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Effective Monetary Stimulus: Measuring the stance of monetary policy in New Zealand

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NON-TECHNICAL SUMMARY[1]

The Reserve Bank of New Zealand sets monetary policy using the Official Cash Rate (OCR) as its policy tool to target price stability and maximum sustainable employment. However, the Reserve Bank's monetary policy stance is also set by its communication of what might happen to the OCR in the future.

To set monetary policy appropriately, the Reserve Bank must assess overall financial conditions and their implications for inflation and employment. To do this, the Reserve Bank must take account of the range of interest rates at each borrowing horizon (i.e. the yield curve). This is because how household and firms view the outlook for interest rates can also have an effect on today's business activity, wage and price setting behaviour, and eventually inflation – it is not just the level of current interest rates that matters for economic activity and price setting. For example, a homeowner taking out a mortgage, or a firm taking out a loan, often borrow at longer terms and therefore consider current interest rates and the likely evolution of future interest rates when making decisions.

The Reserve Bank uses a range of tools to assess financial conditions in New Zealand. In particular, the Reserve Bank attempts to gauge how stimulatory or contractionary monetary policy needs to be to stabilise the economy. One tool to help in a broad assessment of monetary conditions – how stimulatory interest rates are – is the effective monetary stimulus (EMS) measure.

The EMS is a summary statistic that takes account of the (nominal) neutral interest rate and interest rate outlook. It provides a snapshot of the interest rates faced by businesses and households across the yield curve, and assesses whether these interest rates are stimulatory or contractionary for the economy.

The EMS is, of course, just one summary of overall monetary/financial conditions. The Reserve Bank also takes account of other influences when assessing overall conditions. For example, exchange rates, credit spreads, and uncertainty indicators are all monitored as part of the Bank's policy assessment. It is that total assessment, rather than the EMS or yield curve alone, that is taken into account when considering the appropriate OCR setting to achieve the macroeconomic outcomes.

In this Note, we show how the EMS is constructed for New Zealand. We also show that the EMS measure is a useful indicator of the stance of monetary conditions. Lastly, the EMS measure also fits with the Reserve Bank's narrative of the stance of monetary policy through history.

[1] The authors would like to thank Leo Krippner, Tugrul Vehbi, Amber Wadsworth, Finn Robinson, Christie Smith, and staff at the Reserve Bank of New Zealand for discussion and feedback.

1. Introduction

The Reserve Bank of New Zealand is tasked with setting monetary policy in New Zealand. The current goal of monetary policy is to provide price stability and support maximum sustainable employment. The official cash rate (OCR) is the main tool used for setting monetary policy. The OCR either stimulates or contracts the economy through transmission to the yield curve – the future interest rates that apply over different time horizons.

In this Analytical Note, we introduce the effective monetary stimulus (EMS) measure for New Zealand. EMS measures the stance of monetary policy by taking into account the long and short end of the yield curve. The calculation of EMS, its suitability as a measure of monetary conditions, and a historical interpretation of policy settings are discussed in the following sections.

EMS is useful to examine for a number of reasons. First, EMS capture the entire yield curve – which policy makers should take into account when assessing monetary conditions and setting policy.

Second, EMS extends our understanding of what influences monetary conditions by capturing both expectations of future monetary policy, and a term (risk) premium component. Credible policy makers can directly influence expectations about the future OCR. However, policy makers have less influence over the pricing of risk in fixed-income markets.[2]

The EMS is, of course, one element of overall monetary/financial conditions. The Reserve Bank also takes account of other influences when assessing overall conditions. It is that total assessment, rather than the EMS or yield curve alone, that is taken into account when considering the appropriate OCR setting to achieve the macroeconomic outcomes.

This paper proceeds as follows. Section 2 describes and constructs the EMS measure for New Zealand. Section 3 examines the driving forces behind the EMS. Section 4 evaluates the usefulness of the EMS as a measure of stimulus. Section 5 concludes.

2. Measuring the stance of monetary policy

The OCR can be set at a level to either stimulate output and increase inflation in the economy (expansionary) or dampen output and reduce inflation (contractionary). In theory, the OCR can also be set at a level that is neither expansionary nor contractionary. This is referred to as the (nominal) ‘neutral rate’.

[2] A central bank may have some influence over the risk premium, by conducting unconventional monetary policy, such as quantitative easing. Stable and credible monetary policy can also act to reduce the risk premium on bonds over time, see Callaghan (2019).

The difference between the OCR and the neutral rate determines how expansionary or contractionary monetary policy is at any given time. However, monetary policy affects economic behaviour through a number of channels which means that simply looking at the current OCR relative to neutral will not fully reveal the monetary policy dynamics in the economy.

Interest rates are an integral part of the transmission of monetary policy. Lower interest rates, for example, can:

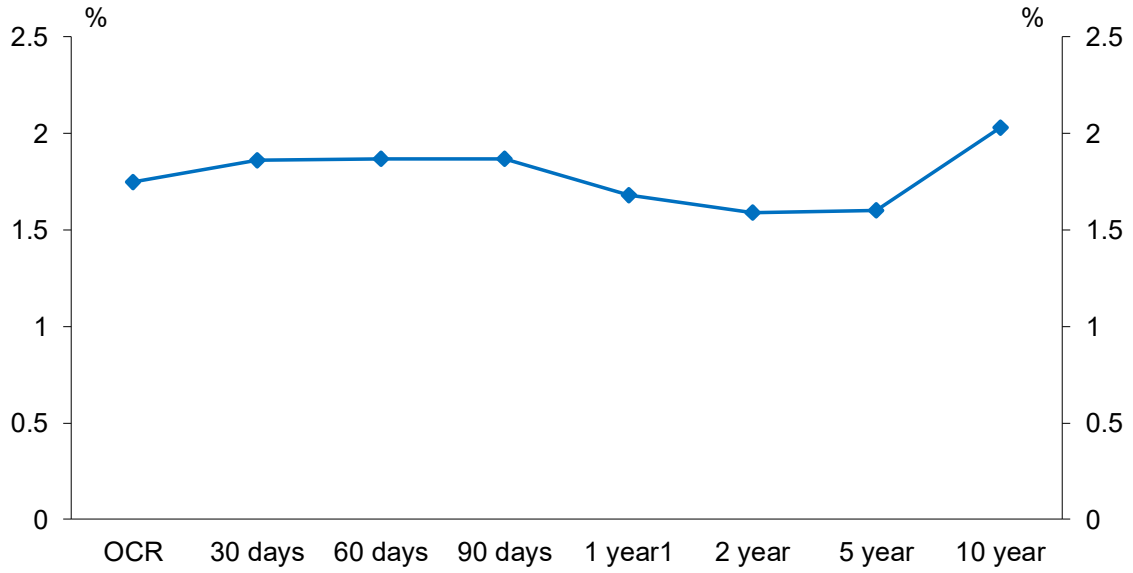
- encourage households to save less and spend more today (an inter-temporal substitution channel);
- boost asset prices and household wealth, and encourage people to spend more (the wealth channel), and;
- affect the cash flows of borrowers and lenders on variable interest rates (a cash-flow channel).

Variable (floating) interest rates follow the OCR level reasonably closely. This means the transmission of monetary policy through the cash-flow channel (above) is determined by looking at the OCR level. However, for the other channels, expectations and long-term interest rates are very important. Households consider both today's interest rates and likely future interest rates when making decisions about spending and saving.

The OCR is an overnight interest rate, whereas the interest rates faced by businesses and households are longer term. These longer-term interest rates largely determine economic behaviour (Drew and Sethi, 2007). There are a number of limitations to examining monetary conditions solely via the OCR. First, the transmission from the OCR to household and business interest rates can vary over time (Drew et al., 2008). Second, global economic conditions also can have a direct effect on the New Zealand yield curve (Krippner, 2010; Lewis and Rosborough, 2013).

The yield curve captures these different interest rates or yields with different maturities (but otherwise almost identical characteristics) observed at a single point in time (figure 1). Policy makers need to take account of the long and short end of the yield curve when assessing the outlook for economic activity and prices (McDermott, 2016).

