What drives the New Zealand dollar?

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This article draws together some of our recent exchange rate research. The research is interpreted against an asset price view of the exchange rate, which has become increasingly relevant as foreign exchange market turnover has become dominated by capital market transactions unrelated to trade in goods and services. Factors that affect expected relative returns on New Zealand dollar assets (eg interest rates, export commodity prices, fixed asset prices and a notion of equilibrium) are found to explain a considerable part of exchange rate cycles, even though they explain only a small part of short-term exchange rate fluctuations. The sources of the relative stability of the Australia-New Zealand bilateral exchange rate and the larger variation of the New Zealand-United States bilateral exchange rate are explored.

1 Introduction

What drives the New Zealand dollar? This is a question that affects the Reserve Bank every day in terms of forecasting inflation, understanding the consequences of changes in interest rates, achieving our institutional objective of avoiding unnecessary instability in the exchange rate, and more recently, making decisions about foreign exchange market intervention. It is a question that is important in more tangible ways for New Zealanders engaged in activities that reach outside our borders. While domestic stability, in terms of prices, output and interest rates, has improved dramatically in the past two decades, both short-term exchange rate fluctuations and cyclical exchange rate movements have continued to be large.

What drives exchange rates is a question that has frustrated economists for decades. After a period of optimism for exchange rate models in the 1970s and early 1980s, Meese and Rogoff (1983) showed that no exchange rate models could systematically outperform the simple assumption that today's exchange rate is the best estimate of tomorrow's exchange rate.

This article draws together our recent empirical research that explores determinants of the New Zealand dollar. The research is set against an asset price view of the exchange rate, whereby the value of the New Zealand dollar responds to a forward-looking calculation of the discounted sum of returns to holding New Zealand dollar assets. A few factors that affect expected relative returns (eg interest rates, export commodity prices, fixed asset prices and a notion of equilibrium) are found to explain a considerable part of exchange rate cycles, even though they explain a much smaller part of short-term exchange rate fluctuations. The close integration of the Australian and New Zealand economies is estimated to be an important factor in the relative stability of the Australia-New Zealand bilateral exchange rate compared to the New Zealand-United States bilateral exchange rate.

The remainder of the article is structured as follows. Section 2 introduces the asset price view of the exchange rate and sets out its main implications for exchange rate behaviour. Section 3 discusses uncovered interest parity as a driver of the exchange rate, and the roles of exchange rate expectations and forward-looking behaviour. While an asset price framework fits with the short-term volatility we observe, and offers an explanation for the difficulty in reliably predicting future exchange rates, section 4 considers the notion of a more stable equilibrium exchange rate. Section 5 considers how well fundamentals associated with expected returns can explain observed exchange rate fluctuations. The findings support exchange rate cycles driven by relative expected returns on New Zealand dollar assets, particularly interest rate differentials and commodity prices, but moderated by reversion toward equilibrium. Section 6 considers the implications for the trade-offs between volatility in the exchange rate and in other economic variables. Section 7 concludes.

2 The asset price view of exchange rates

A crucial factor in exchange rate behaviour has been the evolution of the foreign exchange market. Prior to 1985, most foreign exchange market activity was associated with financing international trade flows. With the lifting of capital controls in 1984-5 and the floating of the New Zealand dollar in March 1985, transactions associated with investment and securities grew rapidly. By 2001, international trade in goods and services accounted for less than 2 per cent of foreign exchange market turnover.[1]

As foreign exchange market turnover has become dominated by financial transactions rather than those related to trade,[2] the exchange rate has increasingly come to be viewed as an asset price. An asset price is viewed as the present value of the future net income stream associated with a particular entity or asset. This model can be applied to all sorts of assets, such as shares, bonds, housing, etc. As an asset price, the exchange rate responds to the market's current expectation of a discounted sum of returns to holding assets denominated in New Zealand dollars relative to those denominated in other currencies. While free capital mobility underpins the market, the exchange rate may be bid up or down in response to changes in a wide range of factors that affect expected returns and risk, without capital flows necessarily having to take place.

The asset price framework has at least three important implications for the determination of the exchange rate. First, when market expectations of present or future returns change (ie there are changes in fundamentals or risks that can affect returns), or if the discount rate applicable to such future returns changes, the market immediately re-prices the currency in response to the news. The prevalence of news in driving the exchange rate helps to explain the high degree of short-term variation observed in floating exchange rates and the empirical difficulty in explaining exchange rate movements, and particularly in forecasting exchange rates.[3]

Second, both current and expected future economic policy will affect the exchange rate. This helps to explain why, for example, attempts during the Asian crisis to defend falling currencies by raising interest rates was largely ineffective - higher interest rates were not perceived as sustainable given the weak state of the domestic economies. Closer to home, the importance of expected future policies helps to explain why changes in the Official Cash Rate (OCR) have had little same-day effect on the exchange rate.[4] With a clear objective for monetary policy, a published model and regular OCR review dates, changes in the OCR are largely anticipated and priced-in prior to the announced change.

For example, while the January 2004 rise in the OCR was seen by many as a surprise, the surprise was, in fact, only a matter of timing. The markets were already pricing in an OCR rise in March. Moreover, positive US data a few days earlier had brought forward expectations of a US tightening cycle. So while the announcement was "news", it didn't affect the expected sum of discounted returns by much and had little effect on the exchange rate. More generally, the Reserve Bank's ability to manipulate the exchange rate through interest rates is very limited. Any announced interest rate path which the markets interpret as inconsistent with meeting the inflation target, would be unlikely to change expected real returns by very much or for very long, and would thus have a minimal effect on the exchange rate.

