

Preliminary Draft, comments welcome

**New Zealand's economic reforms after 1984
and the neutral real rate of interest**

(March, 2003)

L. Christopher Plantier¹

Abstract: Ex-post real short-term interest rates in New Zealand (NZ) averaged around 7.5 per cent between 1984 and 1989. With the passage of the Reserve Bank Act in late 1989 and the Fiscal Responsibility Act of 1994, one might expect declines in real interest rates due to NZ's commitment to price stability and fiscal prudence. In fact, real rates in NZ did decline following these macroeconomic reforms, and averaged about 6 per cent from 1994-99 and 3.75 per cent from 1999-2002. Despite these beneficial policy reforms, a persistent gap remains between real rates in NZ and the rest of the world. Using a panel of OECD countries, this paper examines what macroeconomic factors might explain this persistent gap, especially whether the above reforms helped lower it.

In particular, this paper estimates how much of the decline in NZ real interest rates can be accounted for by international factors common to all countries (e.g. lower inflation variability generally and lower net public debt in OECD countries) and country-specific factors (e.g. differences in net public debt, net foreign assets, and inflation variability). The results suggest that much of the decline in real rates can be explained by international factors, and some by fiscal policy changes. This panel approach also indicates that NZ's large negative NFA position is responsible for the persistent gap in real interest rates, as in Lane and Milesi-Ferretti (2002).

¹Adviser, Economics Department, Reserve Bank of New Zealand, 2 The Terrace, PO Box 2498, Wellington, New Zealand. Phone: (64) 4-471-3876 email: plantierc@rbnz.govt.nz
The author would like to thank David Archer, Nils Bjorksten, Bob Buckle, Leslie Hull, Ozer Karagedikli, Les Oxley, Donggyu Sul and participants at the NZESG March 2003 meetings. All remaining errors are my own.

Disclaimer: The views expressed are those of the author and do not necessarily reflect the views of the Reserve Bank of New Zealand.

Introduction

Anyone who reads the financial press regularly in New Zealand knows that real interest rates are generally higher here than in Australia or the United States. The question of why real interest rates are higher in New Zealand (NZ) is a matter of some debate. A few people argue that the hawkish stance of the Reserve Bank of New Zealand (RBNZ) with respect to inflation has caused real interest rates to remain persistently above those of Australia and the United States. Under this logic, if only the RBNZ would follow a more relaxed approach to inflation control, then real interest rates would be more similar to Australia, the United States, and Europe. Another school of thought is that NZ's indebtedness, particularly household indebtedness, has affected foreigners' willingness to lend to NZ generally. By this line of reasoning, if only households would reduce their overall indebtedness by saving a bit more (or make better investment decisions), then foreigners would demand a lower real return on their borrowed funds. This paper uses a panel of OECD countries to assess whether any evidence exists that external indebtedness, measured by net foreign asset (NFA) positions as a per cent of GDP, relates to NZ's generally higher real interest rates, similar to Lane and Milesi-Ferretti (2002). This paper also shows that reductions in public sector indebtedness have probably lowered real interest rates in NZ, all else equal, and suggests that further reductions might lower real interest rates.

Unlike past studies that use Taylor rules,¹ we focus on long-term interest rates because they are determined more by persistent domestic imbalances between savings and investment, and foreigners' willingness to lend to NZ compared with short-term interest rates. Generally speaking, short-term interest rates are determined by the domestic business cyclical position or by shocks the central bank expects to affect this position, and one assumes that they

¹ Drew and Plantier (2000), Huang et al (2001), Plantier and Scrimgeour (2002), Huang (2002), and Buckle et al (2002) all suggest that the RBNZ's average cyclical response of short-term interest rates is not unusual.

fluctuate around a real interest rate with a constant mean. One common result from these Taylor rule studies is useful for our focus on longer term issues though. In all of these Taylor rule studies, NZ faces a much higher neutral real rate (NRR) of interest than other countries, even once one accounts for differences in the state of the business cycle (ie the output gap), inflation, the response to the aforementioned arguments, and allows for interest rate smoothing.² Ultimately, relative cycle positions can not provide the answer to why NZ has traditionally paid and currently pays higher real interest rates, so the question of why the NRR is so high remains.³

The neutral real rate (NRR) of interest concept goes back to at least Wicksell (1907) in economics, but remains an ill defined concept amongst central bankers. In fact, if you ask seven central bank economists their definition, you will likely get more than seven answers. This disagreement or lack of clarity partially relates to what one conditions on, as Wicksell's 1907 definition clearly assumes that all other factors are held constant. For example, the Taylor rule provides one definition of the NRR that is conditional on the output gap and inflation relative to target, see Plantier and Scrimgeour (2002) for its evolution. However, a much broader interpretation would be one that conditions on a wider set of variables, possibly including variables that have stochastic trends like a country's output, see Laubach and Williams (2001). In a related paper, Archibald and Hunter (2001) discuss the neutral real rate of interest extensively, and focus on a number of different ways of thinking about the concept. Their discussion of the issue highlights why many views of the NRR co-exist, and

² Huang's (2002) paper uses a technique from English et al (2002) that does not distinguish between the neutral real rate (NRR) and the central bank's inflation target. For this reason, Australia and New Zealand have roughly the same constant in her regressions. That is, NZ may still have a higher real rate but lower inflation target over history, while AU has a lower real rate but a higher inflation target. For a discussion of this issue in the New Zealand context, see Plantier and Scrimgeour (2002). Given recent changes to New Zealand's Policy Targets Agreement (PTA), differences in effective inflation targets may be trivial going forward, but they have played a role historically.

³ In "Trans-Tasman interest rates – why is New Zealand paying more?" Conway and Orr (2001) attempt to explain short-term interest rate differentials using a number of cyclical factors. They conclude "We have argued that there are no real reasons for higher interest rates in NZ other than the balancing of risks between the central banks." However, balance of risks is unlikely to explain a permanent difference in real rates.

why central bankers find the NRR a useful concept.⁴ For our purposes, we focus on variables that help explain the trends in real long-term interest rates across countries, and why a persistent real interest rate gap exists between NZ and the rest of the world. In this paper, our preferred definition of neutral real rate is one that is conditional on persistent domestic imbalances between savings and investment, hence our focus on long-term interest rates, and on risk factors like inflation variability.⁵

In regards to international trends in interest rates and foreigners' willingness to lend to NZ, the RBNZ discussion paper by Eckhold (1998) is quite illuminating. Eckhold (1998) shows the importance of foreign long-term interest rates, especially Australian long-term interest rates, in explaining much of the trend in NZ long term interest rates. This analysis suggests that foreign long rates represent an important opportunity cost for holders of NZ's liabilities, and that declines in foreign long rates can explain much of the decline in NZ long-term interest rates, see figures 1a and 1b. However, from the analysis, it is not clear that the appropriate foreign interest rate is the same for all countries, ie European long-term bonds tend to be priced off of German long-term bonds, while Australian bonds tend to be priced off of US bonds. Therefore, the analysis is most consistent with segmented capital markets that relate to each other through various linkages, rather than a single global market. Moreover, it is unclear whether there is something more systematic behind the relationship between foreign interest rates and NZ interest rates.