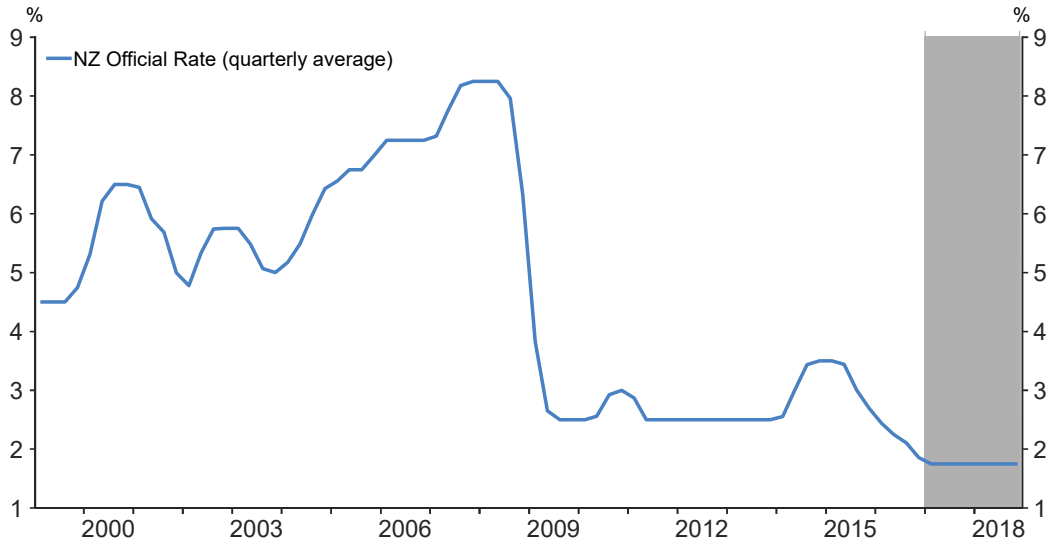
Figure 1: A stylised New Zealand yield curve



Source: Reserve Bank of New Zealand.
Note: Figure 1 uses data on wholesale interest rates obtained from the Reserve Bank on 20 March 2019. See: https://www.rbnz.govt.nz/statistics/b2.

To illustrate these points, we can look at period over 2017 and 2018. The OCR remained steady at 1.75 percent, following a series of declines from 2015 (figure 2). From 2017, the policy rate by itself signalled no net change in monetary conditions.

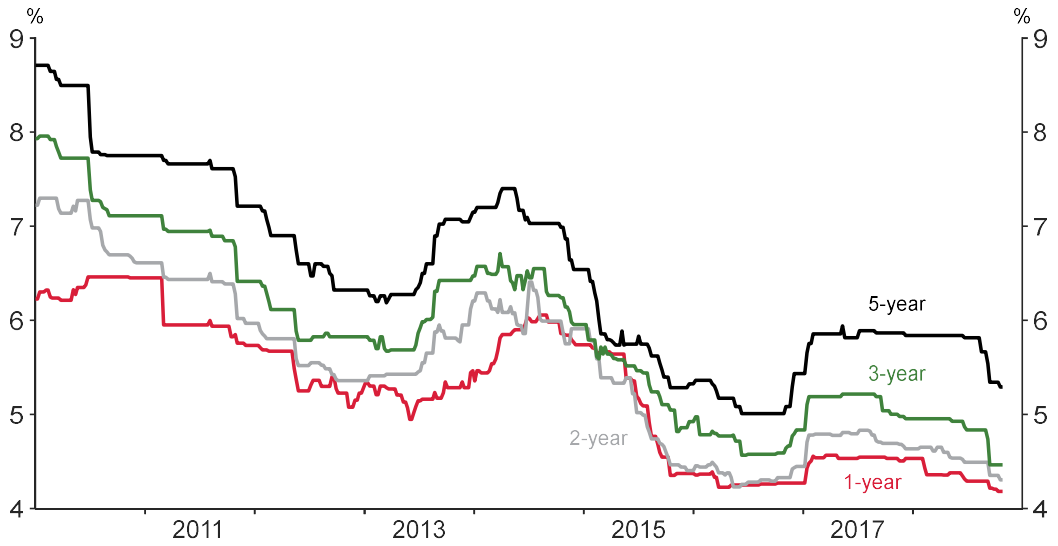
Figure 2: Official cash rate



Source: Reserve Bank.

However, during this time households and businesses experienced an easing in monetary conditions (figure 3). The Reserve Bank was communicating a flat OCR track in the early part of the forecast horizon, and was pushing back the date at which future increases in the OCR were expected (in successive Monetary Policy Statements). Market participants were also lowering their outlook for short-term interest rates. This resulted in a substantial reduction in market and household interest rates across the yield curve, with swap rates falling around 1 percentage point at most tenors. The low OCR and Reserve Bank communication was one factor that contributed to the easing monetary conditions.

Figure 3: New Zealand mortgage interest rates



Source: interest.co.nz.
Note: The rate shown for each term is the average of the latest rate on offer from ANZ, ASB, BNZ, and Westpac.

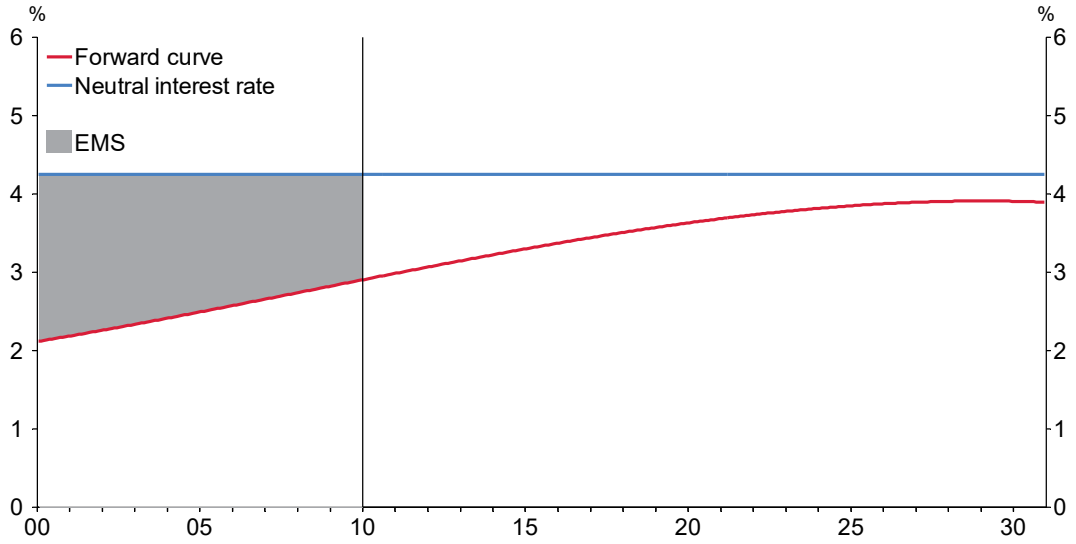
3. Constructing the EMS in New Zealand

3.1. Theory behind the EMS

The effective monetary stimulus (EMS) measure is a useful benchmark for assessing the stance of monetary policy. The EMS provides a consistent measure of monetary settings over time. This note takes Krippner's (2014) original work on the EMS concept, and its extension in Halberstadt and Krippner (2016), and applies it to the New Zealand economy.

Following Halberstadt and Krippner (2016) and Krippner (2014), we define EMS in this paper as the cumulative difference between the market outlook for short-term interest rates (the forward curve) and the neutral interest rate, at a given time horizon (figure 4).

Figure 4: Stylised chart of EMS calculation



Note: x-axis shows maturity (years).

The EMS is represented by the shaded grey area (in figure 4). The EMS can be specified with equation (1):

$$EMS_{t,h} = \int_0^h f_{t,h}\, dt - \int_0^h n_t\, dt \qquad (1)$$

where h is a chosen horizon, f is the chosen forward rate path from time t to time h, and n is the neutral interest rate.

Calculated this way, a *positive* EMS suggests that policy settings are expected to be contractionary, on net, over the relevant horizon. A *negative* EMS suggests that policy settings are expected to be stimulatory, on net, over the relevant horizon.[3]

The calculation of EMS can be simplified somewhat by rearranging equation (1), as detailed in Halberstadt and Krippner (2016). First, we can divide through by h, technically converting the EMS measure to an annual average concept. This is the concept that will be used in the remainder of the paper, whilst retaining the 'EMS' label.

The simplified annual average calculation of the EMS is depicted in equation (2):

[3] The EMS can also be compared across time. A higher EMS suggests policy settings are relatively more contractionary.

$$EMS_{t,h} = \frac{1}{h}\int_0^h f_{t,h}\, dt - \frac{1}{h}\int_0^h n_t\ dt \qquad (2)$$

The EMS measure is equal to the average of the forward rate over horizon h, less the average of the neutral rate over horizon h. The second part of equation 2 simplifies to the neutral rate, given the expected neutral rate is constant at any point in time.

