
ARTICLES

The transmission mechanism of New Zealand monetary policy

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In the first of two articles on the transmission mechanism of New Zealand monetary policy, we provide a detailed account of the process by which changes in the Reserve Bank's primary monetary policy instrument, the Official Cash Rate (OCR), eventually come to influence the general level of prices. As such, the article is a guide to how the Bank perceives policy decisions to propagate through the New Zealand economy, and to the relative weight it assigns to the strengths of the various channels that together comprise the transmission mechanism. A second article, to be published in a forthcoming issue of the *Bulletin*, considers how this mechanism may have changed over time and how this has influenced the implementation of monetary policy in the most recent business cycle.

1 Introduction

Every six weeks, the Governor of the Reserve Bank decides whether current monetary policy is set appropriately to ensure that the Bank's price stability objective is met, and if not, how policy should be adjusted.² This follows a comprehensive decision process that includes a review of a wide range of economic and financial data, economic projections and information from the Bank's business contacts.

A decision to adjust policy settings can be implemented by changing the level of the OCR directly, or by signalling to financial markets a future course for monetary policy that differs from the prevailing market view. There are several links in the 'textbook' causal chain between a change in such settings and eventual inflation outcomes, which are collectively known as the transmission mechanism of monetary policy.

A flow chart that illustrates the key features of the transmission mechanism is shown in figure 1. The diagram provides a stylised representation of how various elements of the economy are affected by an increase in the OCR over time and is intended to serve as a 'roadmap' for the discussion in this article. In the flow chart, the links that are

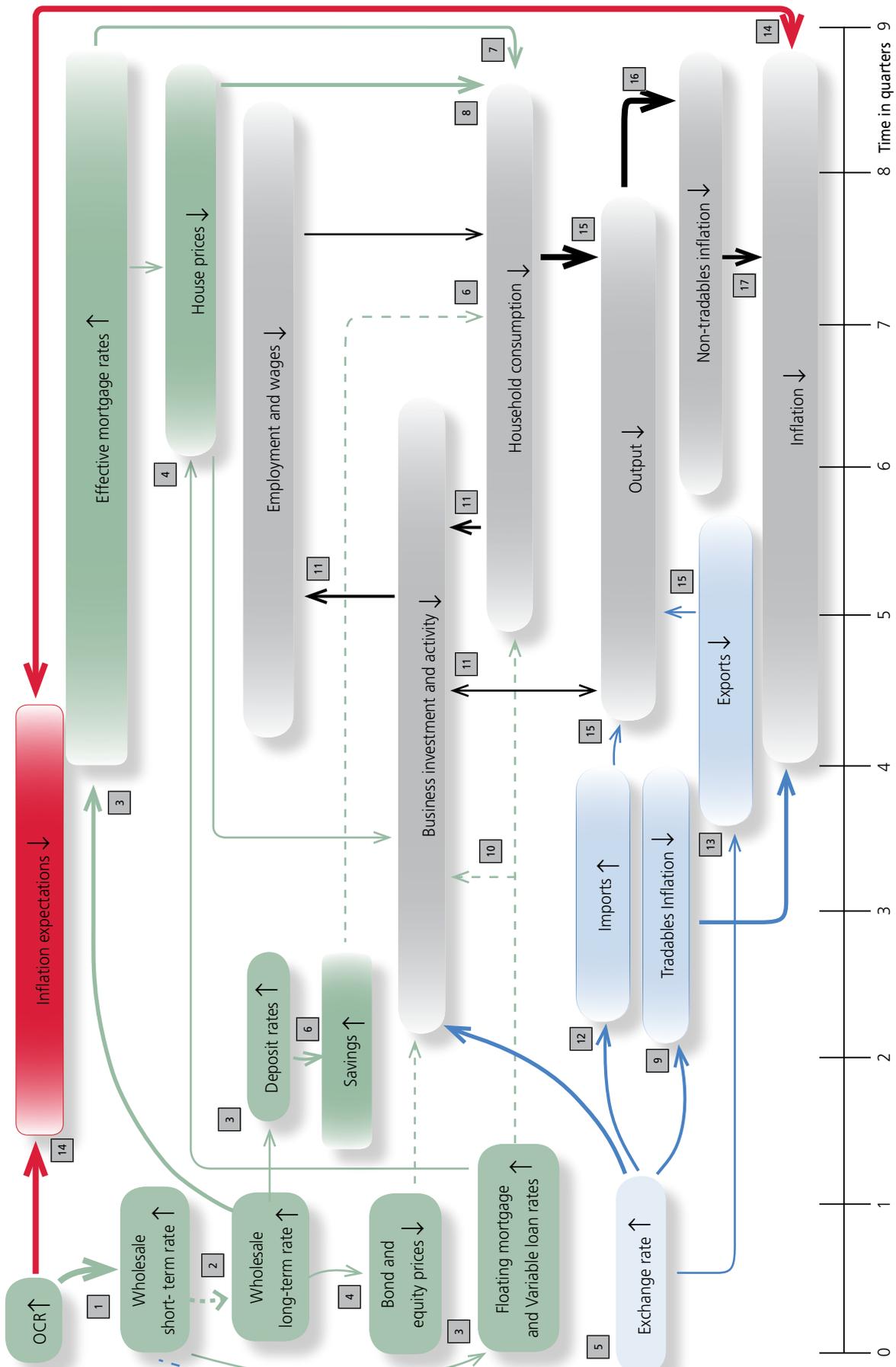
more important than others for the transmission of monetary policy are mapped in relatively thick arrows. This does not necessarily imply that these links represent empirically strong economic relationships as well, and so we denote 'strong' economic relationships by solid lines. Relationships that are more equivocal, for whatever reason, are shown in dotted lines. Green lines generally form part of the interest rate channel of the transmission mechanism, blue lines denote the effect of changes in the exchange rate, and red lines refer to effects related to inflation expectations. There is some natural overlap between these, especially late in the monetary cycle, and these overlapping links are in black.