⁴ Also, Governor Ian McFarlane discusses the NRR concept in a September 2002 RBA bulletin article entitled "What Does Good Monetary Policy Look Like?" He states that "For a healthy economy, the inflation rate would neither rise nor fall in trend terms, and so the long-run average *real* interest rate would also be stable. It is this rate which is often referred to as the 'neutral rate of interest'."

⁵ For example, Conway and Orr (2001) state that "The neutral interest rate depends on factors that determine the supply and demand for savings in the economy."

By contrast, Conway and Orr (2002) assume that each country faces a common world real interest rate, but that persistent domestic imbalances between savings and investment and various risk factors can affect the actual real rates that country faces.⁶ In particular, large and permanent net government debt positions can create a permanent wedge between the world real rate and a particular country's real rate. Even in this analysis, however, there is still quite a bit of judgement required in order to get sensible results. In other words, capital markets again appear to be segmented, since these risk factors do not always apply equally to all countries, ie the United States and Switzerland are viewed as safe havens that do not have to pay for their risk factors. Another issue is whether the world real interest rate varies over time. Since we are less concerned with forecasting than Conway and Orr (2002), we allow the world real interest rate to vary on an annual basis. By doing so, we capture observed and unobserved world factors that vary over time, and we can focus more on the factors that determine why countries differ from this common world rate.⁷ Additionally, these common world factors may often cancel out what appears to be driving real rates lower in NZ, eg the decline in inflation variability in NZ may just be part of a wider worldwide phenomenon. Finally, we do not use a moving average of current accounts to gauge a country's indebtedness or appetite to borrow. Instead, we use net foreign asset (NFA) data from a recent cross-country study.

Lane and Milesi-Ferretti (2001) examine the level of indebtedness of numerous countries, developed and developing, and provide net indebtedness positions for these countries back to 1970 on a consistent basis. Their NFA data forms an important input into this study, since it helps address one of the key problems often involved in panel data studies, ie consistent data. In a second paper using their NFA data, Lane and Milesi-Ferretti (2002) attempt to explain

⁶ Conway and Orr (2002) essentially use the technique outlined in Orr et al (1995).

⁷ Ford and Laxton (1999) find that the aggregate OECD government debt level affects real interest rates in various countries, suggesting bond market integration and crowding out effects, even though many other studies find conflicting evidence of country specific government debt.

the level of indebtedness by fundamental factors like demographic factors, per capita GDP, and fiscal imbalances using an error correction method (ECM). Also, they investigate the link between a country's NFA position and its real long-term interest rate. According to their results, they find that countries with more negative NFA positions tend to pay higher real interest rates on average. Our results support their findings on this dimension despite some differences in our approach. For instance, Lane and Milesi-Ferretti (2002) use a DOLS approach that allows for leads and lags of the regressors, where we do not allow for leads in our estimation of the relationship.

More recent structural models of the NRR include Laubach and Williams (2001) and Nelson and Neiss (2001). Both of these papers focus more on the closed economy case, and show that the NRR has cyclical variation that is typically ignored in expositions of the NRR concept. For example, persistent shocks to productivity can alter the NRR in both models. Despite the focus on the closed economy case, Nelson and Neiss (2001) claim that the results also apply to the open economy case, except that the adjustment costs may differ as well as the dynamics to various shocks. We do not attempt to explore how productivity or other shocks propagate through the economy or their effects on our definition of the NRR. Rather, we focus more on the cross-sectional aspect of why the NRR varies across countries, so it is unclear if these two studies directly relate. This is especially true since they are more concerned about time series properties of the NRR, and they do not concentrate on the effects of a country's NFA position. Moreover, both of studies above do not examine the impact of fiscal imbalances on the NRR, like Conway and Orr (2002), nor do they control for the effects of observed and unobserved world factors, as we do, that may impinge upon domestic real interest rates in an open economy context.

The panel data set

We focus on 23 OECD countries in our widest panel, ie countries that have most series available back to at least the middle 1980s. Overall, we exclude 7 countries from the 30 in the OECD, including the transition countries of central Europe, Korea, Mexico, and Turkey.⁸ The data for this study comes from several sources, but in each case every attempt was made to use series from the same source and with roughly the same definition. For example, the long term interest rate series are from Datastream with most series being 10-year government bond interest rate, but in some cases a slightly longer or shorter term was used based on availability.⁹ To calculate inflation and inflation variability, we employ the consumer price index in the various countries drawn from Datastream, but also use CPI data for AU and NZ that excludes interest costs and GST. To calculate exchange rate changes and variability relative to the US dollar, we employ the exchange rate data from the St. Louis Federal Reserve Bank website, see <http://research.stlouisfed.org/fred/index.html>.

The most difficult data to gather and compare across countries is net foreign asset (NFA) positions of countries. This task was made significantly easier by Lane and Milesi-Ferretti (2001), who compile annual NFA data for various developed and developing countries, and try to model the structural determinants of it. Because they apply a consistent methodology and adjust for valuation changes, their NFA positions are well suited for our purposes. The NFA data from Lane and Milesi-Ferretti (2001) are available at <http://econserv2.bess.tcd.ie/plane/data.html> for those interested in using the data, or wishing to know more about how they were constructed. Since the data are annual, we

⁸ For a complete listing of OECD countries, see link below <http://www.oecd.org/oecd/pages/home/displaygeneral/0,3380,EN-countrylist-0-nodirectorate-no-no-159-0,00.html>

⁹ In order to include Greece and Iceland, we had to use short rates in place of long-term interest rates. However, we check that our results are not sensitive to this issue by excluding these two countries. In the end, other data issues with Greece mean that we do not include them in our reported regressions.

linearly interpolate them to the quarterly frequency. The practical effect of interpolation is unlikely to be large, since much of the variation in these series is cross-sectional, and we are interested more in the low frequency movements of NFA positions.

While the decision of which countries to include or exclude is unlikely to be random and may introduce some bias into the results, we believe the inclusion of more countries helps focus on the cross-sectional aspects of why real interest rates differ. Consequently, we have tried to keep the country set as wide as possible. However, because of data limitations on net public debt ratios, but also in order to facilitate comparison to a recent paper by Conway and Orr (2002), we limit ourselves to the six countries they studied most intensively. Our results appear robust in their smaller subset, and are not that dissimilar to their results. By using their data on net government debt ratios, we can also see whether there exists a difference between private debt, NFA ratio minus public debt ratio, and the public debt ratio. Figures 2 through 6 illustrate the patterns for the key variables in AU and NZ compared to the panel mean, including the patterns of private and public debt ratios. From the preliminary data on private debt ratios in Figure 4, AU and NZ private debt is significantly larger than the mean of the six country panel. Unfortunately, we only have public debt for the six countries studied most intensively by Conway and Orr (2002), but are constructing our own broader set of net public debt ratios from OECD data.