In addition, the average of a short-rate over any given horizon will be (approximately) equal to that horizons' spot rate. For example, the average of the outlook for the 90-day bank bill rate over the next five years will equal the current 5-year swap rate (approximately – as there is also a term premium component, which we discuss in section 4). As a result, the first part of the equation simplifies to the chosen horizon spot interest rate.

Therefore, the EMS equation can simplified as the difference between the relevant horizon spot rate, and the neutral interest rate:

$$EMS_{t,h} = r_{t,h} - n_t \qquad (3)$$

where r is the relevant horizon spot rate.

Calculating the EMS measure as in equation (3), therefore, requires choices for the:

- interest rate instrument;
- neutral rate; and,
- time horizon.

Section 3.2 outlines the proxies we choose for each of these variables.

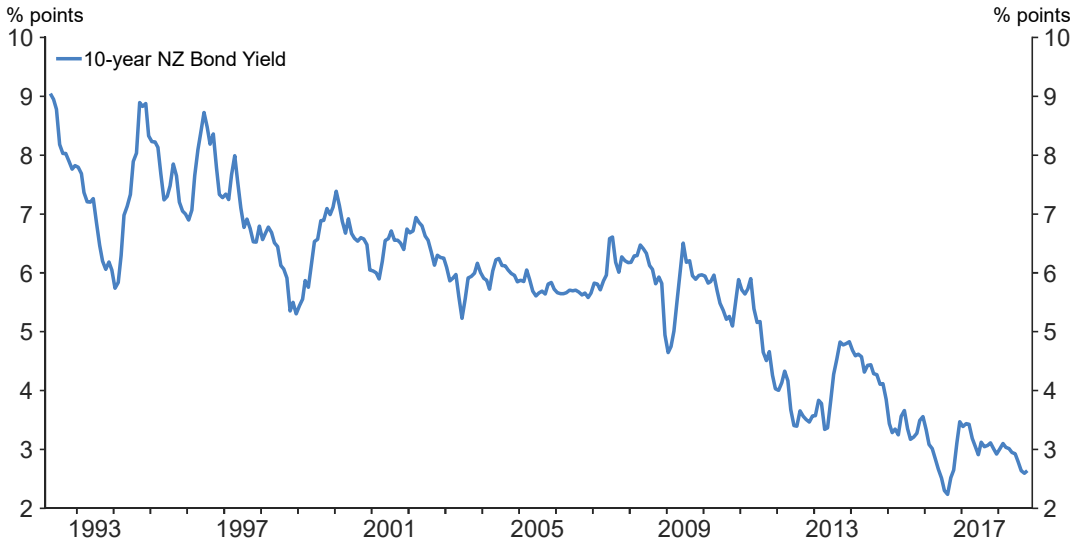
3.2. Construction of the EMS measure for New Zealand

Interest rate instrument and time horizon

To construct the EMS we use estimates for the market interest rate. 10-year New Zealand (NZ) Government bond yields are chosen as the appropriate interest rate (depicted in figure 5).[4] Zero-coupon government bond yields are used because they are best suited to the neutral interest rate we are using.

[4] We also construct the EMS with other NZ Government bond yield maturities. See Appendix A (figures A1 and A2) for results.

Figure 5: 10-year NZ Government bond rate (constant maturity)



Source: Reserve Bank estimates.

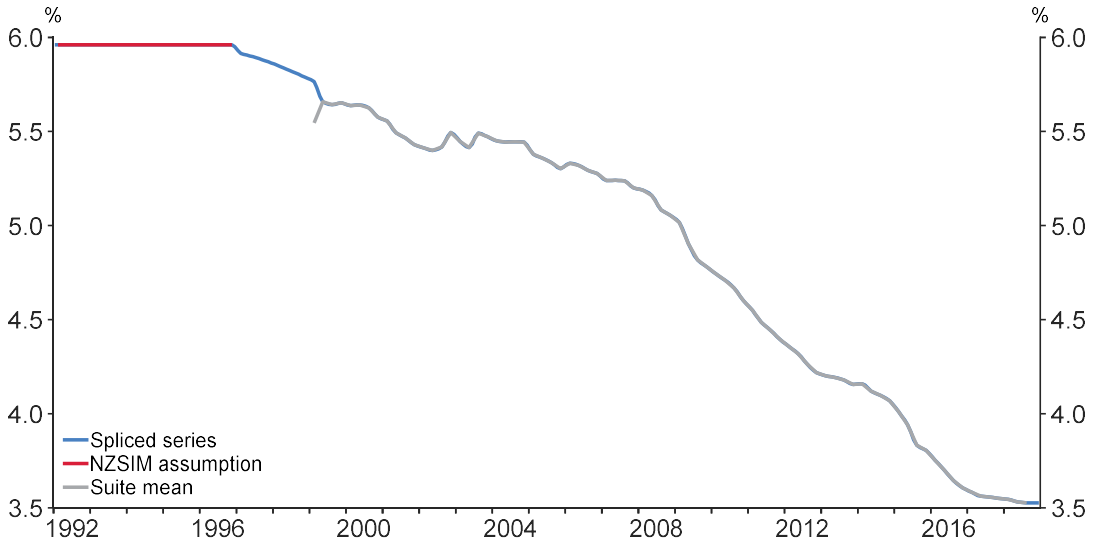
In theory, the longest interest rate available would be the best option for the interest rate instrument. This is because the horizon of an EMS measure needs to be sufficiently long in duration to capture the full impact that policy rate expectations and policy actions have on the current yield curve. However, given New Zealand's lack of longer-term rates, the 10-year rate would better reflect both current and future interest rates that are relevant for households.

Neutral interest rate

To construct the EMS we use the median of the Reserve Bank's suite of neutral interest rate indicators as the measure of the neutral rate (figure 6). This suite of models is only fully available back to 1999, so prior to this we use the NZSIM assumption of the neutral 90-day rate.[5]

[5] NZSIM is the Reserve Bank's core macroeconomic model (Austin and Reid, 2017; Kamber et al., 2015).

Figure 6: The neutral interest rate assumption in calculating the EMS

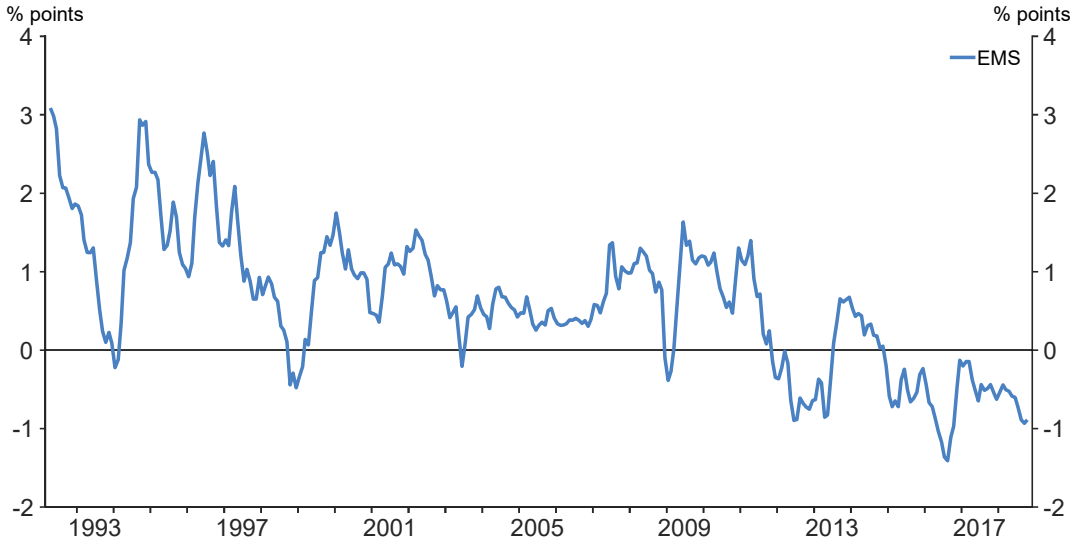


Source: Reserve Bank estimates.

The EMS measure

Combining the chosen interest rate instrument, neutral rate, and time horizon above, we calculate the EMS for New Zealand (figure 7). The EMS is calculated at a monthly frequency.

Figure 7: EMS measure (monthly)



Source: Reserve Bank estimates.