The numbers next to the links provide easy reference to points in the discussion below. The boxes with graded shading indicate the time of peak change in a given variable. Since these times are naturally subject to uncertainty, the faded colours towards the ends of the boxes indicate less likely times for these peak changes.

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² The current price stability objective of monetary policy is formally specified in the Policy Targets Agreement 2007 as: "the policy target shall be to keep future CPI inflation outcomes between 1 per cent and 3 per cent on average over the medium term." See <http://www.rbnz.govt.nz/monpol/pta/3027051.html>.

Figure 1
The transmission mechanism of New Zealand monetary policy



Link	From	To	Reasons (in the context of an OCR increase)
1	Official Cash Rate	Wholesale short-term interest rates	Domestic interest rate arbitrage
2	Wholesale short-term interest rates	Wholesale long-term interest rates	Expectations hypothesis; expected future activity, inflation and monetary policy; foreign monetary policy
3	Wholesale short- and long-term interest rates	Retail borrowing, lending and deposit interest rates	Margin preservation by banks and financial intermediaries
4	Wholesale short- and long-term interest rates	Asset prices including bonds, equities and housing	Future interest, dividend and rental payments are more heavily discounted; higher debt-servicing costs; tighter credit criteria
5	Wholesale short- and long-term interest rates	Exchange rate	Interest parity conditions; foreign monetary policy
6	Retail borrowing and lending interest rates	Household savings and consumption	Returns to savings increase; current consumption more expensive in terms of future consumption
7	Retail mortgage interest rates	Household consumption	Higher mortgage payments; lower disposable incomes for discretionary spending
8	House prices	Household consumption and business activity	Wealth effects; less collateral available for discretionary loans
9	Exchange rate	Tradables inflation	Cheaper imports
10	Retail borrowing and lending interest rates	Business investment and activity	Higher rate of return required from investment; larger debt-servicing costs
11	Expected future household consumption and overall activity	Current business investment and activity	Lower expected earnings in future
12	Exchange rate	Imports	Substitution away from domestically produced goods in favour of imports
13	Exchange rate	Exports	Reduced competitiveness and consequently lower export earnings
14	Official Cash Rate	Inflation expectations	Monetary policy credibility
	Inflation expectations	Current inflation	Workers and firms reduce wage and price demands in expectation of lower future inflation; weaker incentives to spend now rather than later
15	Consumption, investment and net exports	Aggregate output	Output is the sum of consumption, investment, net exports (and government spending)
16	Aggregate output	Non-tradables inflation	Actual output declines relative to economy's supply potential, reducing pressure on economic resources
17	Tradables and non-tradables inflation	CPI inflation	CPI inflation is the sum of tradables and non-tradables inflation

Figure 1 shows that the most immediate impact of a change in monetary policy settings is seen in the markets for short-term bank bills and bonds, and in those for highly liquid financial assets such as foreign exchange.³ Prices for longer-term bonds, equities, and other asset classes such as property and housing also respond to a change in policy settings. The net effect of a change in these bond and asset prices is to prompt households and firms to re-assess their consumption, investment and other business decisions. In turn, these decisions percolate through to aggregate spending in the economy, with their presence being significantly felt at the macroeconomic level after one or two quarters, and persisting for up to three years. Finally, and again with a lag, changes in aggregate activity influence pricing pressure in the economy – prices will tend to rise as activity expands and decline as activity falls.

Some of the links noted above are relatively timely and well understood; others are subject to considerable uncertainty around both the timing and magnitude of their impact on the economy. For example, policy changes tend to have a well-defined impact on short-term interest rates, but much less direct and less certain consequences for house prices. Other complications may arise in practice. First, the impact of a change in settings will often depend on the current state of the economy. In a buoyant economy with rising inflation pressure, the Bank may need to tighten policy more aggressively than in an economy where activity and sentiment are subdued. Second, the transmission mechanism tends to change over time as the economy evolves. Finally, a crucial part of the transmission mechanism concerns how households and firms form expectations of future prices and activity. In general, the more the Bank is able to influence these expectations, the easier is the task of maintaining low and stable inflation.⁴

The remainder of this article considers the transmission mechanism of monetary policy in more detail. In section 2, we discuss the monopoly role of the Reserve Bank in supplying New Zealand cash and how this allows the Bank to set the OCR. We also consider how the OCR and Bank communications influence other wholesale and retail interest rates. Section 3 looks at how real activity is affected and section 4 describes the final link in the chain of causality from the OCR to the price level by considering the aggregation of individual decisions and their impact on inflationary pressure.

The discussion in this article is generally framed in terms of a tightening of monetary policy. For the most part, the effects of an easing in policy will be symmetric in direction, though not necessarily in timing or magnitude.

2 The OCR and its effect on financial prices

Two important features of the New Zealand financial system help ensure that the Reserve Bank can exercise influence on short-term interest rates. First, like central banks in other countries, the Reserve Bank has been granted a legal monopoly on the issuance of currency notes and coins. Second, the Reserve Bank serves as the government's bank in that all payments accruing to the central government must be settled in Reserve Bank liabilities.⁵ The need to issue notes and coins to their own customers and the need to transact with the government combine to create incentives for commercial banks to maintain accounts with the Reserve Bank, with the account balance known as *settlement cash*.