Finally, the asset price framework changes how we must view the interaction between the exchange rate and the balance of payments. Prior to 1985, in an environment of capital controls and a fixed exchange rate, we used to think of exchange rate depreciations as being driven by current account deficits and the need to attract financing to prevent a run down in reserves. This can be understood in terms of the balance of payments identity: current account balance plus capital account balance equals the change in reserves. The exchange rate depreciation would both attract financing[5]

1 In 2001, current account debits plus credits amounted to about US$40 billion, while NZD/USD turnover in the New Zealand and Australian foreign exchange markets amounted to US$7.2 billion per day. The NZ dollar is also widely traded in New York (an additional $1 billion per day) and London (no disaggregated figure for the NZ dollar). See Rosborough (2001).

2 The view that the exchange rate is best regarded as an asset price goes back at least to the early 1980s. See Frenkel and Mussa (1980), Mussa (1982).

3 Originally shown by Meese and Rogoff (1983). See Chen and Rogoff (2002) for an update.

4 Gray (2004).

5 The incentives for financing can be understood in terms of portfolio balance models (see Branson and Henderson 1985 for a basic model and Cushman 2003 for a recent application to exchange rate determination for the US-Canada exchange rate). To encourage investors to increase holdings of New Zealand dollar debt in their portfolios, the debt must offer higher relative yields – either a larger interest rate differential or a fall in the relative price (an exchange rate depreciation). The required yield increase rises in line with the level of net foreign debt, to offset diversification losses in foreign portfolios, over and above any potential increases in default risk.

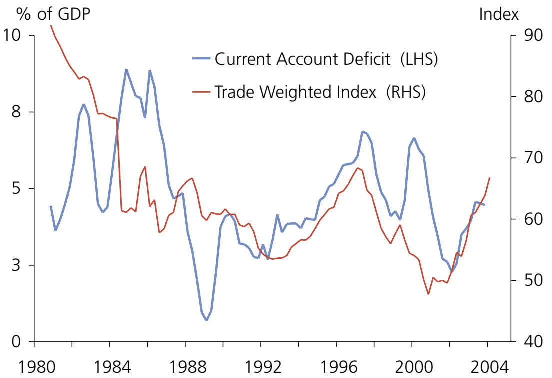
and improve the current account position (by increasing export competitiveness and reducing import demand).

In an asset price framework, with capital markets driving the exchange rate, the current account is forced to adjust. However, the current account adjustment should moderate exchange rate fluctuations in two ways. First, an appreciation of the New Zealand dollar means a deterioration of the current account (exporters receive less foreign currency and cheaper imports stimulate import demand) which implies a fall in demand for New Zealand dollars. This fall in demand, however, may not affect the exchange rate by much, since international trade accounts for such a small part of foreign exchange turnover.

Second, a current account deficit implies a rise in net foreign debt that needs to be financed. The expected depreciation required to attract financing of the rising net foreign debt reduces expected returns on New Zealand dollar assets, putting downward pressure on the New Zealand dollar.

Figure 1 illustrates how the relationship between the exchange rate and the balance of payments appears to have changed over time. In the early 1980s, large current account deficits were offset by depreciations of the New Zealand dollar. From about 1990, growing current account deficits generally coincide with currency appreciations, consistent with the idea that capital markets have driven the exchange rate, forcing the current account to adjust, rather than the other way around.

Figure 1
The balance of payments and the exchange rate



Source: Statistics New Zealand, RBNZ data

3 Uncovered interest parity

The assets most widely traded across borders are debt securities, such as bills, bonds or notes issued by governments, state-owned entities and private sector corporations, including banks. Quality and risk characteristics are relatively easy to assess in the case of debt securities, and debt securities are traded in liquid markets, including derivatives markets. The expected relative return to holding New Zealand dollar debt depends on (i) the (risk-adjusted) interest rate differential between New Zealand and foreign securities, and (ii) the expected change in the exchange rate. If the expected relative return is zero, there is no incentive for arbitrage, and uncovered interest parity (UIP) is said to hold. When UIP does not hold, there is an incentive to shift capital into the currency expected to yield a higher net return, leading to an appreciation of that currency.

While the interest differential is observed at the beginning of the period, the change in the exchange rate over the period of the security is not. If investors had perfect foresight, then high (risk-adjusted) domestic interest rates relative to foreign interest rates should always be offset by proportional exchange rate depreciation. This is not, however, what we tend to see in practice.[6]

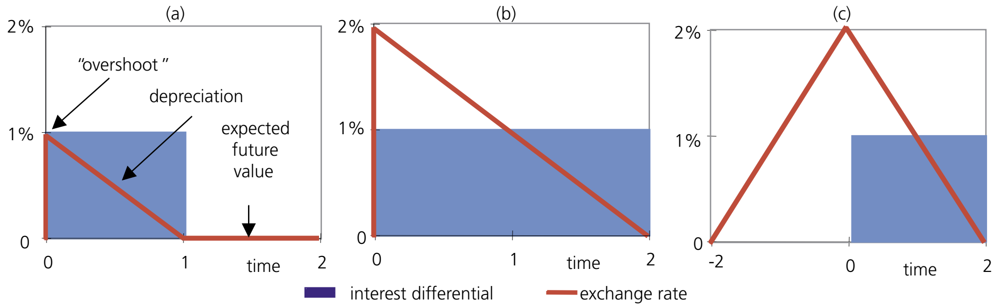
Forward-looking behaviour also helps to reconcile efficient markets theory with what we observe. If investors are forward-looking, today's exchange rate is its expected future value, plus the expected sum over time of the interest differential.[7] The exchange rate initially "overshoots" its future expected value by the sum of the interest differential over time and then depreciates over the life of the security so that expected profits are zero over the investment period.[8]

As shown in figure 2, both the size of the interest rate differential and its expected duration determine the extent of the initial "overshooting".[9] For example, a 100 basis

6 There is a large literature on the empirical failure of this form of UIP. See Flood and Rose (2002) for an example. This is, however, a good description of covered interest parity since forward exchange rates are generally determined by interest rate differentials so profits are arbitraged away.
7 See Allsopp and Vines (2000).
8 This is the intuition captured in the "overshooting" model of Dornbusch (1976).
9 See MacDonald and Nagayasu (2000) who find interest differentials on longer maturity securities to be associated with larger exchange rate responses.