The EMS shows that the Reserve Bank's OCR setting has provided a significant degree of monetary stimulus to the New Zealand economy over the last two years. Between 1992 and 2008, the EMS was largely positive indicating contractionary monetary policy. Following the Global Financial Crisis (GFC), the OCR dropped, and the EMS progressed into negative territory indicating stimulatory monetary policy. As of 2018, the EMS measure indicates near-record levels of monetary stimulus. These monetary conditions have been assisted by long-term yields decreasing. Appendix B outlines a more detailed history of monetary conditions through the lens of the EMS.

4. Decomposing the EMS: Expectations and the term premium in New Zealand

Long-term interest rates are determined by the expected path of short-term interest rates (at any given time) and a term premium component.[6] The term premium is the expected additional return (i.e. risk premium) that investors demand to compensate them for the risk associated with a long-term bond.[7] The term premium creates a wedge between market participants' expectations of future short-term interest rates and the prices being traded (Callaghan, 2017).

Therefore, we can decompose the EMS into a market expectations component, and a term premium component, as detailed in Halberstadt and Krippner (2016). This decomposition follows a term structure model from Callaghan (2019) and Adrian et al. (2011).

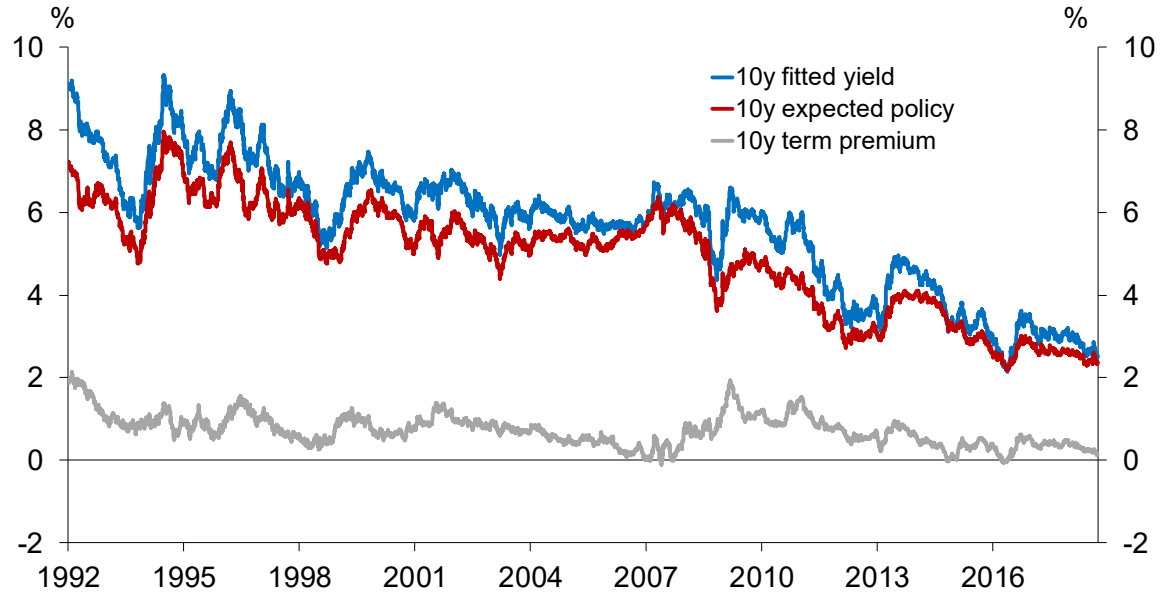
We decompose the EMS measure (equation 3) by splitting the interest rate into an expected policy component and a term premium component, as in equation (4):

$$r_{t,h} = \beta_{t,h} + \rho_{t,h} \tag{4}$$

where β is the average expected short-term interest rate over h years, starting from time t, and $\rho_{t,h}$ is the term premium on the h-maturity rate.[8] Figure 8 plots the decomposition of the New Zealand 10-year bond rate into the expectations and term premium component (Callaghan, 2019).

[6] See Callaghan (2017) and Kim and Orphanides (2007).
[7] See Friedman (1979), Fama and Bliss (1987), and Campbell and Shiller (1991).
[8] The interpretation of the indicator largely depends on knowing what the unobservable term premium is at any point in time. Since different models can produce different term premium estimates, the interpretation of the monetary stance may then be rather subjective and model dependent.

Figure 8: A decomposition of the New Zealand 10-year bond yield



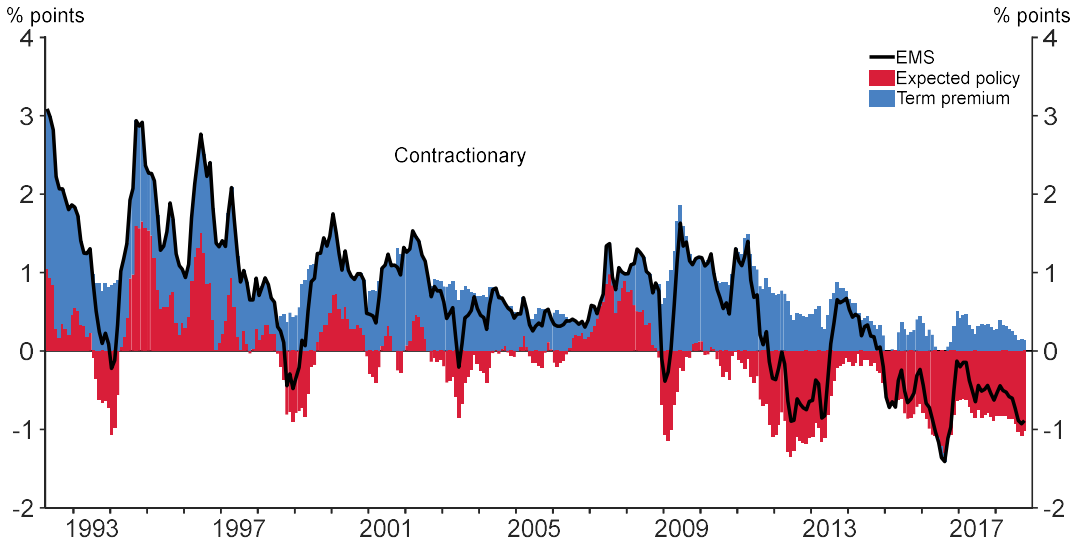
Note: The expectations component is the estimated average expected policy rate over the next 10 years.

This decomposition means the EMS can be defined by equation (5), as:

$$EMS_{t,h} = \beta_{t,h} + \rho_{t,h} - n_t \quad (5)$$

The decomposition shows that movements in both the stance of monetary policy and the term premium contribute substantially to net stimulus over history (figure 9). The decline in the term premium since the early-1990s partly explains why the EMS has trended lower. More recently, expectations of future policy have also played a larger role in contributing to the EMS.

Figure 9: Term premium and expectations EMS decomposition



Source: Reserve Bank estimates.
Note: Expected policy refers to expected policy relative to the neutral rate.

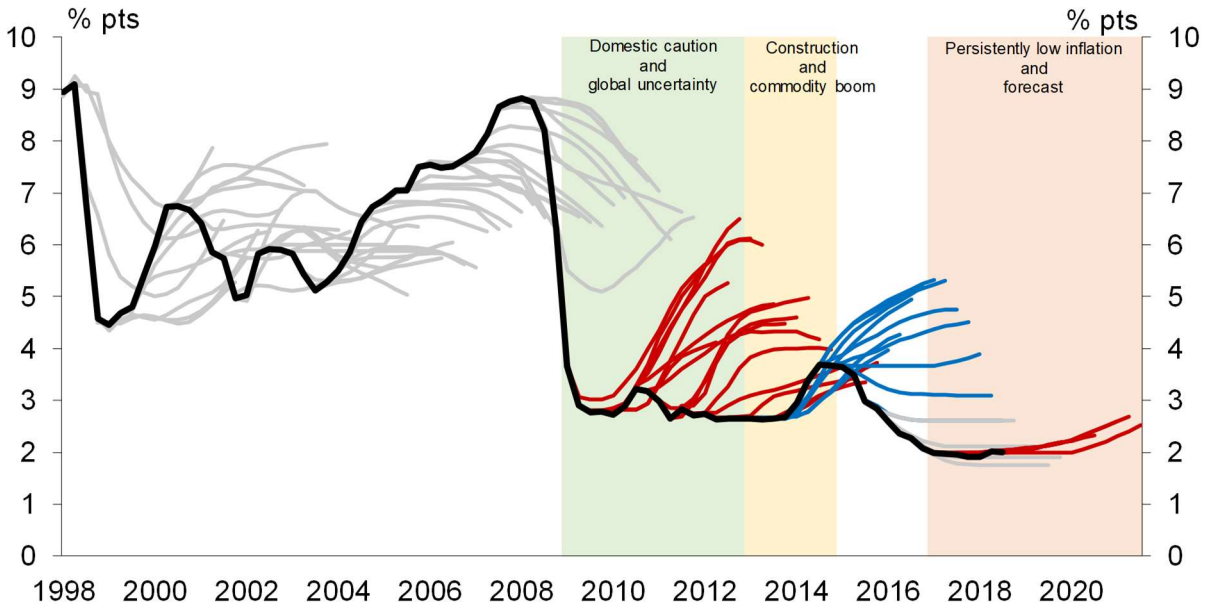
The decomposition in figure 8 allows us to understand monetary conditions in certain periods more clearly because it incorporates expectations of future rate changes and the tightening or loosening in financial conditions caused by the term premium.[9] In the remainder of this section, we describe the evolution of the EMS in the wake of the Global Financial Crisis.

