US Monetary Policy, Global Risk Aversion, and New Zealand Funding Conditions

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28 March 2017

Abstract

US monetary policy shocks transmit internationally and affect financial conditions of small open economies such as New Zealand. Using monetary shocks identified by high frequency surprises around policy announcements, risk aversion series decomposed from VIX, and other economic and financial variables, I show in a structural vector autoregressive framework, US monetary policy transmits to New Zealand households and financial firms via different channels. In the former, global risk aversion plays a large part in transmitting US monetary policy – when US monetary policy tightens, risk aversion heightens, and banks constrain credit towards households. In the latter, RBNZ's response to US monetary policy is identified as the major channel of transmission. As US monetary policy tightens, inflationary pressure in New Zealand soars, prompting RBNZ to raise OCR, in turn increasing the risk-free component of banks' cost of funds. International comparison among Australia, Canada, Sweden and UK shows that countries respond similarly and systematically to US monetary shocks.

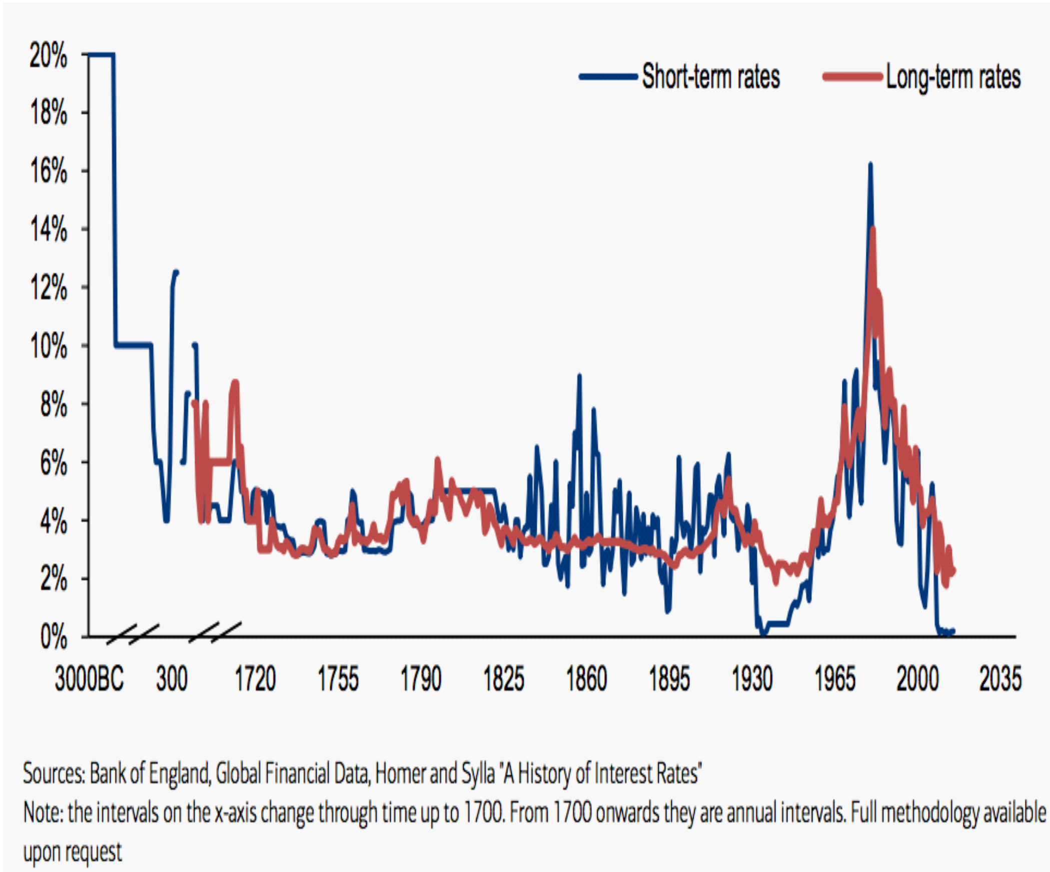

Chart 1: Global interest rates in 5000 years

I. Introduction

Global interest rates have been at the lowest in history (Chart 1), and are likely to rise in the future as the global economy recovers. Indeed, the US Federal Reserve has recently raised its benchmark interest rate for the third time in a decade, setting its path to reach the projected level of 2% by 2019 and 3% by 2023 (Chart 2). In this light, it is crucial to understand the impact of this trend on small open economies like New Zealand, as the outcomes on issues such as financial stability and housing affordability will matter for the conduct of monetary policy, fiscal policy, and the intricate coordination between them.[1] The closest studies available to date are Wong (2012) and Munro and Wong (2014), yet both have focused on the domestic relationship between the Official Cash Rate (OCR) and banks' funding costs. This paper fills the gap by looking into how global factors affect New Zealand

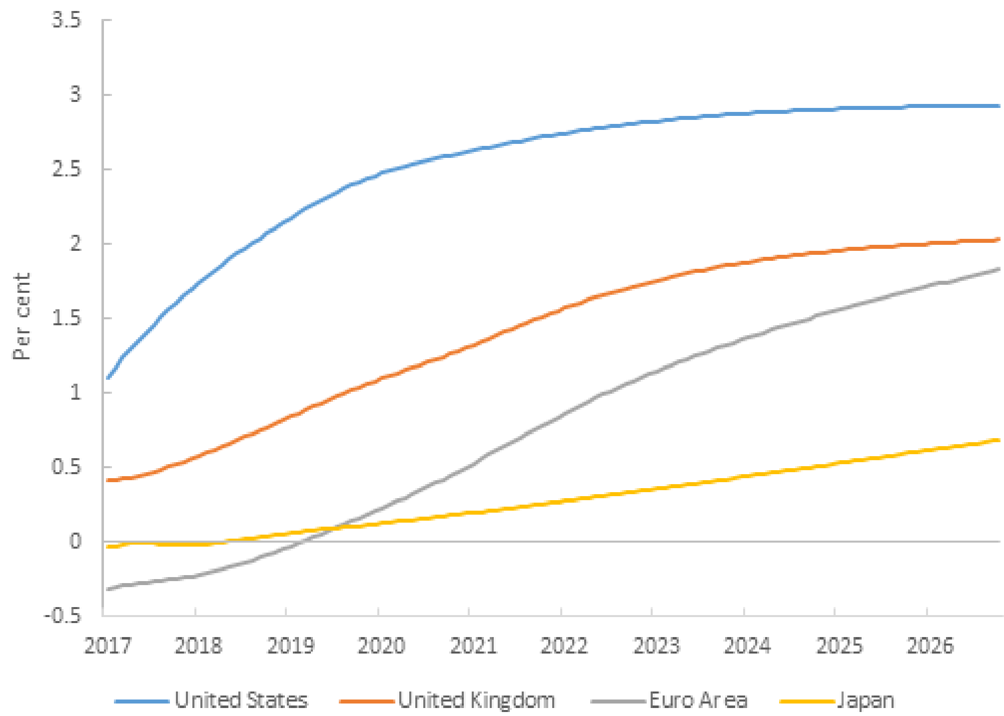

Chart 2: International forward 3-month rate. Source: Bloomberg; author' scalculations.

households and banks.