The important implication of being the monopoly supplier of currency and settlement cash liabilities is that the Bank is able to set the price at which it will lend (and borrow) settlement cash. In New Zealand, this price is known as

³ The exchange rate can be thought of as an asset price, reflecting the foreign currency value of New Zealand dollar-denominated assets.

⁴ This is a major argument for transparent monetary policy and hence the considerable effort the Bank expends communicating policy decisions, such as through the published *Monetary Policy Statements*.

⁵ This means that banks making tax payments to the government, for example, cannot settle by issuing liabilities such as commercial bills or bonds to the government. The only accepted means of payment is cash (or an equivalent claim against the Reserve Bank of New Zealand).

the 'Official Cash Rate' (OCR).⁶ The Bank's counterparties can obtain settlement cash overnight from the Bank at an interest rate 0.5 percent above the OCR and deposit funds with the Bank overnight at the OCR.⁷ The OCR is thus the benchmark overnight interest rate in New Zealand because no bank would normally pay another bank a higher interest rate for overnight cash or accept a deposit rate lower than that offered by the Reserve Bank.

Longer-term rates in New Zealand can loosely be thought of as a sequence of overnight rates, which the Bank influences via the OCR (abstracting, for now, from foreign interest rates and other influences on New Zealand rates). In this sense, the OCR is also a benchmark for New Zealand's longer-term interest rates. The corollary is that the shorter the maturity of the interest rate, the tighter its link to the prevailing OCR.⁸ In contrast, as the maturity of the interest rate lengthens, its level depends more on expectations of future OCR settings. Adjusting the OCR will influence other interest rates, but the magnitude of this effect depends on whether the move was anticipated by financial markets, and whether the Bank provides an indication for future policy that differs from the prevailing view in the markets.

⁶ The OCR was introduced in New Zealand in March 1999. Prior to this, since the mid-1980s monetary policy had been implemented by controlling the quantity, rather than the price, of settlement cash. However, the main aim of the Bank was always to influence financial market prices. Adjusting the settlement cash target enabled the Bank to influence short-term interest rates, but this influence was much less precise than under the present OCR regime. Brookes and Hampton (2000) discuss the introduction and operation of the OCR and Nield (2006) describes recent changes to the system and the Bank's liquidity management regime.

⁷ Commercial banks can obtain settlement cash from the Reserve Bank subject to the collateral requirements on such borrowing, as detailed in Nield (2006).

⁸ For example, take the 30-day bank bill rate and assume that the next OCR review date is at least 30 days away. In this case, the 30-day rate will be very close to the OCR, since the overnight rate is not expected to be changed for a month. If 30-day rates did in fact differ from the OCR, there would be an opportunity for traders to arbitrage this difference away, subject to possible credit, liquidity and term risk premia, by borrowing from the Reserve Bank and lending at the 30-day rate.

For simplicity, we have focused on the overnight inter-bank market in this article in explaining the link between the OCR and short-term interest rates. It should be noted that there are relatively few participants in this market when compared to the number participating in forward interest rate markets, especially in those for Overnight Indexed Swaps (OIS), which are the instruments that banks use for much of their short-term funding. See Choy (2003) for more detail on OISs and also footnote 12.

In New Zealand, the monetary policy instrument is the OCR, rather than some measure of the quantity of money. This reflects the view that, in modern economies, it is difficult and most likely undesirable to try and influence demand and inflation by using a monetary target (box 1 expands on this issue).

Wholesale interest rates

1 To illustrate the impact of monetary policy on short-term interest rates, we assume that the Bank increases the OCR in a one-off move that surprises the market, and that the market does not anticipate further policy changes over the next 90 days. In this case, we would expect the change in the OCR to be immediately and almost fully transmitted to other short-term wholesale interest rates with a maturity of up to 90 days.⁹

2 The extent to which an increase in the OCR feeds through to longer-term wholesale rates is much less certain. Longer-term rates are determined by an average of current and expected future short-term domestic rates and by benchmark foreign interest rates, the influence of which tends to increase with the maturity of the domestic rate. In addition, other factors such as country risk premia tend to be more important at longer horizons. Assuming no change in foreign interest rates and other factors, if the increase in the OCR is perceived as just the first step in curtailing rising demand and inflation pressure, longer-term rates of up to around two years in maturity may increase by as much or more than the increase in the OCR, with a diminishing impact on rates with longer maturities. In contrast, and perhaps more consistent with a surprise increase in the OCR, longer-term rates may remain unchanged or even decline on the expectation that monetary policy will need to be looser in the future – either because markets view the OCR increase as unnecessary and/or because inflation is expected to decline in the future, resulting in an eventual decrease in the OCR.

⁹ Wholesale interest rates are defined as those on bank bills, government bonds and other instruments that are normally traded on by banks and financial institutions. These are in contrast to retail interest rates, which generally apply to products that are marketed by these banks and financial institutions to individual investors and firms.