The presence of unit roots in the data, especially long-term interest rates, is clearly a concern. At the moment, we have not done thorough tests on the presence or absence of unit roots, nor have we examined how well the variables in our panel cointegrate if they are unit roots. The results arrived at so far do rely on the assumption that a reasonable cointegrating vector exists. Based on the more thorough work of Lane and Milesi-Ferretti (2002), we feel confident that the results will hold up to more rigorous inspection, and are currently exploring panel unit root tests and homogeneity tests for coefficients of interest.

Panel methodology

The general model used to analyse long-term interest rates across countries is

$$(1) \quad y_{it} = \alpha_i + \gamma_t + X_{it}' \beta_i + \varepsilon_{it} \text{ for } i = N \text{ and } t = T.^{10}$$

For country i in period t , y is the nominal long-term (10 year bond) interest rate minus the expected inflation rate, α is constant term that allows for fixed country effects, γ is a time dummy to capture common time period effects, and X is a vector of regressors for observed factors. β is a vector of parameters for country i that can be restricted to be the same across countries, or allowed to be country specific. ε is an $N \times T$ matrix of error terms that are assumed to be both independent and identically distributed (iid), as well as normally distributed.

In this paper, we establish a base panel model that relies on the assumption of a constant or time-varying real world interest rate that is the same for all countries, ie we do not allow for fixed effects. After that, we make allowance for persistent domestic imbalances between savings and investment and various risk factors as in Conway and Orr (2002). The time-varying real world interest rate is an important departure from Conway and Orr (2002), and helps explain roughly half of the fall in real interest rates in NZ. Another key difference from Conway and Orr (2002) is that we do not proxy for expected inflation with the HP filtered trend of inflation, since this introduces some artificial dynamics that could drive results. Consequently, we use current annual CPI inflation instead of the HP filtered trend of inflation. In this sense, our study is closer to that of Lane and Milesi-Ferretti (2002) who

¹⁰ We express the equation in its most general form, but do not employ fixed effects in any of our reported regressions. In the future, we may test for the presence of fixed country effects.

utilise next year's inflation rate. We then gradually alter the base model to deal with various issues, and examine how sensitive results are to different specifications.

In every specification, we correct for heteroskedasticity and weight the residuals according to differences in the variances of each equation. The equations also possess significant serial correlation, so we address the serial correlation by modelling the residuals as a common AR(1) process. In the future, we will model this serial correlation more rigorously by checking the residuals for higher order serial correlation, but have only used an AR(1) in all the regressions because this specification soaks up most of the serial correlation based on the partial autocorrelation functions.¹¹ In some cases, however, an AR(2) may be more appropriate, yet the general results do not seem affected by whether one uses an AR(1) or AR(2) to correct for serial correlation. Essentially, we are assuming that the interest rate converges back to the real world rate plus the other factors that determine persistent differences in real long-term interest rates or NRRs. This approach is quite similar to Conway and Orr (2002), who estimate an error correction method using a systems based approach in order to deal with any endogeneity and cross correlation problems. Unfortunately, we have only employed an AR(1) correction thus far, but will check whether the results change dramatically due to endogeneity and cross correlation problems.

¹¹ In the case of the residuals for the last column of table 3, our preferred model at this point, NZ and AU residuals possess little and no higher order serial correlation, respectively, based on the Ljung-Box Q-statistics. However, the residuals for the other countries still possess some higher order serial correlation, which suggests we need to address this issue more thoroughly.

Preliminary Empirical Results

Tables 1 through 3 present the results achieved thus far for different specifications and countries. Table 1 is the base model for 22 countries that includes only a constant world real interest rate and the various economic reasons why real interest rate might differ across countries. From the first column of results in Table 1, the most basic model captures much of the variation between and within countries, and the signs of the variables are correctly signed. The coefficient on the key variable of interest, the NFA ratio, is negative and significant, and suggests that a 10 percentage point decline in the NFA ratio, moving from -50 to -60 per cent, leads to a 29 basis point increase in a country's real interest rate. Also, inflation and exchange rate variability are both positive and significant, and suggest that more uncertainty in these measures leads to higher real interest rates.

Unfortunately, the residuals display significant serial correlation, so we employ a common AR(1) coefficient to model the residuals in the second column of results. The effect of this correction makes the inflation and exchange rate variability coefficients insignificant, but leaves most of the other coefficients roughly the same. To examine whether modelling the premium a country pays over the US affects the results, the last column shows the results when the dependent variable is real long rate of each country minus the real long rate of the US. While this makes the constant world real interest rate insignificantly different than zero, the NFA position, change in the exchange rate, and the common AR(1) coefficient remain significant. Also, the model still explains much of the variation within and between countries. Overall, the effect of a country's indebtedness position, the NFA variable, holds up quite well at around 25 basis points per 10 percentage point deterioration, and is a significant factor in 22 countries studied in Table 1.

Table 2 examines the effects of annual time dummy variables in place of a constant world real interest rate, and provides some additional robustness checks. Column 1 of Table 2 shows that the world real interest rate declines over time, falling from 4.94 per cent in 1990 to 2.54 per cent in 2001, and that the effect is relatively minor on the coefficient estimates. As an additional check, Column 2 demonstrates that the exclusion of Japan from the sample does not dramatically change the results, and suggests that the results are not being driven by Japan's inclusion in the sample. Column 3 in Table 2 employs the real long rate in each country minus the US real long rate as the dependent variable, so that we can investigate whether modelling differentials over the US long-term interest rate alters the results. As before, the coefficients are robust, but an interesting pattern exists in the time dummies. For 1990 and 1991, the rest of the world pays a significant premium over the US, but it gradually falls, and is negative and insignificant in the latter part of the sample. In this instance, the time dummy may be capturing some general convergence or integration process that we have not explicitly modelled.

Table 3 restricts the panel to the six countries studied most intensively by Conway and Orr (2002), and uses their net government debt ratios to construct private and public debt ratios as separate regressors.¹² For the six country panel base model in column 1, both private and government debt ratios are important, and government debt is statistically larger in absolute value. Again, the time dummies show a decline in the world real interest rate and the inflation and exchange rate variability are insignificant. Column 2 and 3 correct for serial correlation with a common AR(1) coefficient, and compare the effects of having a constant versus a time-varying world real interest rate. Overall, the results are roughly the same, but the effect of government debt is slightly larger in absolute value in columns 2 and 3. One interesting result is that inflation variability is positive and significant in column 2, with the

¹² The six countries are Australia, Canada, Germany, New Zealand, Sweden, and the UK.

coefficient being about 0.5. Since NZ's inflation variability falls from about 5 per cent to less than 1 per cent, this effect may explain 2 percentage points of the decline in real long term interest rates in NZ.