Figure 2

Uncovered Interest Parity



point interest differential on a one year debt security might be expected to lead to an initial 1 per cent exchange rate appreciation, followed by a depreciation of 1 per cent per year for a year (figure 2a). If, however, the interest rate differential is expected to persist for two years, the resulting increase in the expected sum of returns should lead to an initial appreciation of 2 per cent followed by a depreciation of 1 per cent per year for 2 years (figure 2b). So the exchange rate response is larger for interest differentials on longer-maturity securities and on short-term securities that persist. If the interest differential is anticipated (eg strong economic news suggests rising inflationary pressure and future increases in interest rates), the exchange rate may be bid up before the interest differential opens (figure 2c).

As short-term exchange rate movements are difficult to predict, near-term portfolio investment decisions may in practice be made on the basis of the (risk-adjusted) interest differential alone. This implies positive returns to holding the higher yielding currency, and continued incentives for capital to flow towards the higher yielding currency, as long as the interest rate differential persists or until overvaluation begins to alter exchange rate expectations. While persistent profit opportunities may seem at odds with efficient markets, there is probably some truth to this, consistent with the enduring findings of Meese and Rogoff (1983) that today's exchange rate is the best estimate of the future exchange rate, particularly for time horizons of less than one year.[10]

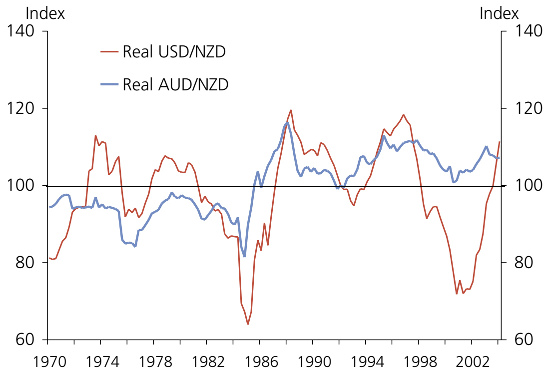
Arbitrage conditions similar to UIP should apply to other types of assets. Typically, however, the expected returns on other types of assets will be more difficult to estimate, as the nominal return on most assets is only known ex post (while the nominal interest return is known at the beginning of the investment period), and specific risk and quality characteristics will often be difficult to assess.

4 Long-run equilibrium in the foreign exchange market

While an asset price framework emphasises news as the driver of exchange rates, the notion of "equilibrium" remains important for expected returns. Implicit in the discussion of UIP above was a notion of a future equilibrium exchange rate. As the New Zealand dollar comes to be seen as "over-valued", expected returns to holding New Zealand dollar assets fall as the currency is expected to depreciate.

Figure 3

Australian dollar and US dollar real exchange rates



Note: March 1992 quarter = 100. Sources: RBNZ, Statistics New Zealand data.

10 Technical factors (eg timing of closing out of positions) may dominate "fundamentals" for relatively short time periods. See Chinn and Meese (1995) and Mark (1995) for longer run forecast performance. Many of the models that challenge Meese and Rogoff (1983) incorporate nonlinearities, eg Taylor and Peel (2000).

What determines the long-run equilibrium? If we accept that there was a fall in New Zealand's risk premium in about 1985, the real value of the New Zealand dollar appears to have fluctuated around a fairly constant average value relative to Australia and the United States (figure 3). While this might appear as reversion to a stable equilibrium, there are reasons to expect the equilibrium to vary over time, in response to broader structural changes in the economy.

Two analytical frameworks can be used to assess long-term equilibrium exchange rates: the concept of purchasing power parity and the notion of macroeconomic balance. These two concepts are discussed in the next parts of this section of the article.

Purchasing power parity

Purchasing power parity (PPP) is based on the law of one price: with competitive markets, in the absence of transactions costs and barriers to trade, the prices of identical goods in different countries should be the same when denominated in the same currency, leaving no profitable arbitrage opportunities in the goods market. While the law of one price applies to a single good, PPP applies to the price of a basket of goods and services. If PPP holds, then the real exchange rate (nominal exchange rate multiplied by the ratio of the domestic price level to the foreign price level) should be stationary, meaning that over time it reverts back toward some equilibrium level.

In practice, exchange rates between countries with large differences in inflation do tend to move to offset the differences in inflation. However, exchange rates between countries with low and stable inflation often do not appear to revert toward PPP, particularly for US dollar cross rates.[11] Some studies using very long data sets support the idea that in low inflation countries, PPP will apply over the longer term, once cumulative relative price developments grow sufficiently large.

There are, however, several reasons why PPP may not hold. First, persistent short-term factors, such as persistent interest rate differentials, that drive nominal exchange rates also drive real exchange rates in a low inflation environment, and therefore lead to substantial deviations from PPP in the short term.

Second, transactions costs and trade barriers may create bands where prices diverge, but there are no profitable arbitrage opportunities. Arbitrage only leads to adjustment to the edge of the band. While PPP is generally measured relative to consumer prices, transactions costs are much larger at the consumer level than at the producer level.[12]

Third, in the absence of perfect competition, price differences may persist. For example, the removal of the ban on parallel importing in 1998 should have increased price arbitrage in the market for branded goods and strengthened adjustment toward PPP by increasing the pass-through of exchange rate changes to domestic prices.