Box 1

The role of the money supply in the transmission mechanism

The discussion in this article largely ignores the role of the supply of money. The Reserve Bank is not alone in placing relatively little importance on monitoring various measures of money *vis-a-vis* other economic indicators; financial markets observers and participants also do not actively assess the consequences of changes in the money supply. This may seem at odds with Milton Friedman's maxim that "Inflation is always and everywhere a monetary phenomenon", and with the fact that standard expositions of monetary policy are frequently framed in terms of money supply management. Indeed, one popular textbook defines monetary policy as "the control of the money supply".¹⁰

So, how exactly does money matter for the New Zealand economy? In one sense, money is auxiliary to the economy – that is, in the absence of economic surprises, output, inflation, interest and exchange rates and other macroeconomic variables will settle at some stable value, and the money supply will adjust to whatever level is necessary to ensure this outcome. For example, for a given set of interest rates, households require a certain quantity of physical cash to finance retail spending, and this is supplied without limitation by the Reserve Bank, directly changing the level of the narrowest measure of money –

that of the sum of the notes and coins in circulation. For this same set of interest rates, the household and firm decisions described below and the financial intermediation and credit creation by banks will result in new levels for other, broader, measures of money. Thus, the Reserve Bank decides only on the price of money – the OCR – with quantities being created either directly by the Bank or by the banking system as necessary to satisfy demand for money.

Though the quantity of money is not a policy target in itself, it could potentially have a role to play in the policy process as an indicator of future activity. This is because a policy tightening that aims to curb activity should, over time, also result in a reduction in the demand for money and thus in the observed growth rate of various monetary aggregates. Continued strong growth in the monetary aggregates may indicate that monetary policy settings are inconsistent with the desired outcome for output and, consequently, inflation. In practice the links between money growth, output and inflation are often quite weak and unstable from one business cycle to the next. As a result, monetary aggregates have generally not proven to be particularly useful indicators for monetary policy.¹¹ Despite the unstable link between money growth and inflation, the Bank does look to various measures of sectoral credit for corroborative evidence on trends in that sector. Credit approvals by banks for housing are one such example.

Retail interest rates

3

Changes in wholesale rates affect the interest rates that banks and other financial institutions charge and offer their customers for loans and deposits. Overall, these retail rates should increase fairly quickly by an amount similar to the change in wholesale rates, although the speed and extent of this link will depend on the financial product

in question and competitive pressures.¹²

The retail interest rates that matter most for monetary policy may change over time as financial preferences and structures evolve. In the current business cycle for example, two to five year fixed mortgage interest rates, have proven to be

in implementing monetary policy. For introductory motivation to this strategy, see ECB (2000).

¹² In practice, the link between wholesale and retail rates is more complex. Banks generally raise wholesale funding at maturities of up to 90 days, paying variable interest. This funding strategy poses little problem for banks in terms of managing floating-rate mortgages. However, there is a re-pricing risk associated with the mismatch between the banks' wholesale funding maturities and the maturities of most fixed-rate mortgages. Banks hedge against this risk by 'swapping' the variable interest payments due on their liabilities for fixed receipts from other participants in financial markets. Consequently, the funding costs for fixed mortgage rates are more closely related to these 'swap' rates than to the banks' wholesale funding rates.

¹⁰ See Mankiw (1997).

¹¹ Financial innovation is an important determinant of the changing patterns of credit creation by banks. Derivatives and swaps allow banks to better manage their asset and liability portfolios and are likely to result in increased credit creation for a given increase in base money by the Bank. In this way, financial innovation may contribute to the instability of the link between money growth and output noted above. See also Boaden (1994). The European Central Bank (ECB) is one of the few developed-economy central banks to place formal emphasis on monitoring the growth rate of money

the “preferred habitat” of the majority of mortgage lending in New Zealand, and hence have been the rates over which the Bank has desired the greatest leverage.¹³ In years gone by, floating rate mortgages were a rather more dominant form of household borrowing.

Bonds, equities and real estate

4 To the extent an increase in the OCR affects longer-term interest rates, we also expect to see an impact on the market prices of other assets, such as bonds, equities and real estate. As long-term interest rates rise, bond prices unambiguously fall since the discounted stream of future interest receipts on the bond declines. Future dividend and property rental income streams are also discounted more heavily, reducing the relative attractiveness of equities and real estate in the household asset portfolio.¹⁴ With respect to real estate (or other assets commonly funded by borrowing), a further transmission channel operates: as interest rates rise, some households may find that the servicing costs on their desired loan exceed commercial bank imposed limits. This, in turn, will tend to curtail demand at the margin.¹⁵

However, other factors may dominate the impact of the monetary-policy induced increase in longer-term rates on asset prices. For example, equity and house prices may continue to climb on the basis of genuine ‘fundamental’ factors (such as rising incomes, immigration and productivity growth rates) or because markets are in ‘bubble’ mode wherein the rational response to increasing rates is ignored by market participants. It is important to note that in this ‘bubble’ mode, asset prices would likely have risen faster if the OCR had not increased, potentially exacerbating the costs of the inevitable correction. Markets may also

interpret a surprise increase in the OCR as being indicative of increased strength in current or expected economic activity, placing further upward pressure on asset prices. Despite these complications, research suggests that, on average, monetary policy has a correctly signed and significant impact on both house and equity prices.¹⁶

The exchange rate

5 In a relatively open economy such as New Zealand’s, the impact of interest rates on the exchange rate is an important part of the transmission mechanism. The exchange rate is the price of New Zealand dollars relative to other currencies and, in the short term, depends on both domestic and offshore monetary policy conditions amongst other factors. All else equal, a surprise increase in the OCR will immediately appreciate the NZD, as higher domestic rates attract foreign capital. In theory, the price of the NZD should be bid-up to a level such that the expected depreciation from that point is just sufficient to leave an investor indifferent between holding New Zealand dollars or some other currency.¹⁷ Empirical support for this relationship is hard to come by, reflecting the fact that the response of the exchange rate to monetary policy actions is likely to be heavily influenced by expectations of future monetary policy.¹⁸ Another empirical anomaly is that both the initial appreciation and subsequent depreciation have tended to be larger than suggested by theory. In broad terms, however, the NZD cycle has tended to follow the monetary policy cycle – appreciating when the Bank is tightening policy or has a tightening bias, and depreciating when the Bank is easing.