In principle, there are two channels through which US monetary policy affects New Zealand bank's funding cost. Any market cost of fund consists of two components: the risk-free rate determined by the Reserve Bank of New Zealand (RBNZ), and a risk premium determined by the market perception of risks borne by banks (Chart 2). When the federal funds rate rises, the New Zealand dollars depreciate and New Zealand exports soar. This brings inflationary pressure to the country, in turn prompting RBNZ to raise OCR, as such raising the risk-free component of NZ banks' funding. The impact of federal funds rate on local risk premium is less clear. On one hand, depreciated NZ dollars increase the debt burdens of NZ firms that have borrowed US dollars, increasing their probability of default. On the other hand, the increase in exports implies that firms' profits are higher and balance sheets stronger, offsetting their likelihood to default. On top of these forces is the role played by global risk sentiment in affecting local risk premium. On one hand, US monetary

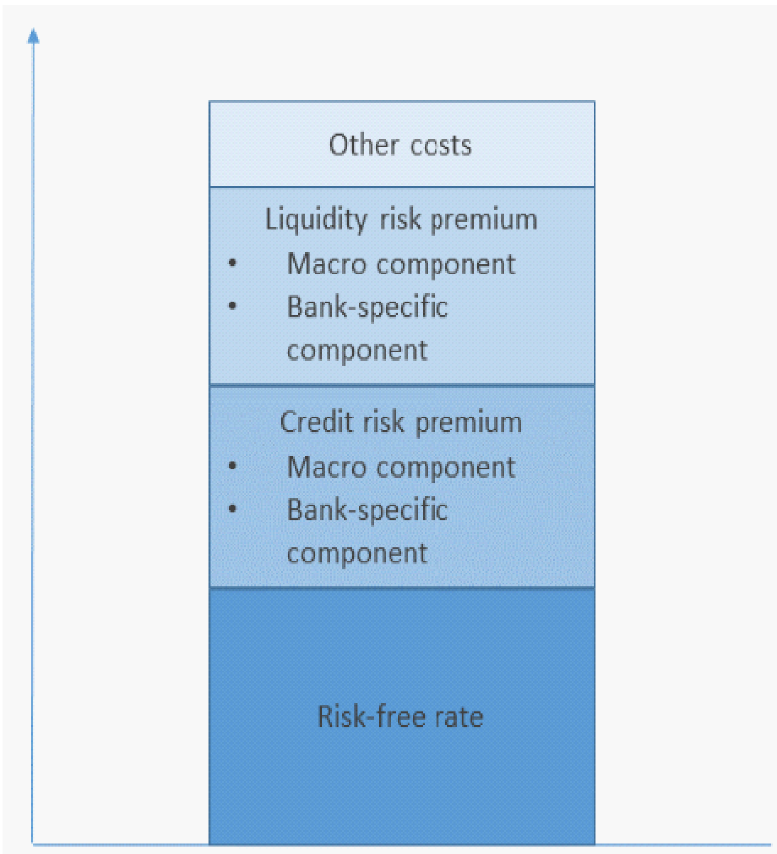

Chart 3: Components of bank' sfunding costs

contraction tends to go with heightened risk aversion, resulting in tightened credit from global to local banks in periphery countries. On the other hand, according to the risk-taking channel of monetary policy (Borio and Zhu, 2012; Tong, 2016), low interest rates have encouraged banks to take risks; one would expect higher interest rate would deliver the opposite effect. A priori, therefore, how local cost of funds changes with US interest rate is unknown.

In this paper, I use structural vector autoregression (SVAR) to model the interrelations among US monetary policy, global risk appetite, and NZ real and financial variables. Two challenges usually confront these studies. First, US monetary policy tends to co-move with other financial variables, such as exchange rate and local policy rate, making it difficult to disentangle causation from correlation. Second, although risk sentiment is critical to asset-pricing and banks' risk-taking in the literature (Rajan, 2006; Adrian and Shin, 2008; Borio and Zhu, 2008), there exists no conventional method to measure it. The CBOE Volatility Index (VIX) is usually used as a substitute, but the calculation of VIX itself implies that the index also captures the conditional uncertainty of the stock market, on top of risk sentiment.

To overcome the first challenge, I use a method known as high frequency identification to extract the exogenous component of US monetary policy shocks (Matheson and Stavrev, 2014). This method makes use of intraday information embedded in the fed funds futures contract. Fed funds futures incorporate all market participants' views on the average federal funds rate. On an FOMC date in which the federal funds target rate is announced, one can compare the futures rate within a tight time-frame (30 minutes) of the announcement. If the futures rate changes within this period, it can be inferred that market is surprised by the announcement, as it is unlikely that any other significant event occurs within this time-frame. One can then deduce the exogenous component of US monetary shock using the surprises as instrumental variable. In parallel, to identify the sentiment of risk aversion, I leverage on the research of Bekaert and Hoerova (2014), who have compared 31 models to come up with the most informative forecast model for conditional stock market variance. I use this winning model to compile the conditional uncertainty, subtracting which from VIX allows me to obtain the risk aversion series.

I present the results in three parts. In the first part, I use the SVAR model to come up with a gross estimation of US monetary policy on NZ funding costs. It is found that a shock equivalent to a 13 basis points (bps) increase in US 1-year risk-free rate leads NZ domestic funding cost to rise by 11 bps in a year. The same shock also leads the household's mortgage cost and the external funding cost of banks to rise by 10bps and 13bps respectively. In short, the magnitude of impact can roughly be thought of as one-to-one.

In the second part, I consider the channels of transmission by analysing the NZD-USD cross currency swap spread, the credit default swap (CDS) spread of NZ banks, and the mortgage spread of NZ households. The currency swap spread reflects the relative cost of raising a NZ dollars loan domestically to foreign, and is largely determined by the relative interest rates between the two countries. I find that following US monetary tightening, it is *relatively* cheap to raise funds overseas than local, implying that NZ interest rate has risen by more than US interest rate following the US monetary shock. It also implies that US monetary policy mostly transmits through OCR rather than the risk premium channel, as is verified by the result of CDS spread. CDS spread measures banks' credit risks. When placing it in the model in the stead of funding costs, it is found that US monetary policy does not significantly affect NZ banks' credit risk. In contrast, the local monetary policy does. Reading these evidence together affirms that to the extent that NZ banks' cost of funding changes following US monetary tightening, it is largely due to RBNZ's response that affects the risk-free component of the banks' funding cost.

The channel of transmission is different in the housing market. Whereas global risk aversion seems to exert little influence to banks' cost of fund, it affects the mortgage cost significantly – a one standard deviation shock in risk aversion leads the NZ 2-year fixed mortgage rate to go up by 17 bps in a year. Subsequent analysis on mortgage spread confirms that global risk sentiment affects the perceived risks of households. One plausible explanation is that house price falls following the increase in OCR, thinning the equity in the mortgage loans and widening the external finance premium as a result.

In the third part of the analysis, I put New Zealand experience in the context of comparable countries: Australia, Canada, Sweden, and United Kingdom. Like New Zealand, these countries are floating exchange rate regimes (defined by IMF) that have adopted inflation targeting around 1990s. They have also pursued open capital account policies as New Zealand does (as measured by the Chinn-Ito index of Chinn and Ito, 2006). Of the five countries, it is found that New Zealand's responses to US monetary shock and global risk aversion shock rank in the middle. Using forecast error variance decomposition, it is found that about 8.7% of the variation in NZ CDS spread (banks' credit risks) can be explained by shocks in US monetary policy, after Australia's 9.3% and Canada's 11%. Also, about 39% of NZ mortgage spread (household's credit risk and other macro risks) is explained by risk aversion shocks, a smaller magnitude than those in Sweden and United Kingdom, which are above 65%. Putting all these results in perspective, it is perhaps preliminary but prudent to suggest that, when it comes to financial stability concerns, no active change in the present monetary regime is needed apart from the awareness that New Zealand is and always will be influenced by global factors, as would any other countries.

In what follows, I discuss the methods in section II, and the results in section III. Section IV concludes.

II. Methods

To analyse the interactions among real and financial variables in a tractable manner, I employ a structural vector autoregression model as follows:

$$AY_t = \sum_{j=1}^{p} C_j Y_{t-j} + \varepsilon_t,$$

where Y_t denotes the vector of endogenous variables, and ε_t is the vector of structural shocks. Y_t includes six variables, namely, 1-year US government bond rate, global risk aversion, industrial production, local policy rate, local funding condition variable, and exchange rate.