2009 – 2013

The OCR was set at near-record low levels. However, the EMS indicates that monetary stimulus was more muted because the term premium, and hence longer-term rates, were higher over that period. The term premium increased because investors reassessed the risk of investing in New Zealand dollar-denominated bonds. This partially offset the easing stimulus provided by a low OCR. The Reserve Bank's forward guidance over 2010- 2011 also partially offset monetary stimulus. The forward guidance suggested that policy would tighten sharply in coming years (figure 10), which led to higher long term rates.

[9] See Appendix B for further details. There is an endogeneity here. The stance of monetary policy (via expectations) can be used to offset the term premium. However, this was not the case in 2009-2012, and 2013-2014.

Figure 10: Reserve Bank 90-day interest rate projections



Source: Reserve Bank.
Note: The black line shows the 90-day rate over history. The grey lines show Reserve Bank projections for the 90-day rate. The red and blue lines show projections for the 90-day rate during the highlighted periods: 2009-2013, 2013-2014, and 2017 onwards.

Late 2013

Monetary policy quickly become contractionary in late 2013, as the Reserve Bank moved into a hiking cycle. The EMS contracted primarily due to the increase in the OCR as well as the Reserve Bank's forward guidance that policy tightening would continue. Both actions caused market interest rates to rise (Williams, 2017). The remaining third of the monetary tightening was due to a higher global term premiums, after the taper tantrum in the US pushed up long-term rates globally.[10]

Post 2017

Since early-2017, the Reserve Bank communicated its expectations that the OCR would remain at 1.75 percent for "some time to come". The communication of a flat OCR track into 2019 and 2020, while also highlighting 'balanced risks', provided addition monetary stimulus. This stimulus was complemented by lower long-term interest rates as the global term premium declined.

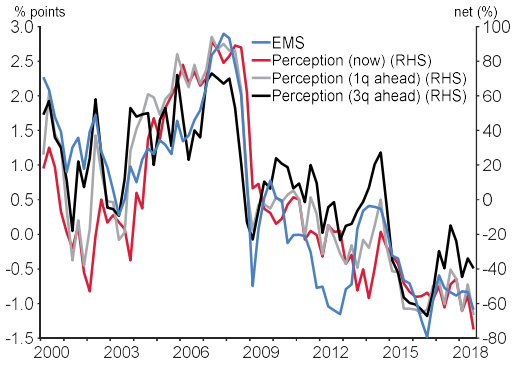
[10] Over the same period in Australia, the term premium also increased sharply but the expected policy component remained low, because there was no change in the RBA policy stance or market expectations for the Australian policy rate (Hambur and Finlay, 2018).

The term premium component appears rather persistent and has a positive contribution to the EMS over the sample period. While we do not examine the cause of this, there are a number of plausible explanations. For example, investors could require higher compensation for holding New Zealand long-term bonds because:

- New Zealand is a small, open economy.
- New Zealand has a large net negative net international investment position.
- New Zealand has a relatively volatile terms of trade, which introduces risks to returns on long-term New Zealand bonds.
- New Zealand has been subject to international shocks, which increase the risk of investing in New Zealand.

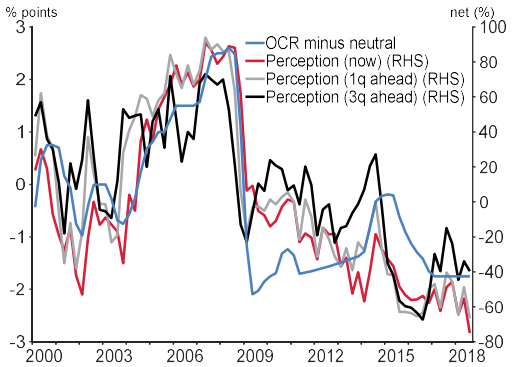
The EMS also appears to be more closely correlated with businesses and professional forecasters' perceptions of monetary conditions relative to the OCR (figure 11a, 11b, and table 1).[11] The EMS has a higher correlation over both one-quarter ahead and three-quarters ahead horizon. The EMS also better reflected perceptions of monetary conditions during the GFC. The OCR was lowered rapidly, whereas perceptions of monetary conditions remained more elevated because risk premiums had spiked. The term premium also likely rose because businesses expected the crisis to be short and sharp and for the OCR to rise (as the Reserve Bank had also forecast). Over the 2009-2013 period, the EMS measure better tracks businesses' perceptions of monetary conditions.

Figure 11a: Perception of monetary conditions and the EMS



Source: Reserve Bank estimates.

Figure 11b: Perception of monetary conditions and the OCR minus neutral



Source: Reserve Bank estimates.

[11] This attempts to capture respondents' broad perceptions of current monetary policy settings and their expectations of the future stance of policy.

Table 1: Correlations of the EMS with surveyed perceptions of monetary conditions

	OCR minus neutral	EMS
Perceptions (now)	0.85	0.78
Perceptions (1q ahead)	0.81	0.87
Perceptions (3q ahead)	0.64	0.86

Note: Table shows correlation over 2000 – 2018.

5. Testing the suitability of the EMS

An empirical assessment of EMS measures relative to traditional metrics for monetary policy is required to determine if the EMS measure is useful beyond a narrative tool in the first instance.

In this section we undertake an initial assessment of the EMS as a measure of monetary and financial conditions. Following Halberstadt and Krippner (2016), we show the use of our indicator in a standard VAR model for monetary policy analysis. This test is purely illustrative, to provide a comparison between the OCR and EMS.[12]

We also assess the EMS be examining the correlation of EMS measures with the known evolution of monetary policy actions and guidance. Section 3 and Appendix B show that the EMS measure tracks well against the evolution of policy and guidance over history.

The EMS is also a useful tool if interest rates in New Zealand reached the effective lower bound (ELB). At the ELB, central banks can use forward guidance to influence interest rate expectations (Bauer and Rudebusch, 2011). The EMS captures the monetary stimulus provided by committing to low interest rates in the future, as long-term interest rates decline. In addition, the EMS also captures the stimulatory effects of quantitative easing (i.e. asset purchases) on market interest rates via the lower term premium (Drought, Perry, and Richardson, 2018).

5.1. Assessing EMS using a standard VAR for monetary policy analysis

To examine the properties of the EMS, we compare the performance of EMS to the short-term interest rate when used as the monetary policy variable in a simple VAR model. Unlike the OCR, which is tightly controlled by the Reserve Bank, the EMS can change for reasons outside the Reserve Bank's control (such as the term premium).

[12] Furthermore, in a VAR context, the impulse responses from the OCR can be readily interpretable as, for example, how a variable responds to a change in the OCR. It is more difficult to interpret the EMS, as the EMS is not set directly, and influenced by the term premium and expectations. We make no attempt here to analyse the EMS beyond a simple VAR.

Hence, the strict causation of the Reserve Bank's monetary policy to macroeconomic outcomes is less defined for the EMS than for the OCR.

We use a small NZ monetary policy vector autoregression (VAR) for our empirical analysis. The VAR is estimated as in equation (6):

$$\begin{pmatrix} Z_t \\ R_t \end{pmatrix} = \sum_{i=1}^{p} \beta^i \begin{pmatrix} Z_{t-i} \\ R_{t-1} \end{pmatrix} + \epsilon_t \qquad (6)$$

where Z_t is a vector of non-policy variables (core inflation, the unemployment rate or real output growth), R_t is a relevant measure of monetary policy (OCR or EMS), and ϵ_t is a vector of residuals. The unemployment rate gap (inverted) is ordered first, followed by core inflation (the sectoral factor measure), then the policy variable.