Fourth, price arbitrage can only be expected to equalise the prices of goods that are traded between countries. Price differences in non-traded goods may lead to differences in price levels, even when the prices of traded goods are equal across countries,[13] and traded goods prices often include non-traded components such as retail costs.

Finally, differences in the baskets of goods that make up domestic and foreign consumer price indices may lead to changes in relative prices levels over time, even if the law of one price holds for each good or service.

Macroeconomic balance

In a macroeconomic balance framework, the sustainable real exchange rate is one that is consistent with both internal balance (meaning output is at potential with non-accelerating inflation) and external balance (meaning the current account is being financed by a sustainable rate of capital flow).[14] The long-run real exchange rate is affected by structural factors underlying both the current account and the capital account, such as productivity, trade policy, terms of trade, the composition of fiscal spending and factors that affect a country's underlying propensity to be a

11 This is one of macroeconomics' major puzzles. See Rogoff (1996), Obstfeld and Rogoff (2000).

12 Obstfeld and Rogoff (2000).

13 See MacDonald (1997) for a discussion of factors that may alter the PPP equilibrium, including relative productivity, relative savings and the terms of trade.

14 See Wren Lewis (2004) for a study of New Zealand.

net lender/borrower, such as demographics and the stock of government debt.[15] As such, the long-run equilibrium real exchange rate may vary over time depending on a variety of factors including:

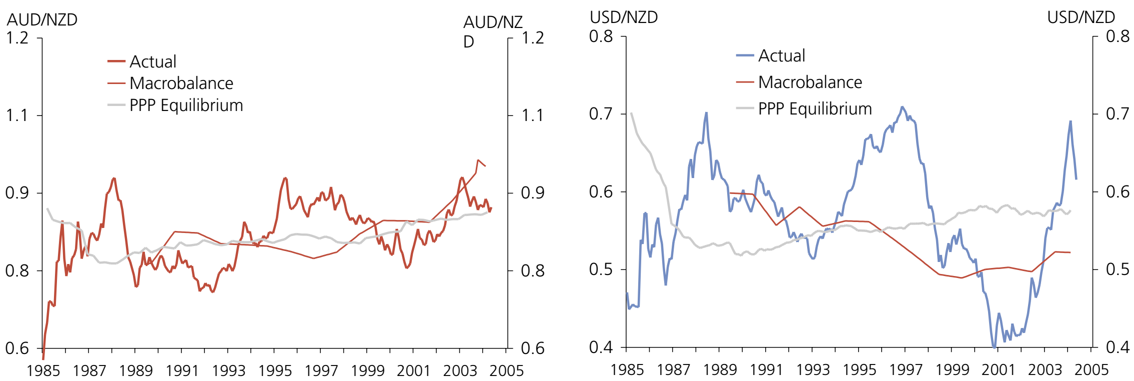
- relative current account positions – an unsustainable current account deficit implies a devaluation of the domestic currency to restore balance;
- unemployment – if domestic unemployment is high, then a larger depreciation is required to restore balance;
- the net foreign asset position - a higher stock of net foreign liabilities implies higher payments on net foreign liabilities and a greater depreciation to achieve current account balance;
- relative productivity growth - a country with high productivity growth in its export sector can sustain an appreciating currency;[16]
- relative inflation (PPP); and
- the terms of trade (export prices relative to import prices) -if the terms of trade improves, less depreciation is required to restore balance.

Figure 4 shows some estimates of bilateral exchange rates that are consistent with PPP equilibrium and a current account deficit of 4 per cent of GDP. The New Zealand dollar appears to remain close to "equilibrium" relative to the Australian dollar, but to deviate substantially from equilibrium relative to the US dollar.

Implicit in the macroeconomic balance framework is the idea that real imbalances in the economy will lead to adjustment, either through the exchange rate or through adjustments in the domestic economy. The expected adjustment to imbalances will affect the expected return on New Zealand dollar assets. For example, a high current account deficit implies a future depreciation of the currency, which reduces expected returns to holding New Zealand dollar assets, leading to a re-pricing of the currency. In this way, capital markets may play an important role in the adjustment toward "equilibrium"

Capital market perceptions of the long-run equilibrium exchange rate may, however, differ from those based on the concepts of PPP or macroeconomic balance. For example, some market participants may extrapolate from recent trends – a recent appreciation may be seen as evidence that we are on the rising part of the exchange rate cycle. Alternatively, if the New Zealand dollar remains strong the equilibrium value may be perceived to have risen. These types of expectations may lead to persistent departures from macroeconomic balance or PPP equilibrium. The associated uncertainty about the degree of over- or under-valuation of the currency (see for example figure 4) may lead to bands

Figure 4
Equilibrium exchange rates: PPP and macroeconomic balance



Note: PPP Equilibrium based on historical average of real exchange rate.
Source: Macrobalance estimates from Wren Lewis (2004), PPP normalised on period average.

15 See Faruqee (1995)
16 The Balassa Samuelson effect. See Balassa (1964) and Samuelson (1964).

in which the market does not respond to deviations from a fundamentals-based long- run equilibrium.