The reduced form VAR can be written as:

$$Y_t = \sum_{j=1}^{p} B_j Y_{t-j} + u_t$$

with $u_t = S\varepsilon_t = A^{-1}\varepsilon_t; B_j = A^{-1}C_j$. The variance covariance matrix of the reduced form VAR is

$$E_t\left[u_t u_t'\right] = E_t\left[SS'\right] = \sum .$$

As financial variables in the model tend to move together, it is generally difficult to tell if US monetary policy causes, or responds to, movements in other financial variables. To isolate the former type of causation, I follow Gertler and Karadi (2015), and instrument the US 1-year rate with surprises extracted from fed funds future contracts around FOMC announcements.[2] Fed funds futures reflect market participants' expectation of the federal funds rate. If it changes within a tight window of FOMC announcements (30 minutes), it implies that market is surprised, in turn enabling us to extract the exogenous component of US monetary shock. Specifically, let ε_t^p be the structural monetary shocks, s^p be the response of ε_t^p unto itself $\left(u_t^p\right)$, and s^q be the vector of responses of other variables to a US monetary shock. Under this setup, we can retrieve s^p and s^q by use of an instrumental variable Z_t that is uncorrelated with other structural shocks $\left(\varepsilon_t^q\right)$, but correlated with the structural monetary policy shock (ε_t^p):

$$\begin{aligned} E\left(Z_t \varepsilon_t^{p'}\right) &= \alpha, \\ E\left(Z_t \varepsilon_t^{q'}\right) &= 0. \end{aligned}$$

s^p and s^q can be retrieved by means of a two-stage least square regression. In the first stage, we extract the exogenous component of US 1-year rate $\left(\widehat{u_t^p}\right)$ by Z_t. In the second stage, we can regress the vector of reduced-form residuals of other variables (u_t^q) on $\widehat{u_t^p}$ to obtain a consistent estimate of s^q/s^p. Further manipulation allows us to uncover s^q and s^p respectively.[3]

A. Risk Aversion Index

Another aspect of this study is to assess the response of New Zealand financial conditions to a change in global market sentiment known as "risk aversion", a key determinant of asset prices and risk-taking in the financial market (Campbell and Cochrane, 1999; Rajan, 2006; Adrian and Shin, 2008; Borio and Zhu, 2008). Traditionally, known as the "fear index", the CBOE Volatility Index (VIX) has been used as a proxy for risk aversion.[4] But as VIX conceptually captures both stock market uncertainty and risk aversion, we need a method to identify the latter. Let RV be the realised variance of the S&P500 index and VP be the variance risk premium, VIX can be expressed as:

$$VIX_t^2 = E_t\left[RV_{t+1}\right] + VP_t, \tag{1}$$

The variance premium is our variable of interest. It is usually positive and displays substantial time-variation. Recent finance models attribute these facts either to non-Gaussaian components in fundamentals and stochastic risk aversion (Bollerslev et al.,2009; Drechsler and Yaron, 2011), or even Knightian uncertainty (Drechsler, 2013).

To disentangle VP from VIX, I follow the method of Bekaert et al. (2013) and Bekaert and Hoerova (2014). The challenge lies in finding a good estimation of the conditional variance of stock returns, $E_t\left[RV_{t+1}\right]$. Bekaert and Hoerova (2014) compare across 31 models, and find that the Corsi's HAR model (Corsi, 2009), supplemented with the squared VIX, wins over other models in terms of root-mean-square error and other criteria.[5] I therefore use

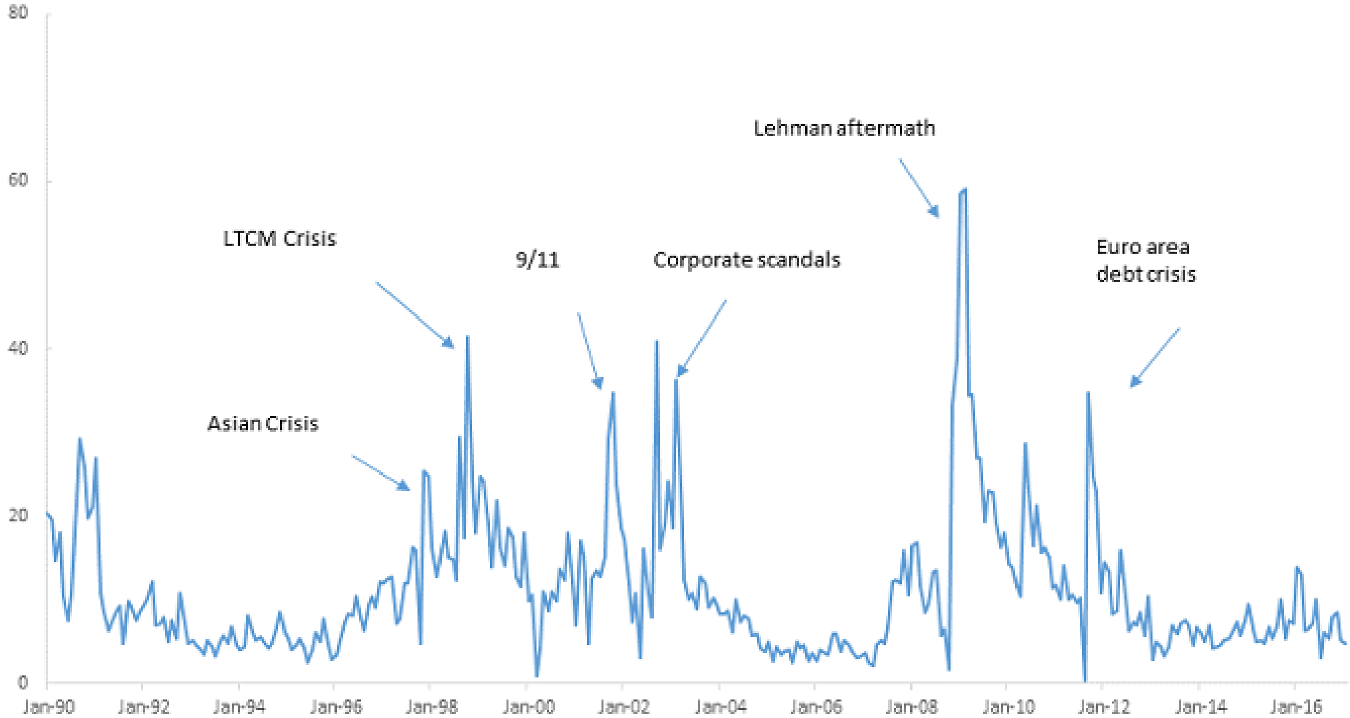

Chart 4: Monthly risk aversion

the HAR model to estimate realised variance. Daily data between 1990 and 2016 are used in the estimation. The resulting coefficients are (with heteroskedasticity-robust standard errors in brackets):

$$RV_t^{(22)} = \underset{(0.88)}{0.69} + \underset{(0.05)}{0.41} VIX_{t-22}^2 + \underset{(0.07)}{0.16} RV_{t-22}^{(22)} + \underset{(0.06)}{0.22} RV_{t-22}^{(5)} + \underset{(0.02)}{0.004} RV_{t-22}^{(1)},$$

where $RV_t^{(22)}, RV_t^{(5)}, RV_t^{(1)}$ represent realised variance at monthly, weekly, and daily interval respectively.[6] Once we obtain the empirical projections of the realised variance, we can compute variance premium as the difference between VIX and the physical conditional expected variance as specified in equation (1). The decomposed variance premium will be used as our risk aversion series (Chart 4).