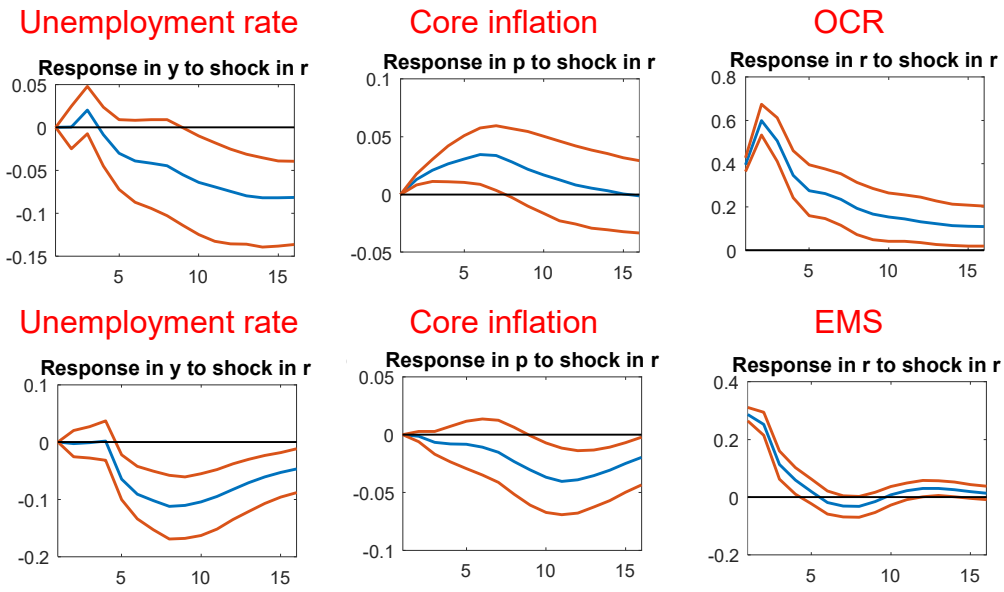
The model uses a standard Cholesky decomposition that imposes a recursive ordering for the contemporaneous effects of shocks (see Bernanke and Mihov, 1998). Specifically, ordering the monetary policy variable last ensures that policy movements due to the unemployment rate and inflation are appropriately removed from the model.

We assess the performance of the EMS measure by contrasting it against the typical VAR setup with the OCR as the monetary policy variable. Figure 12 displays the impulse responses from the VAR for both the OCR and the EMS as a policy indicator.

Our results indicate that a tightening in EMS leads to a decrease in core inflation, which troughs after 12 quarters. A tightening in the OCR leads to an increase in core inflation, displaying the typical price puzzle.[13] Both measures of stimulus show an increase in the unemployment rate following a tightening. Appendix C shows the full impulse response results, and also shows the similar results found when GDP growth is used instead of the unemployment rate.

[13] In VARs, a monetary tightening often leads to the price puzzle, a counterintuitive increase in inflation in the impulse response function. See Sims (1986).

Figure 12: Impulse responses from shock to OCR and EMS



Note: y is the unemployment rate (inverted). The top row shows the impulse response from a one standard deviation shock in the OCR. The bottom row shows the results from a one standard deviation shock in the EMS. The unemployment rate is inverted. The x-axis shows the quarters since the shock. Confidence bands represent a one standard-deviation increase/decrease in the VAR shock.

The empirical application suggests the EMS measure is reasonable as a measure of monetary and financial conditions in New Zealand. One beneficial feature of the EMS is that it more completely accounts for OCR expectations and the term premiums that influence households and firms consumption/investment and saving/borrowing decisions. It also remains informative even when overnight rates have reached their lower bound.

6. Conclusion

In this note, we introduce the EMS for New Zealand. The EMS measures the stance of monetary policy by taking into account market interest rates in the short and long term, and term premiums, as well as policy and forward guidance. We draw several conclusions.

First, the EMS is useful as an explanatory tool and shows that monetary conditions are not strictly determined by the Reserve Bank setting the OCR. The EMS shows that monetary conditions are also influenced by events in global markets, and the Reserve Bank's forward guidance.

Second, the stance of monetary policy and the term premium contribute substantially to net stimulus over history. The decline in the term premium since the early-1990s partly explains why the EMS has trended lower. More recently, expectations of future

policy have also played a larger role in contributing to the EMS and stimulatory monetary conditions.

However, the EMS is, of course, simply one element of assessing overall monetary/financial conditions. The Reserve Bank also takes account of other influences, e.g. from the exchange rate, credit spreads, and uncertainty indicators, when assessing overall conditions. It is that total assessment, rather than just the EMS or yield curve alone, that is taken into account when considering the appropriate OCR setting to achieve the macroeconomic outcomes.

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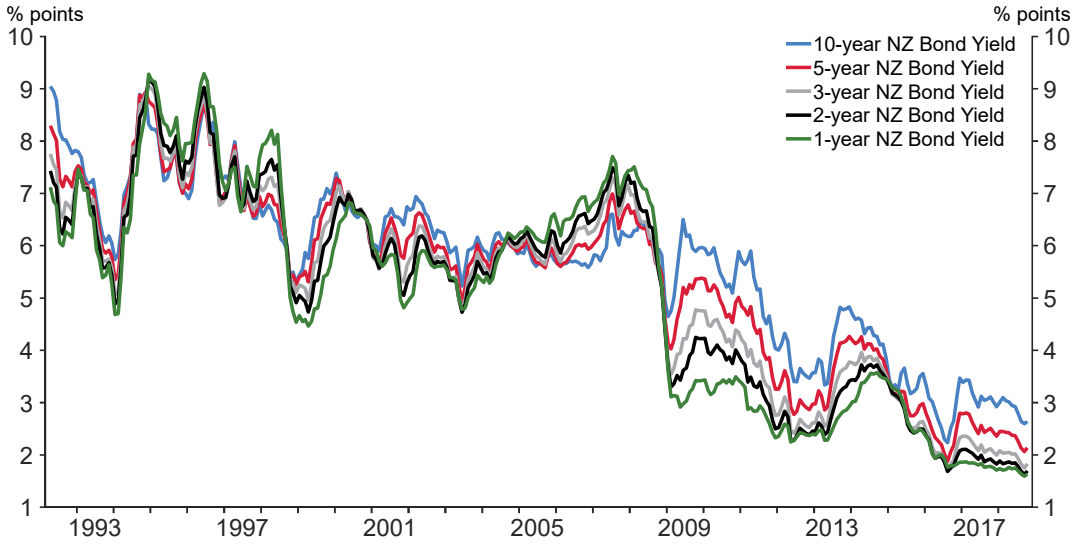
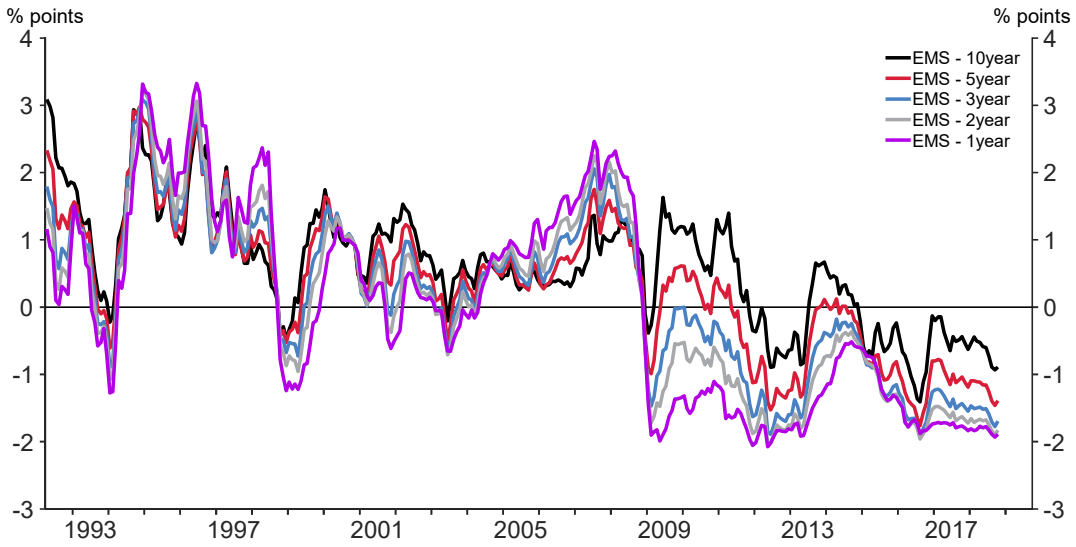
Appendix A: Extra charts

Figure A1: NZ Government bond yields



Source: Reserve Bank estimates.

