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What in the world moves New Zealand bond yields?

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NON-TECHNICAL SUMMARY[1]

International financial markets have become increasingly integrated over recent decades. In this paper we examine how short-term fluctuations in international bond yields influence changes in New Zealand bond yields. Using bond yields for 12 advanced countries we use statistical techniques to identify the co-movement among these yields, and thus estimate two-year and 10-year World Interest Rates. We then use these results to look at how changes in the estimated World Interest Rate and idiosyncratic changes in the bond yields of Australia and the United States affect New Zealand interest rates.

When using monthly data, changes in World Interest Rates (two or 10 years) are reflected almost one for one in New Zealand interest rates. In addition, Australian-specific 10-year bond movements have a significant effect on New Zealand 10-year bond rates. Overall, 62 percent of the variability in the New Zealand 10-year bond yield can be explained by global factors. By contrast, only around 34 percent of the variation in New Zealand two-year rates is explained by global factors, suggesting that fluctuations in short-term bond yields are driven to a greater extent by expected New Zealand monetary policy and by domestic data releases. Similar results are found for Australia.

Daily changes in bond yields were also examined. At a daily frequency much less of the variability (less than 40 percent) in New Zealand interest rates can be explained by global factors, at least as estimated here. However, the results using the World Interest Rate have materially more explanatory power than tests looking just at the impact of Australian and US bond yields on New Zealand.

There has been a persistent difference, on average over the last couple of decades, between the level of New Zealand bond yields, and the level of bond yields seen in other advanced economies. This paper is focused on short-term changes in bond yields, and does not attempt to shed any light on the important issues around the differences in the levels of interest rates.

[1] We would like to thank Leo Krippner, Anella Munro, Michael Reddell, Christie Smith, and Dan Thornton for comments and suggestions.

1. Introduction

There is extensive literature about the determination of interest rates. Economic models often describe the underlying long-run level of bond yields as the weighted sum of short-term interest rates plus a time-varying term premium (Lee and Prasad 1994). Interest rates can also be thought of as determined by macroeconomic factors, such as monetary policy and inflation, fiscal policy (and a country's credit rating), and a risk premium (Poghosyan 2012 and Brook 2003). In an uncovered interest parity framework, local interest rates are a function of their offshore equivalent, risk and exchange-rate adjusted (Chinn and Meredith 1998). In all cases, once the level of interest rates is derived, changes in interest rates are typically assumed to be the result of new information (such as changes to activity or policy) or by change to risk premia.

Over recent history, international linkages have become more prominent in discussions around the pricing of financial instruments, such as bonds and equities (although trade channels continue to be key, Forbes and Chinn 2004). For example, changes in small open economies' interest rates are often compared to changes in larger countries' yields. In the case of New Zealand, interest rate movements are often compared with those in the United States (US) and Australia.

The majority of the literature exploring the relationship between New Zealand and other countries' interest rates was undertaken a decade or more ago. Those papers were focused on deriving the level of the domestic interest rate rather than its changes. For example, Conway and Orr (2002) built a model of quarterly 10-year rates for eight countries including New Zealand based on actual and expected inflation, government debt, current account levels, and a country's beta (against a global bond portfolio). The model consists of a long-run equation with a short-run error correction model, estimated on a quarterly basis from 1986 to 2002. In a New Zealand-specific framework, Grimes (1994) estimated the level of New Zealand's 10-year and five-year bond yields in the long- and short-run between 1988 and 1993, using domestic and global macroeconomic factors – including Australian and US interest rates – as dependent variables. Eckhold (1998) used a slightly different approach, applying an augmented uncovered interest parity model over the period 1988-1996. In more recent work, Guender and Rimer (2007) assess the change in domestic 90-day bank bill yields with the interest rate spread between New Zealand and Australia and also the NZ-US spread .

The results of those older papers differed across estimations and sample periods and in particular differ around the relative emphasis they place on Australian and US yields in explaining New Zealand bond yields. In most of the earlier papers there is an implicit assumption that the US bond yields were, in some sense, a proxy for global interest rates. In this paper, we investigate the idea of a world interest rate more directly, and distinguishes between the role of changes in the global interest rate and the role of idiosyncratic changes US and Australian yields.