Despite this positive finding that inflation variability reduces the real long term interest rate in NZ, the largest and most robust effect comes from the improvement in the NZ government's net debt position. Net government debt in NZ fell from 50 per cent of GDP to less than 20 per cent of GDP. The effect of this fiscal improvement probably reduced real long term interest rates in NZ by around 150 basis points, or 1.5 percentage points. Further reductions in the government's net debt may also lower NZ's neutral real interest rate, especially if it helps address the persistent domestic imbalances between savings and investment. This analysis highlights the importance of persistent domestic imbalances between savings and investment in permanently changing the real long-term interest rate, even in a small open economy like NZ.

For a more concrete example, we utilise the estimated coefficients in last column of Table 3 to demonstrate what explains the gap between real long rates in NZ and AU from the time-varying world real rate based on time dummies. Figure 7 demonstrates why NZ has had a persistent gap after the economic reform period. In the mid to late 1980s, the gap consisted of about 150 basis points (bps) for inflation variability and 200 bps for public sector debt. After the passage of the Reserve Bank Act of 1989, a significant reduction in inflation variability occurs that eventually sees this factor's effect diminish to around 30 bps. The passage of the Fiscal Responsibility Act of 1994 also seems to coincide with a reduction in public debt. The effect of public sector debt on the gap from world rates falls from around 200 bps to less than 100 bps over the mid to late 1990s. Even with these beneficial reforms, the action of the

private sector offset some of the decline in the gap by borrowing more.¹³ From the mid to late 1980s, the net private sector indebtedness effect rises from almost zero to around 125 bps. The overall picture conveyed by figure 7 is that the macroeconomic reforms that helped ensure price stability and fiscal prudence were very beneficial in terms of reducing real long rates, but that the private sector offset some of these benefits by borrowing significantly more.

In Figure 8, we do the same decomposition exercise to show that while the gap for AU looks relatively stable, its components change somewhat over time. Figure 8 shows the effects of policy changes in AU look much less dramatic when compared with NZ. On the whole, both public and private indebtedness seem to explain why AU and NZ pay and have paid somewhat higher real interest rates than other countries according to the empirical results in this paper, but public sector indebtedness has generally reduced the gap between real interest rates in AU and NZ compared to the rest of the world.

Conclusion

The empirical results confirm the findings in Lane and Milesi-Ferretti (2002) that the NFA position of a country is negatively related to the country's real long-term interest rate. In other words, countries with large negative NFA positions can expect to pay higher real interest rates relative to the rest of the world, all else equal. However, this paper also explores whether other variables, such as inflation variability, exchange rate variability, and the government's net debt position, have an effect on real interest rate differentials. While inflation and exchange rate variability are significant and positively related to real rates across

¹³ A natural question is whether there is a negative correlation between public sector and private sector debt ratios generally that may be causing a multicollinearity problem. In all the countries, public sector and private sector debt ratios are positively correlated to varying degrees, although the contemporaneous correlation is not excessive and averages around 0.6.

countries in some specifications, these results do not hold up when we model the serial correlation as an AR(1) or use time dummies to control for common world effects.

Nevertheless, the decline in NZ of inflation variability may contribute to lower real rates in NZ, but the general worldwide decline in inflation variability compared to the 1970s and 1980s may dominate any country-specific effects, see Figure 2. To that end, about 50 per cent of the overall decline in real long-term interest rates in NZ relates to declining world real interest rates, yet this effect can not explain NZ's persistent gap between world rates.

A key contribution of this paper is that the composition of the NFA position can also affect the real interest rate because government indebtedness has a larger effect than private indebtedness. In our smaller six country panel, we broke a country's indebtedness into private and public sector debt ratios, and reject that they have the same effect at the 10% level of significance for some specifications. The difference in magnitude in the preferred specification, column 3 of Table 3, implies that a ten per cent reduction in net government debt, *ceteris paribus*, leads to a reduction in the real long-term interest rate of about 45 basis points. Even if NZ household's behave in an offsetting manner and simultaneously increase net private debt, as they appear to have done in the 1990s, real long-term interest rate still fall by about 20 basis points for a ten per cent reduction in net government debt. To conclude, reductions in the net indebtedness of the NZ government, around and after the Fiscal Responsibility Act of 1994, have probably lowered real interest rates by almost 150 basis points in the 1990s, all else equal. If the Crown's net indebtedness continues to improve as forecast, further reductions in real long-term interest rates can be achieved, even if the households diminish the effect somewhat by increasing their indebtedness.¹⁴

¹⁴ We do not discuss how a government achieves this reduction in net indebtedness, either by paying off debt or holding assets, and leave the question of the optimal mix for others. We also ignore the question of what happens when and if a government actually becomes a net creditor, since all the governments in the six country panel are currently net debtors.

References

- Archibald, J and L Hunter (2001), "What is the neutral real interest rate, and how can we use it?", *Reserve Bank of New Zealand Bulletin*, 64, 3.
- Barro, R. (1974) "Are Government Bonds Net Wealth?" *Journal of Political Economy* 82: 1095-1117.
- Black, R, V Cassino, A Drew, E Hansen, B Hunt, D Rose and A Scott (1997), "The Forecasting and Policy System: the core model", *Reserve Bank of New Zealand Research Paper* No. 43.
- Bredon, F, B Henry, and G Williams (1999), "Long-term Real Interest Rates: Evidence on the Global Capital Market", *Oxford Review of Economic Policy*, Vol. 15 No.2, 128-142.
- Buckle, Robert A, Kunhong Kim, Heather Kirkham, Nathan McLellan and Jared Sharma (2002), "A structural VAR model of the New Zealand business cycle", Wellington, *New Zealand Treasury Working Paper* 02/26, see link below for paper <http://www.treasury.govt.nz/workingpapers/2002/02-26.asp>
- Conway, P and Orr, Adrian, (2002) "The GIRM: A Global Interest Rate Model" Occasional Paper, *Westpac Institutional Bank*, 2002. See link below for paper, <http://www.westpac.co.nz/olcontent/olcontent.nsf/Content/Economic+&+Financial+Markets+reports?OpenDocument&refr=Business>
- Conway, P and Orr, Adrian, (2001) "Trans-Tasman interest rates – why is New Zealand paying more?" *Occasional Paper*, *Westpac Institutional Bank*, 2001.
- Drew, A and B Hunt (1998), "The forecasting and policy system: stochastic simulations of the core model", *Reserve Bank of New Zealand Discussion Paper* G98/6.
- Drew, A and C Plantier (2000), "Interest rate smoothing in New Zealand and other dollar bloc countries", *Reserve Bank of New Zealand Discussion Paper* DP2000/10.
- English W.B, Nelson W. R., and Sack B.P. (2002), "Interpreting the significance of the lagged interest rate in estimated monetary policy rules", *Board of Governors of the Federal Reserve System Discussion Paper* #24.
- Ford, R and Douglas Laxton (1999), "World Public Debt and Real Interest Rates", *Oxford Review of Economic Policy*, vol. 15, issue 2, pages 77-94.
- Glick, R and K Rogoff(1995), "Global versus country-specific productivity shocks and the current account", *Journal of Monetary Economics* 35 (February): 12-30.
- Harvey, A (1989), *Forecasting, structural time series models and the Kalman filter*, Cambridge University Press, Cambridge, UK.
- Huang, A (2002), "Is monetary policy in New Zealand similar to that in Australia and the United States?", *Reserve Bank of New Zealand related papers for Policy Targets Agreement*, 2002. See also <http://www.rbnz.govt.nz/monpol/pta/0124760.html>