Figure A2: The EMS measure (various bond rates)



Source: Reserve Bank estimates.

Appendix B: The history of monetary conditions in New Zealand through the lens of EMS

A further way to test the suitability of EMS as a measure of monetary conditions is to assess the history of the measure against the Reserve Bank's historical narrative. The EMS closely fits with the Reserve Bank's historical narrative. The narrative used is taken from the Reserve Bank's *business cycle review* Bulletin articles (Williams, 2017; Chetwin, 2012; Brook, Collins, and Smith, 1998).

The first domestic boom (1994Q2 – 1998Q1)

According to the EMS, monetary conditions began to tighten from the middle of 1994, and remained strongly contractionary until 1998. This is largely due to expectations and the term premium. Over this period, GDP growth in New Zealand was beginning to run well above that of other advanced economies, and ahead of potential.

The Reserve Bank's intention at the time was to maintain tight monetary policy. The EMS shows that the Bank achieved this goal.

World financial shocks and drought (1998Q2 to 1998Q4)

Monetary conditions eased over the second half of 1998. A collection of financial shocks dampened confidence and trading partner activity around this time. These shocks included the Asian financial crisis, the Russian debt default and the collapse of hedge fund Long-term Capital Management. At the same time, the New Zealand economy faced two severe droughts through 97/98 and 98/99. As a result of these events, the pace of growth fell substantially in New Zealand.

The EMS identifies a relatively late easing in monetary conditions given these developments. However, the Reserve Bank was slow at the time to recognise the full impact of the Asian crisis – particularly given forecasters had never had to deal with a financial shock emanating in Asia. The Reserve Bank subsequently eased monetary policy settings in 1998 as the scale of the downturn became evident. In addition, the hedge fund Long Term Capital Management contributed to a fall in longer-term world interest rates, which likely contributed to a fall in longer-term New Zealand rates and EMS.

The post-Asian financial crisis recovery (1999Q1 – 2000Q1)

Monetary conditions tightened over this period. This is in-line with the Reserve Bank introducing the OCR in March 1999, and a tightening policy response to growing demand and inflation pressure.

Global headwinds (2000Q1 – 2003Q1)

Monetary conditions remained tight over this period. However, the EMS ticks down around 2003 due to changing expectations of future monetary policy. This is in-line with the prominent shocks from abroad – the dotcom bubble, 9/11, rising oil prices and SARS – and their collective threat to domestic demand.

Domestic boom (2003Q1-2006Q1)

Monetary conditions remained tight over this period. In the domestic economy, there was an expectation of a braking effect from the cumulative monetary tightening, high leverage on private balance sheets, the risk of a fall in overvalued property prices, and labour shortages and capacity constraints.

Oil price spike (2006Q1-2008Q1)

Monetary conditions began to tighten further over this period, largely due to expectations of future policy. The OCR was lifted from 7.25 to 8.25 percent in the first half of 2007. Short-term wholesale rates rose even further as international markets became nervous around the start of the GFC.

Global financial crisis (2008Q1-2009Q1)

The Reserve Bank rapidly provided stimulus to the economy by influencing expectations. However, EMS was contractionary over this period due to an increase the term premium.

The global outlook weakened further and nervousness in markets rose following the collapse of Lehman Brothers in the US in September 2008. Liquidity flows in interbank markets fell sharply. Central banks began rapidly lowering policy rates. The Reserve Bank cut the OCR from its level of 7.5 percent shortly before the Lehman Brothers failure to 2.5 percent by April 2009.

The (brief) post-GFC recovery (2009Q1-2010Q2)

Monetary conditions were contractionary over this period. Although the level of the OCR was set at record low levels and deemed to be expansionary, the EMS shows contraction due to the term premium.

Throughout the recession, the Reserve Bank consistently signalled easy monetary conditions in the near term but a normalisation of the 90-day rate beyond 18 months. On the basis of strengthening medium-term inflationary pressure, the outlook for the 90-day interest rate was gradually increased during the end of 2009 and beginning of 2010, and the OCR itself was increased by 50 basis points during June and July 2010.

Global economic uncertainty (2010Q2-2012Q3)

Monetary conditions moved into stimulatory territory over this period. In part, this is due to expectations. While the OCR cut in March 2011 had initially been regarded as a temporary measure, the weaker world outlook and associated market volatility eventually led the Reserve Bank to believe that this reduction should be maintained. The deterioration in global sentiment over 2011 and 2012 had negative effects on business and consumer confidence in New Zealand.

Domestic construction and commodity strength (2013Q3-2014Q4)

Monetary conditions quickly became contractionary over this period. This was partly due to expectations and signalling from the Reserve Bank from policy guidance. It was also due to the taper tantrum in the United States flowing through to the term premium.

Although inflation was low and expected to remain so in the near term, the Reserve Bank responded to the strong outlook for medium-term inflationary pressures. The OCR was increased by 100 basis points between March and July 2014, an increase that had been well-signalled by the upwards revisions to the 90-day rate track over 2013.

Persistently low inflation (2014Q4-2017Q3)

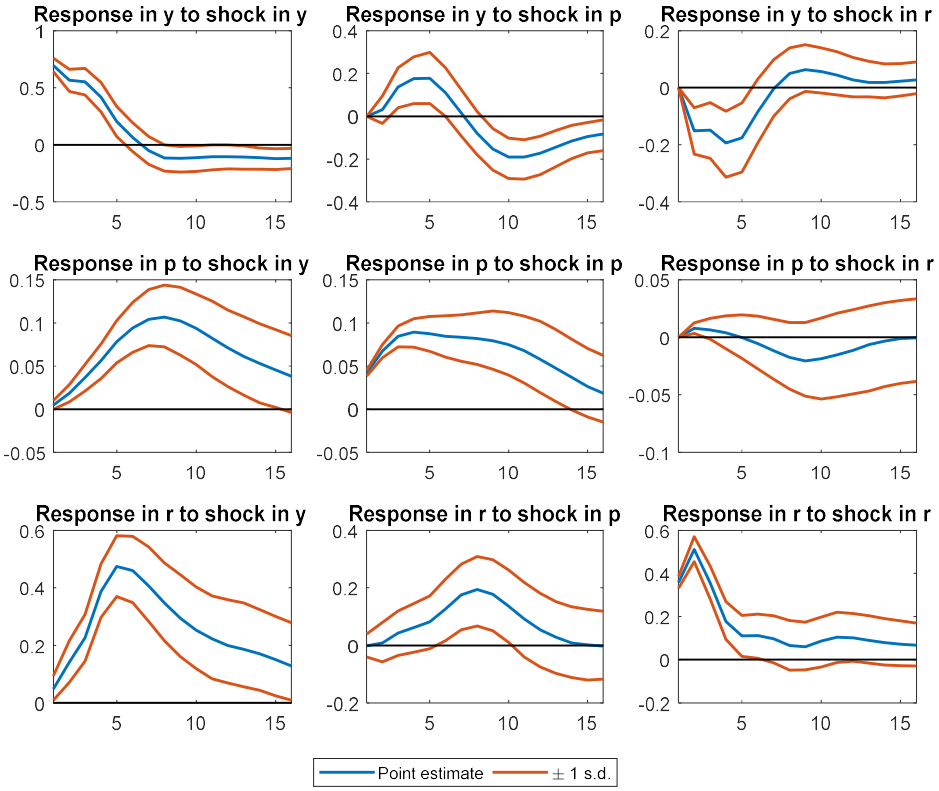
Monetary conditions have been largely stimulatory over this period. Part of the recent easing in monetary conditions has been a fall in the term premium since late-2016. Expectations and policy guidance from the Reserve Bank has also contributed a large amount.

