Comparisons with other economies suggest that New Zealand is one of a few economies who have all experienced high short-term exchange rate volatility over the previous decade. Figure 4 shows that New Zealand, Australia and Japan all face the highest levels of short-term volatility out of the economies included in the analysis.[7]

Figure 4: Real effective exchange rate volatility *(January 1999 to August 2010)*
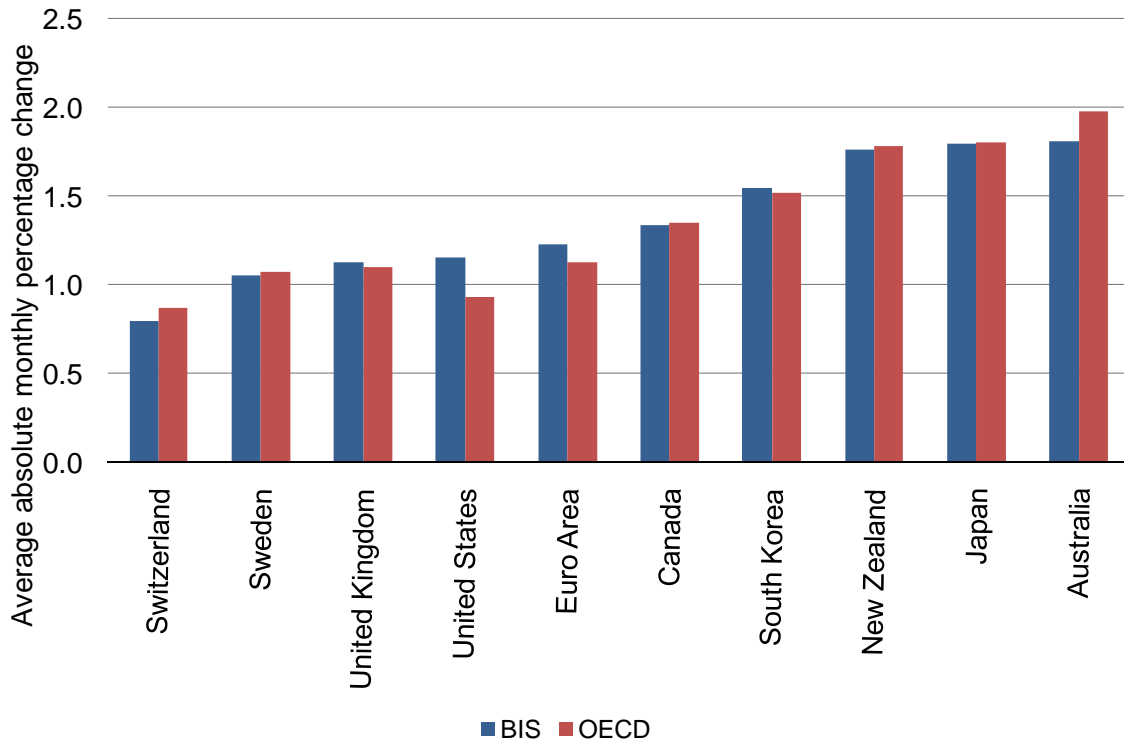
Note: Figure ordered by BIS rankings.

Source: Bank for International Settlements, OECD (Consumer Price Index deflated[8]), author's calculations

Across the currencies that make up the New Zealand TWI there is considerable disparity in the volatility of the various bilateral exchange rates (figure 5). At the firm level, it is these bilateral exchange rates that are likely to be most important.

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[7] This analysis has been repeated using nominal data from both the BIS and the Bank of England. The nominal results are consistent with the real data (although the rankings do change slightly). These results are also consistent with the same analysis using daily data (2025 Taskforce, 2009).

[8] The OECD provides two real effective exchange rate series, one with the Consumer Price Index as the deflator and the other with unit labour costs in manufacturing as the deflator. This latter measure can provide a better measure of the competitiveness of an economy, but it does have some drawbacks, including issues of different measurement between countries. The analysis has been replicated using the OECD's quarterly unit labour cost deflated series. Using this data, the same group of economies appear at the upper end of exchange rate volatility.

Figure 5: Nominal bilateral exchange rate volatility *(January 1999 to September 2010)*

TWI weights:	0.21	0.28	0.07	0.29	0.15
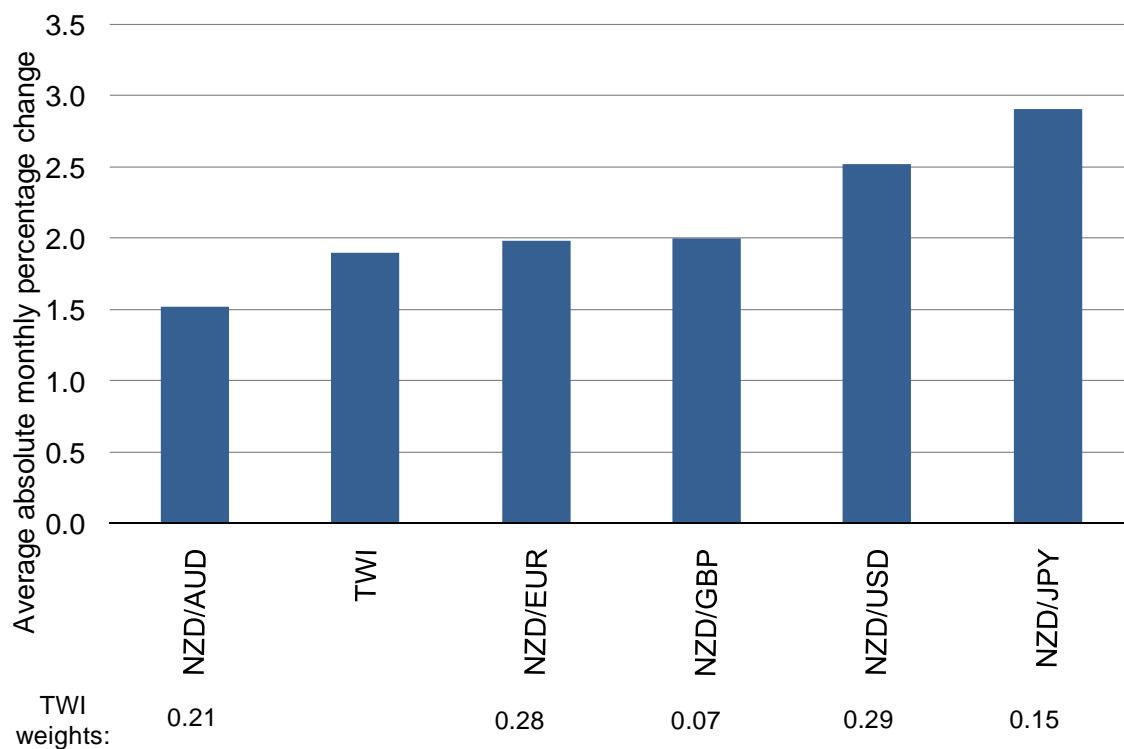
Note: TWI weights shown above were set in December 2009. New weights take effect on 16 December 2010.

Source: Reserve Bank of New Zealand, author's calculations

The NZD/AUD bilateral exchange rate is one of the more stable cross rates globally (out of economies who float their exchange rates (2025 Taskforce, 2009). The NZD/USD bilateral exchange rate is the second most volatile in New Zealand's TWI, largely reflecting the major differences in the two economies and the fact that the US dollar is itself volatile. The NZD/JPY is the most volatile bilateral exchange rate in New Zealand's TWI, but Japan only makes up 15% of the TWI. Figure 6 shows a longer history of the New Zealand dollar against the British pound, US dollar and the Australian dollar.

Figure 6: Bilateral nominal exchange rates *(monthly data, June 1973 to September 2010*)*
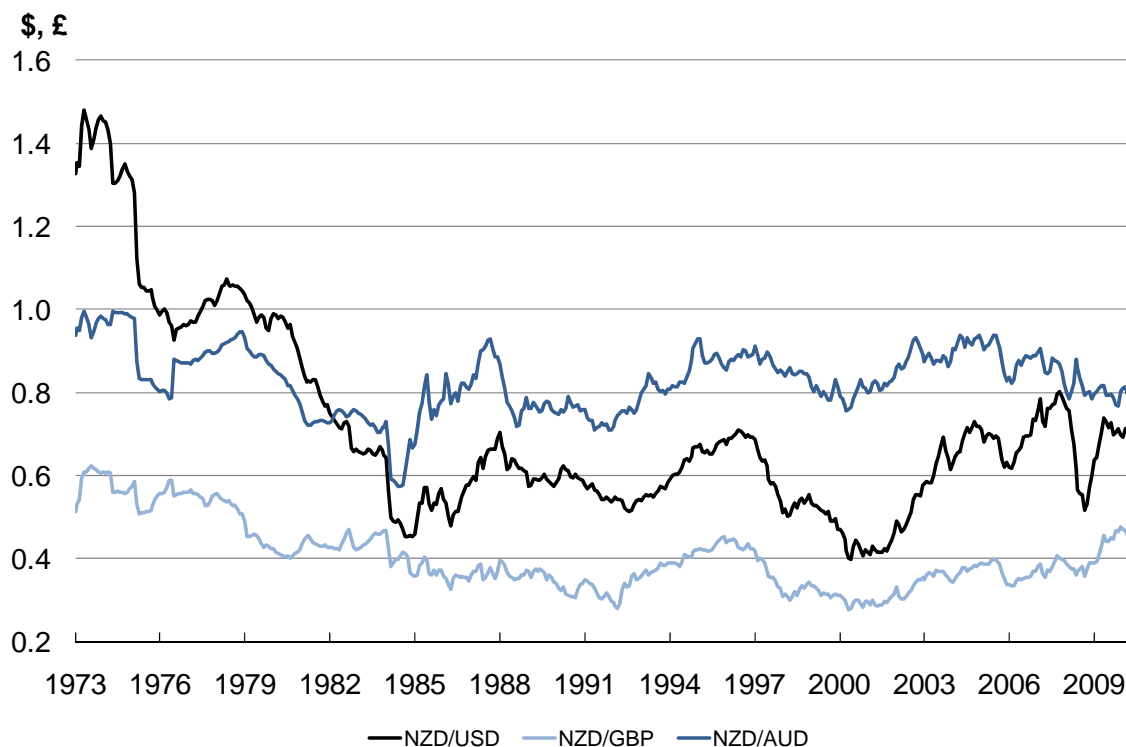
*Data available from 1973 only.