5 Empirical evidence: does an asset price framework fit the data?

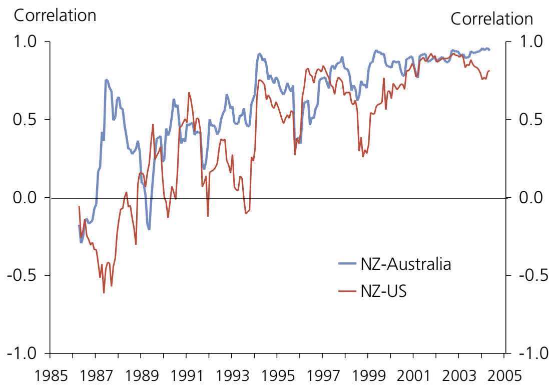
If exchange rates are viewed as asset prices, the prevalence of "news" as a driver might appear to preclude empirical work based on "fundamentals". However, over time news about fundamentals should generally coincide with actual fundamentals, with some leads or lags. This section reports on recent empirical work at the Reserve Bank and considers how variables that are correlated with the exchange rate might affect expected relative returns on assets denominated in New Zealand dollars. While the foreign exchange market aggregates a lot of information, it turns out that a few explanatory variables can explain a reasonable part of the cycles observed in the New Zealand dollar, at least within the sample period.

Interest rates: the return on fixed income assets

In a clever twist on the UIP relationship, an IMF study[17] covering 1990 to 1999 looked at monetary policy announcement-day effects (corrected for same-day financial news), and estimated a 2-3 per cent appreciation of the New Zealand dollar in response to a 100 basis point rise in 90 day interest rates. An update of this work[18] for the OCR period found that, while the result held for the whole period (but with reduced significance), OCR changes have been largely anticipated and associated with no significant exchange rate response.

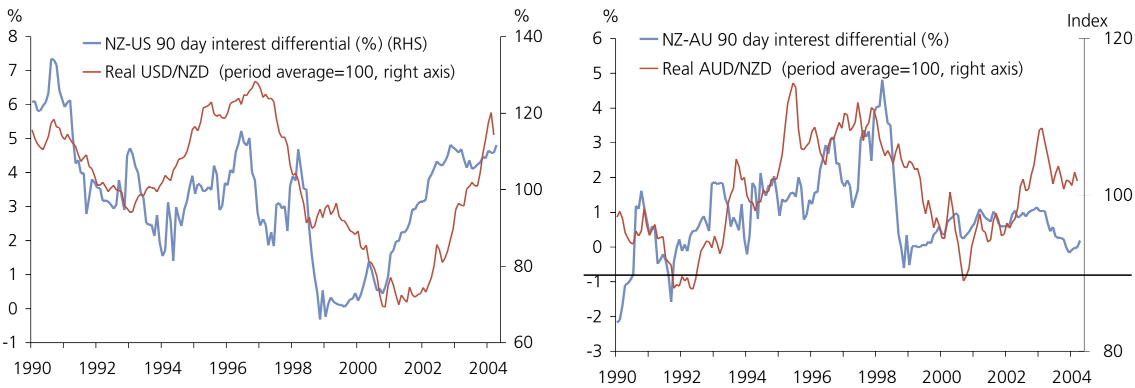
Over a month or a quarter, however, high New Zealand 90 day interest rates relative to our trading partners are associated with appreciation of the New Zealand dollar (figure 5). A 90 day interest rate differential of 100 basis points is associated with an exchange rate appreciation of about 6 per cent in the long-run relative to the Australian and US dollars.[19] In

Figure 6
Capital market integration:
Co-movement of long term interest rates



Note: Correlation of monthly changes in 10-Year interest rates over the previous year. Source: RBNZ data.

Figure 5
90 day interest rate differentials and the exchange rate



17 Zettelmeyer 2000, IMF Working Paper WP/00/141

18 Gray (2004).

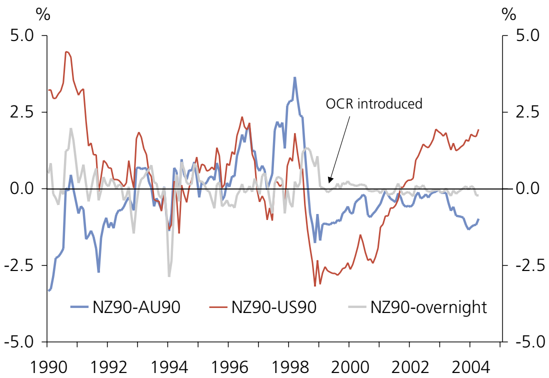
19 Huang (2004).

contrast, long-term interest differentials are not found to be significant as a driver of the exchange rate.[20]

Relatively recent changes in the determinants of interest rates help to explain these findings. In principle, a given interest rate differential on longer maturity securities would be expected to have a larger impact on the exchange rate than an equivalent differential on short-term instruments because the security lasts longer. If, however, New Zealand long term interest rates adjust in response to deviations from UIP, the required exchange rate adjustment should be small. Figure 6 illustrates the increasing co-movement between New Zealand and foreign 10-year interest rates.[21] Assuming New Zealand interest rates respond to foreign interest rates, but not vice versa,[22] Australian and US interest rates now explain most of the variation in New Zealand 10-year interest rates, implying a high degree of capital market integration and interest rate adjustment.

At the short end of the maturity spectrum, the story is almost the opposite. Since the introduction of the OCR in March 1999, 90 day interest rates have moved closely with overnight interest rates (figure 7). This close relationship reflects a fall in arbitrage risk between short-term interest rates and overnight funds as monetary policy has become more predictable (reflecting a clear objective, published model, scheduled OCR review dates and the overnight interest rate defended within a ±25 basis point band around the OCR). This relationship is not unique to New Zealand. In Australia, a similar cash rate system was introduced in the early 1990s, and internationally there has been increasing focus on controlling interest rates rather than monetary quantities over the past decade.