B. Other Model Setup

The results are presented in two parts. In the first part, I estimate the impact of US monetary policy on various measurements of NZ funding costs – domestic funding cost, external funding cost, and household funding cost. In the second part, I look into the funding spreads in order to trace the channels of transmissions of US monetary policy.

The first part consists of four regressions. In the first regression, which is also the benchmark regression, I estimate the relations among six endogenous variables – the instrumented 1-year US Treasury rate, the risk aversion series (logged), the industrial production series of New Zealand (logged), the Official Cash Rate (OCR), the domestic funding rate obtained from the Reserve Bank of New Zealand (RBNZ), and the logged exchange rate of NZ dollars in terms of US dollars (an increase means appreciation of NZ dollars). The domestic funding rate is a weighted average New Zealand dollars cost of funding compiled by RBNZ. Details of all data can be found in the Appendix.

In the next three regressions, I repeat the benchmark exercise but replacing domestic funding rate with the 2-year fixed mortgage rate, 1-year external funding rate, and 1-year external funding spread respectively. The mortgage rate is the cost of real estate financing for NZ households, its increase reflects an increase in NZ risk-free rate, heightened risk profile of NZ households, or increased cost of funds of NZ banks. The 1-year funding rate is defined as the 1-year NZD swap rate plus the USD/NZD cross currency basis swap rate, and represents the New Zealand dollars cost of a NZ bank to raise a 1-year loan overseas. The 1-year swap spread is the USD/NZD basis swap points. It represents the difference between cost of funding overseas and domestically. Specifically, when a NZ bank raises funds overseas, it first issues a US dollars loan, and then swaps it for a NZ dollars loan via currency swaps. The interest rate of the US dollars loan raised offsets the US interest rate the bank receives from the swap, and as such, the true cost of this loan consists of the NZ interest rate and the basis points dictated by the swap contract. Section B of the Appendix discusses the usage of currency swaps in details.

To trace the drivers of changes in the funding costs, in the second part of the results, I replicate the benchmark regression, but replace the funding cost with funding spreads. I use two types of spreads individually. The first type of spreads used is the Credit Default Swap (CDS) spread of NZ financial firms. CDS spread is compiled by the Risk Management Institute of the National University of Singapore. It represents the premium the buyer of a CDS pays in exchange for protection against potential defaults of a reference entity. An increase in the CDS spread implies a higher probability of default (PD), and as such serves as a measurement of the viability of NZ banks.[7] For our purpose, we use the average 1-year CDS spread of all financial companies identified by the Bloomberg Industry Classification.

The second type of spread used is the mortgage spread. It is the mortgage rate less the risk-free rate. As the duration of the two rates matches, the spread captures only the credit and liquidity premia, but not the term premium. An increase in mortgage spread reflects either an increase in the perceived risks of households or an increase in NZ banks' cost of funds.

To put the New Zealand results in the context of international experience, I compare the regression results of the CDS and mortgage spreads of New Zealand with those of Australia, Canada, Sweden, and United Kingdom. Like New Zealand, these countries are floating exchange rate regimes (defined by IMF) that have adopted inflation targeting around 1990s. Moreover, they also pursue open capital account policies as New Zealand does (as measured by the Chinn-Ito index of Chinn and Ito, 2006). As such, they should serve as a valid comparison with New Zealand.

Monthly data between early 1990s and April 2016 are used for each country. Six lags are chosen, which is a compromise between the Akaike Information Criterion (which suggests around 2 lags) and the likelihood ratio test of Lütkepohl (2005), which tends to suggest lags closer to 12 months. Block exogeneity constraints are placed on the coefficients of US 1-year rate and the global risk aversion to reflect the assumption that only global variables affect local variables, but not vice versa. Results are presented as impulse response functions (IRFs) and forecast error variance decomposition (FEVD). IRF shows the response of a variable to a shock in the impulse variable over 36 months. FEVD attributes the total variation of a variable to the structural shocks of other variables in the model. The IRF panels report the 90 per cent confidence bands, computed using parametric bootstrapping methods.[8] Apart from s^p and s^q, the impulse response functions of other variables are determined by Cholesky decomposition in the order listed at the beginning of this section.

III. Results

This section presents the results in three parts: the impact of global factors on NZ funding cost, its drivers, and international comparison. As there are more IRFs than what can be presented concisely, we focus on the impact of shocks to US monetary policy and global risk aversion.

A. Impact on NZ Funding Costs

Overall, there is a significant impact of US monetary policy on NZ funding costs (Chart 5). A one standard deviation (sd) shock in US monetary policy (which generates about 13 basis points increase in the US 1-year rate) leads to an increase in NZ domestic funding costs by about 6 basis points (bps) three months after the shock (upper left panel).[9] The pace of rise peaks at about 12 bps by the eighth month, before receding gradually to the initial level. Similarly, the upper right panel shows that an equivalent increase in US interest rate leads the NZ mortgage rate to rise by about 10 bps 12 months after the shock. As such, the magnitude of US interest rate on NZ funding rates is roughly one-to-one.

The lower panels present the impact of US monetary policy on NZ external funding costs. The impact of US monetary policy is persistent (significant over 36-month horizon). A shock in US monetary policy leads the external costs to rise by about 18 bps over three years (13 bps by the first year, 21 bps by the second year, 19 bps by the third year). Interestingly, the external funding spread drops throughout the 36-month horizon, implying that, *relative*