Source: Reserve Bank of New Zealand

Commentators often assess New Zealand's exchange rate volatility relative to others using the US dollar as the common term. In comparisons of economies' bilateral exchange rates with the US dollar, this paper finds that the New Zealand dollar is the most volatile (figure 7).[9] The United States makes up the largest part of New Zealand's TWI. Around 17% of New Zealand's trade goes to the United States.[10] While this is significant and will be important for individual exporters, the TWI is a better indicator of economy-wide exposure to exchange rate movements. While the US dollar does make up the largest part of New Zealand's TWI, it only counts for 29% of it, explaining why the NZD/USD is more volatile than New Zealand's TWI (see figure 5). Box 2 explains why movements in the currency of denomination in trade may not have a significant impact on exporters in the medium term.

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[9] The exact same results are found using the Bank of England's nominal series of bilateral exchange rates against the US dollar over the same timeframe. The Bank of England series includes the euro, and the volatility of the euro against the US dollar sits in the middle of the group in figure 5.

[10] For information on the changing nature of New Zealand's trade flows see Zhang (2009).

Figure 7: Nominal exchange rate volatility against the US dollar *(January 1999 to September 2010)*
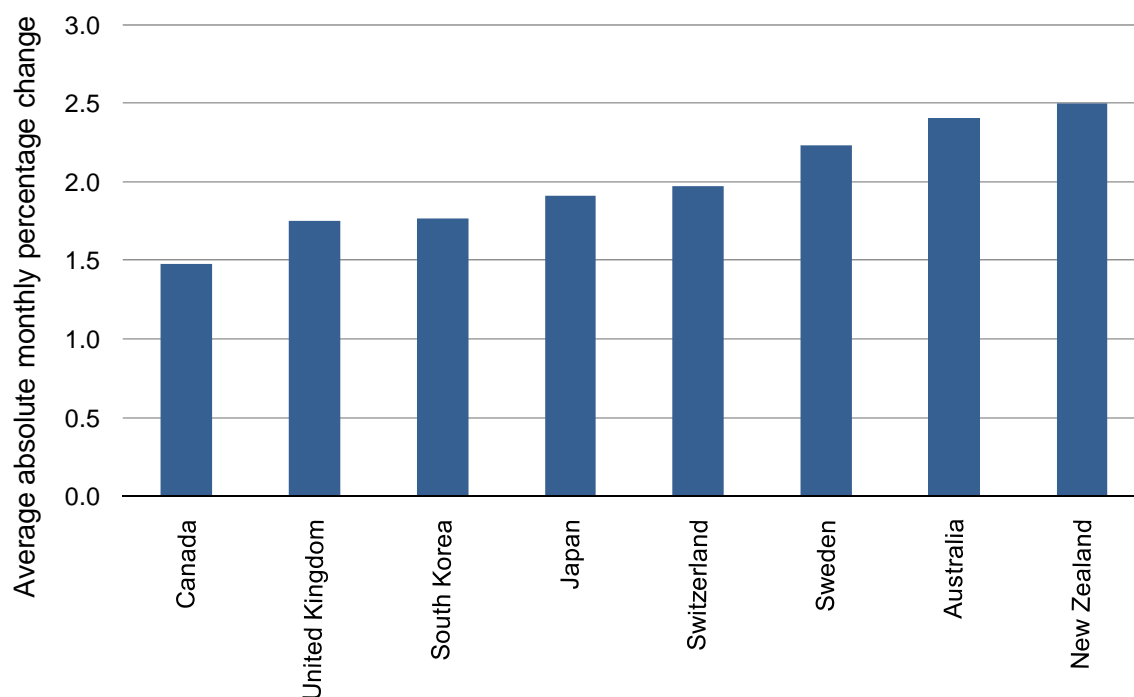
Source: Bank of England, author's calculations

Box 2: The importance of the currency of denomination

A significant portion of New Zealand's trade is denominated in US dollars. When this occurs, short-term movements in the NZD/USD exchange rate are likely to have a significant impact on New Zealand dollar export receipts. However, in the medium term the exchange rate that actually matters is that between New Zealand and the regions that ultimately consume the traded goods.

To illustrate and explain this point, consider a stylised example. Europeans are the only consumers of milk powder and they are willing to pay US$4,000 per tonne for it, the EUR/USD exchange rate is 1.30 and the NZD/USD is 0.70. At these exchange rates, a New Zealand exporter of milk powder would receive NZ$5,714 per tonne of milk powder sold. Imagine that the US dollar depreciated by 10% against all currencies. In the short-term, New Zealand export receipts would fall by 10% (to NZ$5,195).

However, because the euro price of milk has decreased considerably, demand for New Zealand milk powder from European consumers will increase. As supply is likely to be constrained in the medium-term, this increase in demand will push up the US dollar price by 10% (in reality the price increase would likely be slightly less than 10%). New Zealand exporters would now receive NZ$5,714 per tonne of milk powder sold. The increase in the US dollar price in the medium-term, along with the depreciation of the US dollar against the Euro and New Zealand dollar, leaves New Zealand exporters with the same amount of export receipts as before the original depreciation of the US dollar occurred.

The results above can be sensitive to the start and end points of the series. To explore this, some of the analysis above has been replicated using the BIS monthly real effective exchange rate series, but using start points of 1992 and 1964.[11] The analysis above has also been replicated using an end point of 2007. For the time period 1992 to 2010 and 1964 to 2010 the results do not materially change despite affecting the ordering of a few economies, except that New Zealand looks considerably less volatile. When the time period 1999 to 2007 is examined similar results are found to those shown in figure 3.

Data in the charts above is also used to explore how New Zealand's real effective exchange rate volatility differs from economies with different currency regimes. Figure 8 shows that the real exchange rate of economies that are part of a currency union, the euro, or that target a particular rate against a basket of currencies, can and do fluctuate, though not as much as economies with floating exchange rates. An economy that fixes its exchange rate to another currency can only achieve stability against that one currency, which will fluctuate against other currencies. Also, an economy can only fix its nominal exchange rate, and has less influence over the real exchange rate. The real exchange rate is influenced by relative price movements, which depend on a range of factors that cannot be controlled. Furthermore, if the exchange rate cannot act to absorb macroeconomic volatility, then it will emerge elsewhere in an economy, e.g. economic growth rates and unemployment rates (Mabin, forthcoming).