Figure 7
Effective monetary policy control of 90 day interest rates

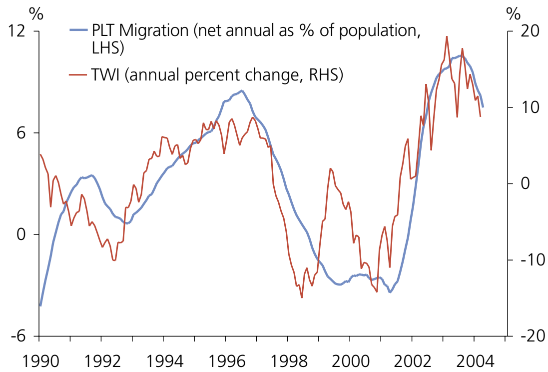


Note: Interest differentials adjusted for constant risk premium (1992-2004 average). NZ 90-day-overnight differential calculated as difference between 90-day rate and average overnight rate for the same period. Source: RBNZ data.

The ability of monetary policy to anchor short-term interest rates means that short-term interest differentials are determined by relative monetary policies, which reflect persistent relative domestic demand pressures and hence inflationary pressures. As exchange rate changes are difficult to predict at short horizons, persistence in short-term interest rate differentials may present continued incentives for uncovered interest rate arbitrage. If interest rates do not adjust in response to this arbitrage, adjustment toward UIP must come through the exchange rate.

The strong estimated exchange rate response to short-term interest differentials may also reflect two related factors. First, the short-term interest rate differential reflects domestic demand pressures, and therefore relative profitability and asset returns as well as interest returns. Second, large observed exchange rate cycles may encourage herd-like behaviour: not only do high interest rates imply higher interest returns, but also a higher yield due to the expected exchange rate appreciation.

Figure 8
Net migration and the exchange rate



Sources: Statistics New Zealand, RBNZ data.

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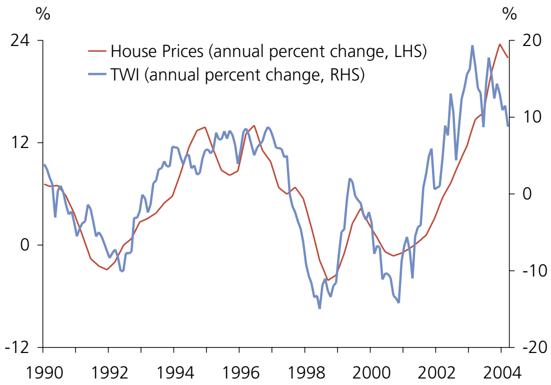
20 Huang (2004), Stephens (2004), Munro(2004a)

21 For a more rigorous treatment in an error correction framework, see Munro (2004a).

22 This implies foreign capital market domination, consistent with New Zealand's relatively small economy and capital market.

Figure 9
House prices and the exchange rate



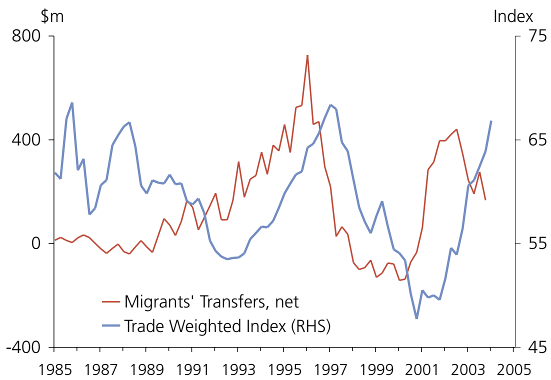
Source Quotable Value NZ, RBNZ data.

Migration, domestic demand and the return on residential property

Changes in the exchange rate are highly correlated with both migration (figure 8) and house prices (figure 9). To some extent, the correlation with migration could be coincidence. Periods of a strong New Zealand dollar in the mid 1990s and in the past year coincided with high net immigration; but the strong New Zealand dollar also coincided with large and persistent interest rate differentials. In the mid-1990s it was unusually high New Zealand interest rates, and since 2001 it has been unusually low US interest rates.

This coincidence aside, there are still good reasons why high net migration may be associated with a strong New Zealand dollar. First, high rates of net immigration tend to fuel domestic demand. Buoyant domestic demand is associated with increased profitability, which increases the attractiveness of New Zealand assets, and leads to higher domestic interest rates. This much is probably captured in the interest rate differential.

Figure 10
Migrants' transfers ($m) and the exchange rate



Sources: Statistics NZ, RBNZ data.

Second, capital flows associated with migration can be quite large (see figure 10), as migrants bring or take capital with them to purchase a house or business and fund other expenditures. Capital flows into the housing market put pressure on house prices, reinforce domestic demand pressures through a wealth effect, and encourage domestic investment in housing. With low domestic savings, mortgages are financed through external borrowing, and so amount to a further capital inflow, and greater upward pressure on the exchange rate. Viewed another way, both the exchange rate and house prices are important asset prices that reflect some of the same underlying demand factors. While migration may sometimes be a causal factor, interest rate differentials are probably a broader measure of demand pressures.

Commodity prices and the return on primary production

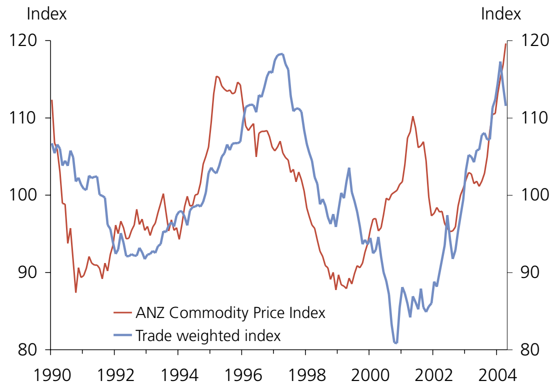
A rise in export commodity prices (in US dollar terms) implies higher expected returns to rural land and other assets associated with primary production, and possibly higher future interest rates, implying an appreciation of the New Zealand dollar. Viewed in terms of actual capital flows, higher US dollar denominated receipts for these exports means greater demand for New Zealand dollars and upward pressure on the New Zealand dollar.