¹³ This preference could stem from the fact that banks’ lending margins have tended to be lowest at these maturities as they compete for market share, or that in recent times, world longer-term rates have been at fairly low levels, possibly resulting in relatively cheap borrowing at these maturities. An alternative explanation has it that the market’s expectations of future monetary policy, which have not always aligned with those of the Reserve Bank, have simply pushed down longer-term interest rates.

¹⁴ In 2001, New Zealanders held 85 percent of their household asset portfolios in real estate. See Scobie, Le and Gibson (2007).

¹⁵ In this regard, the households’ self-imposed budget constraints and debt appetites are also likely to be important.

¹⁶ See Buckle *et al* (2000) for a quantification of the impact of monetary policy on domestic equity prices and Coleman and Landon-Lane (forthcoming) on the impact of interest rates on house prices.

¹⁷ This relationship between interest rates and the exchange rate is known as uncovered interest parity (UIP).

¹⁸ This is not to suggest that monetary policy is the only, or indeed even the unambiguously dominant, explanatory variable for exchange rate movements. A vast literature is devoted to examining both structural explanatory variables such as productivity differentials and trade policies and more cyclical ones such as commodity prices and the terms of trade. Munro (2004) provides a summary of the major drivers of the dynamics of the NZD.

3 Financial prices and their effect on activity, demand and import prices

The next set of causal links in the monetary transmission mechanism is from the newly determined interest and exchange rates and other asset prices to the aggregate level of economic activity. These links are complex in that there are various second-order effects that can either strengthen or offset the direct effect of interest rates on activity. For example, interest rate changes that require a household to make larger mortgage payments over previous levels will, for a given level of income, typically result in a reduction in its discretionary spend on other goods and services. An increase in saving is also expected, given that the return to saving increases with higher interest rates. However, should individuals expect the new monetary stance to reverse in the near future, the consumption-saving tradeoff is likely to be considerably muted.¹⁹ Also, if households expect significant future inflation and doubt the central bank's commitment to low inflation, then current consumption may actually increase.

6 Despite these complications, a change in interest rates corresponds to a change in the incentives for consumption, savings and investment over time and should therefore have an impact on household and firm decisions. A money interest rate is no more than the price of a current dollar in terms of a future dollar and an increase in this price increases the number of future dollars that are required to compensate for the use of a current dollar. Consumption and investment are dollar-denominated and so a rise in the interest rate should make both current consumption and investment more expensive relative to their future cost. Therefore, all else equal, rising interest rates induce households and firms to postpone current expenditures.

It is important to note that the discussion thus far has been framed in terms of the nominal interest rate; that is, the price of funds has not been adjusted to account for the fact that dollars lose purchasing power over time as a result of inflation. In principle, households and firms have no reason to value dollars in themselves; they are valued because they

¹⁹ Of course, this depends on the degree to which households are constrained in terms of cash flows.

may be used to purchase goods and services that satisfy wants. A real interest rate discounts a nominal rate for the effects of inflation and it is this interest rate that is the true reward for foregone consumption.²⁰ This suggests that it is only when the real interest rate increases that current consumption is restrained and current saving encouraged. However, for 'liquidity-constrained' households with significant debt obligations and little discretionary income, increases in nominal interest rates will still tend to depress consumption in the short run, irrespective of the impact on real rates.

In the remainder of this section, we assume that inflation expectations are sufficiently well anchored such that an increase in nominal interest rates unambiguously increases the real interest rate too. We begin by evaluating the impact of interest and exchange rates on household decisions, and then consider decisions made by businesses.

Household consumption and savings

7 As noted above, banks and other lending institutions ordinarily pass on increases in interest rates to those households with variable- or floating-rate mortgage contracts. This and any new borrowings at longer-term rates will tend to increase debt-servicing costs at the margin. In principle, households that already hold fixed or capped interest rate mortgage contracts with lending banks are insulated against interest rate increases until the contracts are renewed. However, given that households with fixed mortgages can expect lower future disposable income, the effects on consumption and saving detailed below will begin to apply soon after headline retail rates increase, though the peak effects are likely to be delayed until the higher repayments actually materialise. In summary, each household that carries a mortgage will face higher loan repayments at some point, increasing effective mortgage interest rates and eventually lowering disposable income for spending on other goods and services.

Survey data show that about a third of New Zealand households hold mortgages and that three-fifths of such

²⁰ Taxes on nominal interest income provide an additional complication in the tradeoff between current and future consumption.

households owe less than half of their home's value to lenders.²¹ In itself, this may suggest that the bulk of New Zealand households – those that rent, are mortgage-free, or have significant equity stakes in their homes – are largely immune to the consumption-suppressing effect of tighter monetary policy. However, this overlooks several important qualifications. First, banks can be expected to offer higher interest rates on savings accounts and term deposits, increasing the incentive to save.²² Second, the New Zealand tax system confers advantages to a high gearing of investment property, and so many of the eight percent of households that do own investment property are likely to be especially sensitive to mortgage rate increases. Some landlords will look to pass on mortgage rate increases to tenants, others may look to sell down their residential property investments. Third, many households, including those without mortgages, use other forms of borrowing such as personal loans, credit cards, overdrafts or hire purchase contracts. The interest rates on these other forms of credit may also increase over time, if not for existing loans then for those borrowing at the margin.