Figure 8: Real effective exchange rate volatility: different exchange rate regimes *(January 1999 to September 2010)*
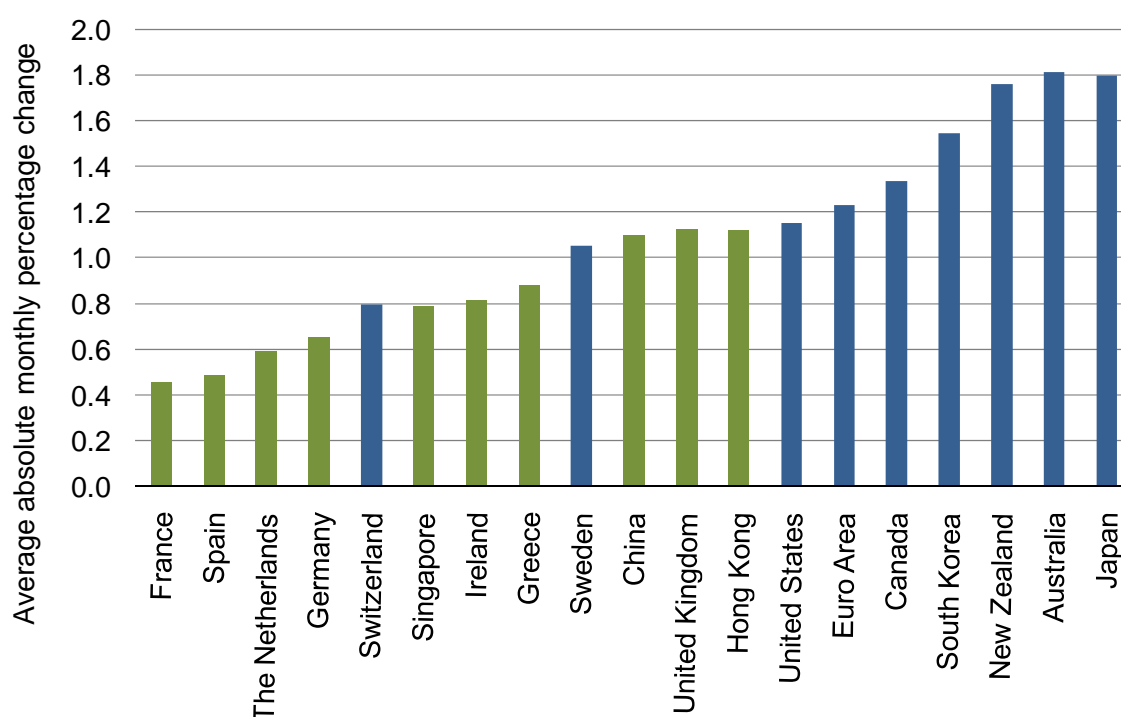
Note: Bars in green reflect economies that have mostly been part of a currency union, the euro, or that have targeted a particular rate against a currency or a basket of currencies for most of the period analysed. Bars in blue reflect economies that have had floating exchange rates for most of the period analysed.
Source: Bank for International Settlements, author's calculations

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[11] 1992 is chosen because it is when most economies in the analysis have floating exchange rates and low and stable inflation. 1964 is chosen because of data availability.

3.2   Medium-term variability

Although an economy may have a volatile currency on a short-term basis, this need not necessarily result in large exchange rate cycles. New Zealand has only experienced a small number of cycles since the dollar was floated in 1985. This makes drawing firm conclusions from the data challenging, and the comments that are made in this section are made with the caveat of this limited data.

Available evidence suggests that New Zealand has a considerably variable exchange rate, and even though different measures suggest different degrees of variability, other relevant economies also face high variability.

Figure 8 shows the ranges within which the various exchange rates have fluctuated over the past 18 years (high/low analysis). While being a simple measure, it has the advantage that it gives us an *indication,* absent any judgement, of how variable New Zealand's exchange rate has been compared to other economies. Figure 9 shows that New Zealand has a similar degree of variability to Australia, Canada, the Euro Area, Sweden and South Korea.[12] Over that period, the high in the real value of the New Zealand TWI in 1997 was almost 60% above its low in 2000.

Figure 9: Real effective exchange rate amplitude: high/low analysis *(monthly data January 1992 to September 2010)*
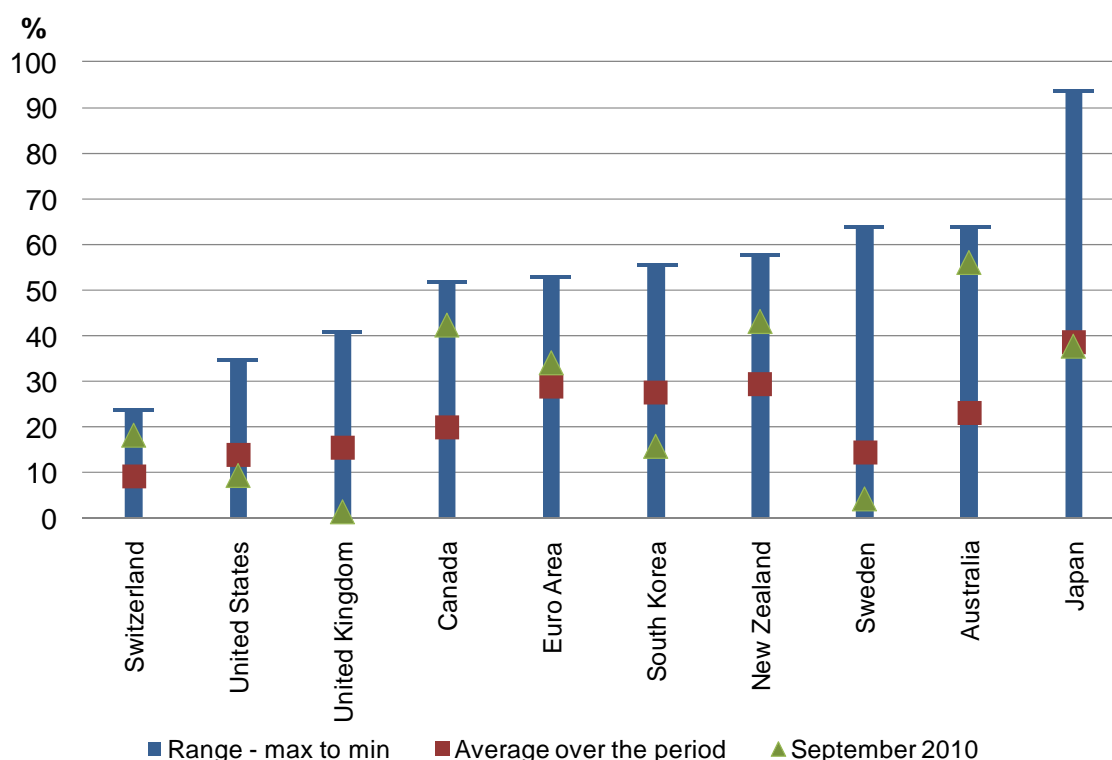
Note: The range is based on two data points. The average and the September 2010 figures used in this figure are presented in percentage form relative to the minimum value of the series. Data for South Korea and the Euro Area are taken from mid-1998 and 1999 respectively.
Source: Bank for International Settlements, author's calculations

The high/low analysis can miss important information about the size of different cycles, and can be influenced by changes in equilibrium levels of exchange rates (see Section 4.2 below). Because of this, the high/low analysis should be seen in conjunction with a more

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[12]   Similar results are found using OECD data.

robust peak/trough analysis. While this latter technique captures more information, a disadvantage is that there are no hard-and-fast rules defining the peaks and troughs of a cycle; it relies on judgement in deciding where the peaks and troughs of the cycle are.[13]

The peak/trough analysis (figure 10) shows a similar result to the high/low analysis: New Zealand does face considerable variability in its exchange rate, but so do some other relevant economies. Looking across both measures, New Zealand, Australia, Japan and South Korea consistently appear as the economies with the most variable exchange rates. Depending on the measure used, Sweden and the Euro Area also appear to have highly variable exchange rates.

*Figure 10: **Real effective exchange rate amplitude: peak/trough analysis** (monthly data, January 1992 to September 2010)*
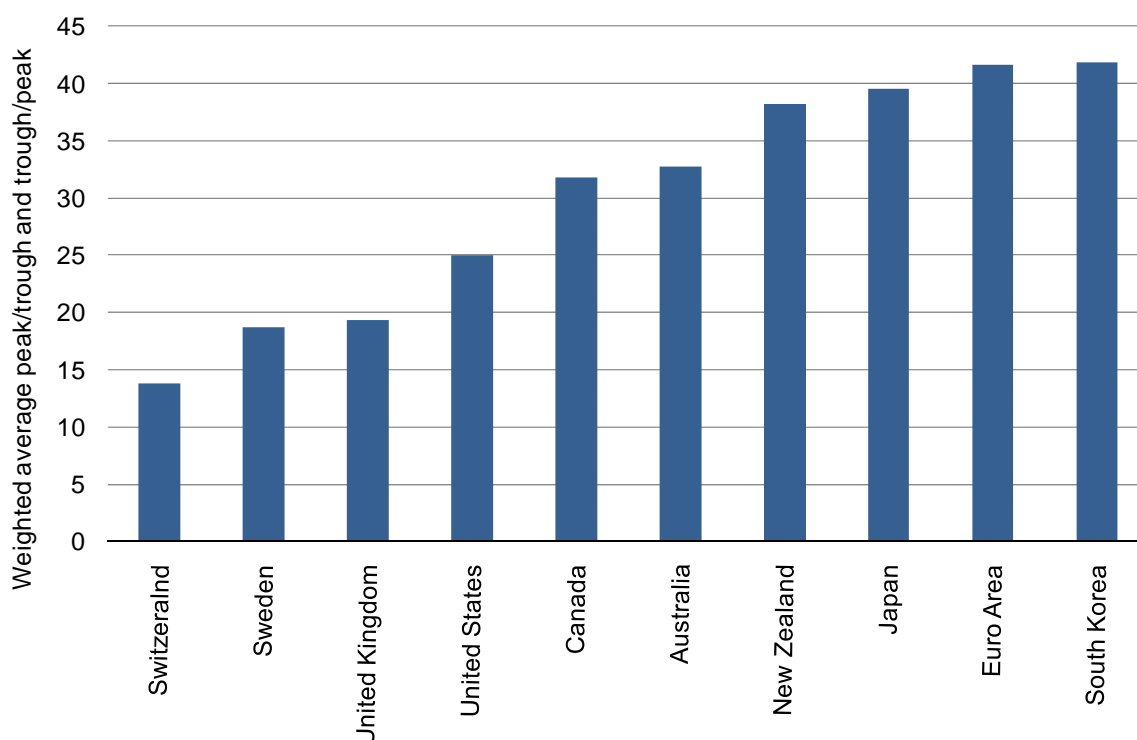
Note: See footnote 5 for an explanation of how the weighted average is calculated. Data for South Korea and the Euro Area are taken from mid-1998 and 1999 respectively.
Source: Bank for International Settlements, author's calculations