The outlook for inflationary pressures steadily weakened over 2015, and the 90-day rate forecast was lowered further in response – from no bias to an easing bias. In response to the weaker inflation outlook, the Reserve Bank lowered the OCR by 100 basis points between June 2015 and December 2015. Inflation expectations at the 1- and 2-year horizons fell significantly in March 2016. The Reserve Bank reduced the OCR by a further 25 basis points in response, due to concerns that the decline in short-term inflation expectations would become self-fulfilling and reduce future inflation outcomes. Further weakening of the inflation outlook – partly accounted for by

continued strength in the New Zealand dollar and persistent weakness in global inflation – and concern that inflation expectations could decline further, led the Reserve Bank to lower the OCR by another 50 basis points to 1.75 percent by November 2016.

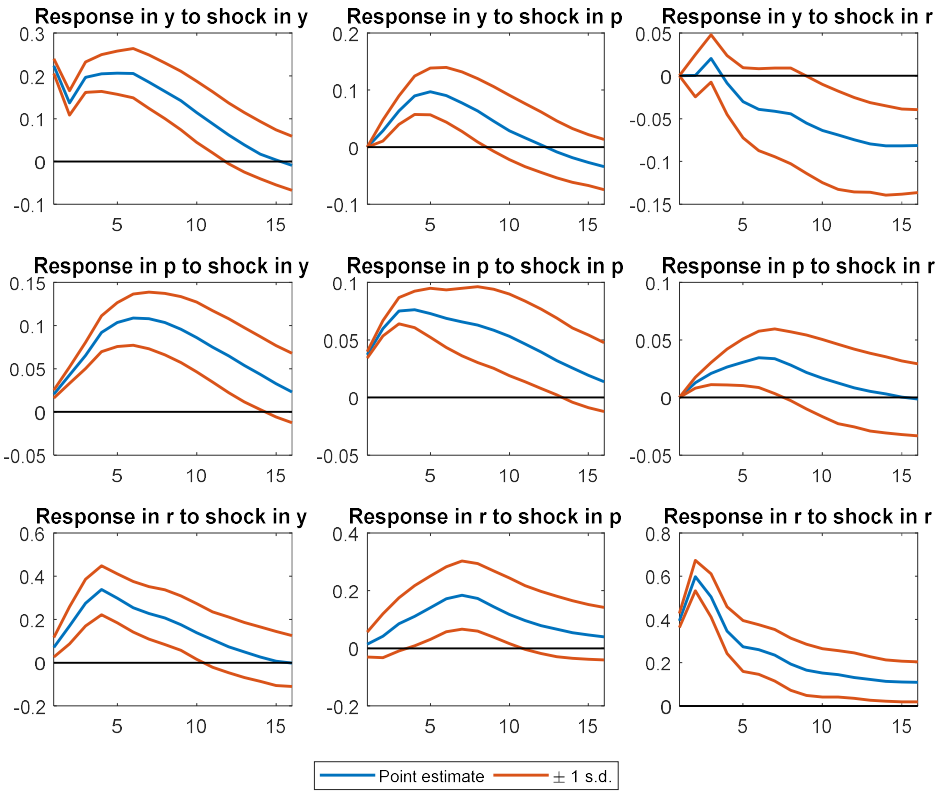
Appendix C: VAR impulse response functions

Figure C.1: OCR shock with GDP growth



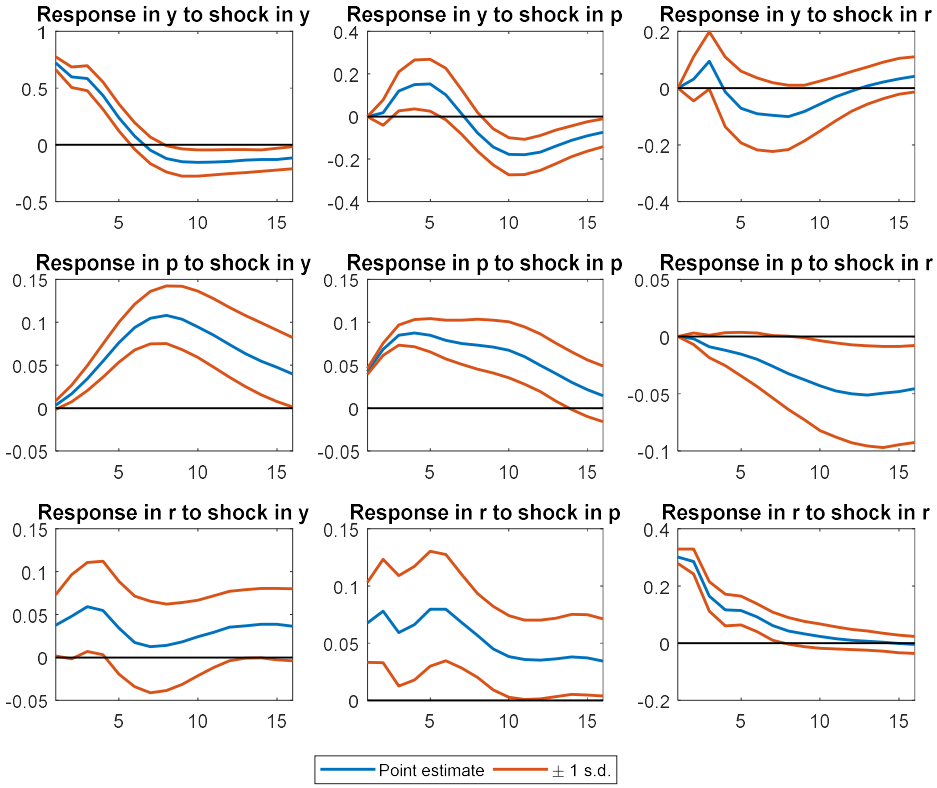
Note: y is annual production GDP growth, p is annual core inflation (sectoral factor model), r is the OCR. Four lags are used.

Figure C.1: OCR shock with unemployment rate



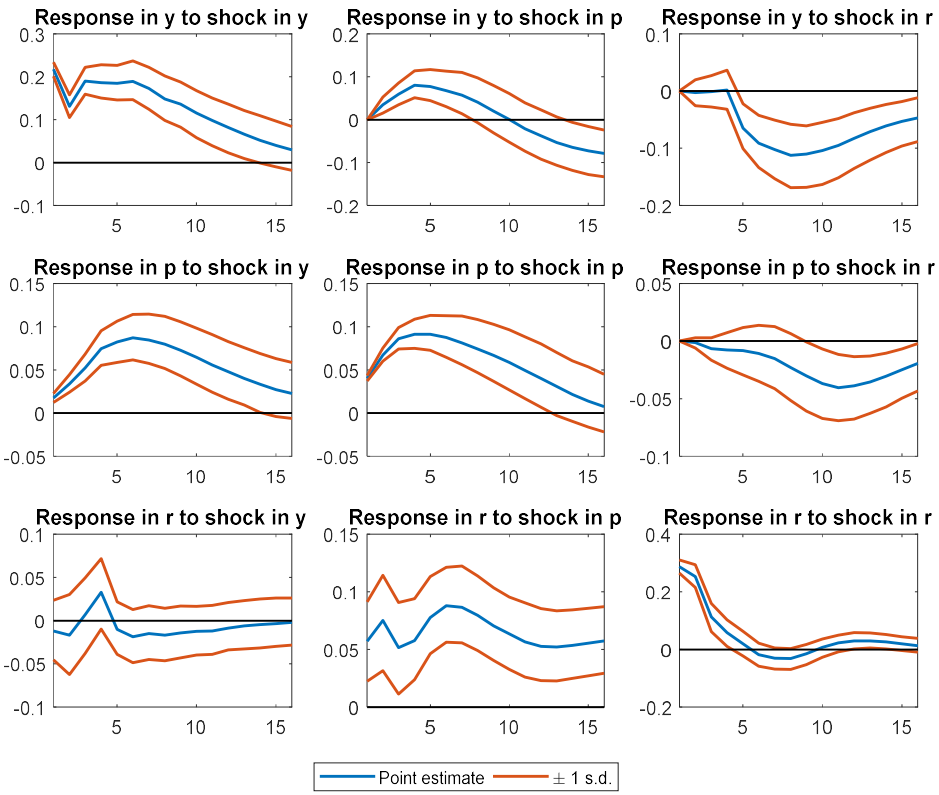
Note: y is the unemployment rate (inverted), p is annual core inflation (sectoral factor model), r is the OCR. Four lags are used.

Figure C.3: EMS shock with GDP growth



Note: y is annual production GDP growth, p is annual core inflation (sectoral factor model), r is the EMS measure. Four lags are used.

Figure C.4: EMS shock with unemployment rate



Note: y is the unemployment rate (inverted), p is annual core inflation (sectoral factor model), r is the EMS measure. Four lags are used.