Either way, the appreciation associated with a rise in export commodity prices potentially plays an important buffering role. If a 1 per cent rise in export commodity prices leads to a 1 per cent appreciation of the New Zealand dollar, then commodity exporters will face stable export prices in New Zealand dollar terms.[23]

As shown in figure 11, the buffering role of the exchange rate generally appears to be on the order of one-to-one. In our empirical studies, the estimated exchange rate appreciation

23 While this may be true in aggregate, producers of manufactured goods or commodities whose prices have risen by less than average may see a fall in income or loss of competitiveness.

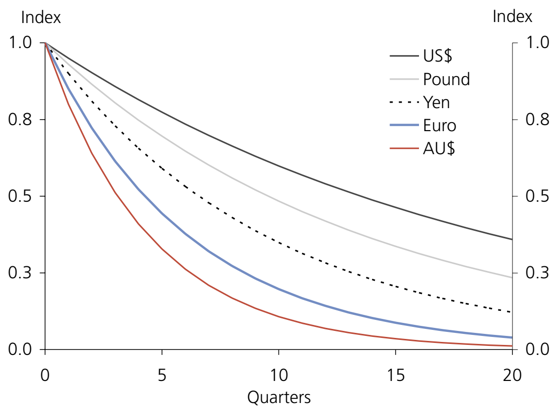
Figure 11
Commodity export prices and the exchange rate



Note: 1990-2004 average=100. Source: ANZ, RBNZ data

in response to a 1 per cent rise in commodity prices varies from 0.3 per cent for the AUD/NZD and 0.5 per cent for the USD/NZD in the short-term (Munro 2004b); 0.7 per cent for the TWI in the medium term (Wren Lewis 2004); and 0.6 for the AUD/NZD and 1.8 per cent for the USD/NZD in the long run (Huang 2004).[24] The estimated relationship between commodity export prices and the exchange rate is stronger relative to the US dollar than the Australian dollar. This may result from a degree of co-movement between Australian and New Zealand commodity export prices which, despite different compositions (eg Australian metals), are partly driven by world demand.

Figure 12
Estimated New Zealand real exchange rate adjustment toward PPP



Note: Estimated adjustment toward PPP, in the absence of other influences on the exchange rate, based on first order autoregressive process. Source: Luo and Plantier (2003).

24 Chen and Rogoff (2002) estimate a USD/NZD appreciation of 0.5 to 2.3 per cent in the long run.

Reversion toward equilibrium

Much of the evidence of reversion toward "equilibrium" is based on an equilibrium defined by PPP. In international studies, adjustment toward PPP is estimated to be slow, with half the adjustment typically taking 3 to 5 years for major currencies against the US dollar.[25]

For New Zealand, Luo and Plantier (2003) estimate a similar speed of adjustment relative to the US dollar, but faster adjustment between the New Zealand dollar and other currencies in New Zealand's trade weighted exchange rate index (TWI). As shown in figure 12, the fastest estimated adjustment is against the Australian dollar (with half of the adjustment taking less than a year), and the slowest against the US dollar (half of the adjustment in 3.75 years), with the euro, yen and UK pound falling somewhere in between. This helps to explain the relatively larger and more persistent fluctuations of the New Zealand dollar against the US dollar, and relatively smaller fluctuations against the Australian dollar. So a better understanding of the reasons for slow adjustment may be important in terms of understanding exchange rate volatility.

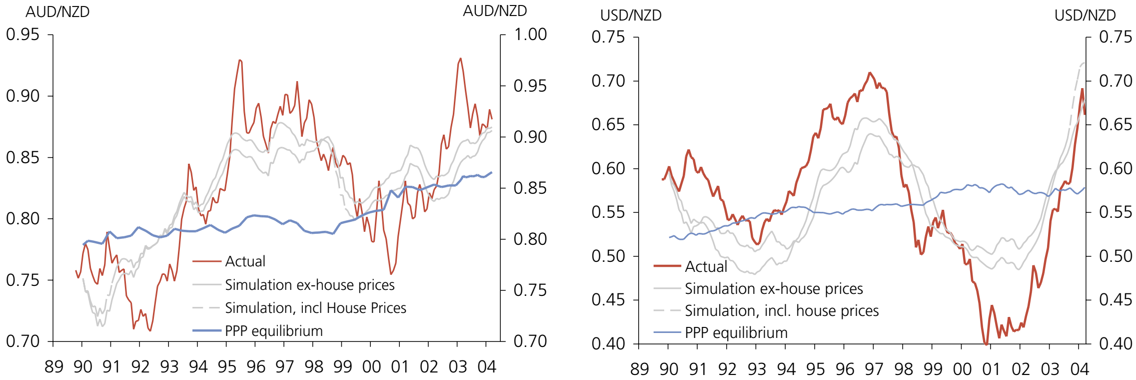
Slow adjustment toward PPP for US dollar exchange rates was initially thought to be the result of slow price adjustment, but several recent international studies suggest that the bulk of the adjustment toward PPP occurs through the exchange rate, and that it is, in fact, slow exchange rate adjustment, rather than slow price adjustment, that leads to slow equilibrium reversion.[26]

Exchange rate adjustment toward PPP may come through goods market adjustment (through the current account) or through a capital market response to deviations from "equilibrium". With international trade accounting for a small part of foreign exchange market turnover, the capital market response may be more important. As discussed above, capital market adjustment toward "equilibrium" may be slow because of uncertainties about the equilibrium level. In addition, estimated adjustment speeds may be biased if factors that drive the exchange rate away from PPP

25 Rogoff (1996). Some studies (eg Cashin & McDermott 2001) challenge this.

26 See Cheung, Lai and Bergman (2003) for a vector error correction model, and Engle and Morley (2001) for a state-space model.