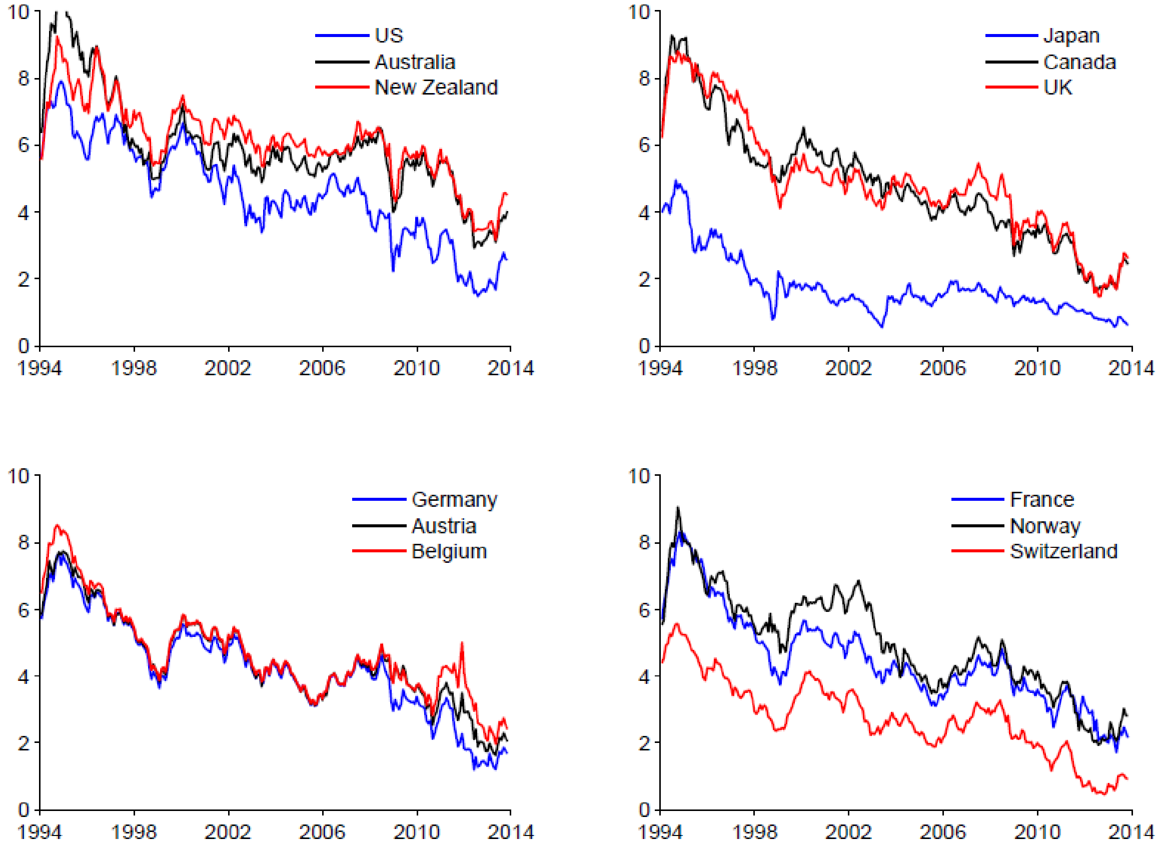
This research adds to the body of literature in multiple ways. The paper updates older work that looks at the impact other countries have on domestic interest rates but it takes a slightly different approach. The paper applies principal component analysis to capture the global element of bond yields and doesn't assume that the source of a global interest rate comes from any one particular country. Within the global contribution, the elements are further segregated into the WIR and individual country-specific drivers. This allows our model to assess the direct relationship between New Zealand and its top two trading partners, once the effect from the WIR has been controlled for. The paper also captures the behaviour of financial market trading across time zones, when evaluating daily changes.

2. Methodology And Data

2.1. The World Interest Rate

Figure 1 charts the generic 10-year bond yield for each of twelve countries (New Zealand, the United States, Australia, Japan, Canada, the United Kingdom, Germany, Austria, Belgium, France, Norway, and Switzerland). There are similar trends across all countries. For example, since 1994, 10-year bond yields have trended lower. In the medium-term (one to two years) yields have tended to move in a similar fashion, for example in the period during 1997-1998 and from July 2008. On a day-to-day basis, financial centres frequently follow the direction of the previous time zone's interest rates (for example, New York follows London, and Asia follows New York), to varying degrees. These trends could be characterised by a global interest rate.

Figure 1: Selected country generic 10-year bond yields, monthly, January 1994 – October 2013
Percent



Source: Bloomberg

We create a WIR by using principal component analysis on a data set of generic bond yields.[2] We use nominal yields, since we are interested in changes over short time periods. For the monthly WIR at the 10-year maturity, we use the government generic bond yields from January 1994 to October 2013 for the United States, the United Kingdom (UK), Germany, Austria, Belgium, France, Norway, Switzerland, Japan, Canada, Australia, and New Zealand. This time period was chosen because of data availability and because general price stability had become reasonably well-established in these countries by 1994. For daily data, the full sample of countries is used but due to data difficulties the sample period is reduced to 5 January 1995 until 9 October 2013. For monthly data on two-year generic bond yields the sample period is January 1995 to October 2013 and Austria is not included, due to data restrictions. All interest rate data are taken from Bloomberg, except for New Zealand two-year bond data, which are from RBNZ/Reuters.