8 Even so, it is the wealth effects associated with house price changes that are presumed to play a major role in the interest rate channel of the transmission mechanism. The net effect of a fall in (real) house prices is that households are likely to feel less well-off than previously, and to consequently reduce expenditure on consumption, especially of durable items. The empirical evidence in New Zealand suggests that the wealth effects for housing in New Zealand are indeed large relative to other OECD countries, while those from changes in financial asset prices are relatively small.²³ In addition, housing is often used as collateral for other loans, including business loans in New Zealand, and falling house prices reduce the availability and attractiveness of such loans.²⁴

Finally, it should be noted that households with asset portfolios that are concentrated in interest-bearing deposits will see their incomes rise with higher interest rates and some may choose to increase consumption at such times. However, this effect is not considered important in the New Zealand experience and, on balance, the available evidence suggests that aggregate consumption does tend to decline as interest rates increase.²⁵

9 When the exchange rate appreciates in response to an increase in interest rates, households tend to increase their consumption of imported goods and services.²⁶ This increase is due to the fact that a given amount of NZD can now purchase more foreign-produced items (an 'income effect') and, as discussed further below, there is also a switch away from the products of domestic, import-competing firms (a 'substitution effect'), whose prices generally become less competitive relative to imports.

An exchange rate appreciation may also affect households via its impact on assets held overseas. As the exchange rate appreciates, the New Zealand dollar value of these assets and the income streams derived from them will tend to decrease. The fall in asset values is likely to have wealth effects and negatively influence consumption as above. Though data limitations prevent quantification, the overall impact of these wealth and income effects on consumption is likely to be much less important than the other channels above (in part, because households that have substantial offshore assets are presumably fairly well-off and hence relatively less sensitive to short-term fluctuations in these asset prices).

²¹ See Scobie, Le and Gibson (2007).

²² Following a monetary tightening, non-bank financial institutions also increase yields offered on riskier debentures and sub-investment grade bonds.

²³ See Hull (2001) and De Veriman and Dunstan (2007) forthcoming.

²⁴ See Meltzer (1995) and Bernanke and Gertler (1995) for more on the role that banks and financial intermediaries play in the transmission process and also for an assessment of the impact of financial innovation.

²⁵ Estimates suggest only eight percent of the New Zealand household asset portfolio is held in deposit accounts, Scobie, Le and Gibson (2007). For a range of recent empirical evidence of the impact of monetary policy on output, see Smith and Haug (2007), Liu (2006), Matheson (2006), Lubik (2005), Santacreu (2005), and Buckle *et al* (2003).

²⁶ For households, the largest 'imported services' are visits overseas.

The impact of interest rates on firms

10 An increase in interest rates is likely to reduce firms' investment in new capital because higher interest rates mean that anticipated revenues from new investment are discounted more heavily, raising the threshold for investment. Rising interest rates also make debt finance more expensive. Firms that can issue corporate bonds will normally have to offer higher yields, and others that borrow on the money market or from banks pay higher servicing costs. Importantly, the small own-and-operate nature of many New Zealand businesses means that firms often borrow from banks using housing as collateral, and may face stricter credit criteria in the face of falling asset values.

Some medium-sized New Zealand firms are either wholly-owned subsidiaries of larger foreign conglomerates or have significant direct foreign ownership. These firms may find it easier to bypass tighter credit conditions at home by directly sourcing funds from parent companies or by using the essentially inherited credit ratings of parent companies to raise cheaper finance in international money markets. Further, just as with households, there may be some firms that actually benefit from interest rate increases such as those with substantial cash reserves. With higher interest income from these assets, the firms may increase investment or pay higher dividends to shareholders.

11 On balance however, as with consumption, investment is believed to decline in the medium term as interest rates rise. To summarise, firms find it more difficult to raise funds to finance investment and require a higher rate of return from this investment, both making it less likely that this investment will be initiated.²⁷ Beyond the impact of rates on the level of new business investment, if the decline in broader economic activity is expected to be sustained, over time firms will look to cut back overall activity – scaling back operations, reducing staffing levels or hours worked, and possibly closing plant altogether.

²⁷ An alternative explanation of the same effect is offered by the theory of Tobin's q – the ratio of a firm's market value to its replacement cost of capital. To summarise, when q is high, the price of equity in a firm is high relative to the outlay it must make on new capital. As such, raising equity finance for investment expenditure is a cheap and worthwhile exercise. See Mishkin (1995).

The impact of the exchange rate on firms

At the macroeconomic level, an exchange rate appreciation tends to reduce inflation through both direct and indirect channels. The direct, and relatively quick, channel results in a lower NZD price for foreign-produced goods and services, lowering the tradables measure of inflation. These lower prices are normally passed on through the supply chain, lowering prices of both intermediate goods and final goods in the Consumer's Price Index basket. However, the pass-through of changes in import prices through to final goods prices is relatively low in New Zealand. One possible explanation for this may be that suppliers of imports are pricing to market; that is, the New Zealand dollar price of some imported goods may be independent of the international price, with foreign suppliers and/or the local importer absorbing gains and losses from movements in the exchange rate.²⁸

The indirect, and relatively slow, effect on exporting and import-competing firms is to make them less competitive, reducing earnings, and dampening overall activity and inflation pressures. The persistence of any exchange rate movements determines the potency of *both* of these channels. Short-term fluctuations in the exchange rate are unlikely to have a large impact on earnings streams as many New Zealand firms can manage this risk through hedging arrangements.²⁹ Moreover, as an appreciation of the exchange rate reduces the NZD price of elaborately transformed capital goods (of which there is little domestic production), business investment may rise. This is provided firms are confident that any monetary policy-induced slow-down in the economy will prove short-lived. However, over a complete business cycle, the swings in the exchange rate are difficult to fully hedge against and the aggregate forces above generally apply. We now describe how these forces affect individual firms, assuming that they are not able to fully hedge against exchange rate movements.