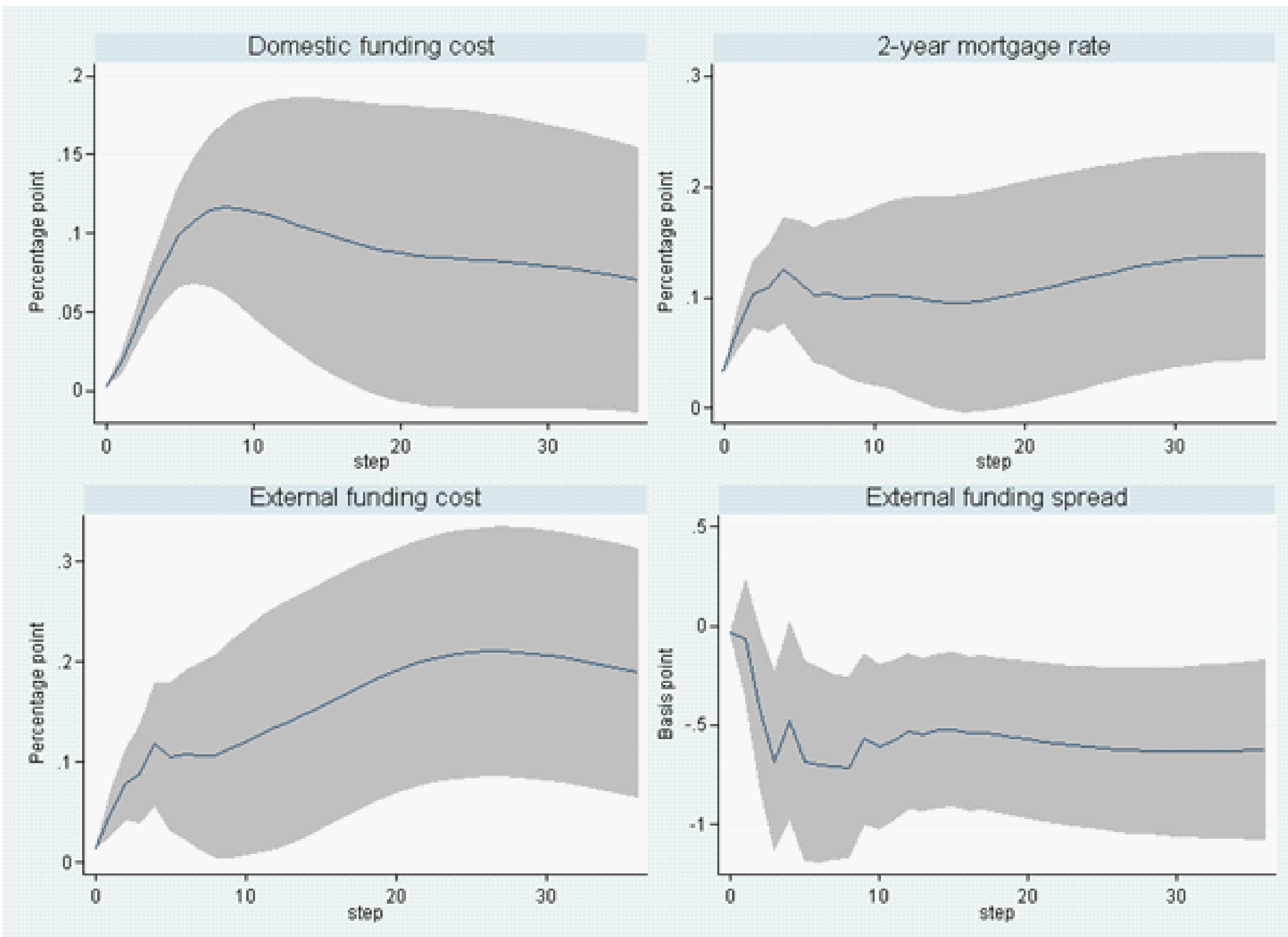

Chart 5: Impact of US monetary shock on NZ funding costs. Shade denotes 90% con dence bands.

to domestic financing, it is cheaper to raise NZ dollars overseas following a US monetary tightening. Reading the two panels together, it means that most of external funding costs change is channeled via the Official Cash Rate. The channel is simple. When US monetary policy tightens, NZ experiences inflationary pressure, prompting RBNZ to raise OCR, in turn affecting the swap cost of banks. In addition, the narrowing of the funding spread implies that in response to the US monetary tightening, OCR has risen by relatively more than the federal funds rate. In a currency swap, the spot exchange rate is used to convert currencies at both the start and the end dates of the swap. When OCR rises by more than federal funds rate, it creates an appreciation pressure on NZ dollars, which is, however, not reflected in the spot rate at the end date due to the swap contract arrangement. As such, the basis swap points adjust downward to reflect the (uncompensated) appreciation of NZ dollars.[10]

Summary 1. *A shock equivalent to a 13 bps increase in US 1-year risk-free rate leads NZ domestic funding cost to rise by 11 bps in a year. It also leads the household's funding cost and external funding cost of banks to rise by 10bps and 13bps respectively. The fall in the external funding spread following US monetary tightening implies that it is* ***relatively*** *cheap to borrow USD and convert to NZD following US monetary tightening. It also implies that OCR has risen relatively more than federal funds rate following the monetary tightening.*

Chart 6 shows the response of NZ funding conditions to shocks in global risk appetite. Risk aversion exerts insignificant impact on banks' funding costs (upper and lower left panels). It does, however, cause mortgage rate to rise by about 17 bps one year after the shock. As banks' funding costs haven't been much affected, the change in mortgage cost can be inferred as a heightened perception of risks on the part of NZ households. Also, the external funding spread temporarily widens (lower right panel), suggesting that investors prefer to hold US dollars in times of heightened risk aversion.

Summary 2. *Risk appetite exerts little influence on banks' funding costs, but changes the*

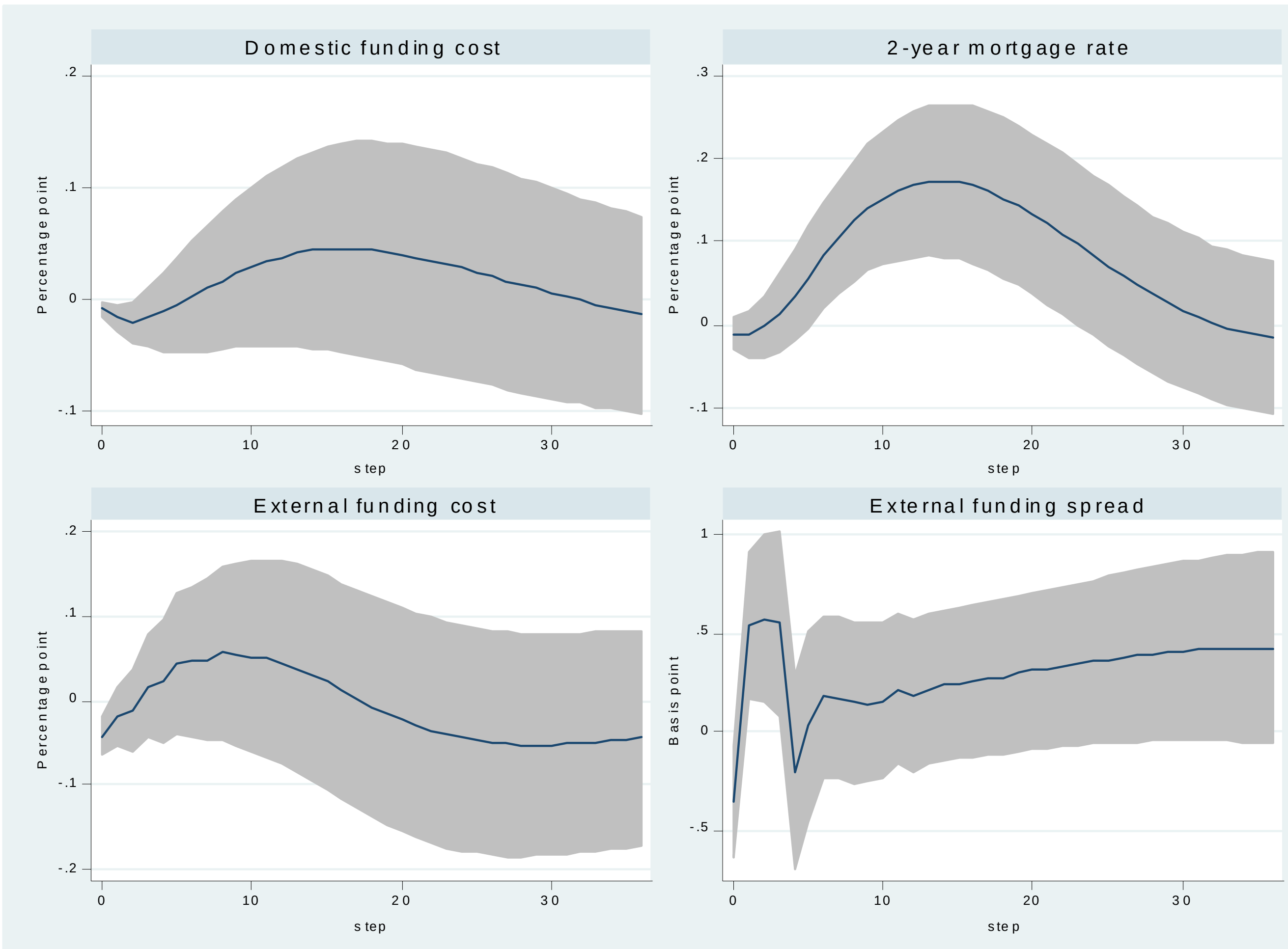

Chart 6: Impact of risk aversion shock on NZ funding costs. Shade denotes 90% con dence bands.

way banks perceive the riskiness of households, resulting in higher mortgage costs. Also, it is found that investors prefer to hold US dollars temporarily when risk aversion heightens.