Principal components extract the underlying common factors that best explain fluctuations in the data. The main advantage of principal components analysis is that no *a priori*

[2] Principal component analysis (PCA) is a mathematical technique that reduces the dimensions of data in a number of correlated variables into a smaller number of uncorrelated variables, called principal components (Jolliffe, 2002).

structure to the model is assumed. In this way, influences such as expectations of future events, such as economic growth, relative policy stances, and macroeconomic outturns, and market structure differences such as liquidity or 'safe-haven' characteristics do not have to be explicitly modelled. We implicitly assume that the relevant information from the macroeconomy is reflected in global and domestic bond yields rapidly. For example, if a shock or news develops in the US the WIR captures how this propagates throughout various countries' interest rates based on the co-movements of individual interest rates. However, the WIR will not identify where the shock came from or why interest rates moved, only the extent of commonality between interest rates. Thus we are agnostic about whether a particular country drives the WIR.

Using the factor loadings from the first principal component and following the technique used in Groth and Zampolli (2010), we create the WIR by taking a weighted average of the individual countries' bond yields. Three WIRs are created: a 10-year and a two-year WIR at the monthly frequency, and a 10-year daily WIR.

2.2. Model specification

After calculating the WIR, we estimate its impact on changes in domestic bond yields. To better represent the behaviour of interest rate moves, and to distinguish between global and country-specific influences, we add the idiosyncratic rate movements of each country's two most important trading partners from among the countries in this sample.[3] In turn, these are derived as the residual movement in their interest rates after the world interest rate contribution has been taken into account.

The equation estimated is:

$$\Delta y_t^A = \beta_1 + \beta_2 \Delta y_t^{WIR} + \beta_3 idio_t^B + \beta_4 idio_t^C + \varepsilon_t \qquad (1)$$

where

$$idio_t^B = \varepsilon_t^B = \Delta y_t^B - \gamma_1 - \gamma_2 \Delta y_t^{WIR} \qquad (2)$$

and

$$idio_t^C = \varepsilon_t^C = \Delta y_t^C - \rho_1 - \rho_2 \Delta y_t^{WIR} \qquad (3)$$

y_t is the 10-year generic bond yield at time *t* defined in basis points, with *Δ* the first difference operator, and *A*, *B*, and C denote the domestic, first trading partner, and second trading partner respectively, *WIR* is the world interest rate, *idio* is the idiosyncratic term for each country, and ε_t is an error term.

Three specifications for New Zealand are estimated: monthly changes in 10-year bond yields, monthly changes in two-year bond yields, and daily changes in 10-year bond

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3 The trading partner figures were sourced from the CIA's World Factbook.

yields. The estimation is repeated for Australia, using monthly data on 10-year and two-year bond yields.

2.3. Trading session timing for daily data

On a particular day, New Zealand's bond yields respond to offshore movements occurring in New Zealand's evening/night (the previous calendar day in those time zones). For example, in a typical trading session, the market opens in London, news develops, then the US session opens (in London's afternoon), and more news or information is released. European and US markets price in these developments, and in most cases these bond markets close having priced in news outturns from both centres. Hence, European and US bond yields price contemporaneously. Around the end of the US trading day, New Zealand opens and prices in the global information, then Australia opens, and lastly Japan. Because the New Zealand, Australian, and Japanese sessions overlap, markets tend to price in one another's developments before they close for their trading days. For this reason, when we use daily data to extract the WIR and estimation the equation, we keep the European and North American markets contemporaneous and changes in New Zealand, Australian, and Japanese bond yields are lagged one trading day to the rest of the sample. The underlying assumptions here are that New Zealand has little impact on global interest rates and the trading day starts in London and ends in Australasia and Japan. Table 1 illustrates this trading session timing via correlations with New Zealand interest rates. The increase in correlations between New Zealand and the Northern Hemisphere (right-hand side column) demonstrates how the timing of trading sessions matters for daily changes in interest rates.