²⁸ Another factor that is commonly proposed is that the low pass-through environment is a reflection of the credibility of monetary policy (see Herzberg *et al.* 2003). Historically, changes in the degree of import price pass-through have been an important factor in explaining changes in the monetary policy transmission mechanism, and this will be discussed in a follow-up *Bulletin* article.

²⁹ See Briggs (2004) for a discussion of the currency hedging strategies of New Zealand firms. In addition to currency hedges, some firms will have so-called 'natural hedging' arrangements in place.

Importers

12 The import sector of the New Zealand economy can be usefully summarised as consisting of a large number of small firms that (i) import finished goods and services, (ii) manufacture goods with a large share of imported raw materials, (iii) provide domestically produced goods and services that compete directly with those provided by importing firms and (iv) a number of other firms that are subsidiaries of their multi-national parents. In general, the size and nature of the firms in the first three classes implies a lack of significant market power and they are generally believed to either pass on large fractions of gains from cheaper imports or – for firms in the import-competing category – to drive down prices in response to cheaper imports, the net effect being to shift demand from domestically-produced goods to imports.³⁰

Exporters

13 The export sector in New Zealand is diverse with (i) a relatively large number of medium-sized firms that export primary and manufactured goods, (ii) important onshore industries such as education and tourism, and (iii) one large dairy co-operative in Fonterra. The degree of pricing power that these exporting firms enjoy in international markets varies significantly, and consequently so does their degree of insulation from exchange rate fluctuations. For example, firms that exploit market niches can afford to be relatively inflexible in pricing, while others that supply smaller quantities of undifferentiated products in global commodity markets are unlikely to enjoy this luxury.

For the firms that cannot dictate international prices, a rising exchange rate tends to reduce the competitiveness of New Zealand produced goods and services as they become more expensive in foreign currency terms. Assuming no change in world prices for commodities or manufactured exports, the net effect of this loss of competitiveness is a reduction in revenues for exporting firms. In response to this, firms are likely to curtail employment hours paid, reduce new employment opportunities, resist wage and other input cost

³⁰ As noted above, an important plausible alternative is that importing firms simply absorb exchange rate effects into their margins.

increases, pay smaller dividends to shareholders, and may even choose to move production facilities overseas. Each of these effects places downward pressure on various income streams flowing to households, reducing overall discretionary consumption.³¹

The role of expectations

As noted previously, inflation expectations can have a major bearing on the ease or difficulty with which the Reserve Bank achieves its inflation objectives. We have already discussed the importance of expectations in relation to the link between nominal and real interest rates. However, their significance deserves deeper analysis with respect to the household and firm decisions described above.

Survey measures of consumer and business confidence are keenly scrutinised by the Bank as indicators of future inflationary pressure and of the likely impact of monetary policy. A monetary policy tightening can be relatively ineffective at times when the general economic mood is buoyant: if firms are confident of good demand even at times of high interest rates, they may be prepared to increase investment despite the higher costs of debt servicing. Conversely, as uncertainty about the future increases, agents are likely to be more conservative in their decision-making.

14 Monetary policy is *credible* if households and businesses are convinced of a central bank's commitment to its stated goals, and of the bank's ability to engineer outcomes that realise these goals. A monetary policy tightening can be interpreted as a central bank's response to undesirable expected future strength in activity and inflation. If the tightening is credible, households adjust down their own expectations and reduce *current* consumption and investment because future economic conditions are now anticipated to be less conducive to new

³¹ Although an exchange rate appreciation will curtail export activity on balance, there is an offsetting influence that can be important at times: even if the trade-weighted exchange rate appreciates, the vagaries of bilateral exchange rate movements can actually render some exporting firms more competitive, at least over the short term. In particular, manufacturing exporters who source inputs denominated in US dollars and export to Australia will tend to gain against their Australian competitors if the New Zealand dollar appreciates against the US dollar, but depreciates against the Australian dollar.

employment opportunities and wage growth. Of course, since current activity directly influences future activity, the reduction in current output so achieved makes it less likely that further policy tightening will be required.

Heightened inflation expectations are especially pernicious when they are not linked to any well-defined views on future activity. Such expectations are commonly considered self-fulfilling, as manifest in the classic wage-price spiral: households expect prices to rise and so bargain for higher wage increases; these higher wages are quickly spent in anticipation of the rising prices, thereby *actually* increasing prices as demand grows rapidly and well ahead of supply capacity. Consequently, anchoring inflation expectations to activity and more helpfully to a nominal inflation target can lead to desirable economic outcomes with less policy action than would otherwise be required.³²

4 From activity and aggregate demand to a change in inflation

15

Total output in the economy is the sum of consumption, investment and government expenditure, plus net exports.³³ We have discussed above how tightened monetary policy reduces these expenditures and now turn to the next step in the causal chain – the link between aggregate activity and low and stable inflation.