Table 1 presents the data used in the peak/trough analysis, and figure 11 shows the movements in each economy's real effective exchange rate. The table shows the turning points identified for each economy, and the duration (in months) of each peak (trough) to trough (peak). The table shows that the New Zealand dollar's peak-to-trough phases have been shorter than the one trough-to-peak phase experienced. This trough-to-peak phase has been the largest of the economies in the table, and very similar to the phase Australia experienced at around the same time. This is clearly shown in figure 11. Both South Korea and Japan have experienced larger peak to trough phases than New Zealand.[14]

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[13] We have taken the general rule of thumb that peak (trough) to peak (trough) data points should be five or more years apart, and that a phase should be no less than six months. Exceptions have been made for very sharp depreciations of significant magnitude. This differs from the method used by Harding and Pagan (2002) and Schmidt-Hebbel (2006). Using their method would have generated many small phases within a short-term horizon, which is not the key focus of this paper.

[14] Schmidt-Hebbel (2006), in his analysis spanning 1986-2005, finds that exchange rate cycles are longer and more extreme in New Zealand than the average comparator economy (Australia, Canada, Chile,

South Korea, Japan, the Euro Area (based on one trough-to-peak phase), Australia, Canada and New Zealand all experienced relatively long cycles over the period analysed.

Table 1: Amplitude and duration of real effective exchange rate cycles (monthly data, January 1992 to September 2010)

	Peak	Trough	Amplitude* (months duration in parentheses) Peak to trough		Trough to peak		Average Amplitude -all turning points
Example	Jun-96	Jul-99	30.0		40.0		35.0
	Oct-03	Dec-09	35.0				
Switzerland	Nov-95	Mar-00	18.3	(52)	10.2	(34)	
	Jan-03	Oct-07	13.0	(57)			13.8
Sweden		Apr-95			14.2	(18)	
	Oct-96	Sep-01	26.5	(59)	13.2	(51)	18.7
	Dec-04	Mar-09	20.9	(39)			
United Kindgom		Jul-95			26.2	(57)	
	Apr-00	Aug-03	11.9	(40)	8.7	(41)	19.4
	Jan-07	Jan-09	30.8	(24)			
United States		May-95			28.7	(81)	
	Feb-02	Mar-08	28.8	(73)	17.6	(12)	25.0
	Mar-09						
Canada		Nov-01			41.0	(72)	
	Nov-07	Mar-09	22.6	(16)			31.8
Australia		Sep-93			22.8	(42)	
	Mar-97	Mar-01	27.6	(48)	43.8	(88)	30.1
	Jul-08	Dec-08	26.3	(5)			
New Zealand	Mar-97	Oct-00	39.0	(43)	44.6	(81)	
	Jul-07	Feb-09	31.0	(19)			38.2
Japan	Apr-95	Aug-98	45.5	(40)	28.9	(20)	
	Apr-00	Jul-07	47.9	(87)	35.8	(18)	39.5
	Jan-09						
Euro Area 1999 →		Oct-00			41.7	(93)	41.7
		Jul-08					
South Korea mid-1998 →		Jun-98			40.4	(109)	
	Jul-07	Feb-09	43.3	(19)			41.8

* The figures in these columns are the respective weighted averages of each phase e.g. peak to trough (see footnote 5 for an explanation of how this is calculated). The economies are listed in order of the lowest to highest average amplitude.
Source: Bank for International Settlements

Norway and Sweden). With the addition of several more years to the analysis, the results in this paper look slightly different to his.

Figure 11: Real effective exchange rates *(monthly data, January 1992 to September 2010, all in indexed form)*
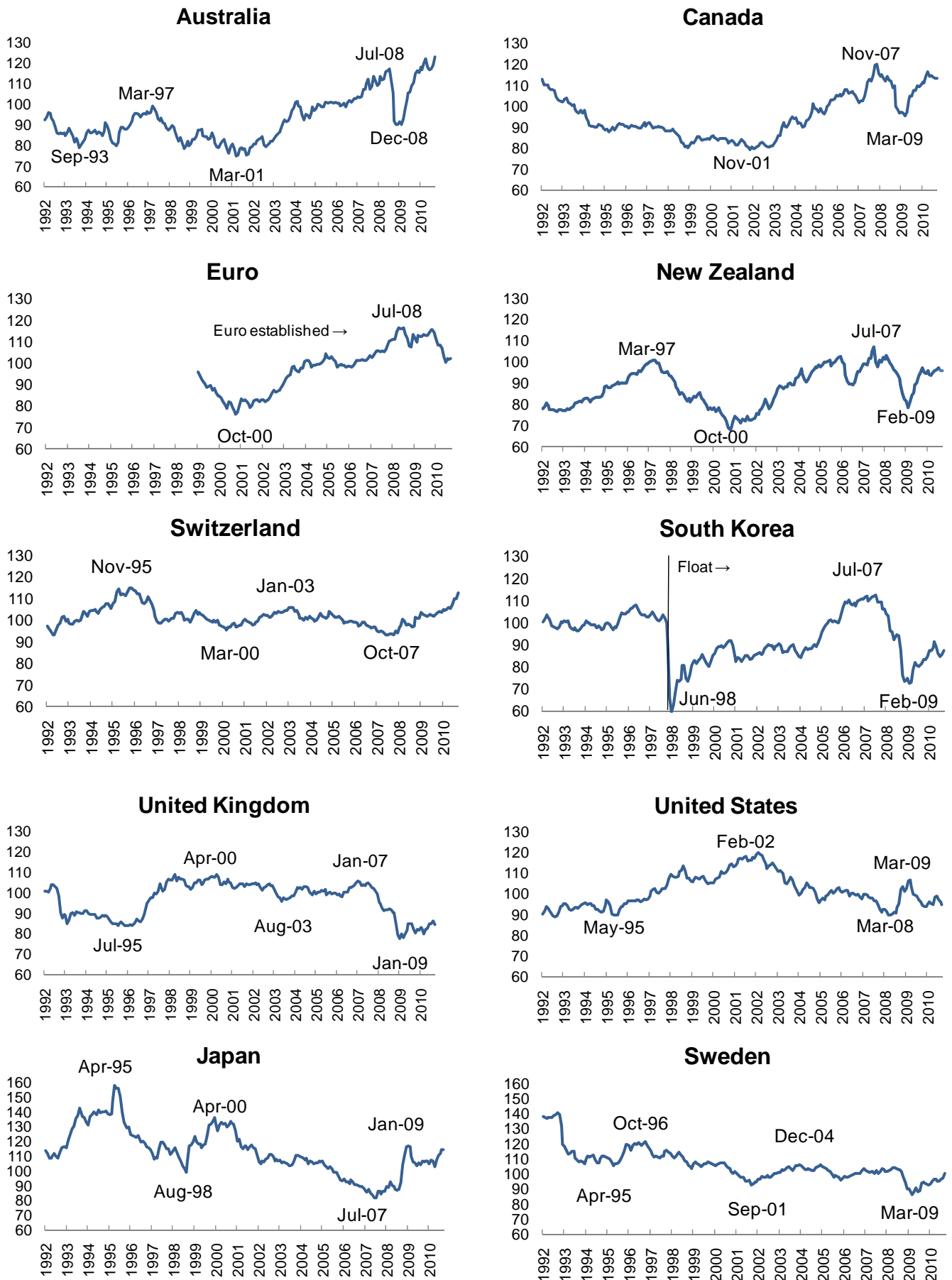
Source: Bank for International Settlements

The data analysed so far suggests that New Zealand has similar exchange rate cycles to Australia and the two real exchange rate series appear to experience similar medium-term variability (figure 12). The stronger terms of trade that Australia has experienced recently can explain part of the divergence in the level of the exchange rate over the previous four years.