Table 1: Correlation between changes in selected countries' 10-year bond yields with NZ 10-year bond yields

Daily frequency, correlation over the sample period

	Contemporaneous	Trading session timing
United States	0.14	0.48
Germany	0.20	0.30
United Kingdom	0.19	0.30
Australia	0.56	0.56
Japan	0.15	0.15

Source: RBNZ calculations

3. Results

3.1. The World Interest Rate

In all three specifications of the WIR (monthly 10-year, daily 10-year, and monthly two-year), the first principal component explains at least 87 percent of the variance in global interest rates (results in the Appendix), with the second principal component explaining to less than five percent. We are comfortable that the first component captures the information that we require to represent the WIR (and an evaluation of the eigenvalues support this). Factor loadings for the first principal component based on monthly data for 10-year bond yields are shown in Table 2 (the loadings for all specifications can be found in the Appendix). All countries have a positive influence, which raises our confidence that the first principal component represents the WIR. The factor loadings for the top six countries are all large and similar in magnitude, meaning there is a high degree of commonality among these interest rates.[4]

Table 2: Factor loadings of the World Interest Rate

Monthly frequency, 10-year bond

Canada	0.36	*France*	0.29
United Kingdom	0.35	*Austria*	0.28
Norway	0.31	*Belgium*	0.28
United States	0.30	*New Zealand*	0.23
Germany	0.30	*Switzerland*	0.23
Australia	0.30	*Japan*	0.17

Source: RBNZ calculations

Figure 2 illustrates the WIR compared with each country's 10-year bond yield.[5] The trend and profile of individual country yields and WIR are similar. We note other observations, such as New Zealand and Australian interest rates have been consistently above the WIR, while Switzerland and Japanese interest rates have been consistently below. The remaining countries' interest rates have tracked the global rate more closely.[6,7] While we observe some persistent differences in the level of the WIR and individual country interest rates, our method is purely statistical and focused on changes in interest rates rather than levels *per se*. This means we are unable to, and do not attempt to, examine reasons for the levels differences.

[4] To check if the level of and variance of bond yields were influencing the factor loadings, 10-year yields were standardised and an augmented WIR was created using principal component analysis. The WIR was robust to standardisation.

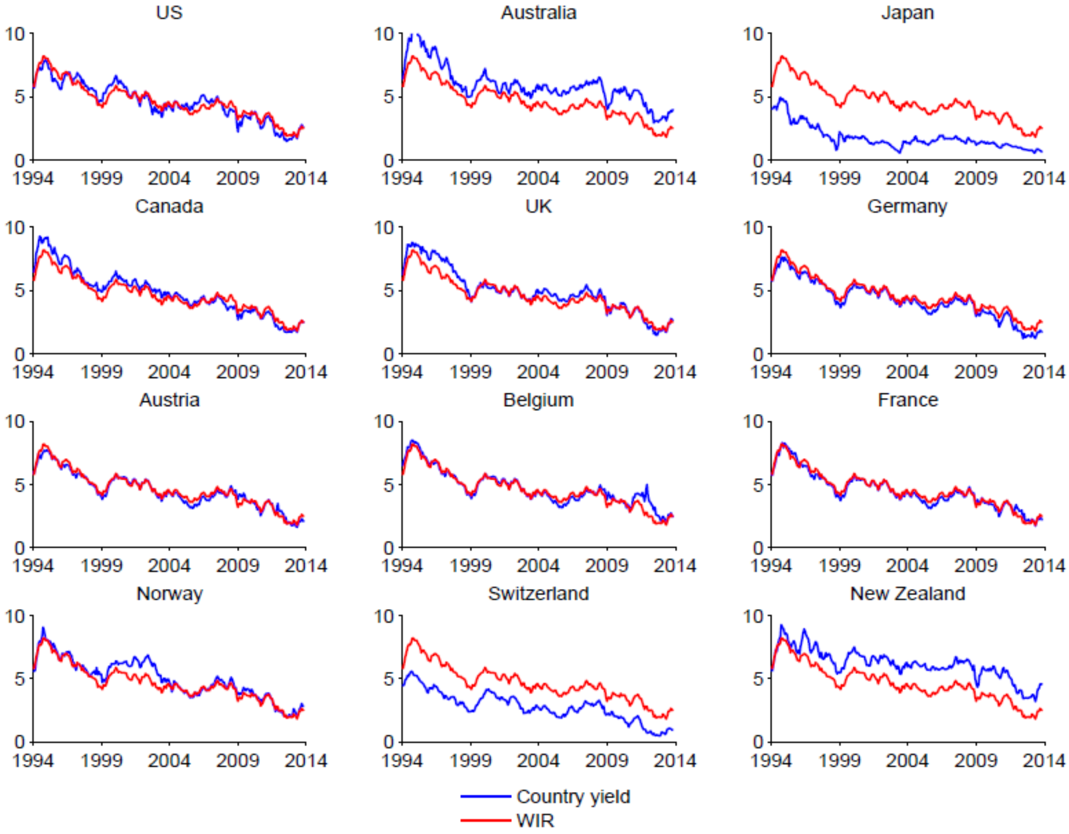
[5] The monthly and daily charts look identical, with the exception of the period frequency.