B. Drivers of NZ Funding Costs

The previous section shows that banks' funding costs, either domestic or foreign, increase following a monetary contraction in US. As a bank's funding cost comprises of both a risk-free component and a premium that reflects its creditworthiness and liquidity conditions in the market, it is a priori unsure how US monetary policy channels through. As such, chart 7 presents the response of NZ financial sector's average CDS spread to a variety of shocks. CDS spread measures the perceived creditworthiness of a firm.

The top left panel shows that by itself, US interest rate has little impact on NZ banks' credit risk profile. The IRF there is largely insignificant throughout the horizon. In contrast, local monetary policy and exchange rates may influence banks' credit risks positively. There also seems to have a small impact of global risk aversion on domestic banks' creditworthiness. Reading charts 5 and 7 together, one can say that the impact of US monetary policy is channelled mostly through OCR. An increase in OCR not only raises the risk-free component of banks' funding costs, apparently, it also raises the risk premium component of banks.

Similarly, chart 8 shows the response of NZ mortgage spread to shocks. The major difference with the previous chart is that, when it comes to mortgage cost, global risk aversion seems to exert large impact on the perceived creditworthiness of households. This may be due to factors not captured in the model. One obvious suggestion is house price. It may be that when OCR rises in response to US monetary tightening, New Zealand house price falls and, with depreciated collateral, banks charge higher mortgage rate on households. Note that the middle right panel is insignificant, implying that OCR affects only the risk-free component of mortgage cost, but not the risk premium component (mortgage spread).

Summary 3. *Impact of US monetary policy transmits to NZ banks and households via different channels. US monetary tightening affects OCR setting, in turn influencing both the*

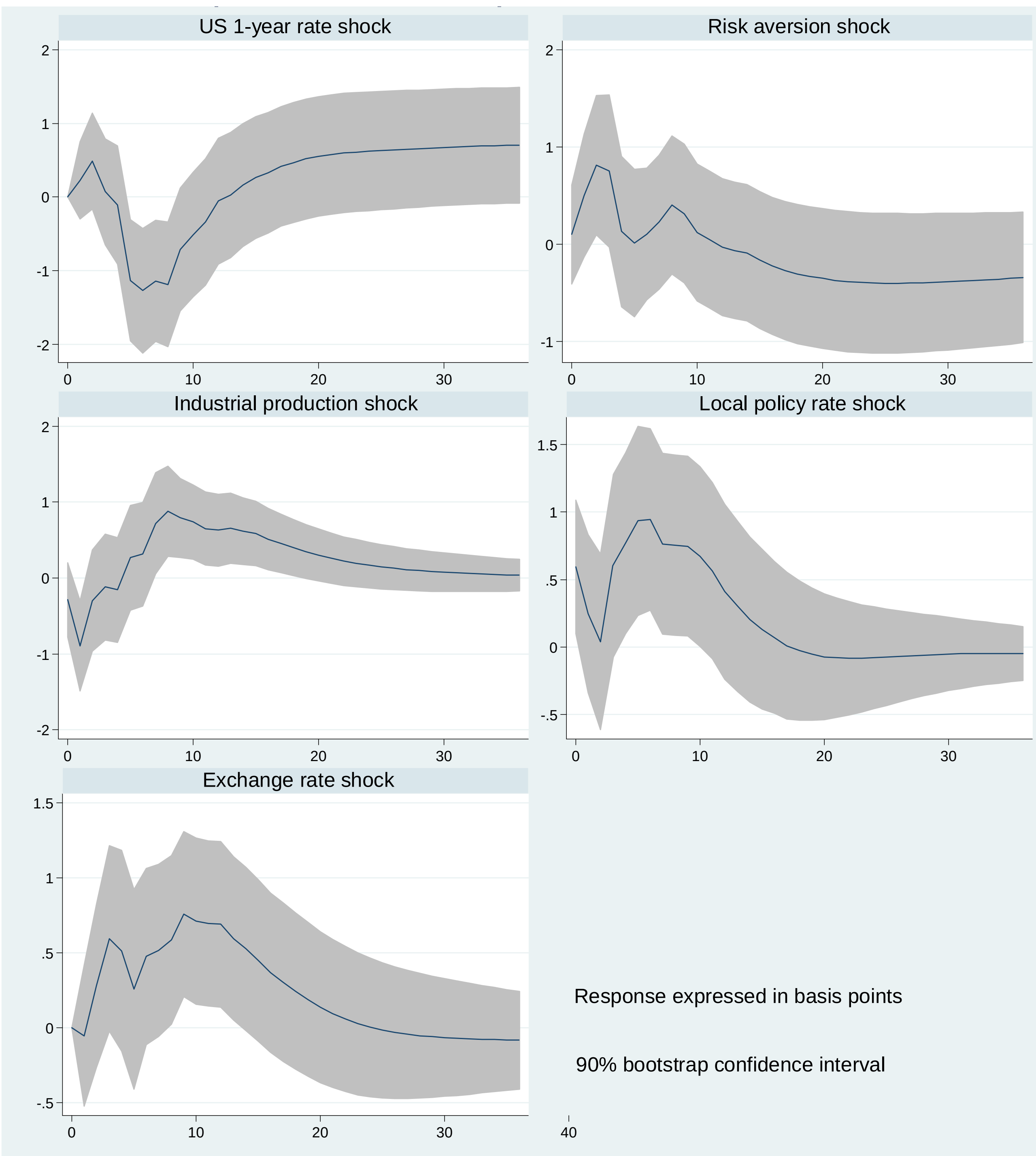

Chart 7: Response of NZ CDS spread.