Figure 12: Australia and New Zealand's real effective exchange rate variability *(monthly data, September 1963 to September 2010)*
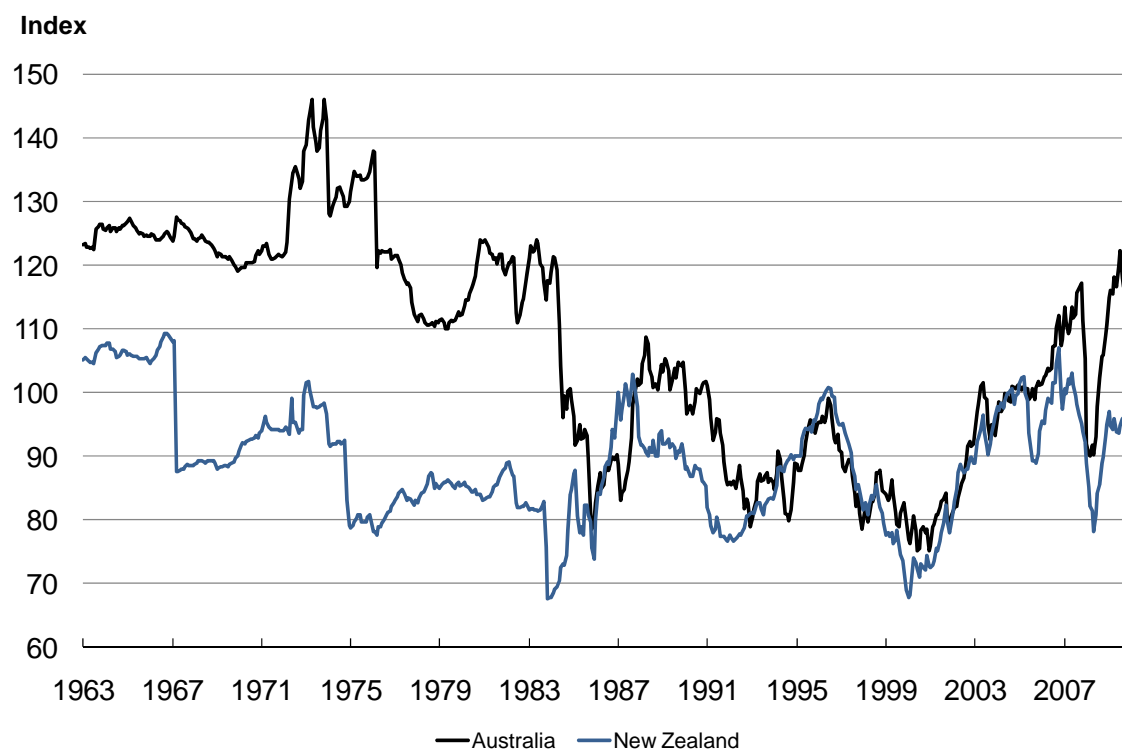
Source: Bank for International Settlements

Who should New Zealand be compared with?

This paper has shown that the high variability of New Zealand's exchange rate cycles appears to be similar to several economies. But are these economies the right comparators? There are some reasons to suspect that for New Zealand, medium-term exchange rate variability may matter more than for other economies.

Canada is a commodity exporter like New Zealand, but its larger size and its proximity and access to the United States market means that not only does it have a large domestic market, but also a large neighbour with which it has a relatively stable exchange rate. Sweden and the United Kingdom are similar in this regard, having all of Europe at their doorstep. Japan has a very different economy from New Zealand's, with a larger manufacturing sector. South Korea is not commodity based and it has access to a wide range of fast growing markets in very close proximity. Australia may be the closest comparator economy, in that it is relatively small and faces a similarly long distance to markets, but it has a larger domestic market than New Zealand and there is a predominance of mining in its composition of exports.

Given New Zealand's small size, exchange rate variability may be more damaging for New Zealand than for other economies. The impact of the exchange rate on New Zealand's exporters and wider economy will be discussed in Mabin, forthcoming.

Conclusions on the evidence

New Zealand experiences a volatile exchange rate over short-term horizons. The volatility of bilateral exchange rates shows considerable variation across New Zealand's major trading partners.

The number of exchange rate cycles since New Zealand's exchange rate was floated is limited, and the measures this paper has used to assess medium-term variability are not perfect. To counter this, many sources, measures, time periods and comparator economies have been used. The data points to the conclusion that New Zealand experiences large exchange rate cycles, but that this is common to several other relevant economies.

4   Drivers of the exchange rate

What makes New Zealand's exchange rate behave the way it does? In this section, the paper first examines the factors that cause the exchange rate cycles or medium-term variability that has just been examined. Secondly, it discusses the concept of equilibrium exchange rates.

4.1   Medium-term cycles

No one model of the exchange rate can adequately account for movements in the New Zealand dollar over all time periods. The exchange rate is a key relative price, but another perspective is that it can be viewed as an asset price (Munro, 2004). Such a view has become increasingly relevant as foreign exchange market turnover has come to be dominated by financial transactions.[15] This means that factors that influence capital markets are now likely to have a bigger impact on exchange rates.

Factors that affect the expected relative return on New Zealand dollar assets are found to explain a significant part of exchange rate cycles. These include interest rate differentials between New Zealand and other economies, relative growth performance and attitudes to risk. More fundamental drivers such as export commodity prices and the terms of trade, and productivity growth, will also drive New Zealand dollar returns, particularly over longer timeframes.

4.1.1 Interest rate and growth differentials and risk appetite

Interest rate differentials are an important driver of the exchange rate as they most clearly reflect the relative returns on holding New Zealand dollar assets. Figure 13 shows the broad relationship between the short-term interest rate differential[16] and the TWI over time. Other factors obviously play more or less of a role at different times such that the precise relationship is not stable over time. Particular instances include the late 1990s, and the late 2000s.

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[15] As of 2007, trade-related transactions had fallen to around 5% of New Zealand foreign exchange market turnover, much lower than it was 20 years ago (BIS, 2007).

[16] The difference between an average of short-term (90-day) interest rates in United States, Germany and Japan and New Zealand short-term (90-day) interest rates.

Figure 13: Short-term interest rate differentials and the TWI *(quarterly data, Q1 1996 to Q4 2010)*
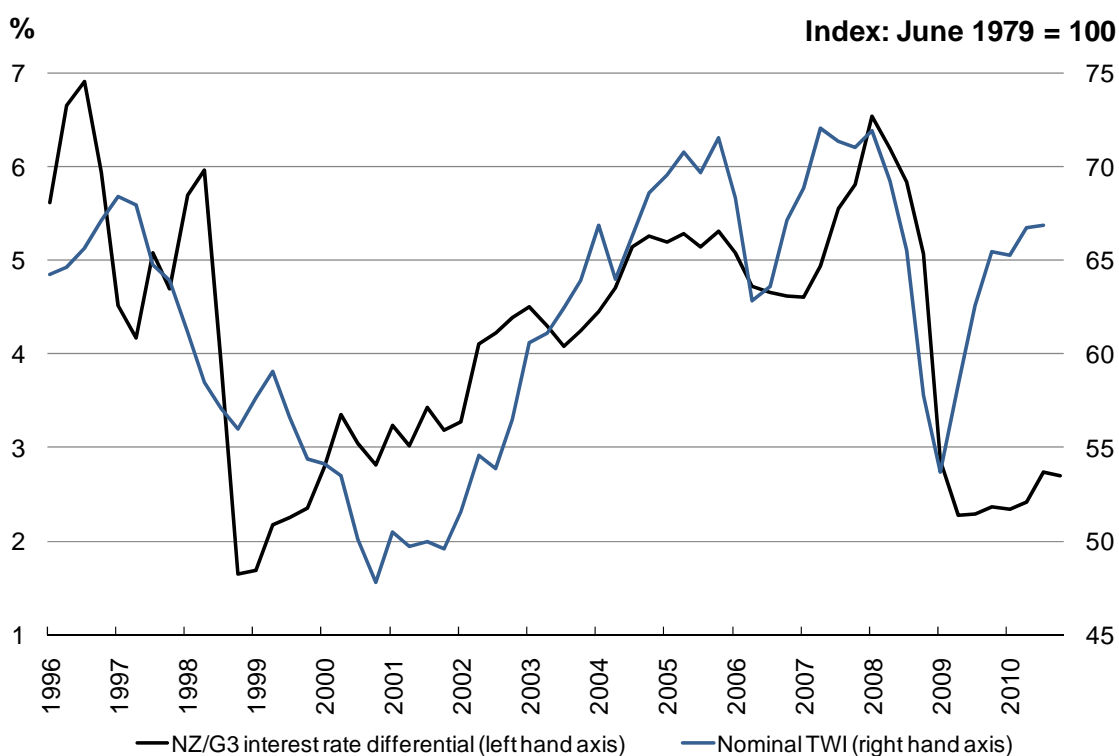
Note: G3 refers to an average of 90-day interest rates in Germany, Japan and the United States.

Source: Reserve Bank of New Zealand, the Treasury

The relationship between interest rates and the exchange rate also holds at the bilateral exchange rate level (see figure 14 for example). For instance, over the past year the decline in the NZD/AUD cross-rate is consistent with the interest rate differential moving negative, while the converse is true for the NZD/USD cross-rate.