[6] To test the sensitivity of the principal component calculation to the 2007-2009 global financial crisis, we split the sample at September 2008, when Lehman Brothers Holdings moved into Chapter 11 bankruptcy. We find that even with the severe interest rate movements during this time, our estimate of the WIR is robust.

[7] To test the sensitivity of the WIR, we calculated alternative specifications that included additional European countries, excluded Japan, and excluded all euro area countries except for Germany. The effects on the WIR were negligible.

Figure 2: Individual 10-year bond yields versus the 10-year World Interest Rate

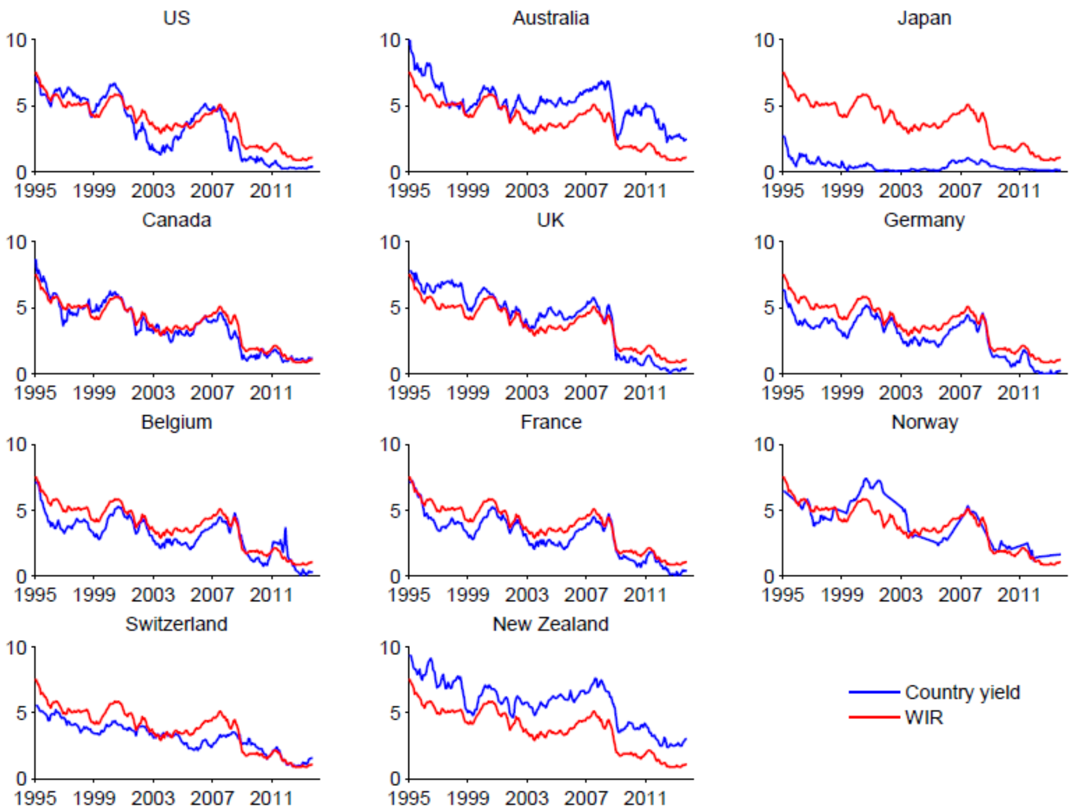
Monthly average, percent



Source: Bloomberg, RBNZ calculations

Figure 3: Individual two-year bond yields versus the two-year World Interest Rate

Monthly average, percent



Source: Bloomberg, RBNZ/Reuters, RBNZ calculations

3.2. Monthly-average changes in bond yields

The results for the monthly estimations are shown in Tables 3 - 6. The idiosyncratic components from Australia and the US are included in the estimation for New Zealand. In the Australian equation, idiosyncratic factors were estimated for the US and Japan.

The regressions look broadly well-behaved, with the signs and relative sizes of the coefficients as we might expect and Durbin-Watson statistics around 2. The estimations were tested for structural breaks. At the monthly frequency, the null hypothesis of no structural break was accepted using the Quandt-Andrews unknown breakpoint test (results can be found in the Appendix).

We find that global factors explain 62 percent of the monthly moves in New Zealand interest rates. The results also show that when the WIR increases 10 basis points, New Zealand's 10-year yield increases 10 to 11 basis points. The direct effect from the idiosyncratic components has a much smaller effect. The US idiosyncratic factor (i.e. deviations between the US and the estimated World Interest Rate) has a small but insignificant effect, while Australia has a positive and significant impact on domestic yields. When the Australian-specific component rises 10 basis points, New Zealand's yield increases 5 basis points on average. The notable impact of Australian yield changes on New Zealand is consistent with Australia having been New Zealand's largest trading partner, the cyclical correlation in commodity prices between the two countries, and the common shocks often experienced by the two countries.