³² On the other hand, if future inflation is expected to exceed the Bank's target, households are likely to compensate for the expected loss of purchasing power of their incomes by bargaining for larger wage increases in the current period. In the canonical policy view, firms respond to these higher operating costs by raising prices and the higher expected inflation is realised.

³³ The goals and nature of fiscal policy imply that monetary policy has little influence on government spending. Consequently, though this spending accounts for about a fifth of GDP – a third, if government transfers are included – we have paid it little attention.

The dominant theory, both in New Zealand and overseas, for thinking about the link between aggregate activity and inflation is an economic relationship known as the expectations-augmented Phillips curve.³⁴ The essential features of this relationship in New Zealand are:

1. When aggregate output expands above the economy's 'supply capacity' (also known as potential output) a positive 'output gap' opens up and non-tradables inflation rises.
2. A rise in inflation also causes expectations of future inflation to increase.
3. To prevent ever-increasing inflation and inflation expectations, a more than one-for-one monetary policy response is required to return output to potential levels and to re-anchor inflation expectations at the target rate.

The output gap and resource pressures

The Phillips curve is couched at the macroeconomic level, but underlying the notion of a positive or negative output gap and inflationary pressures are individual firms operating, on balance, at or away from their normal capacity levels. As we have seen, in response to an interest rate increase and declining demand, firms may limit new job opportunities and perhaps reduce hours worked by existing employees, putting downward pressure on wages.³⁵ In practice, wages are 'sticky' in that they are not often reduced in nominal terms. Rather, the wage contribution to lower inflation derives from slower increases in wages than previously or from a decline in real wages that reduces purchasing power and, consequently, aggregate demand.

³⁴ A recent *Bulletin* article by Hargreaves *et al* (2006) discusses the evolution in thinking about the Phillips curve and how it is used to model and forecast inflation in New Zealand. See Drew (2007) for a recent discussion on New Zealand's potential output and supply capacities.

³⁵ If, as is common, there are costs associated with hiring new employees, firms are unlikely to actually issue redundancies unless the economic downturn is expected to be protracted. Instead, they are more likely to 'hoard labour'. However, should the downturn be longer and deeper than desired, many firms will be forced into cutting the demand for labour and the economy may undergo a 'hard landing'.

A monetary policy easing on the other hand may result in rather more nominal wage adjustment than is the case when policy tightens. A decrease in the OCR eventually results in expanded activity through much the same mechanism described above. To meet additional demand, many firms look to hire additional staff, or to perhaps increase the hours worked by existing employees. In an environment of strong employment growth and job security, these extra demands on labour tend to increase unit labour costs, because labour is able to achieve relatively favourable employment terms and conditions. Unit labour costs might rise, in addition, because some firms will hire workers that have less skills or experience, and hence lower productivity levels. Overall, the extra demand for labour and improved employment prospects will tend to be associated with upward pressure on wages and prices – economic booms that expand the level of output significantly above its potential level are usually followed by a pick-up in domestic or non-tradables inflation.

Irrespective of a monetary tightening or easing, the change in aggregate output typically results in changes in the non-tradables inflation rate about one or two quarters later. In practice, the lags depend on the exact source of demand pressures, the existing level of capacity in the economy, and a host of other factors that together determine the basic flexibility of an economy to adjust to economic disturbances.³⁶ In summary, about a year after a surprise increase in the OCR, the economy experiences a decline in tradables inflation, with peak effect in non-tradables and overall inflation arriving somewhat later.

A final element of uncertainty that policy makers must grapple with is the size of the output gap itself. In practice, the output gap cannot be measured with much precision –

the potential growth rate is subject to shocks that alter supply capacities.³⁷ Some of these disturbances might be very long-lived. Labour market reforms in New Zealand in the early 1990s, for example, paved the way for a prolonged period of increasing employment rates, lifting supply capacities. Other shocks might be relatively short lived, such as fluctuations in weather conditions that affect New Zealand's agricultural supply. In addition to these shocks, different sectors in the economy might start to hit bottlenecks at different stages of an upturn. Overall, the Bank views the output gap as a helpful indicator of aggregate resource pressures, but one that must be corroborated with other indicators of capacity in the economy.³⁸

5 Summary

In this article, we have considered the various transmission channels of monetary policy in New Zealand in some detail. We describe the sequence of events that lead from a change in the OCR, and/or expectations of future policy changes, to eventual inflation outcomes. We also offer a flavour of the parts of the transmission mechanism that the Bank regards as particularly important, highlight the specific elements of the channels that are relatively straightforward, and those that are subject to considerable uncertainty. The focus in this discussion has been on how the transmission mechanism is thought to work in general, rather than at specific times in New Zealand's economic history. In a subsequent edition of the *Bulletin*, we will turn our focus to how the transmission mechanism has changed over time, and how these changes have affected the operation of policy over the recent business cycle.

³⁶ An economy with structural policy settings that engender more flexible labour and product markets is better able to cope with positive (and negative) shocks and the monetary policy transmission mechanism overall will tend to work more speedily. For an illustration of these issues in the context of economic adjustment in the Euro Area versus the US, see Drew *et al* (2004) and Bayoumi *et al* (2004).

³⁷ Measuring output gaps accurately is especially difficult in real time; that is, historical estimates are relatively easier to obtain than those for the current period. For estimates of the uncertainty around potential output in New Zealand, see Claus *et al* (2000) and Graff (2004).

³⁸ See Hargreaves *et al* (2006).

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