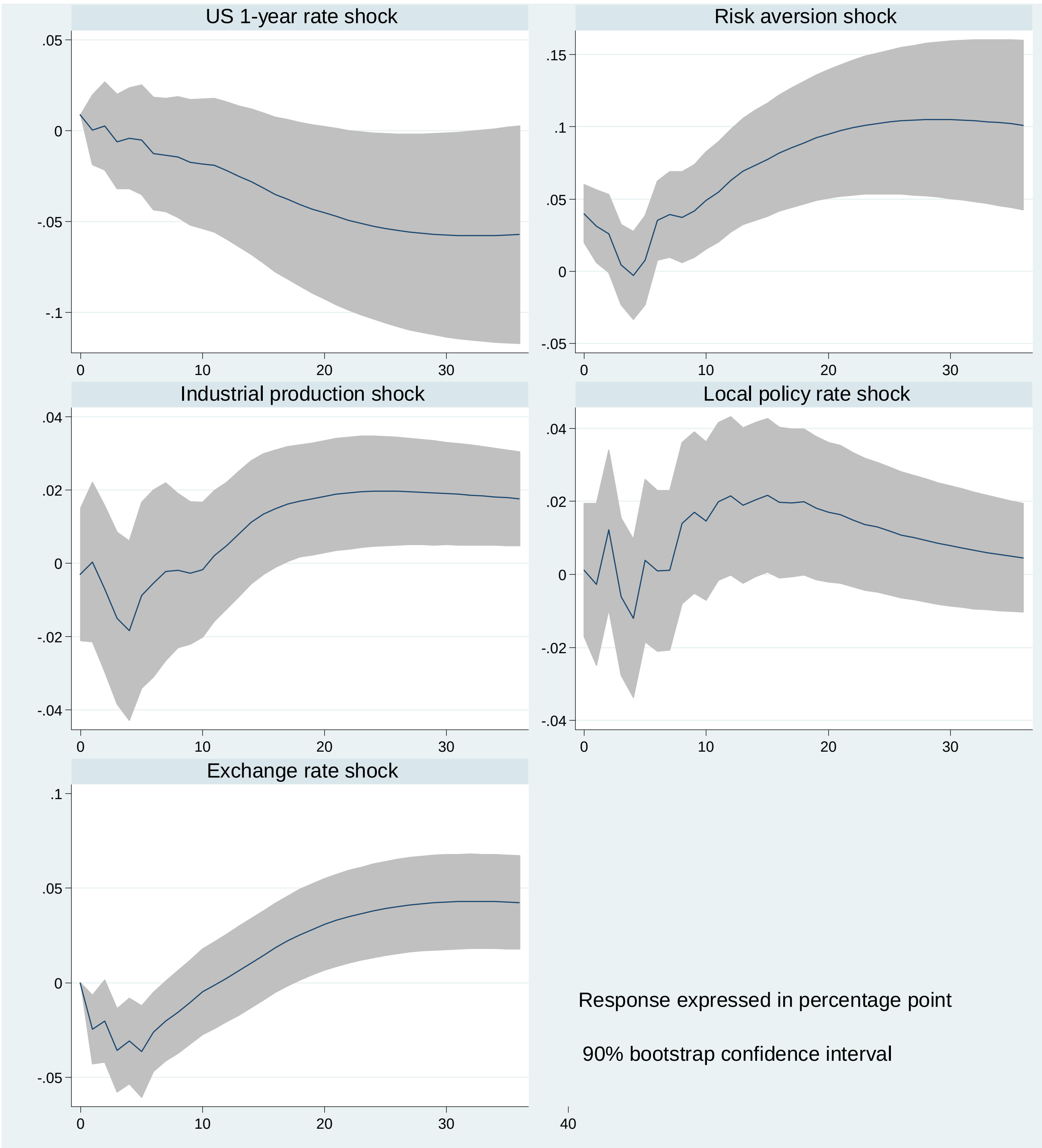

Chart 8: Response of NZ mortgage spread

	CDS spread					
	1-year US rate	Risk aversion	Industrial production	Local policy rate	Own shock	Exchange rate
Australia	9.3	2.1	0.4	11.7	58.4	18
Canada	11	5.3	0.4	10.2	67.8	5.3
New Zealand	8.7	2.7	6.4	5.8	71.9	4.7
Sweden	6.7	29.6	3.3	9.6	40.9	9.9
United Kingdom	2.2	12.8	3.3	7.3	65.2	9.3
	Mortgage spread					
Australia	31.5	2.5	2.8	4.2	45.3	13.8
Canada	17.6	1.3	3.4	2.2	67.8	7.7
New Zealand	7.5	38.8	1.4	2.1	45.3	4.9
Sweden	1.2	68.2	1.3	7.4	13.7	8.1
United Kingdom	1.2	65.7	3.5	1.1	25.8	2.8

Table 1: International variance decomposition. Numbers represent the percentage of varia-tion in CDS and mortgage spreads attributable to the respective structural shocks. Variance decomposition results are recorded two years after the initial shock.

risk-free and risky components of banks' funding. In contrast, OCR does not significantly explain mortgage spread. Global risk appetite does.

C. International Comparison

To put New Zealand's experience in context, we repeat the above exercises on Australia, Canada, Sweden, and United Kingdom. Tables 1 summarises the FEVD results.Of the five countries, New Zealand has a medium exposure to US monetary policy, in terms of its influence on funding and mortgage spreads –New Zealand ranks the third among the five countries in both instances. On average, however, risk aversion shocks explain most of the variation. It accounts for about 11 per cent of variation in CDS spread and 35 per cent in mortgage spread across countries.

Table 2 presents the international IRFs. Reading the top section of the results, we can see that by itself, US monetary policy does not significantly affect CDS and mortgage spreads of most countries, implying that its effect is indirectly transmitted through other variables. The lower half shows that risk appetite however is quite influential of both

Response of CDS spread to US monetary shock	After 1 year	After 2 years	After 3 years
Australia	-16.8	-0.2	6.3
Canada	20.8	21.1*	25.9*
New Zealand	-0.3	3.9	4.4
Sweden	-10.5	-0.7	5.7
United Kingdom	-1.7	-3.5	-0.6

Response of mortgage spread to US monetary shock	After 1 year	After 2 years	After 3 years
Australia	-38*	-44.5*	-32.1*
Canada	-20*	-22.7*	-22.5*
New Zealand	-17.4	-41.6*	-45.4
Sweden	-4.5	-8.8	1.9
United Kingdom	4	-11.7	-7.2

Response of CDS spread to risk aversion shock	After 1 year	After 2 years	After 3 years
Australia	-0.9	0.7	0.9
Canada	3.7*	3.7*	3.2*
New Zealand	0	-0.4	-0.3
Sweden	2.8*	2.7*	2.3*
United Kingdom	2.1*	1.9*	1.3*

Response of mortgage spread to risk aversion shock	After 1 year	After 2 years	After 3 years
Australia	-0.1	4.5*	6.4
Canada	0.2	1.7	2.8*
New Zealand	6.3*	10.2*	10.1*
Sweden	9.2*	11.4*	9.5*
United Kingdom	15.5*	16.1*	13.7*

Table 2: International impulse response functions. * denotes result is 10% statistically significant. Response, in basis points, is scaled to the impulse of a 100 bps shock in US interest rate and 1 sd in risk aversion respectively.

CDS and mortgage spreads: a shock in risk aversion significantly raises CDS spreads in Canada, Sweden and UK, and the mortgage spread in New Zealand, Sweden, and UK. In summary, therefore,

Summary 4. *New Zealand's exposure to global influence, in terms of CDS and mortgage spreads, is medium. Its CDS spread's exposure to US monetary policy is behind Australia and Canada (and above Sweden and UK), and its mortgage spread exposure to global risk aversion is behind that of Sweden and UK (but above Australia and Canada). International IRFs confirm that NZ households' exposure to global risk aversion is common and normal.*

IV. Conclusion

Using structural vector autoregression with instrumented US monetary policy and a proxy for risk aversion decomposed from VIX, this paper finds that the magnitude of US monetary policy on NZ funding costs is approximately one-to-one. Subsequent analyses reveal that the channels of transmission in the banks' funding and mortgage markets are different. In the former, US monetary policy is channelled mainly via OCR, in RBNZ's attempt to mitigate inflationary pressure induced by US monetary contraction. In the housing market, in contrary, global risk aversion has served as a key conduit for transmission. Putting New Zealand's experience in international context, it is found that New Zealand's response is moderate. Unless further evidence suggests otherwise, in regard to financial stability concerns, the first best advice would be to hold the present monetary policy mechanism unchanged.

The crude abstractions of the model used in this paper suffer from several deficiencies. In particular, it uses CDS and mortgage spreads as proxies for the external finance premium in the literature (Bernanke and Gertler, 1989), when indeed, the former is more a component of the premium, and the latter a symptom of it. A more systemic approach would be along the lines of Mizen and Tsoukas (2012), who compile bond premia across countries from firm-level data. This paper also confines itself within the domain of positively describing the impact of monetary policies, without endorsing their optimality, as in Agur and Demertzis (2012). Enriching the present model along these directions may prove fruitful in informing the international linkages between global monetary policies and regional financial risks.

A Data

All data are monthly. All CPI and IP are seasonally adjusted. CPI, IP, exchange rate and VIX are logged. All IP series are sourced from IMF. Name in square brackets refers to the Bloomberg syntax. Except for Singapore, all mortgage spreads are calculated as the difference between the respective mortgage rate of the country and the risk-free five-year government bond rate. Government bond rate, exchange rates and VIX are drawn from Bloomberg.

A. Australia

Monthly data from 1993:6 to 2016:4.

CPI: Interpolated from the quarterly Australia CPI All Groups Goods Component [AUCPI Index]. Source: Australian Bureau of Statistics.

Mortgage spread: Australia Lending Rate for Standard Housing Loans Issued by Mortgage Managers [AILRHLMS Index] less [GACGB5 Index]. Source: RBA.