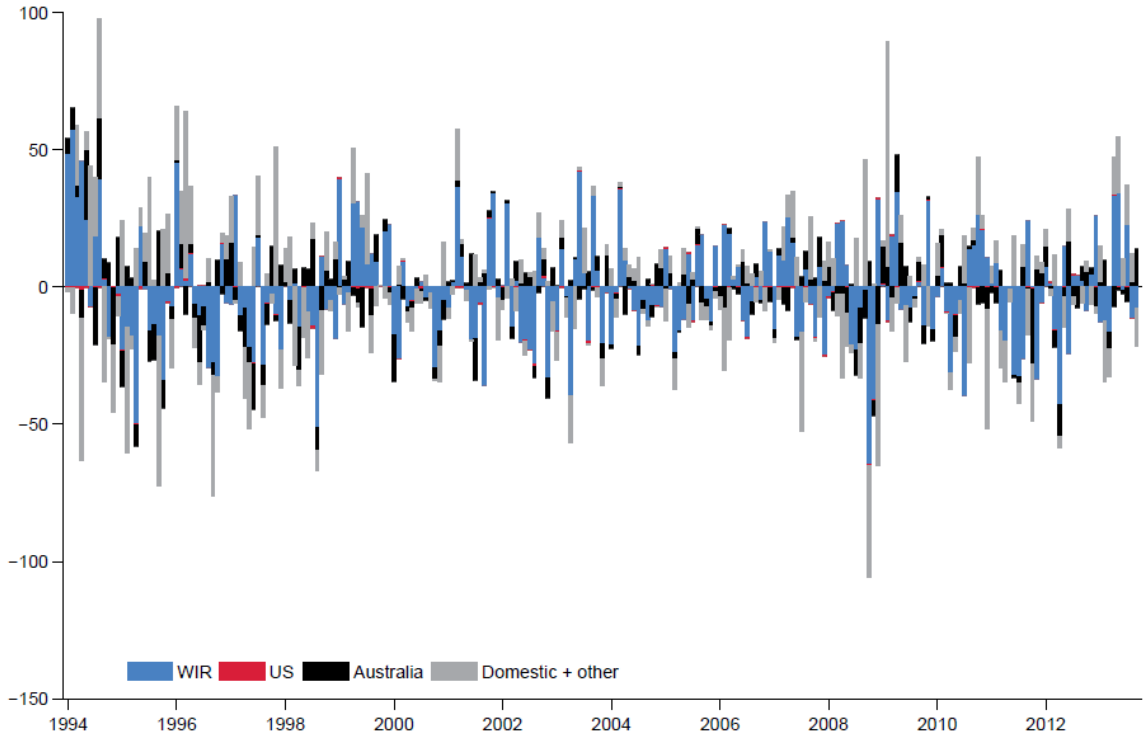
Table 3: New Zealand 10-year bond yield model
Results

Variable		Coefficient	T-statistic	p-stat
Constant	β_1	0.80	0.97	0.3336
y^{WIR}	β_2	1.08	18.35	0.0000
$idio^{US}$	β_3	0.02	0.28	0.7811
$idio^{AU}$	β_4	0.47	7.10	0.0000
Adjusted R^2		0.620	*Durbin-Watson*	2.16

Source: RBNZ calculations

Figure 4 illustrates monthly changes in New Zealand rates decomposed into its global and domestic (plus other) elements.

Figure 4: Decomposition of New Zealand 10-year bond yield movements
Basis points, monthly



Source: RBNZ calculations

The effect of global factors on Australian yields is slightly stronger than in New Zealand's case (an adjusted R^2 of 0.68 compared to 0.62 respectively). Both estimates suggest the direct effect from the WIR is slightly larger than one. The country-specific components of the US and Japan are not significant in explaining moves in Australian interest rates.

Table 4: Australian 10-year bond yield model
Results

Variable		Coefficient	T-statistic	p-stat
Constant	β_1	0.83	0.77	0.4436
y^{WIR}	β_2	1.31	22.50*	0.0000
$idio^{US}$	β_3	0.06	0.79	0.4319
$idio^{JP}$	β_4	0.03	0.51	0.6139
Adjusted R^2		0.681	*Durbin-Watson*	2.24

Source: RBNZ calculations. * Significant at the 5% level

At the two-year duration (Tables 5 and 6) the regression models are less well explained. For New Zealand the adjusted R^2 falls to 0.34 percent from 0.62, and for Australia the statistic falls to 0.48 from 0.68.