- Huang, A, D Margaritis and D Mayes (2001), "Monetary policy rules in practice: evidence from New Zealand", Bank of Finland Discussion Paper 18/2001.
- Lane, Philip R. and Gian Maria Milesi-Ferretti (2002), "Long-Term Capital Movements," *NBER Macroeconomics Annual 2002*, in (B. Bernanke and K.Rogoff, eds) Cambridge, MA: The MIT Press.
- Lane, P.R. and G.M. Milesi-Ferretti (2001), "The External Wealth of Nations: Measures of Foreign Assets and Liabilities for Industrial and Developing Nations," *Journal of International Economics* 55, 263-294.
- Laubach, T and J Williams (2001), "Measuring the natural rate of interest", *Federal Reserve Board Finance and Economic Discussion Series*, 2001-56.
- Levin, A, V Wieland and J Williams (2001), "Performance of forecast-based monetary policy rules under model uncertainty", European Central Bank Working Paper 68, July.
- McFarlane, I (2002), "What Does Good Monetary Policy Look Like?" *Reserve Bank of Australia Bulletin*, September.
- Nelson E, and K Neiss (2001), "The real interest rate gap as an inflation indicator," *Bank of England Working Paper*.
- Orr, Adrian, Edey, Malcolm, and Kennedy, Mike (1995) "Real Long-term Interest Rates: The Evidence from Pooled-Time-Series" OECD Economic Studies, No.25 II.
- Plantier, C and D Scrimgeour (2002), "Estimating a Taylor Rule for New Zealand with a Stochastic Neutral Real Rate", *Reserve Bank of New Zealand Discussion Paper DP2002/05*.
- Rudebusch, G (2001), "Term structure evidence on interest rate smoothing and monetary policy inertia," forthcoming in the *Journal of Monetary Economics*.
- Stock, J.H. and M.W. Watson (1993). A Simple Estimator of Cointegrated Vectors in Higher Order Integrated Systems. *Econometrica* 61: 783-820.
- Taylor, J (1999), *Monetary Policy Rules*, NBER Conference Report, University of Chicago Press, Chicago.
- Taylor, J (1994), "The inflation/output variability trade-off revisited", in Jeffrey Fuhrer, *Goals, guidelines, and constraints facing monetary policymakers*, Federal Reserve Bank of Boston Conference Series No 38.
- Taylor, J (1993), "Discretion versus policy rules in practice", *Carnegie-Rochester Conference Series on Public Policy* 39, 195-214.
- Wicksell, Knut (1907), "The Influence of the Rate of Interest on Prices," *Economic Journal* 17: 213-220.

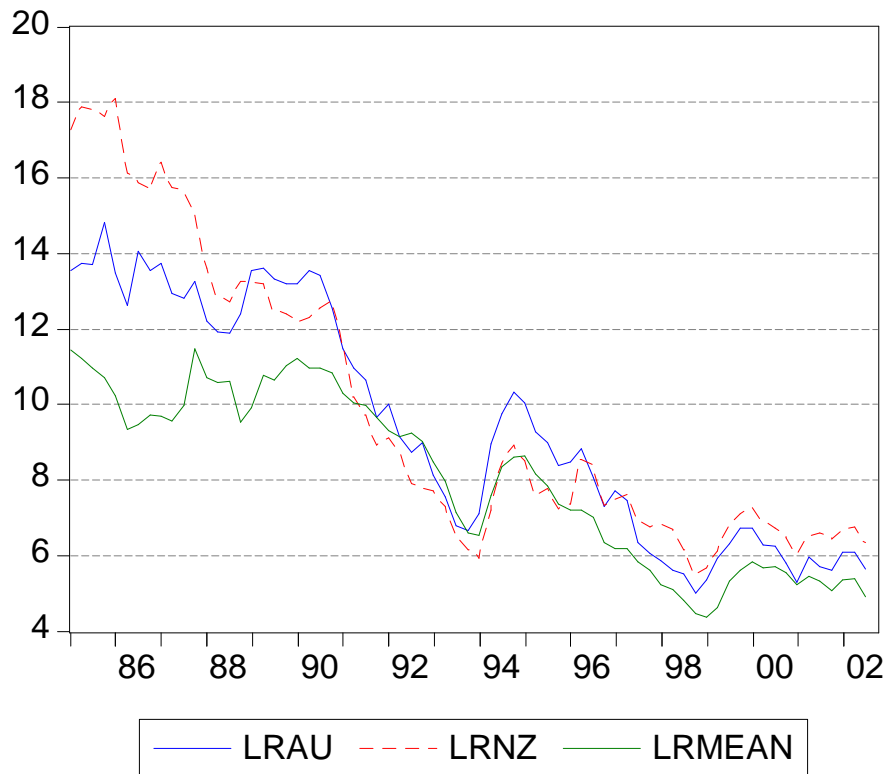
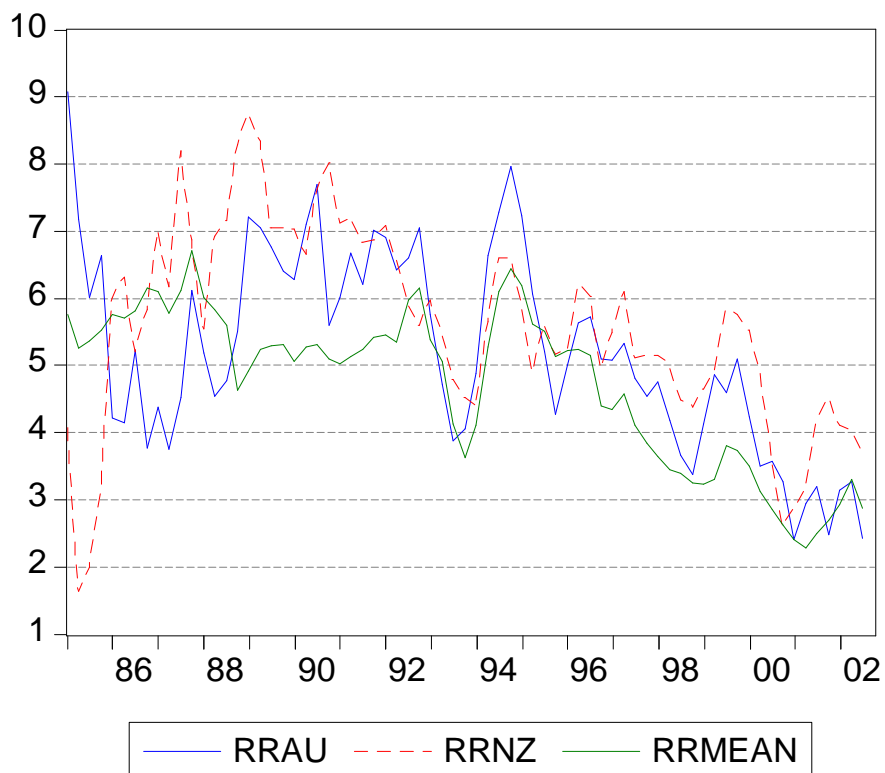
Figure 1a: Nominal 10-year bond rates in AU and NZ**Figure 1b: Nominal 10-year bond rates minus inflation in AU and NZ**