Figure 14: Short term interest rate differentials and New Zealand dollar cross rates *(monthly data, January 1991 to October 2010)*
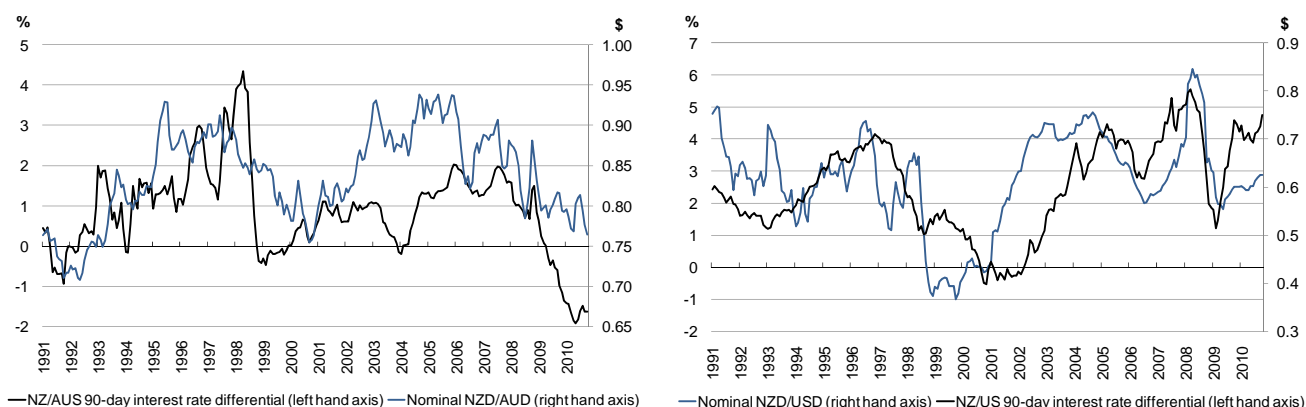
Source: Reserve Bank of New Zealand, Reserve Bank of Australia, Datastream

Over the previous decade, a combination of high New Zealand interest rates (due to strong domestic inflationary pressures and a high neutral real interest rate[17]) and low

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[17] See Labuschagne and Vowles (2010) for a discussion of the neutral real interest rate in New Zealand.

global interest rates led to large amounts of inward capital flows (Dunaway, 2009). This contributed to the appreciation of the New Zealand exchange rate in the mid-2000s.

Low global interest rates over the past decade stemmed from a mix of factors. First, global liquidity increased considerably in the decade following the Asian crisis as investment levels, which fell following the crisis, were not sufficient to absorb the saving being generated. Second, policy interest rates were held low in key major economies in an attempt to boost growth. Third, investor risk appetite increased following a period of relatively stable global growth and low inflation. Amongst other affects, these factors contributed to the rise of the so-called "carry trade".

The carry trade occurs when investors take advantage of interest rate differentials between countries. Carry traders would invest in an asset that has a higher expected rate of return than the costs of borrowing. In currency carry trading terms, investors would borrow in low interest rate countries (like Japan and Switzerland) to invest in higher interest rate countries (like New Zealand and Australia). In theory, the carry trade should not be able to work. Uncovered interest rate parity is a long-run concept, where the exchange rate would be expected to move to offset any arbitrage opportunities created by interest rate differentials. However, over a short-term horizon this does not hold. This means that the exchange rate can remain high for long periods of time, particularly in countries with high interest rates. It can even appreciate further, possibly for a number of years.

The inflows associated with the carry trade has exacerbated the New Zealand exchange rate cycle, as well as maintaining downwards pressure on local longer-term interest rates. Recent RBNZ work suggests that the carry trade has diminished somewhat in New Zealand in the wake of the global financial crisis, as other countries are now more attractive destinations for the carry trade (e.g. Australia, where rising interest rates have meant interest rate differentials have widened against funding currencies) (Cassino and Wallis, 2010).

Cassino and Wallis (2010) also find that risk appetites have at times played the key role in driving the exchange rate during the global financial crisis and its aftermath. For example, at the onset of the global financial crisis the Swiss franc (seen as a safe haven currency) appreciated while the New Zealand dollar (seen as a riskier currency) depreciated. To illustrate the impact of risk preferences Cassino and Wallis (2010) compare the NZD/USD exchange rate to the Standard and Poor's equity index in the United States (figure 15). This equity index is seen as a risk sensitive financial asset and therefore changes in this indicator are a good indication of risk preferences. Investors' risk appetite is a common driver of both the S&P equity index and New Zealand dollar denominated assets.

Figure 15: S&P 500 and the New Zealand dollar/US dollar cross rate (monthly data, January 2006 to October 2010)
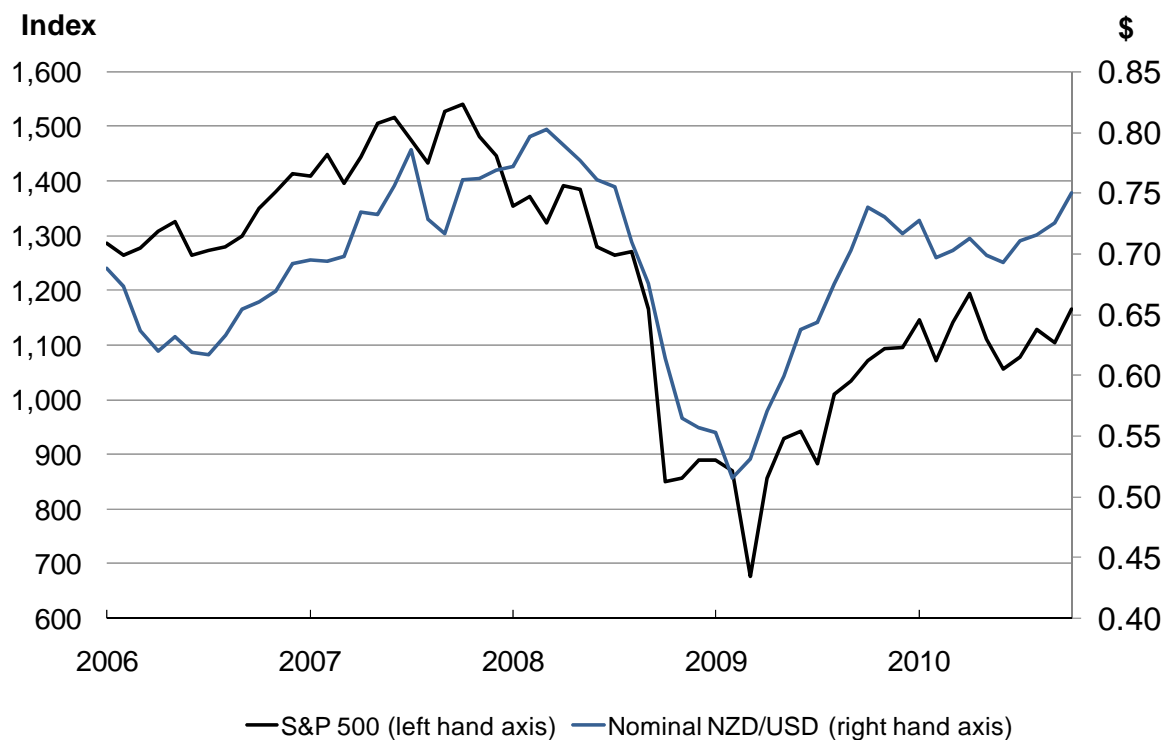
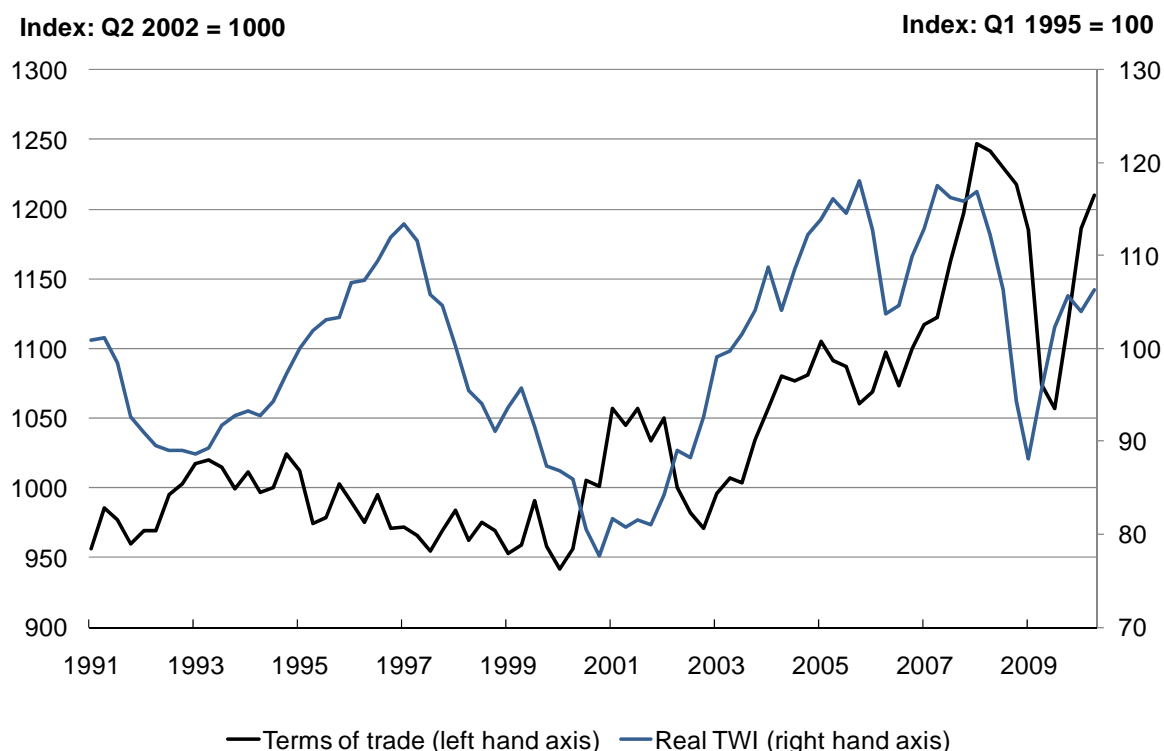Source: Datasteam, Reserve Bank of New Zealand

4.1.2 Domestic drivers

Domestic economic conditions are pivotal to the level of interest rates in any country. The pace of growth and the resulting amount of economic slack or excess demand pressures are key inputs into the stance of monetary policy and hence short-term interest rates. In turn, a range of factors drive economic conditions over both the short and long-term.