The results suggest a slightly weaker direct effect from the two-year derived WIR on two-year interest rates relative to the relationship at the 10-year duration. For New Zealand, when the WIR increases 10 basis points New Zealand's two-year yield increases around 8 basis points. A key difference is in the idiosyncratic components. In this case, the Australian contribution is not significant, which is somewhat surprising given the commonalities and economic ties between the two countries. The US idiosyncratic factor has a moderately negative and statistically significant impact on domestic yields. This result could reflect risk sentiment, where the impact from an increase in the WIR could be dampened by the US idiosyncratic factor. However, we would need a structural model to provide a satisfactory explanation for this empirical finding.

Table 5: New Zealand two-year bond yield model
Results

Variable		Coefficient	T-statistic	p-stat
Constant	β_1	-0.51	-0.35	0.7231
y^{WIR}	β_2	0.80	9.81*	0.0000
$idio^{US}$	β_3	-0.41	-4.47*	0.0000
$idio^{AU}$	β_4	-0.09	-1.43	0.1550
Adjusted R^2		0.339	*Durbin-Watson*	1.67

Source: RBNZ calculations. Significant at the 5% level

Table 6: Australia two-year bond yield model
Results

Variable		Coefficient	T-statistic	p-stat
Constant	β_1	0.12	0.08	0.9400
y^{WIR}	β_2	1.23	14.11*	0.0000
$idio^{US}$	β_3	-0.13	-1.36	0.1768
$idio^{AU}$	β_4	0.01	0.07	0.9407
Adjusted R^2		0.478	*Durbin-Watson*	1.96

Source: RBNZ calculations. * Significant at the 5% level

In general, the results suggest that different parts of the yield curve are affected by different factors. Global events impact the long-end of the curve more substantially than the short-end. This is potentially via its impact on inflation, common global real shocks, and strong trading partner linkages, while the short-end of the curve is more likely to be anchored by factors such as domestic monetary policy and associated domestic data.

3.3. Daily changes in New Zealand bond yields

The daily 10-year WIR is applied to daily changes in 10-year bond yields in New Zealand, in addition to Australian and US idiosyncratic factors. The estimation results have a poorer fit (Table 7), likely reflecting higher volatility at the daily frequency. Changes in the WIR and the Australian idiosyncratic component remain substantial but smaller than in the monthly model. The US idiosyncratic component has a small positive influence and is statistically significant, in contrast to the monthly model where the coefficient was not significant.

Table 7: New Zealand ten-year bond yield model, daily data full sample Results

Variable		Coefficient	T-statistic	p-stat
Constant	β_1	0.02	0.26	0.7943
y^{WIR}	β_2	0.84	48.59*	0.0000
$idio^{US}$	β_3	0.10	6.68*	0.0000
$idio^{AU}$	β_4	0.27	24.18*	0.0000
Adjusted R^2		0.383	*Durbin-Watson*	2.21

Source: RBNZ calculations. *Significant at the 5% level

The Quandt-Andrews diagnostic test for parameter stability was applied to the model in Table 7. The results highlight a lack of parameter constancy, with at least one break and the maximum break point found on 6 December 2007 (result in the Appendix). We are not surprised to find instability in the daily regression, in particular as it is using a daily data set and is in first difference terms. Moreover, the maximum breakpoint date occurs during the global financial crisis: a time where a structural break could reasonably have occurred. The failure to accept the null hypothesis of no breaks in the daily series but not in the monthly regression could be due to the relative power of the former, although the number of observations in the monthly model should give it enough power for us to have confidence in its results. For completeness, the results from both sub sample regressions can be found in Tables 8 and 9.

We also compared the results of the regressions using daily changes in the WIR and the US and Australian idiosyncratic terms, with regressions that attempted to explain daily changes in New Zealand bond yields just with changes in US and Australian interest rates. The WIR models have materially more explanatory power.

The results in Tables 8 and 9 show that New Zealand's sensitivity to the WIR since 2008 has diminished, where the impact on New Zealand yields of a 10 basis point increase in the WIR has fallen from around 9 to 7 basis points. This suggests that domestic policies and events in offshore countries relative to New Zealand's recent experience have seen New Zealand bond yields decouple somewhat from the rest of the world. The impact from the idiosyncratic components of Australia and the US has also diminished in the post-global financial crisis period.