Figure 2: Inflation variability - std of previous 5 years, quarterly

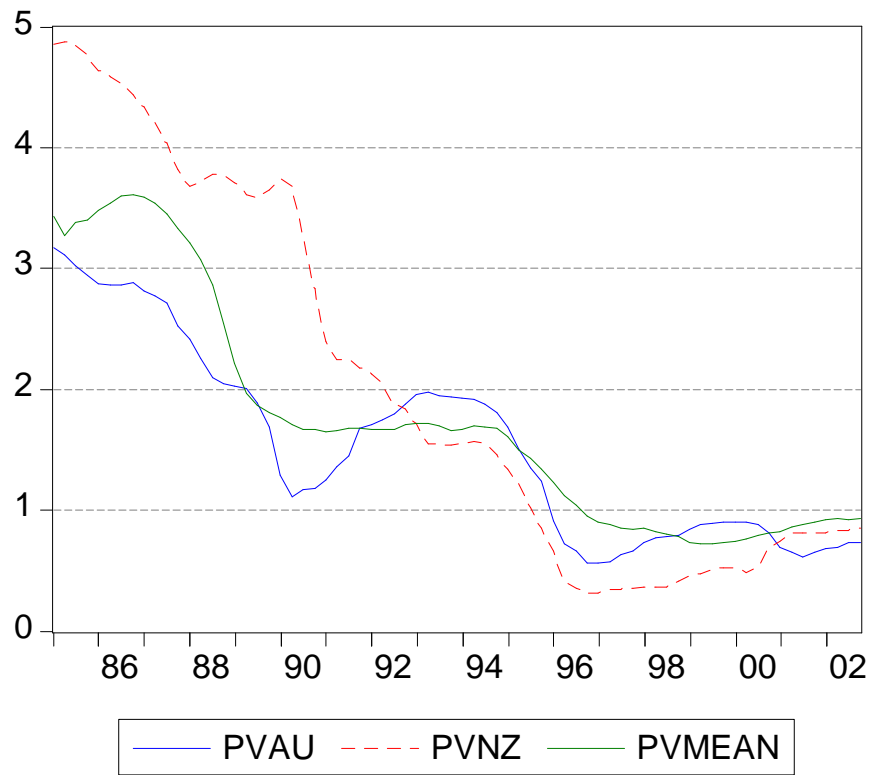


Figure 3: Exchange rate variability - std of previous 5 years, monthly

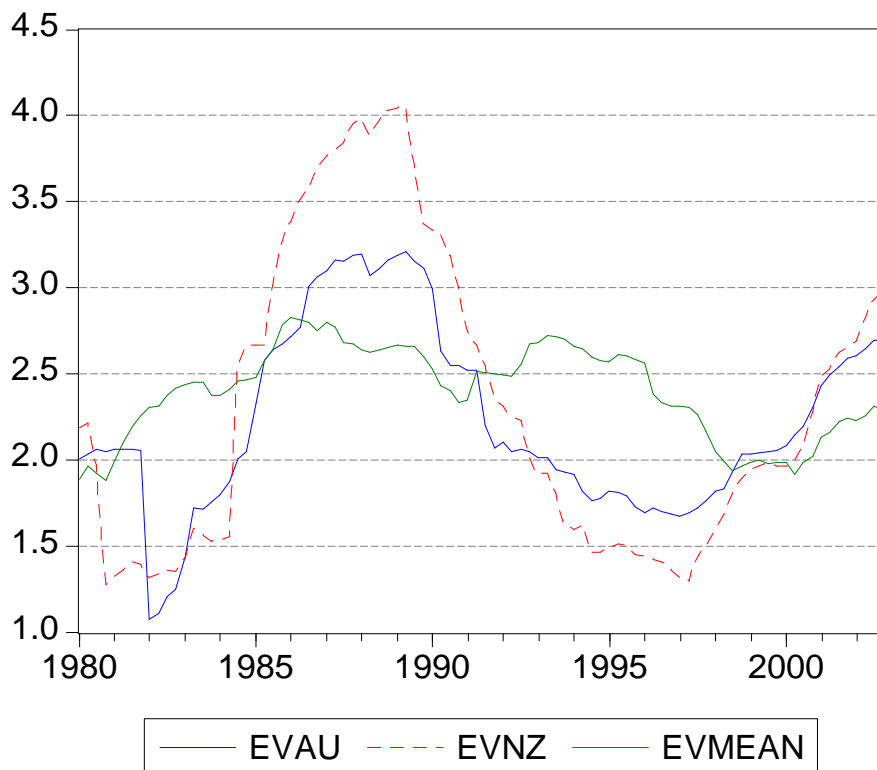


Figure 4: Net private debt of AU and NZ, % of GDP

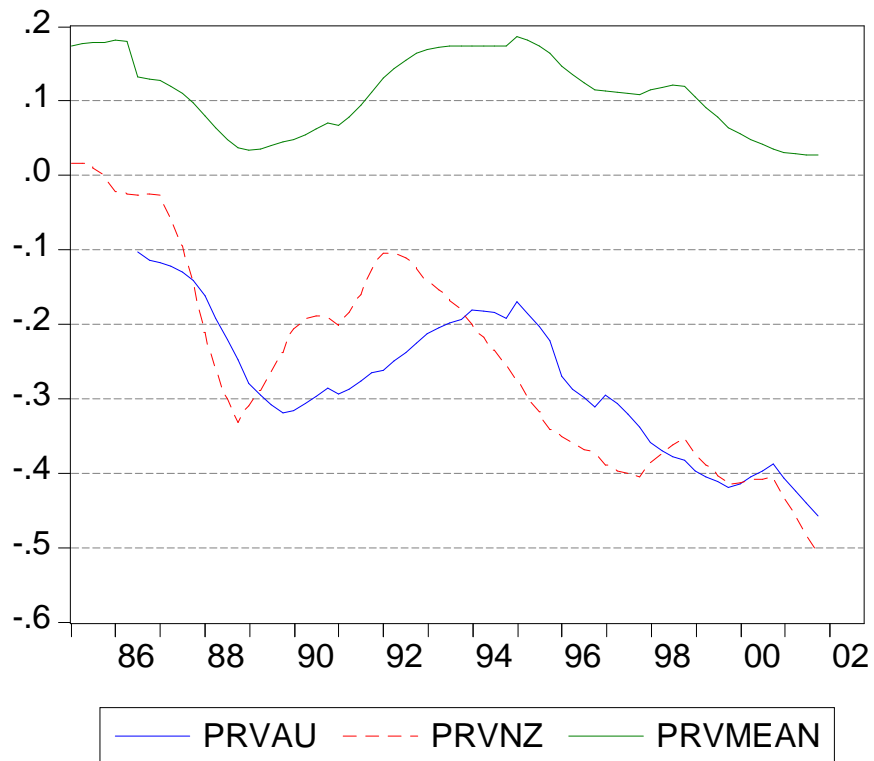


Figure 5: Net government debt of AU and NZ, % of GDP

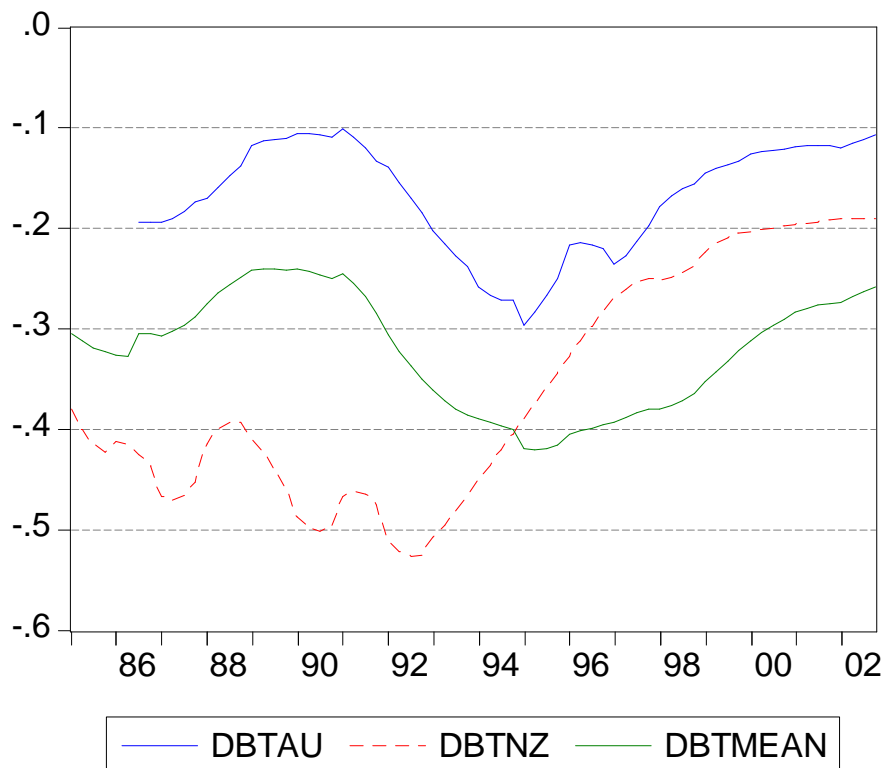
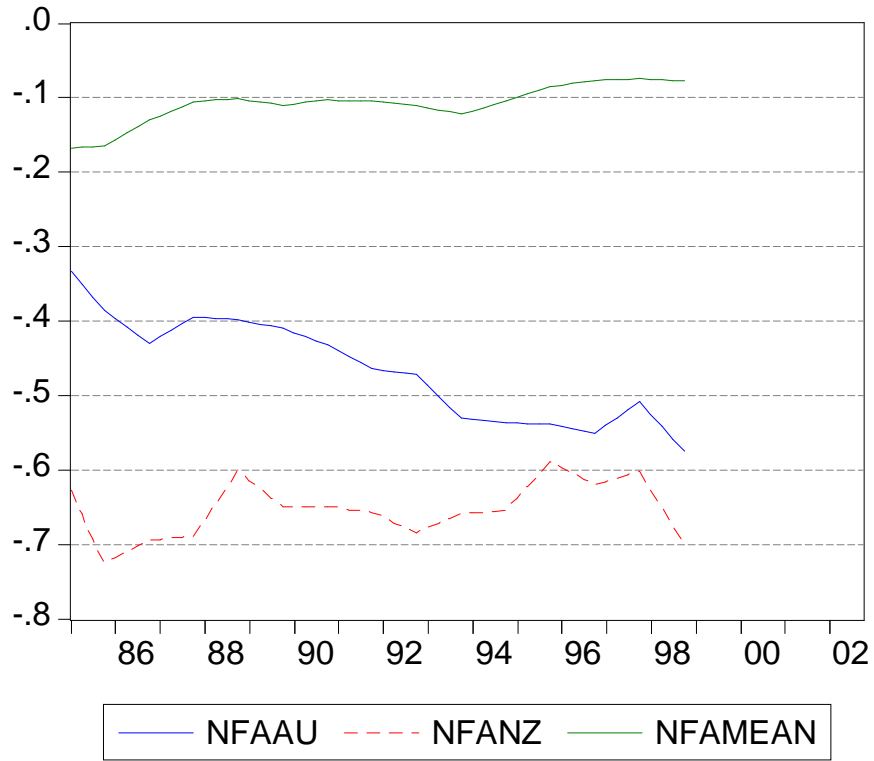


Figure 6: NFA positions of AU and NZ, % of GDP

Panel Regression Tables

Table 1: Base model with constant world rate

Dependent Variable	Real long (RL)	Real long (RL)	RL – US RL
Sample Period	1990:1 2001:4	1990:1 2001:4	1990:1 2001:4
Countries	22	22	21
Excluded	GR	GR	GR, US
	Panel 1	Panel 1	Panel 4
Constant World Rate	2.960 (0.085)	3.482 (0.445)	-0.329 (0.519)
NFA position of country, lagged 12 qrts	-2.876 (0.132)	-2.719 (0.696)	-2.533 (0.523)
% Change in Exch Rate	0.051 (0.004)	0.020 (0.003)	0.033 (0.003)
Inflation Variability	0.223 (0.094)	0.059 (0.259)	-0.086 (0.273)
Exch Rate Variability	0.454 (0.034)	0.029 (0.179)	0.183 (0.203)
Common AR (1)		0.922 (0.012)	0.893 (0.016)
R-squared	0.602	0.920	0.856
Adjusted R-squared	0.600	0.920	0.855

Bolded numbers indicate significance at 5 per cent or better.