The New Zealand dollar is found to be affected by export commodity prices and the wider measure of the terms of trade (figure 16). Export commodity prices have the biggest influence on the terms of trade. The New Zealand dollar is sometimes referred to as a commodity currency, along with the Australian and Canadian dollars (Huang, 2004). Commodity prices, and the terms of trade more generally, impact on the exchange rate through multiple channels, directly lifting the trade balance and strengthening domestic incomes. This can have both short-term impacts on demand, and hence the cyclical path of the exchange rate, and long-term impacts via the ability of the economy to pay for a particular level of imports. At times it may be difficult to disentangle the effects of whether the terms of trade helps determine the long-run equilibrium for the exchange rate (discussed below), or whether it is an influence on exchange rate cycles (deviations away from long-run equilibrium).

Higher prices for New Zealand commodity exports mean that the expected return from this activity will be higher. Stronger returns for commodity exports lead to expectations that interest rates will rise in the future to dampen demand, which will in turn typically lead to an appreciation of the New Zealand dollar.

Figure 16: Terms of trade and the TWI *(quarterly data, Q1 1991 to Q2 2010)*

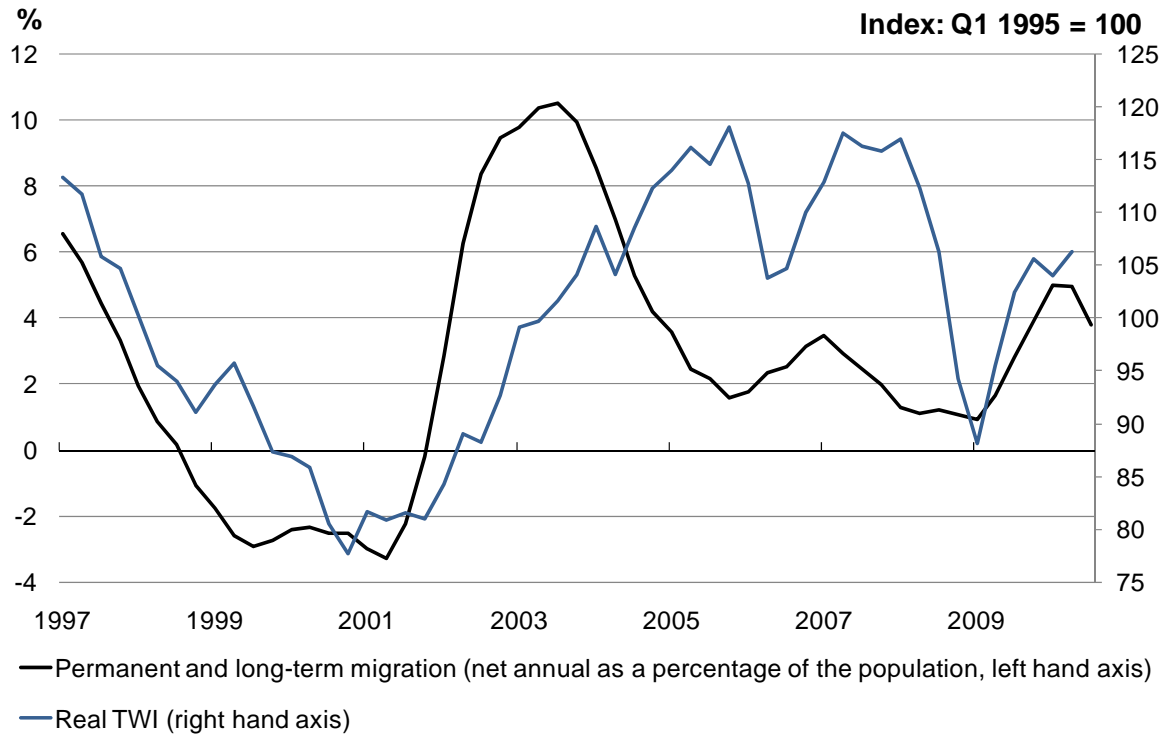Terms of trade (left hand axis) —— Real TWI (right hand axis)

Source: Reserve Bank of New Zealand, Statistics New Zealand

Fiscal policy, migration cycles and housing cycles can all exacerbate exchange rate cycles in that they add to domestic demand. This in turn affects interest rate differentials as interest rates rise in response to domestic demand pressures. The significant increase in government spending (Blick, Hampton, Mears and Janssen, 2010) seen from 2005 added to demand and inflation pressures at a time when unemployment was very low and the economy was stretched in terms of its productive capacity. The pressure on monetary policy to control inflationary pressures contributed to an exchange rate that remained overvalued for some time.

Figure 17 shows the correlation between migration cycles and exchange rate cycles in New Zealand. The relationship was particularly strong from 1997 to the early 2000s. It has since weakened as other factors have played a larger role. Figure 18 shows the close relationship between house prices and New Zealand's TWI. The relationship is strong from 1991 through until 2008. Both migration and house prices reflect underlying demand factors in the economy. High net immigration not only contributes to demand in the economy in itself, but it also contributes to higher levels of capital flows as migrants bring capital into the economy when they arrive (Munro, 2004). This then contributes in part to housing cycles because one of the likely uses for this capital is to purchase housing.

Figure 17: Migration and the TWI *(quarterly data, Q1 1997 to Q3 2010)*

—Permanent and long-term migration (net annual as a percentage of the population, left hand axis)

—Real TWI (right hand axis)

Source: Statistics New Zealand, Reserve Bank of New Zealand, author's calculations

Figure 18: House prices and the TWI *(quarterly data, Q1 1991 to Q3 2010)*

—House price index (annual change)　　—Nominal TWI (annual change)
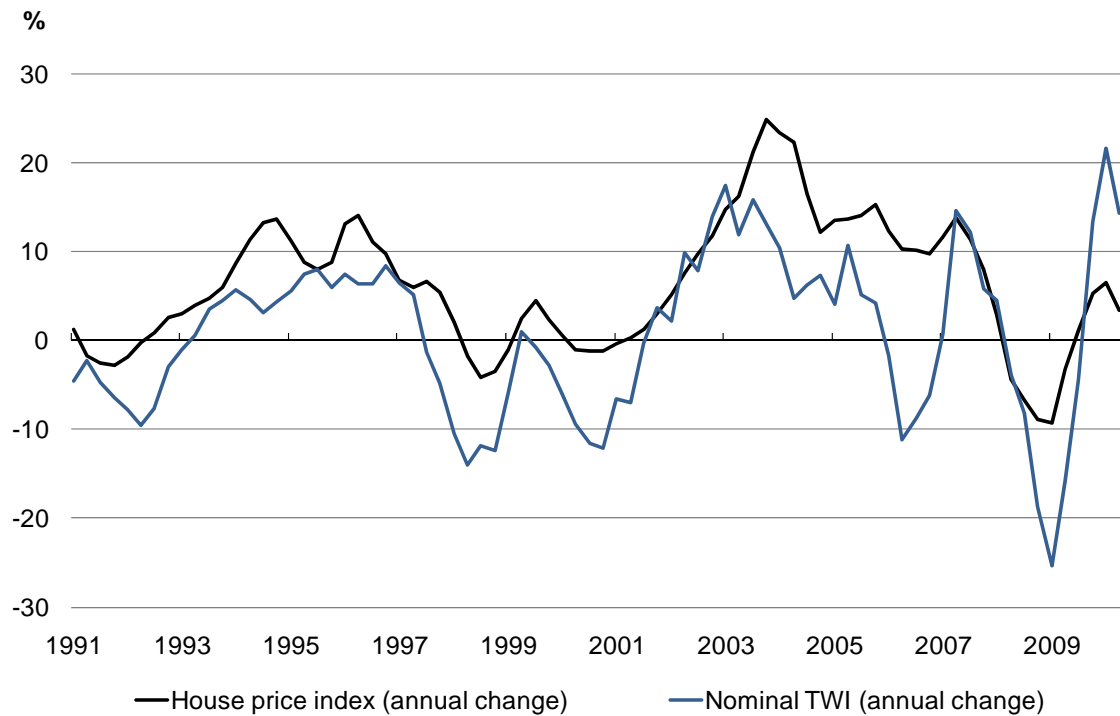
Source: PropertyIQ, Reserve Bank of New Zealand, author's calculations

4.2　Equilibrium level

The concept of an equilibrium exchange rate is difficult to pin down, and is often interpreted in different ways. Some analysts equate the level that the exchange rate has averaged over a long-term horizon with a concept of equilibrium. Others argue that, since the exchange rate is determined continuously in foreign exchange markets by the supply and demand for currencies, the exchange rate will always be in equilibrium. Another approach views the equilibrium exchange rate as a theoretical concept based on the idea that over some time period, the exchange rate will tend to move towards a level that reflects fundamental factors in the economy, e.g. productivity levels and the terms of trade. This section of the paper focuses on this last definition of the equilibrium exchange rate.