Policy rate: Cash Target Rate [RBATCTR Index]. Source: RBA.

B. Canada

Monthly data from 1990:1 to 2016:8.

CPI: Canada CPI NSA 2002=100 [CACPI Index]. Source: Statistics Canada.

Mortgage spread: 5 Year Conventional Mortgage Rate [CANMORT5 Index] less [GCAN5YR Index]. Source: Bank of Canada.

Policy rate: Bank of Canada Bank Rate.

C. New Zealand

Monthly data from 1990:1 to 2016:4.

CPI: New Zealand CPI All Groups (2006.6=1000) [NZCPCCPI Index]. Source: Statistics New Zealand.

Mortgage spread: 2-year fixed mortgage rate minus 2-year NZD swap rate. Source: RBNZ, Bloomberg.

Policy rate: Official Cash Rate spliced with Overnight interbank cash rate. Source: Reserve Bank of New Zealand.

Domestic funding rate: series downloaded from RBNZ. It provides an indication of registered banks weighted average New Zealand dollar cost of funding and claims. The figures exclude foreign currency funding, which accounts for approximately 21% of total registered bank funding at December 2015. New Zealand dollar funding costs also exclude the impact of hedging, for example interest rate swap costs incurred against fixed rate claims.

1-year NZD/USD basis swap rate: 1 year NZD swap rate plus 1-year NZD/USD basis swap rate.

D. Sweden

Monthly data from 1997:1 to 2016:8.

CPI: Sweden CPI 1980=100 [SWCPI Index]. Source: Statistics Sweden.

Mortgage spread: Sweden 5y mortgage bond rate less [GSGB5YR Index]. Source: Riksbank.

Policy rate: Sweden Repo Rate (Effective Rate) [SWRRATE Index].

E. United Kingdom

Monthly data from 1995:1 to 2016:8.

CPI: UK CPI EU Harmonized 2015=100 [UKRPCHVJ Index]. Source: Office for National Statistics.

Mortgage spread: 5-yr Mortgage Fixed Rate [UKMRM5Y Index] less [GUKG5 Index]. Source: Bank of England.

Policy rate: Bank of England Official Bank Rate [UKBRBASE Index].

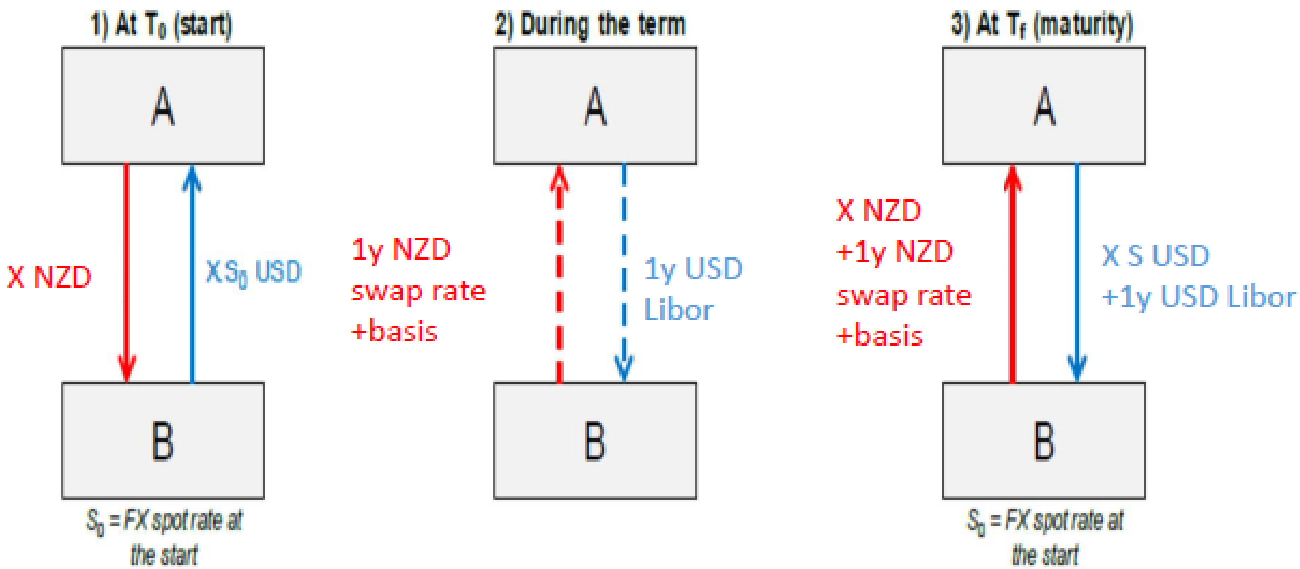

Chart 9: Illustration of flows involved in a NZDUSD cross currency basis swap

B Currency Hedge of New Zealand Banks

There are three reasons for New Zealand banks to borrow US dollar: to fulfil the domestic needs of New Zealander for US dollar or New Zealand dollar, and to fulfil the foreign demand for New Zealand dollars. The New Zealand bank (call it ASB for short) does not need to hedge in the first case, but would hedge in the second and third case.

If a New Zealand firm wants to borrow USD loan for hedging and speculation purpose, then it would approach ASB for USD loan. In this case, ASB does not need to hedge, as it is simply acting as a conduit to pass the USD loan from global banks to the New Zealand firm. As the USD assets and liabilities of ASB are matched, it is naturally hedged.

There occurs times when New Zealanders' demand for NZD is higher than what the domestic funding pool can support. In this case, ASB can borrow USD overseas, swap it into New Zealand dollar, and subsequently lend the New Zealand dollar to local firms. The currency risk of ASB is hedged if it enters into a cross currency swap agreement as illustrated in chart 9. Here, ASB will enter as party B in the chart. The cost of fund to ASB of this exercise is the 1-year NZD swap rate + basis as depicted in step (2) of the chart. ASB's funding cost of the USD loan is offset by the USD interest it receives from step (2) of the chart.

Occasionally, there is a strong offshore demand for New Zealand dollar. In this case, ASB will act as A in the chart to fulfil the temporary needs for New Zealand dollar by foreign banks.

Our definition of the external funding cost is that in the second case – the 1-year NZD swap rate + basis. The basis spread can be seen as the additional cost to New Zealand banks in borrowing New Zealand dollars overseas via swaps.[11]

Notes

*My findings build on some of my PhD work and ongoing research with Prasanna Gai on these issues. Any views expressed are solely those of the author(s) and so cannot be taken to represent those of the Treasury.

[1]And also macroprudential policies.

[2]Federal Open Market Committee meets around eight times a year to decide on the federal funds rate.

[3]See footnote 4 of Gertler and Karadi (2015) for details.

[4]Exactly, VIX measures the "risk-neutral" expected stock market variance for the US S&P500 index.

[5]HAR stands for Heterogeneous Auto-Regressive. See Table 3 of Bekaert and Hoerova (2014).

[6]22 trading days in a month and five trading days in a week.

[7]CDS spread is inferred from PDs, which are exponential linear functions of some input variables (2 macroeconomic factors and 10 firm-specific attributes) where the coefficients depend on the forward starting time. See Duan (2014) for details.

[8]With 1000 repetitions for each IRF.

[9]Unless otherwise specified, this magnitude of the shock in US monetary policy will be used throughout the paper.

[10]The increased demand for US dollars may also reflect investors' tendency to seek refuge in US dollars when perceived uncertainty is high. The currency swap market is illiquid and subject to swings in the relative supply and demand for currencies. When perceived uncertainty is high, which is common following the tightening in US monetary policy, investors prefer to hold US dollars, and so are willing to receive lower interest rate on its non-USD loan.

[11]The basis spread can be negative as in early 1990s. In that case, it is cheaper for New Zealand banks to borrow NZD via swaps overseas.

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