NFA position of country is expressed as a percentage of GDP and equals NFA lagged 12 quarters (3 years) to extend dataset

Table 2: Model with time dummies for time-varying world rate

Dependent Variable	Real long (RL)	Real long (RL)	RL – US RL
Sample Period	1990:1 2001:4	1990:1 2001:4	1990:1 2001:4
Countries	22	21	20
Excluded	GR	GR, JP	GR, JP, US
	Panel 1	Panel 5	Panel 5
NFA position of country, lagged 12 qrts	-2.705 (0.461)	-2.715 (0.457)	-2.447 (0.427)
% Change in Exch Rate	0.020 (0.003)	0.022 (0.003)	0.032 (0.003)
Inflation Variability	0.004 (0.246)	-0.013 (0.251)	-0.222 (0.265)
Exch Rate Variability	0.164 (0.140)	0.173 (0.194)	0.104 (0.193)
Common AR (1)	0.877 (0.017)	0.876 (0.018)	0.870 (0.019)
1990 Time Dummy	4.936	5.129	2.111
1991 Time Dummy	4.864	5.046	1.503
1992 Time Dummy	4.679	4.794	1.009
1993 Time Dummy	3.918	4.040	0.955
1994 Time Dummy	4.258	4.349	0.558
1995 Time Dummy	3.920	4.018	0.862
1996 Time Dummy	3.852	3.946	0.730
1997 Time Dummy	3.806	3.873	0.167
1998 Time Dummy	3.484	3.505	-0.406
1999 Time Dummy	3.316	3.264	-0.739
2000 Time Dummy	2.973	2.962	-0.203
2001 Time Dummy	2.543	2.499	-0.481
R-squared	0.929	0.932	0.871
Adjusted R-squared	0.927	0.931	0.869

Bolded numbers indicate significance at 5 per cent or better.

NFA position of country is expressed as a percentage of GDP and equals NFA lagged 12 quarters (3 years) to extend dataset

Table 3: Six country panel estimates, Conway & Orr comparison

Dependent Variable	Real long	Real long	Real long
Sample Period	1986:3 2001:4	1986:3 2001:4	1986:3 2001:4
Countries	6	6	6
	Panel 3	Panel 3	Panel 3
Constant World Rate		2.481 (0.958)	
Net Private Debt	-2.240 (0.226)	-2.473 (0.679)	-2.552 (0.605)
Net Gov Debt	-3.647 (0.630)	-4.441 (1.545)	-4.470 (1.427)
% Change in Exch Rate	0.011 (0.008)	0.020 (0.008)	0.015 (0.008)
Inflation Variability	0.178 (0.165)	0.536 (0.281)	0.335 (0.275)
Exch Rate Variability	0.177 (0.167)	0.171 (0.335)	0.146 (0.315)
Common AR (1)		0.819 (0.034)	0.788 (0.039)
1986 Time Dummy	3.596		3.919
1987 Time Dummy	3.820		3.801
1988 Time Dummy	3.758		3.386
1989 Time Dummy	3.871		3.425
1990 Time Dummy	4.118		3.726
1991 Time Dummy	3.588		3.132
1992 Time Dummy	4.115		3.554
1993 Time Dummy	2.795		2.532
1994 Time Dummy	4.270		3.362
1995 Time Dummy	3.595		2.784
1996 Time Dummy	3.672		2.982
1997 Time Dummy	3.093		2.734
1998 Time Dummy	2.510		2.598
1999 Time Dummy	2.786		2.583
2000 Time Dummy	2.056		2.074
2001 Time Dummy	1.446		1.661
R-squared	0.761	0.824	0.844
Adjusted R-squared	0.747	0.821	0.835

Bolded numbers indicate significance at 5 per cent or better.

NFA position of country is expressed as a percentage of GDP and equals NFA lagged 12 quarters (3 years) to extend dataset

Net Gov Debt is the current level of net government indebtedness as a percentage of GDP

Figure 7: Decomposition of gap between NZ and world real rate

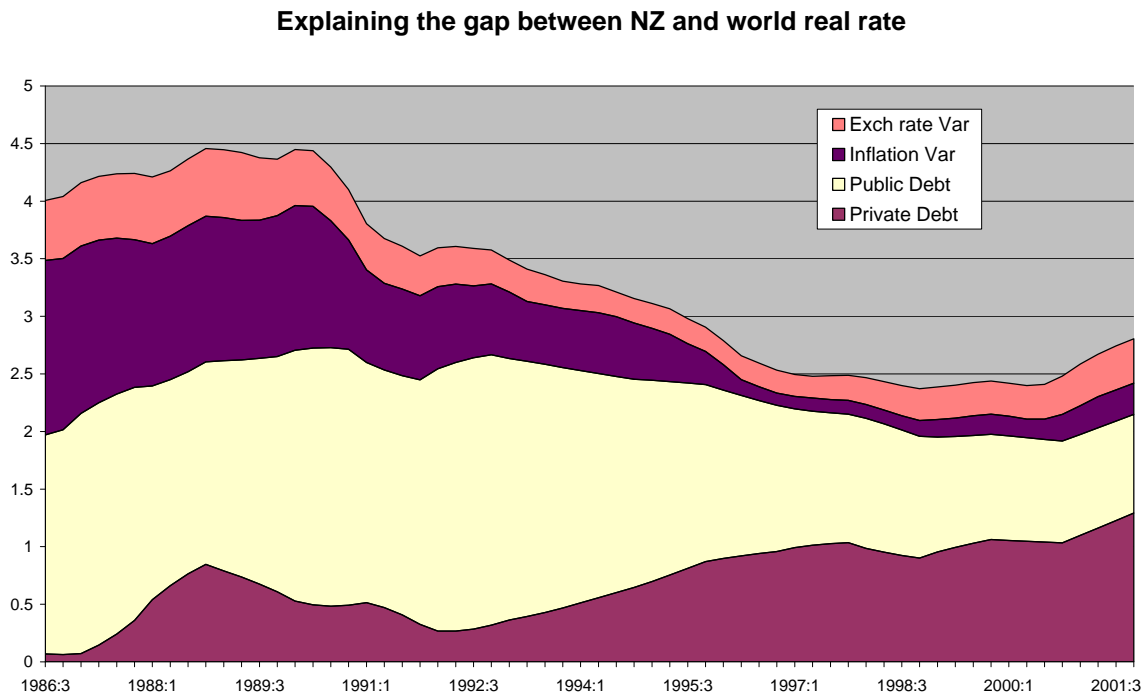


Figure 8: Decomposition of gap between AU and world real rate