Figure 13
Exchange rate simulations



Note: The period 2000-2001 coincided with a large volume of Eurokiwi maturities (unrelated to interest differentials) that may explain some of the New Zealand dollar weakness in those years.

equilibrium, such as relative interest rates and commodity prices, are not controlled for.

Putting everything together

A few factors that affect the flow of returns on New Zealand dollar assets can explain a significant part of the exchange rate cycle. Figure 13 shows paths for the USD/NZD and AUD/NZD generated by an equation that explains changes in the exchange rate in terms of 90 day interest rate differentials, changes in ANZ commodity export prices, deviations from PPP equilibrium, and some inertia.[27]

In this equation, the interest rate differential (driven by relative domestic demand) drives the exchange rate cycle, which is reinforced by some inertia, but moderated by reversion toward PPP equilibrium. Changes in commodity prices lead to short-term changes in the exchange rate, and fluctuations around the main cycle. The estimated reversion toward PPP and inertia can be interpreted as the expected change in the exchange rate. The equation can then be interpreted simply as uncovered interest parity plus commodity price influences.

The exchange rate is estimated to continue to respond to the 90 day interest rate differential until the growing deviation from PPP erodes expected interest returns.[28] The estimated response to commodity prices seems to have strengthened over time, suggesting that the New Zealand dollar plays an increasing role in buffering commodity price shocks.

While the interest rate differential likely accounts for much of the effect of migration (as well as a range of other factors) on domestic demand, to the extent that monetary policy has not fully responded to asset prices,[29] house prices may serve as a proxy for an additional capital flow into the housing market.[30] Explicitly including changes in house prices further helps to explain exchange rate fluctuations.

6 Volatility trade-offs

It is useful to think of volatility trade-offs in terms of the so-called monetary policy "trilemma": a central bank faces three desirable objectives – monetary policy oriented toward domestic goals (principally stability in consumer prices), a stable exchange rate, and international capital market integration – of which only two can be achieved at one time.[31] Since the late 1980s, New Zealand has targeted monetary policy to achieve price stability, allowed free movement of capital and allowed the exchange rate to float

27 This is based on an error correction equation estimated for 1990-2004. The simulation is the cumulated changes in the exchange rate generated by the equation using in-sample coefficients and data. This explains about 25 per cent of monthly changes in the exchange rate but 60 to 80

28 See Stephens (2004) for a discussion of equilibrium based on UIP and PPP.

29 Monetary policy naturally responds to asset prices to the extent that they affect forecast inflation. See Bollard (2004) for more detail on monetary policy and asset prices.

30 This will also capture non-migrant investment in housing. With a negative savings rate and much of this investment financed through mortgages, this represents a capital inflow as the mortgages need to be financed through overseas borrowings.

31 Also called the "impossible trinity", this concept dates at least as far back as the optimal currency are work of Mundell in the 1960s. See Obstfeld et. al (2004) for a good presentation of the rationale and evidence.

freely.[32] Increasing capital market integration (figure 6) may have made the trade-offs between domestic stability and exchange rate stability more binding.[33]

The research discussed above helps to explain why some bilateral exchange rates are more stable than others. Smaller fluctuations in the AUD/NZD than in the USD/NZD can be explained by a common commodity component of exports, smaller interest rate differentials (figure 7), and faster estimated reversion toward equilibrium. These reflect similarities in, and integration between, the New Zealand and Australian economies. Integration of the Australian and New Zealand economies appears to have allowed some stabilisation of the AUD/NZD exchange rate.

7 Summary and conclusions

The asset price perspective helps us to understand large short-term exchange rate fluctuations in response to economic or financial news and focuses attention on factors that affect expected relative returns on New Zealand dollar denominated assets. In our empirical research, factors that affect relative returns - short-term interest rates, commodity prices, a notion of medium-term exchange rate equilibrium and some asset prices – help to explain exchange rate movements, at least within sample periods, and a reasonable degree of the exchange rate cycles observed. However, they do not explain all, or even most of, short-term exchange rate movements, which may be dominated by news, market sentiment and technical factors.

Although short-term interest rate differentials are important for the exchange rate, and short-term interest rates are effectively controlled by monetary policy, it does not follow that monetary policy can effectively manipulate the exchange rate. In New Zealand and elsewhere, it is underlying demand pressures that are driving inflation and therefore monetary policy. With a clear inflation target, an OCR that is seen as inconsistent with meeting our inflation target would probably not change the expected path of interest rates by very much or for very long. Interest rates seen as too high would only lead to expectations of lower interest rates in the future to prevent undershooting of the inflation target. Indeed, since the introduction of the OCR in March 1999, Gray (2004) finds little evidence of OCR surprises, or a systematic exchange rate response to changes in the OCR.

With increasing capital market integration, the monetary policy trilemma suggests that the choice between monetary policy focused on domestic goals and stability in the exchange rate may have become more binding. Indeed, several recent papers estimate the trade-offs between volatility in the exchange rate and volatility in interest rates, inflation and output, to be substantial. However, the high degree of integration between the Australian and New Zealand economies (associated with faster reversion toward equilibrium and common domestic goals, reflected in smaller interest rate differentials) appears to have provided a degree of exchange rate stabilisation.

32 The Reserve Bank has not intervened in the foreign exchange market for the purpose of influencing the currency since the floating of the exchange rate in 1985. In 2004, Parliament approved additional capacity for the Reserve Bank to intervene in foreign exchange markets for the purpose of influencing the level of the currency when it is exceptionally and unjustifiably high or low.

33 Several recent studies have estimated very limited scope for exchange rate stabilisation without a substantial cost in terms of domestic stability. See the article by Chis Hunt in this Bulletin for a more detailed discussion of recent research on volatility. See also West (2003).

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