In practice, the equilibrium exchange rate cannot be observed, and there may be different equilibriums for different time periods (Driver and Westaway, 2004). Several analytical frameworks can be used to explain what the equilibrium level might be and what factors might lead the exchange rate to move away from or toward that level. Each framework depends heavily on assumptions that may not hold in practice.

Two main approaches are the Purchasing Power Parity (PPP)[18] concept and Macroeconomic Balance approach.[19]

PPP is based on the idea that in equilibrium, the prices of goods in one country will be the same in another country when denominated in the same currency. This then leaves no profitable opportunities for buying in one country and selling in another (known as arbitrage). At an economy-wide level, deviations of the real exchange rate from PPP will lead to changes in supply and demand which will move the real exchange rate back to PPP.[20] Competitiveness and cost factors also impact on PPP. In the longer-term, different labour and transport costs will have an impact on location decisions and there will tend to be movement in production from the overvalued to the undervalued economy i.e. capital arbitrage. However, sustained deviations from PPP are common, and the reversion back towards this equilibrium level is often very slow. For example, Rogoff (1996) found that half of PPP reversion typically takes three to five years for major currencies against the US dollar.

One potential reason for sustained deviations away from PPP equilibrium is the impact on the real exchange rate of non-traded goods in the economy. If the tradable sector experiences faster productivity growth in one country, then the ratio of non-tradable prices to tradable prices should grow more quickly. This higher productivity then raises wages in the tradable sector, which in turn 'spills over' and results in higher wages in the non-tradable sector. The resulting impact is higher prices in the non-tradable sector. This is the idea behind the Balassa-Samuelson effect, which suggests that the real exchange rate should take into account the ratio of the relative prices of traded and non-traded goods in both economies, to capture this impact of the non-traded sector (Driver and Westaway, 2004).

The Macroeconomic Balance approach attempts to identify the level of the exchange rate that would be consistent with both internal and external balance (but asset stocks may still

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[18] For a more detailed description of the long-run equilibrium of the exchange rate, see Munro (2004), Driver and Westaway (2004), Brook and Hargreaves (2000).

[18] Variants on the Macroeconomic Balance model are the Equilibrium Real Exchange Rate approach and the External Sustainability approach (IMF, 2010).

[20] Where there are competitive markets, no transaction costs or barriers to trade.

be changing). Internal balance is achieved when the economy is operating at potential output and inflation is stable. External balance is achieved when the current account balance is being financed by a sustainable rate of capital flow. According to this approach, any internal or external imbalances in the economy will lead to an adjustment, in either the exchange rate or in the domestic economy, until balance is achieved. For example, an unsustainable current account deficit (in the sense that the trade balance is not sufficient to service foreign debt) will imply that an eventual depreciation of the exchange rate would be required to restore balance, because the proportion of domestic production that is exported will need to increase.

The Macroeconomic Balance approach implies that the level of the equilibrium exchange rate itself may change over time if there are changes to underlying factors that influence a country's current account position or ability to service foreign liabilities. For example, any increase of the current account deficit reflecting a widening between national saving and domestic investment would lower estimates of the equilibrium exchange rate. Conversely, any increase in a country's ability to service foreign liabilities through, say, an increase in productivity or the terms of trade, would increase estimates of the equilibrium exchange rate. In practice it is difficult to distinguish exchange rate fluctuations around an equilibrium level from changes to the equilibrium level.

The equilibrium exchange rate for New Zealand is likely to be below what it has actually averaged for the past 40 years. Simply put, New Zealand's net international investment position has grown steadily more negative since the early 1970s, reflecting persistent current account deficits (figure 19)[21] and in particular a rising investment income deficit. This indicates that the goods and services balance has not been sufficient to offset rising servicing of New Zealand net external liabilities.

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[21] The PPP measure of the equilibrium level does not capture these trends.

Figure 19: New Zealand's current account balance and net international investment position (quarterly data, Q1 2001 to Q3 2010)
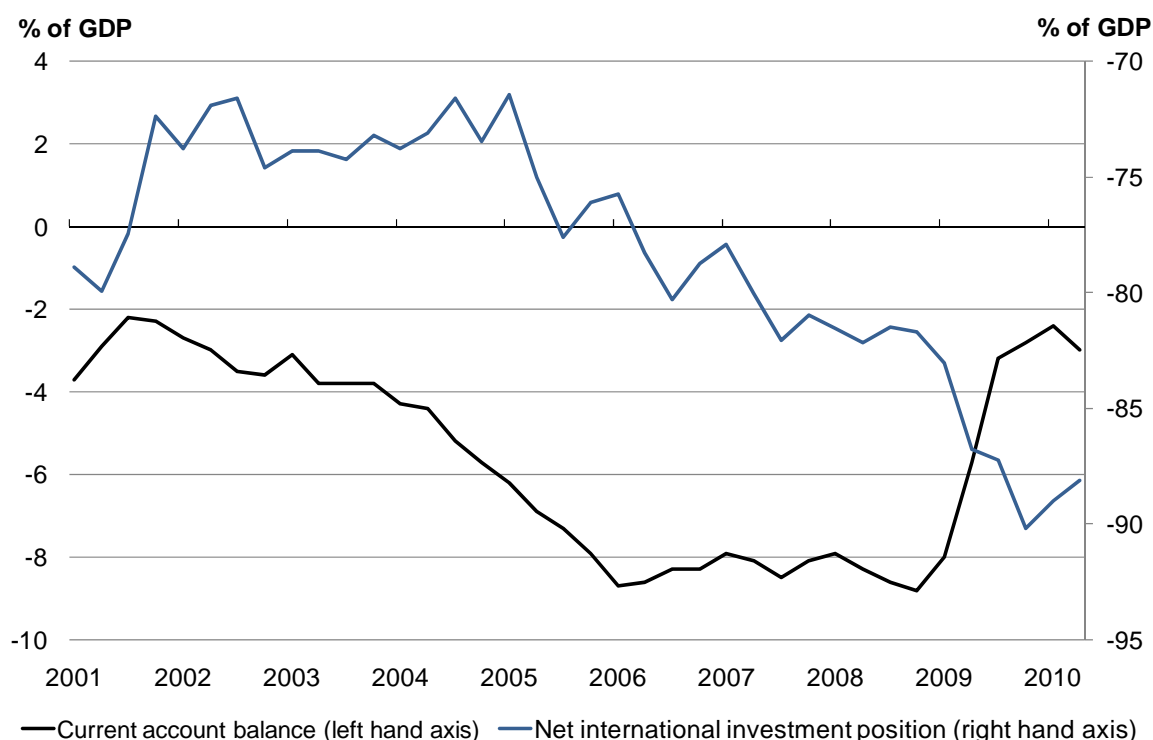
Source: Statistics New Zealand

The terms of trade is one determinant of the equilibrium exchange rate. It has risen about 50% over the past 25 years. The fact that this has not resulted in a reduction in the external imbalance, and therefore an increase in the equilibrium level of the exchange rate, suggests other factors have deteriorated enough to drive the equilibrium exchange rate below the average level actually experienced over the past few decades. Possible reasons include New Zealand's relative productivity performance, and factors that have led to the gap between national saving and investment widening on average over the past decade.

Recent IMF estimates of New Zealand's exchange rate suggest it is currently overvalued by up to 25% (the current deviation from its *long-run equilibrium*) (IMF, 2010). Cline and Williamson (2010) also find that the New Zealand dollar is currently overvalued by 25%. The fact that the exchange rate has not adjusted suggests that there are other factors at work.

Conclusions on the drivers

The concept of relative returns on New Zealand's assets is important in attempting to explain the behaviour of New Zealand's exchange rate cycles. Any factor that affects relative returns on New Zealand assets will drive the exchange rate, e.g. interest rate differentials and other global and domestic factors. More fundamental economic factors tend to influence the long-run equilibrium level of the exchange rate, e.g. productivity differentials and the terms of trade. The main driver is likely to change over time depending on developments in the domestic and global economy.

5   Conclusion

This paper seeks to understand the behaviour of New Zealand's exchange rate cycles, both through looking at evidence of its volatility and variability and through understanding what are the key factors driving it over different time horizons.

This paper finds that New Zealand does have large exchange rate cycles, but that this is also the case in several other relevant economies. Short-term volatility is high in New Zealand, and is similar to the exchange rate volatility experienced in Australia and Japan. It also shows that there are many factors influencing exchange rate cycles, including global and domestic factors.

The findings in this paper raise important questions that will be explored in the companion paper Mabin (forthcoming). Due to New Zealand's small domestic market, the large variability that New Zealand's exchange rate exhibits could be more damaging to New Zealand's economy than similarly variable exchange rates are to other economies. It also raises questions related to policy options to dampen exchange rate variability.

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