Table 8: New Zealand ten-year bond yield model, daily data pre- 6 December 2007
Results

Variable		Coefficient	T-statistic	p-stat
Constant	β_1	0.04	0.53	0.5957
y^{WIR}	β_2	0.93	40.92	0.0000
$idio^{US}$	β_3	0.13	6.54	0.0000
$idio^{AU}$	β_4	0.30	21.61	0.0000
Adjusted R^2		0.397	*Durbin-Watson*	2.38

Source: RBNZ calculations

Table 9: New Zealand ten-year bond yield model, daily data post- 6 December 2007
Results

Variable		Coefficient	T-statistic	p-stat
Constant	β_1	-0.03	-0.32	0.7492
y^{WIR}	β_2	0.71	27.34	0.0000
$idio^{US}$	β_3	0.06	2.84	0.0046
$idio^{AU}$	β_4	0.20	10.94	0.0000
Adjusted R^2		0.367	*Durbin-Watson*	1.77

Source: RBNZ calculations

4. Conclusions and Future work

This paper uses principal component analysis to examine the role that changes in global bond yields have on New Zealand's yields. We find that the first principal component explains at least 87 percent of the variance of global interest rates. We use this to derive World Interest Rates. Monthly changes in the estimated 10-year World Interest Rate have a one-for-one impact on New Zealand yield movements and Australian idiosyncratic events are significant and positive. Global factors explain 62 percent of the monthly variation in New Zealand's bond yields.

In the case of daily movements, after accounting for the behaviour of financial markets with respect to time zones, 38 percent of the changes in New Zealand's 10-year bond yield can be attributed to offshore factors. We extend this work to consider whether the global factor impacts more on long- or short-dated interest rates. We conduct the same analysis for two-year bond yields and find that 34 percent of the variation of changes in domestic New Zealand's two-year rate can be explained by global factors. This reveals that, most likely, fluctuations on the short end of the New Zealand curve are primarily influenced by domestic policy expectations and domestic data releases.

Further work to explore the relationships between these variables is warranted. The number of countries in our sample could be widened to include emerging economies countries to better represent the World Interest Rate. It could also be worthwhile to explore the interpretation of the second principal component of global interest rates. If the daily sample is expanded to incorporate five trading time zones, this may enable a greater understanding of the relationship between global factors and domestic interest rate changes between time zones. Finally, the causality of interest rate movements in Australia and New Zealand could also be assessed.

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6. Appendix

Table A1: Variance explained by each principal component and the associated eigenvalues

Percent

	Monthly data 10-year yield		Monthly data 10-year yield		Monthly data 10-year yield	
Principal component	Variance explained	Eigenvalue	Variance explained	Eigenvalue	Variance explained	Eigenvalue
1	93.77	23.47	87.37	25.05	93.14	19.11
2	2.00	0.50	4.44	1.27	2.3	0.47
3	1.62	0.41	3.49	1.00	1.95	0.40
4	0.92	0.23	1.52	0.44	0.84	0.17
5	0.52	0.13	1.28	0.37	0.61	0.13
6	0.47	0.12	0.62	0.18	0.8	0.10
7	0.31	0.08	0.47	0.13	0.26	0.05
8	0.16	0.04	0.42	0.12	0.16	0.03
9	0.12	0.03	0.17	0.05	0.12	0.03
10	0.06	0.02	0.13	0.04	0.06	0.01
11	0.03	0.01	0.09	0.03	0.03	0.01
12	0.03	0.01			0.03	0.01

Source: RBNZ calculations

Table A2: Factors loadings of the first principal component

Monthly data two-year yield		Monthly data two-year yield		Daily data 10-year yield	
Canada	0.36	*Canada*	0.34	*Canada*	0.36
United Kingdom	0.35	*United Kingdom*	0.44	*United Kingdom*	0.36
Norway	0.31	*Norway*	0.29	*Norway*	0.32
United States	0.30	*United States*	0.40	*United States*	0.31
Germany	0.30	*Germany*	0.29	*Germany*	0.31
Australia	0.30	*Australia*	0.24	*Australia*	0.29
France	0.30	*France*	0.30	*France*	0.29
Austria	0.28	*Austria*		*Austria*	0.28
Belgium	0.28	*Belgium*	0.26	*Belgium*	0.26
New Zealand	023	*New Zealand*	032	*New Zealand*	0.24
Switzerland	0.23	*Switzerland*	0.20	*Switzerland*	0.23
Japan	0.17	*Japan*	0.05	*Japan*	0.14

Source: RBNZ calculations

Table A3: Quandt-Andrews structural break tests, sup F-statistic, Wald test

Regression	Value	p-stat*	Max breakpoint
NZ 10-year, monthly	12.68	0.171	N/A
NZ 2-year, monthly	13.56	0.129	N/A
AU 10-year, monthly	10.91	0.293	N/A
NZ 10-year, daily	55.78**	0.000	6 December 2007

Source: RBNZ calculations. Notes: the null hypothesis assumes no breakpoints. The trimming percentage is 15%. * From Eviews, based on Hansen (1997). ** Significant at the 5% level.